# 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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## Research Highlights from 2018

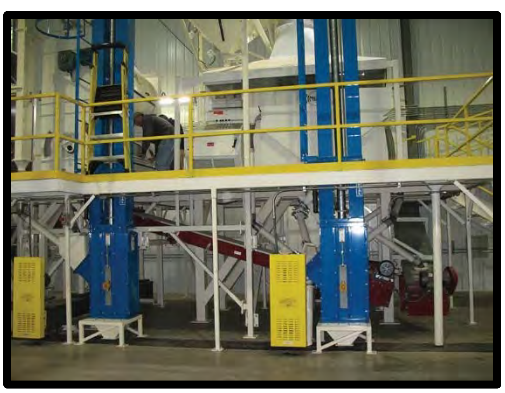


## Crop Variety Comparison Data

The Carrington Research Extension Center conducts research and educational programs to enhance the productivity, competitiveness, and diversity of agriculture in central North Dakota. Research effort focuses on dryland and irrigated crop production practices, crop germplasm evaluation and improvement, crop fertility and crop nutrition, soil health and resource improvement, plant disease control and management, evaluation of new agricultural technologies, cropping systems and crop rotation research, precision agricultural practices, crop-livestock nutrient management, integration of crop and livestock production, beef cattle feeding, feedlot management, intensive cow/calf production, growing and finishing traits, carcass data and meat quality, sustainable agriculture practices, foundation seedstocks production, horticulture and forestry evaluations, and fruit and berry production. The central location of the Carrington Center is significant in that research programs address research needs representing a significant part of agriculture in North Dakota. 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.

**The area of a corn** field that required herbicide application was reduced by 14% in a study where site-specific weed management was used based on UAS-derived imagery. If such a map could be programmed into a sprayer capable of turning nozzles on and off based on a 10 x 10 ft grid cell size, the reduction in the area requiring herbicide would have increased to 40%. The combination of UAS imagery for site-specific weed identification and automatic nozzle control can lead to both economic and environmental benefits through the decreased amount of herbicides applied to fields.

**Spring wheat varieties with increased** tolerance to elevated levels of salinity would be an important advance as producers work to utilize and improve the significant acreage of salt-affected soils in our region. In collaboration with NDSU's spring wheat breeder, the CREC compared released and experimental spring wheat lines for tolerance to salts on land with a salinity gradient in 2018. Some variation in wheat tolerance was identified which may lead to germplasm being specifically selected for improved tolerance to soil salinity.



**The processing of the first** seedlot in the new seed plant at the CREC in October represented the culmination of more than ten years of effort to secure support for construction of a modern facility to clean and condition foundation grade seed. The new plant now has capacity matched to seedsman's demand and much improved worker safety features. The future installation of an optical sorter will complete the plant and present seed conditioning capabilities that further ensure the ability to provide highly pure Foundation grade seed.

**Insect pollinators were studied** in a multi-faceted approach to evaluate their effect on crop performance. Components of the study included determining honey-bee honey accumulation through the growing season, identifying the crops that bees were visiting through pollen analysis, testing flax yield when bees are excluded and evaluating how pollinator plantings can be integrated into production agriculture.

**A study using UAS imagery** to identify dicamba damage on non-dicamba tolerant soybeans demonstrated that both multispectral and regular RGB cameras were able to discern damage caused by different rates of the herbicide. Soybean growers could potentially use such maps with yield monitor data to document yield losses due to off-target dicamba movement.

**An NDSU Extension circular was** written in 2018 that provided a summary of pinto bean response to phosphorus-based starter fertilizer based on research at the CREC from 10 trials conducted from 2009 through 2017. The circular 'Pinto bean response to phosphorus starter fertilizer in east-central North Dakota' (A1883) includes details on seed yield response primarily with liquid 10-34-0 using different application methods and rates.

**Feed bunk management may play** a role in issues relating to sulfur toxicity in feedlot animals. A research project using beef steers consigned as part of the 2018 North Dakota Angus University were utilized in a study to evaluate if bunk management may affect the concentration of hydrogen sulfide gas in the rumen of steers fed distillers grains with solubles. Research on slick bunk management versus bunks managed to continually have feed present will continue to further define potential for mitigation of sulfur toxicity in feedlot cattle.

**A long-term study** of the effects of dicamba drift on broadleaf crops was concluded. Studies have included dry beans, field peas, soybeans, lentils, and potatoes. Soybeans have been the recent focus of these studies. In 2017 very little injury was detected until application rates approached a quarter of the field-use rates. In 2018, much more injury was observed, including injury symptoms at the very lowest application rates in the trial (roughly 2% of use rates).


**In 2018, the Northern Hardy** Fruit Evaluation Project brought information to over 1,100 people through tours, meetings, video conference programs and personal phone calls or visits. These contacts represent an important expansion of the constituents the CREC provides information to beyond the traditional crop and livestock clientele. The majority of people who received information on fruit and berry production were from North Dakota but also included contacts from Minnesota, Montana, Pennsylvania, Michigan, New Jersey and Rhode Island.

**A study was conducted in** 2018 at the CREC and Fargo by NDSU researchers to evaluate fall-seeded cover crop tolerance to soybean herbicides. Seven cover crops planted during August-September were evaluated for growth on soil previously treated during early summer with nine herbicides that have soil residual. The study, supported by the North Dakota Soybean Council, will result in a reference table for farmers and crop advisers when cover crops are planned for establishment following soybean.

**The Dakota Feeder Calf Show** feedout project continues to assist cattle producers in identifying cattle with superior growth and carcass characteristics. The spread in average profitability between consignments from the top five herds and the bottom five herds was $170.16 per head for the 2017-2018 feeding period. Understanding cattle performance and profitability helps producers decide to feed cattle to harvest weight in North Dakota and also to consider genetic purchases for the cow herd.

**Continued to work with wet** distiller's grain and condensed distillers solubles using them as a nutrient source for crop production. Data from the last three years shows that these by-products, where available, can meet a wheat crop's phosphorus needs similar to or sometimes with exceeding efficiency to synthetic fertilizers when applied at the same phosphorus rate.

**Remote sensors were used to** assess mid-season nitrogen status of spring wheat to predict wheat grain protein content. Correlation of normalized difference vegetation index (NDVI) and protein content was best around and right after anthesis. Post-anthesis application of nitrogen is a practice to enhance grain protein. Economics of the practice is dependent on the magnitude of the protein boost as well as market conditions. The study aims to pinpoint the best sensing time and NDVI values to provide a decision aid for producers who may apply post-anthesis nitrogen to enhance grain protein.

**A trial area was mapped** for several key soil characteristics to define the impact of small-scale soil variability on crop production. Erosion due to elevation changes and tillage often wears down the A-horizon. Our results show that while pH was a good predictor of yield on our calcareous soil, CCE (calcium carbonate equivalent) became the dominant factor and strongly affected yield above 2%. New and emerging technologies in precision agriculture may be used to manage problem areas of a field differently based on mapping permanent or slow-to-change soil characteristics of a field.

**A greenhouse trial evaluated corn** and wheat response to watering with $CO_2$-enriched water. Irrigation treatments included CO2 dose, frequency of application and water temperature. Results indicated a positive influence of CO2 on plant growth including increased plant height (wheat and corn) and biomass (corn only). The study was a collaboration with partners from North Dakota's energy industry to assess the potential of using CO2 to increase field crop production.

# Using Unmanned Aerial Systems for Site-specific Weed Management in Corn

*Paulo Flores, Mike Ostlie, and Greg Endres*

In 2017, corn was planted on 3.42 million acres in North Dakota (ND), with a production value of $1.3 billion (NASS-USDA, 2018). Therefore, factors that positively or negatively impact corn production in North Dakota can have a considerable impact on farmers' profit and on the state's economy.

A common agronomic practice for weed control on corn is to make two herbicide applications during the growing season. The first is usually made as a pre-emergence or soon after, and the second is usually made around growth stages V5-V6. The focus of this study is on the second application, which costs (product + application) around $15-20/ac. If one can use UAS (unmanned aerial systems) imagery to generate a weed distribution map for a corn field, a farmer could use such a map to make a decision to spot spray the field instead of making a blanket application across the whole field. Such an approach could save corn growers as much as $5-7 million annually with as little as a 10% reduction in applied acres. The objective of this study was to use UAS imagery to map and quantify weed infestation in corn for site-specific weed management during the second herbicide application.

**Material and Methods**

A 40-acre silage corn field at the Carrington REC was used for this study. Corn was planted on May 14, in a 30-inch row spacing. Our intent was to fly the field 1-2 days prior to the second herbicide application to create a "weed control prescription" map, which would then be programmed into our brand new 2018 model sprayer for site-specific weed control. Unfortunately, technical limitations with the sprayer and weather conditions forced us to revise our plan. According to the technical support, our sprayer could not shut the nozzles on and off based on a "weed control prescription" map. We flew two UASs with different sensors (multispectral and RGB sensors), at different heights, to test their suitability to produce an orthomosaic that could be used to detect weeds between the corn rows. For this study, the imagery collected with a Phantom 4 Pro (P4P), flown at 120 ft AGL (above ground level), showed to be more suitable for our purpose. The weed map was created using imagery collected on June 8. Our approach to map the weeds was basically look for plants growing between the corn rows. Once we determined the location of the center corn rows, we created a 6-inch buffer to each side. All the vegetation inside that area was considered to be corn plants and was deleted, leaving the weeds between the rows. To overcome the technical limitations of our sprayer, we created a grid cell (20 ft long x 30 ft wide) and intersected that with the weed layer (Figures 1 and 2). Every cell that contained at least one weed plant was sprayed, while the ones without weeds were not. The interface of the spray and no-spray cells were marked on the field using flags with different colors.

Weather conditions did not allow a second flight to map weeds or a spray operation close to the first flight date. The trial area was sprayed on June 15 using a 3-point tractor mounted sprayer (30 ft wide), turning the nozzle on and off manually as it moved across the field. The tank mix consisted of 1.3 pint of WideMatch + 28 oz. of glyphosate, applied at a rate of 13 gal/ac. We made 10 passes with the sprayer, and each pass was 48 cells long (around 6.6 acres total). The area adjacent to trial was managed as "business as usual" and it received a blanket application of the same mix and similar rate per acre. Corn silage was harvested on June 14-15, and we flew (120 ft AGL) the trial and adjacent field area with the P4P to assess weed coverage after harvest (Figure 2).

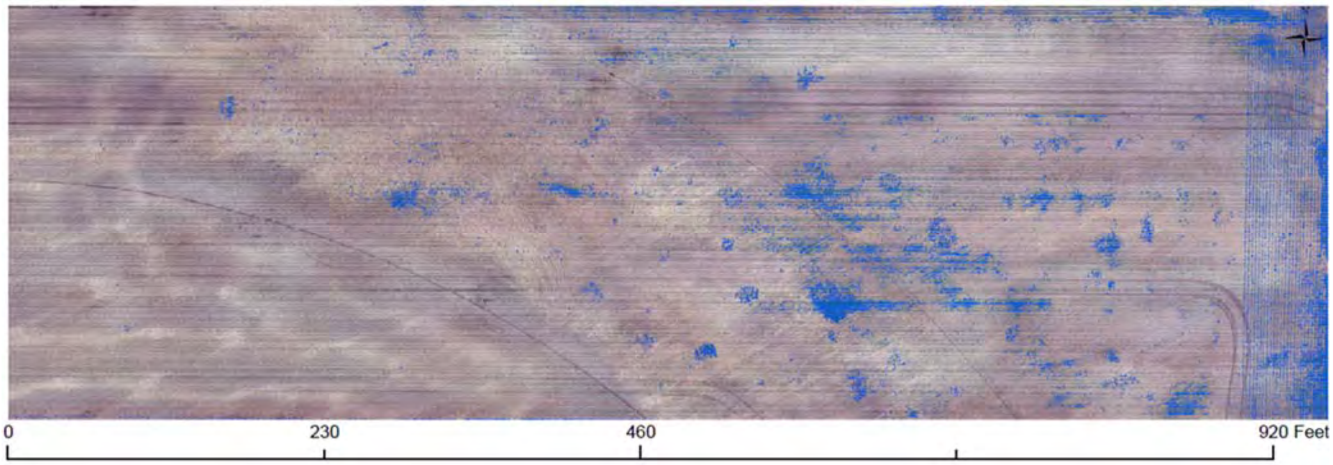



**Figure 1. RGB imagery collected with a Phantom 4 Pro, at 120 ft AGL, on 06/08/2018, used to map weeds (in blue) on silage corn field.**

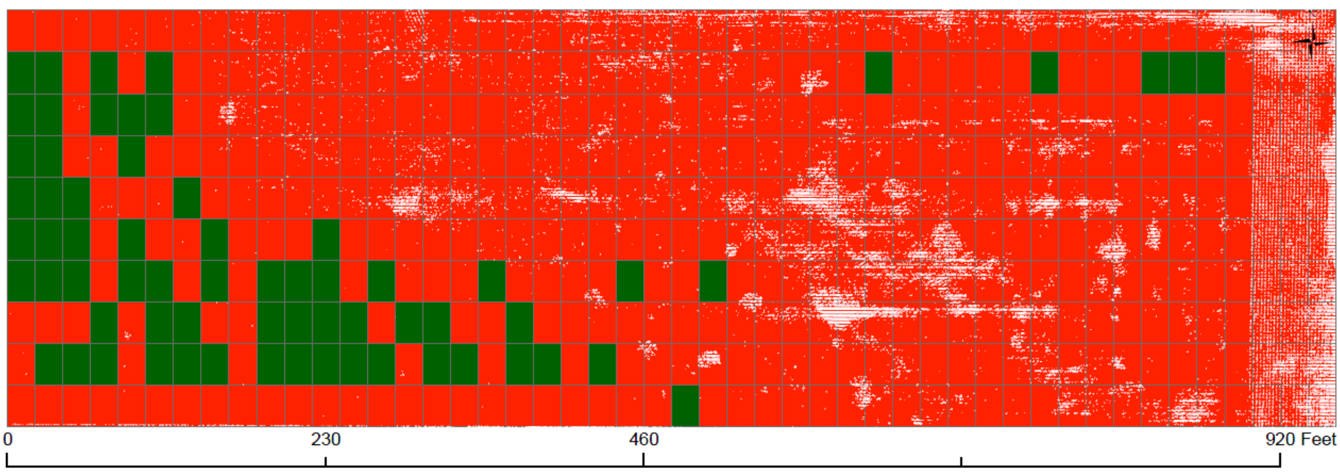



**Figure 2. Grid (20 x 30 ft cell size) overlaid on top of the RGB imagery and intersected with the weed layer (white). Red= spray and Green= no-spray.**

**Results and Discussion**

The P4P flying at 120 ft AGL yielded an orthomosaic with average ground resolution of 0.36 inch/pixel, which allowed us to map the weeds growing between the corn rows (Figure 1). On the east end of the field, one can notice several rows, oriented north-south, misclassified as weeds. Those are actually corn plants, which were planted perpendicular to the rows orientation in each end of the field. We did not spend time trying to correct that because there was a large infestation of weeds in that area, which warranted spraying those cells.

By intersecting the weed layer with the 20 x 30 ft grid cell, there was a reduction of 16% (89 cells out of 461) of the area to be sprayed (Figure 2). That can be of great value for corn growers, since it can result in savings for chemicals and decrease the amount of those chemicals applied to corn fields (environmental benefit). Using the same weed data layer and by decreasing the grid cell size to 10 x 10 ft or to 3.28 x 3.28 ft, the area not sprayed would go up to 40% and 70%, respectively. That shows that such an approach for weed control can potentially have a large impact on both economic and environmental aspects of corn production.

Figure 3 shows the percent weed coverage after corn silage harvest. There were only three (out of 480) cells that showed weed ground coverage higher than 3 percent, and those were cells that were sprayed earlier in the season. The cells that were not sprayed showed similar levels of weed infestation to the vast majority of cells sprayed in the trial area and in the area adjacent to it. The area adjacent to our study received a blanket application with the same products and rates applied to our study, which were applied using the sprayer that we first intended to use for this study.

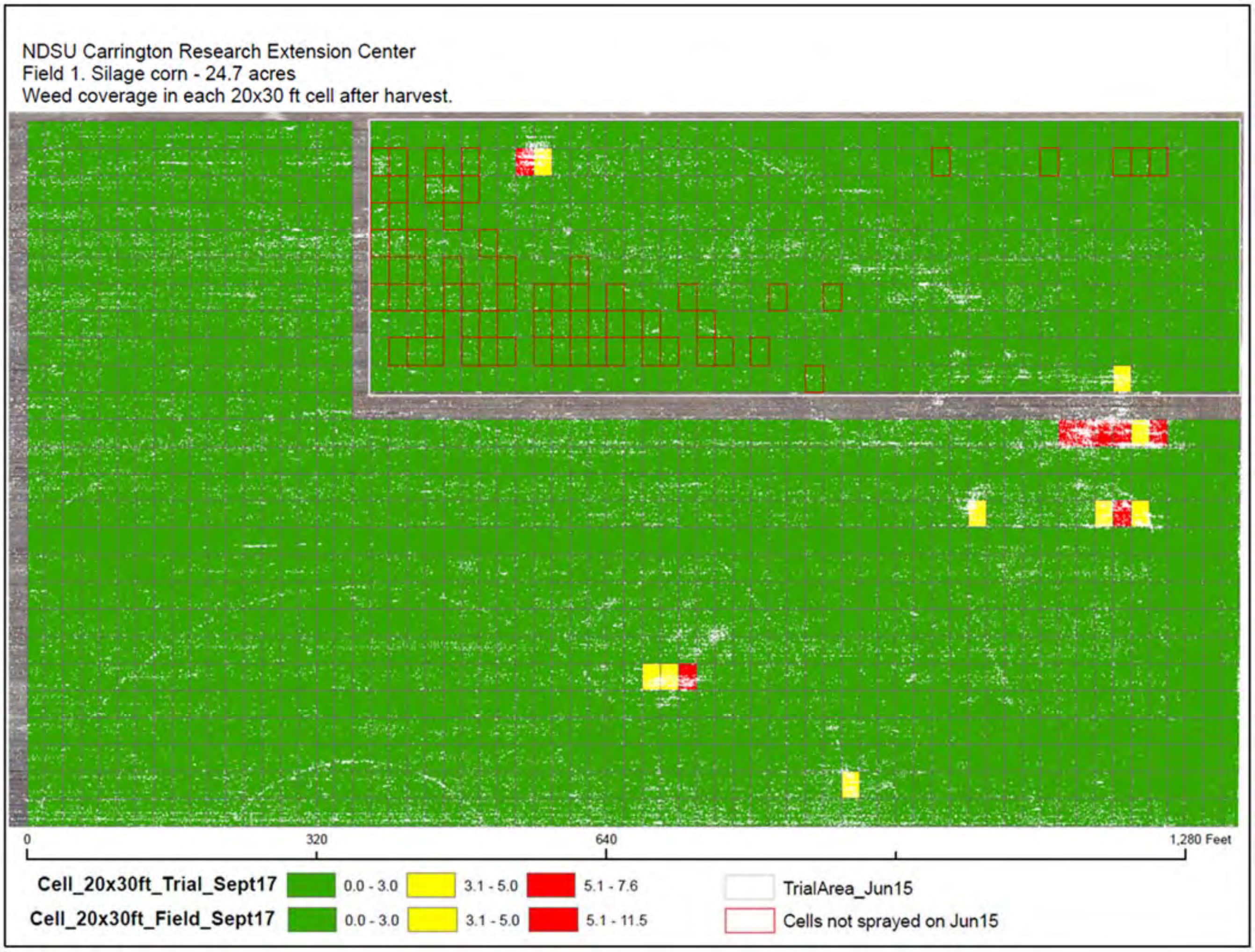



**Figure 3. Percent weed coverage in each grid cell (20 x 30 ft) projected on top of the RGB imagery collected on September 17, 2018, (Phantom 4 Pro, 120 ft AGL) from the both study area (gray box) and the area adjacent to it.**

Based on our results, the use of UAS imagery for site-specific weed control on corn has the potential to generate savings for corn growers by decreasing the area that needs to be sprayed. In addition, there is a potential to decrease the environmental impact of corn production as well, since the approach reported here would lead to less chemicals being applied to corn fields. Those benefits can be increased by the use of sprayer technologies that can automatically handle chemical applications to grids with small cell sizes.

# The Effect of a Late-season Fungicide Application on Winter Wheat Performance

*Mike Ostlie and Blaine G. Schatz*

Winter wheat acres are at historic lows in the United States due to relatively low profit margins and corn and soybean acres moving westward across the Great Plains. However, recent dry and droughty weather has raised concern about water availability for late-season crops. Winter wheat represents an opportunity to take advantage of the early-season moisture during dry years. Management of winter wheat needs to be considered prior to growing the crop. Factors such as stubble type and height, fertility, and pest management programs may be different than spring wheat. Two important factors to consider are wheat variety and the use of a fungicide program.

From 2013-2017, a winter wheat variety trial was conducted at Carrington. This trial consisted of 20-30 varieties each year. Each year, half the trial received a fungicide application at anthesis. The fungicide was either Proline or Stratego. Head disease pressure was low in each of the years under evaluation. In 2016, there was a major hail event near crop maturity. No data were used from that year. Varieties within the trial changed from year to year, nevertheless, there were 13 varieties consistently present for the duration of the study, which will be the focus of this report.

In the simplest comparison, Table 1 demonstrates a nearly 6 bu/ac increase in winter wheat yield by using a late-season fungicide. Grain protein was unaffected by the use of a fungicide. That could be the end of the story, however, not every variety had the same increase. Table 2 lists the average yield of each of the 13 varieties for the duration of the study with and without a fungicide. When looking at the difference between fungicide and no fungicide there was a 1 to 12 bu/ac difference. Some varieties responded very well to the fungicide treatment while others were nearly stagnant. Only Lyman Accipiter, Overland, and Flourish had a consistent and statistically significant yield increase across all sites. Protein content was not affected by fungicide for any variety. While *Fusarium* head blight was the target for the fungicide strategy of this trial, none of these environments had infection levels that would typically be of concern. Instead, it is likely that the fungicide was more effective at protecting the flag leaf and lower leaves from tan spot (even low levels) and possibly provided some general plant health benefits. The tan spot pathogen is our most prevalent leaf spot disease of wheat and all our winter wheat varieties are generally susceptible. In comparing with the *North Dakota Hard Winter Wheat Variety Trial Results for 2018 and Selection Guide* (A1196-18) https://www.ag.ndsu.edu/publications/crops/north-dakota-hard-winter-wheat-variety-trial-results, there is no apparent and consistent correlation between disease susceptible varieties and fungicide response.

**Winter wheat yield with and without fungicide treatment.**

| Treatment | Yield | Protein |
|---|---|---|
| | bu/ac | % |
| Fungicide | 59.2 | 13.95 |
| No Fungicide | 53.6 | 13.90 |
| LSD (0.05) | 2.2 | NS |

**A stripe rust resistant (left) vs. susceptible (right) variety.**

**Table 2. Average performance of each variety across years, along with the effect of applying a fungicide.**

| Variety | Yield: No Fungicide | Yield: Fungicide | Difference[1] |
|---|---|---|---|
| Jerry | 58.2 | 62.6 | 4.4 |
| Lyman | 41.5 | 53.3 | 11.8 |
| Peregrine | 59.1 | 60.6 | 1.4 |
| WB-Matlock | 61.1 | 62.3 | 1.2 |
| AC Broadview | 54.6 | 56.7 | 2.1 |
| Decade | 48.9 | 55.2 | 6.2 |
| Accipiter | 58.9 | 67.6 | 8.7 |
| Overland | 48.2 | 57.1 | 8.9 |
| SY Wolf | 53.1 | 58.3 | 5.2 |
| Ideal | 55.3 | 60.0 | 4.8 |
| Moats | 54.4 | 59.2 | 4.8 |
| AC Emerson | 53.9 | 56.1 | 2.2 |
| Flourish | 49.8 | 60.6 | 10.8 |
| LSD (0.05) | 4.7 | 4.7 | 7.7 |

[1]The difference represents the yield of the fungicide treated plots minus no fungicide.

Winter wheat variety selection is important for many reasons. Fungicide response doesn't have to be one of those reasons. However, it would be important to know if the selected variety has a chance to provide a substantial return on investment or not. But, as always, keep track of the crop stage, scout for diseases, and monitor the weather to ensure the right fungicide choice is made.

## Spring Wheat Response to Phosphorus from Distillers Grains

*Jasper M. Teboh, Szilvia Yuja, Mike Ostlie, and Ezra Aberle*

**Introduction:** Condensed distillers solubles (CDS) and wet distillers grains (WDG), which are co-products from ethanol production, have been shown to contribute phosphorus (P) and nitrogen to wheat and corn in previous trials conducted at the NDSU Carrington Research Extension Center. The cost of acquisition and transportation of CDS and WDGs, and the means to apply on farmlands have made it impractical for most farmers in the state to consider distillers grains (DGs) as a viable fertilizer alternative. However, a few farmers, mostly at close proximity to ethanol plants, who have acquired DGs at a relatively low cost want more evidence to substantiate recent reports of yield gain from application of DGs.

**Materials and Methods:** This trial was conducted on a loam soil with low soil available soil test P at 4 ppm (8 lbs/ac). Soil N was 47 lbs/ac. Treatments included three P sources: commercial inorganic fertilizer as triple super phosphate (TSP), CDS, and WDG. These were applied at 20 and 40 lbs/ac plus a check (0 lbs P). At 20 lbs P, CDS was applied at 270 gal/ac, and WDG at 3.3 T/ac. Fertilizer treatments were applied on the May 2, and incorporated the following day, before seeding wheat (variety Prosper). Sulfur at 10 lbs was applied to the Check and TSP plots as well as N as urea, for a total of 150 lbs N including soil N. at 80 lbs P, the N applied with WDG was greater than 150 lbs/ac. Crop vigor was evaluated on June 14, using a handheld sensor (GreenSeeker). The sensor produces an index called NDVI (Normalized Difference Vegetation Index) which gives higher index values for more vigorous or healthier crops. Yields were recorded following harvest on August 7.

**Results and discussions**

Phosphorus application resulted in significantly higher NDVI values at higher rates, implying enhanced crop vigor, compared to the check. A contrast of the average NDVI values for the TSP treatment versus either CDS or WDG showed that TSP treatments were significantly more vigorous (Figure 1). This was likely due to greater availability of the 80 lbs N as urea (same amount as the check) applied to TSP treated plots compared to 47 and 16 lbs N applied with CDS treatments respectively, at 40 lbs and 80 lbs P, and the 40 lbs N added with WDG at 40 lbs P, respectively. It is likely that N as well as P supplied by CDS and WDG was slowly made available to the crop as a slow release fertilizer.

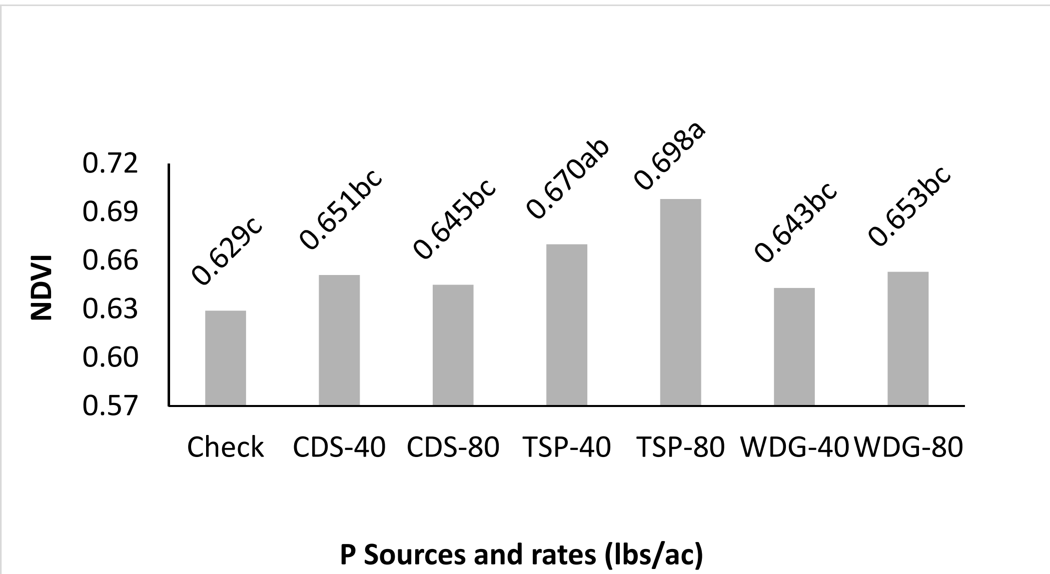



**Figure 1. Effect of P sources (Condensed distillers grains, triple super phosphate, and wet distillers grains) and P rates on wheat vigor (Normalized Difference Vegetation Index).**

Grain yields increased significantly due to P application rates, increasing from 42 bushels at the check to 52 bushels at 40 lbs P, and to 57 bushels at 80 lbs P, averaged across P sources. Yields were significantly greater for each P level for each source compared to the check (Figure 2). Since P had a significant effect on grain yields, and while yield differences between P sources were not significant, it is evident that distillers grains supplied P to the wheat crop. Grain protein content was greater for WDG (14.73) compared to either TSP (14.23) or CDS (14.28), probably due to higher amount of N applied with WDG.

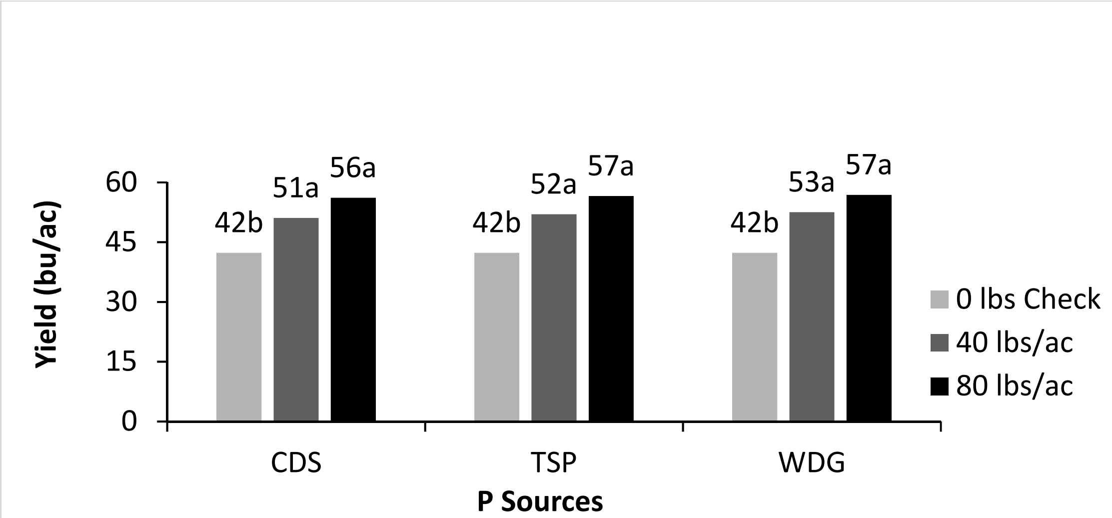



**Figure 2. Yield response of wheat to P supplied from condensed distillers grains (CDS), wet distillers grains (WDG), and triple super phosphate (TSP), at three P rates.**

**Conclusion:** Condensed distillers solubles and wet distillers grains, if applied to the soil before planting, can supply the required P to sustain high yields of corn and wheat.

## Seed Inoculation Strategies on Fields with Prior Soybean Production

*Greg Endres, Mike Ostlie and Tim Indergaard*

Double inoculation of soybean seed is defined as the use of a liquid plus granular formulation of N-fixing bacteria (*Bradyrhizobium japonicum*) with the seed at planting. Double inoculation is a common practice for soybean grown on fields without prior history of soybean production. Six trials were conducted by the CREC during 2015-2018 to examine potential soybean yield response to single versus double seed inoculation on ground with recent soybean production. The trials were partially supported by the North Dakota Soybean Council.

The trials were conducted at Carrington and the CREC off-station crop research site near Wishek. Trial locations were on ground with one to three years separating soybean crops. Seed inoculant treatments (various commercial sources used at labeled rates) included: 1) non-inoculated check; 2) liquid applied with seed; 3) granular applied in-furrow; and 4) liquid plus granular.

The table shows soybean seed yield results for each trial and the average across the six site-years. Statistically for each trial, yield was similar among inoculant treatments including the non-inoculated check. Averaged across trials, yield also was statistically similar among all treatments, though double inoculation tended to have slightly higher yield versus no or single inoculation. In addition, seed protein averaged across site-years (data not shown) was similar among inoculation treatments and the untreated check.

| **Table. Soybean yield with seed inoculant options, Carrington and Wishek, 2015-18.** | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Seed Yield (bu/acre) | | | | | | |
| Inoculation option | Carrington 2015 | Wishek 2015 | Wishek 2016 | Carrington 2017 | Wishek 2017 | Carrington 2018 | 6 site-yr average |
| Untreated check | 30.8 | 22.4 | 57.6 | 68 | 40.2 | 41.9 | 43.5 |
| Liquid | 28.7 | 22.2 | 56.7 | 65 | 45.9 | 46.5 | 44.2 |
| Granular | 25.3 | 24.5 | 56.8 | 61 | 45.8 | 49.4 | 43.8 |
| Liquid + Granular | 27.1 | 25.4 | 58 | 69.5 | 45.3 | 44.1 | 44.9 |
| LSD (0.05) | NS | | | | | | NS |

In summary, this research indicates no seed yield or protein advantage using double- versus single-seed inoculation on ground with recent prior soybean production history.

**Nodulation of soybean treated with granular inoculation.**

## Using UASs to Assess Dicamba Injury to Non-dicamba Tolerant Soybeans in a Drift Simulation Study

*Paulo Flores, Mike Ostlie, and Greg Endres*

In 2017, when Xtend soybean were brought into the market, it was estimated that nationwide, around 3 million acres of non-dicamba tolerant soybeans were injured by off-target dicamba. From that acreage, around 150,000 acres were located in North Dakota.  One the main issues in fields affected by dicamba off-target movement is the difficulty in assessing the extent of a field affected by dicamba and subsequent loss in seed yield. Sensors mounted on a UAS (unmanned aerial system) can quickly provide information to support that assessment. By overlaying a yield map over the imagery, one can assess how the yield changes in areas impacted by dicamba compared to those not affected by it. During the past growing season, we carried out a study primarily designed to answer questions regarding the effect of multiple dicamba exposures on non-dicamba tolerant soybean yield during reproductive stages, and the suitability of the use of a UAS fitted with different sensors (cameras) to make an assessment of the crop response to those exposures. Due to space constraints, this report will focus on the suitability of an off-the-shelf, ready-to-fly UAS to assess the effect of dicamba rates, alone and mixed with glyphosate, on non-dicamba tolerant soybean.

**Material and Methods**

In 2018, a study was established at the Carrington REC to identify injury threshold to soybeans from simulated dicamba and glyphosate drift. Most of the treatments were applied at the R1 growth stage (July 2), with exception of some medium-rate treatments, which were applied at R2 (June 11) and at R2 and R3 (July 11 and July 23). The later applications simulated multiple exposures to dicamba drift. The low, medium, and high dicamba (Clarity) rates were combined with low, medium, and high glyphosate (RoundUp Powermax) rates to assess possible interaction of those products on non-dicamba tolerant soybeans. A detailed list of the treatments is presented in Table 1. Visual injury scores were collected from each plot at 10, 20, 30, and 40 days after treatments (DAT). For imagery collection, we used a DJI Phantom 4 Pro (P4P) equipped with a 20MP RGB camera. We flew several missions at different altitudes (100, 250, and 350 ft AGL [above ground level]) to investigate the impact of flight altitude on our ability to detect differences among treatment. Since we were able to detect such differences from all flight altitudes tested, we will focus on the imagery collected on July 25 and August 15, which were collected two days after the second and fourth visual injury rating evaluations, respectively.

**Table 1. List of treatments and plant injury ratings on non-dicamba tolerant soybeans at different days after application of the treatments.**

| Treatment | Rate | ---------- Plant injury rating, % ---------- | | | |
|---|---|---|---|---|---|
| | fl oz/ac | 10 DAT | 20 DAT | 30 DAT | 40 DAT |
| Check | | 0.00 g | 0.00 f | 0.00 g | 0.00 e |
| DicM R1-R2 | 0.14 | 25.0 d | 26.3 c | 23.8 cd | 26.3 c |
| DicM R1-R3 | 0.14 | 26.3 d | 27.5 c | 25.0 cd | 28.8 c |
| DicM+Adj | 0.14 | 35.0 c | 30.0 c | 27.5 cd | 30.0 c |
| DicL | 0.014 | 5.00 f | 6.30 e | 5.00 f | 2.50 e |
| DicM | 0.14 | 27.5 d | 28.8 c | 25.0 cd | 26.3 c |
| DicH | 1.4 | 46.3 b | 58.8 b | 62.5 b | 68.8 b |
| GlypL+DicL | 0.025 + 0.014 | 12.5 e | 16.3 d | 13.8 e | 11.3 d |
| GlypM+DicM | 0.25 + 0.14 | 33.8 c | 30.0 c | 28.8 c | 27.5 c |
| GlypH+DicH | 2.5 + 1.4 | 61.3 a | 68.8 a | 71.3 a | 73.8 a |

DAT = days after treatment; Dic = dicamba; M = median; R1, R2, R3= soybean reproductive growth stages; Adj.= adjuvant; L = low; H = high; and Glyp = glyphosate. Means followed by the same letter within each DAT are not significantly different.

Images collected during flights were processed with Pix4Dmapper by Pix4D to produce georeferenced orthomosaics (Figure 1). We used ArcGIS software paired with Python scripts to calculate and extract the average “Excess Green” index (ExGr) value for individual plots, which then were correlated with the visual injury scores collected on the field.

**Results and Discussion**

Figure 1 shows an aerial view from the study area collected on July 15, with the ExGr index layer masked to each plot extension. That layer clearly shows the differences among the check plots and those that received the highest rates of dicamba. A more detailed inspection of the imagery allows one to visually identify most of the plots that received the medium dicamba rate.

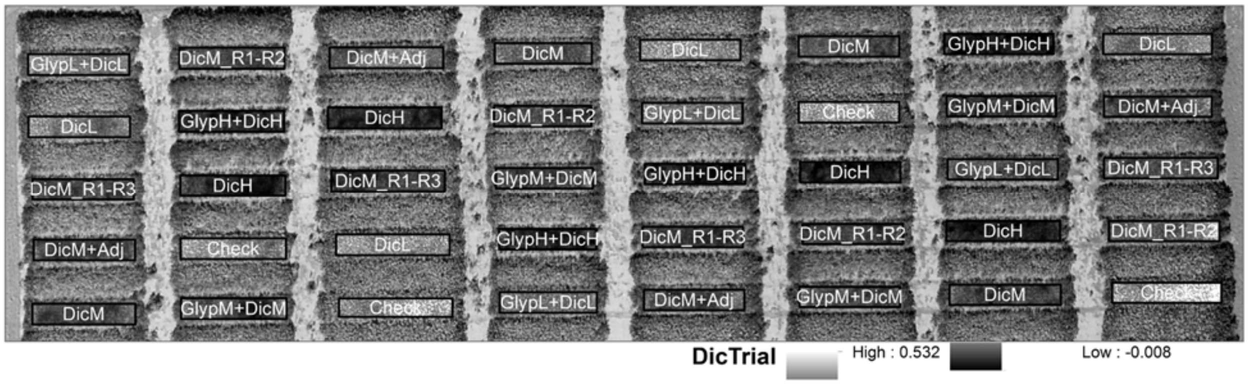



**Figure 1. Dicamba drift study at the Carrington REC. RGB imagery (August 15, 2018, Phantom 4 Pro, 350 ft AGL) on the background with the Excess Green index layer masked to each plot extension.**

Average visual field injury ratings for the treatments are presented in Table 1. There were significant differences among treatments at every evaluation date, and those differences were consistent across time. Based on plant injury ratings, treatments can be ordered as GlypH+DicH>DicH>all DicM treatments>GlypL+DicL>DicL>Check. All the treatments involving medium rates of dicamba, independent of the number of applications (R1, R1+R2, R1+R2+R3), with or without glyphosate, showed similar injury levels. Although there were some significant differences among the DicM treatments on the first two flight dates, data extracted from UAS imagery collected on August 15, showed similar results (GlypH+DicH=DicH>all DicM treatments>GlypL+DicL>DicL>Check; Table 2).

**Table 2. Non-dicamba tolerant soybean average excess green index values calculated from RGB imagery collected at 350 ft above ground level during three flight dates.**

| Treatment | ---------- Excess Green Index ---------- | | |
|---|---|---|---|
| | 25-Jul | 30-Jul | 15-Aug |
| Check | 0.271 a | 0.298 a | 0.153 a |
| DicM R1-R2 | 0.188 d | 0.178 de | 0.082 d |
| DicM R1-R3 | 0.192 d | 0.174 e | 0.072 d |
| DicM+Adj | 0.208 c | 0.204 cd | 0.085 d |
| DicL | 0.236 b | 0.254 b | 0.131 b |
| DicM | 0.201 c | 0.187 cde | 0.082 d |
| DicH | 0.139 e | 0.117 f | 0.042 e |
| GlypL+DicL | 0.213 c | 0.212 c | 0.106 c |
| GlypM+DicM | 0.192 d | 0.177 de | 0.074 d |
| GlypH+DicH | 0.125 e | 0.102 f | 0.042 e |

Dic = dicamba; M = median; R1, R2, R3 = soybean reproductive growth stages; Adj. = adjuvant; L = low; H = high; and Glyp = glyphosate. Means followed by the same letter within each flight date are not significantly different.

Figure 2 shows the correlations between field visual injury rating data at 20 DAT (July 23) and ExGr values (July 25), and injury rating at 40 DAT (August 13) and ExGr values (August 15). Although the flights were carried out two days after the field evaluations, the high $R^2$ (above 0.96 in both cases) show good agreement between field- and imagery-collected data. In addition, one can notice that the treatments were separated out closely following the order listed above for data on Tables 1 and 2.

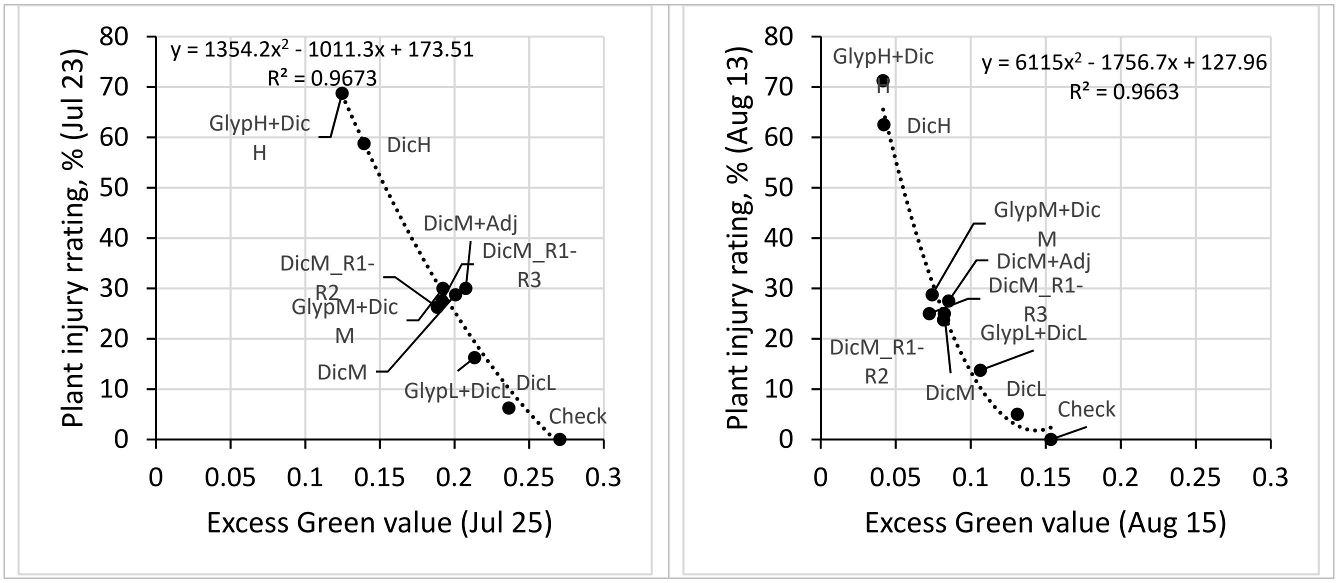



**Figure 2. Correlations between visual plant injury ratings and excess green index at 20 days (left) and 30 days (right) after treatment applications.**

Based on our results, we can conclude that the UAS used in this study (Phantom 4 Pro), flying at 350 ft above ground level, was able to capture imagery that allows one to identify soybean areas affected by dicamba off-target movements. In addition, the imagery collected allows one to discern the level of injury caused by different rates of dicamba on non-dicamba tolerant soybeans.

## An Update to Corn Plant Populations in Central North Dakota

*Mike Ostlie, Blaine G. Schatz, and Greg Endres*

Many surrounding states have recently conducted research to update recommendations for corn plant populations using modern hybrids. Much of that research has come to the similar conclusion that recommendations haven't changed much from the 1980s-1990s. Yet with ever increasing input costs, including seed, managing to the optimum economic advantage needs to be considered rather than yield alone. Purdue University did a nice job of examining plant populations economically (https://www.agry.purdue.edu/ext/corn/news/timeless/CornPopulations.pdf). Using this as a template, a similar table can be generated for North Dakota with local data.

From 2012-2014 a plant population study was conducted at the Carrington Research Extension Center. Each year of the study was conducted under dryland management. The study was arranged as a split-plot randomized complete block design with four replicates. Hybrid maturity and plant population were the two factors being evaluated. The four relative maturities (RM) in the trial were 83, 85, 87, and 90 day. Hybrids were chosen based on the best performing hybrid within each maturity from the previous season hybrid trial. Each hybrid was tested from 20K to 44kK established plants per acre, with 4K plant increments (seven populations total). Plots were hand thinned to ensure optimum spacing of plants.

For simplicity, the first comparison will be about yield alone. Table 1 shows the plant population that resulted in the maximum yield within each maturity group. Importantly, the trend is that with longer maturities, maximum yield is reached at a lower population than shorter maturities. In fact if population were plotted from maturities of 85-90, it would show that for each day increase in maturity, roughly 1000 less plants were needed to maximize yield. Table 2 is a complimentary dataset that emphasizes the effect of plant maturity on needed population. In this case, *average* yield is considered rather than maximum. It took only 19K plants/ac to reach the average yield at RM 90 (16K plants/ac less than max), while it took 31kK plants to reach average yields at RM 83 (5K plants/ac less than max). This indicates strong diminishing returns of increases in plant density at longer maturities. Statistically, the maturities separated into two groups. The RM 83 and 85 hybrids performed similarly and will be herein termed short maturity while the RM 87 and 90 hybrids formed a second group herein called long maturity.

**Table 1. The plant population that resulted in maximum yield for each maturity.**

| RM | pop |
|---|---|
| 83 | 36000 |
| 85 | 39040 |
| 87 | 33650 |
| 90 | 35100 |
| average | 35640 |

**Table 2. The plant population that resulted in an average yield for each maturity.**

| RM | pop |
|---|---|
| 83 | 31000 |
| 85 | 33100 |
| 87 | 25200 |
| 90 | 19250 |
| average | 26450 |

Marginal return was calculated for short (Table 3) and long (Table 4) maturity hybrids. Each table describes the economically optimum plant population, based on the price of corn grain and the cost of seed corn. Generally, the short maturity hybrids required 2 to 4K more plants/ac compared to the long maturity hybrids. As the seed cost goes down and the grain price goes up, we approach the plant population that provided the highest yield for both groups. However, in most 'typical' scenarios the optimum plant population is much lower and deviated by as much as 10K plants per acre within the tables. The staple recommendation of 28K established plants per acre appears to still be fairly accurate with long maturity hybrids. For shorter maturing hybrids, those numbers may need to be adjusted up somewhat, depending on prices.

**Table 3. The plant population that gives maximum economic return based on seed cost / unit (80,000 seeds) and grain price for corn varieties ranging from RM 83-RM 85. 95% stand establishment is assumed.**

| Cost of seed | Price/bushel of grain | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $ / unit | 2.5 | 3 | 3.5 | 4 | 4.5 | 5 | 5.5 | 6 |
| 150 | 32,230 | 33,070 | 33,660 | 34,100 | 34,440 | 34,710 | 34,930 | 35,120 |
| 175 | 31,390 | 32,370 | 33,070 | 33,580 | 33,980 | 34,300 | 34,560 | 34,780 |
| 200 | 30,530 | 31,670 | 32,470 | 33,070 | 33,530 | 33,870 | 34,190 | 34,440 |
| 225 | 29,650 | 30,960 | 31,870 | 32,550 | 33,070 | 33,480 | 33,820 | 34,100 |
| 250 | 28,760 | 30,240 | 31,270 | 32,020 | 32,600 | 33,070 | 33,440 | 33,750 |
| 275 | 27,840 | 29,500 | 30,650 | 31,490 | 32,140 | 32,650 | 33,070 | 33,410 |
| 300 | 26,900 | 28,760 | 30,030 | 30,960 | 31,670 | 32,230 | 32,700 | 33,070 |
| 325 | 25,920 | 28,000 | 29,400 | 30,420 | 31,200 | 31,810 | 32,310 | 32,730 |

**Table 4. The plant population that gives maximum economic return based on seed cost / unit (80,000 seeds) and grain price for corn varieties ranging from RM 87-RM 90. 95% stand establishment is assumed.**

| Cost of seed | Price/bushel of grain | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $ / unit | 2.5 | 3 | 3.5 | 4 | 4.5 | 5 | 5.5 | 6 |
| 150 | 29,490 | 30,320 | 30,910 | 31,340 | 31,680 | 31,950 | 32,170 | 32,360 |
| 175 | 28,640 | 29,630 | 30,320 | 30,830 | 31,230 | 31,550 | 31,800 | 32,020 |
| 200 | 27,810 | 28,940 | 29,730 | 30,320 | 30,780 | 31,140 | 31,430 | 31,680 |
| 225 | 26,950 | 28,230 | 29,140 | 29,800 | 30,320 | 30,730 | 31,060 | 31,340 |
| 250 | 26,070 | 27,520 | 28,530 | 29,280 | 29,860 | 30,320 | 30,690 | 31,000 |
| 275 | 25,170 | 26,800 | 27,930 | 28,760 | 29,400 | 29,910 | 30,320 | 30,660 |
| 300 | 24,250 | 26,070 | 27,320 | 28,230 | 28,940 | 29,490 | 29,940 | 30,320 |
| 325 | 23,300 | 25,320 | 26,700 | 27,700 | 28,470 | 29,080 | 29,570 | 29,980 |

## Use of Remote Sensors to Predict Grain Protein and Yield of Wheat Response to N

*Jasper M. Teboh, Blaine G. Schatz, Szilvia Yuja, Paulo Flores, Mike Ostlie, and Dave Franzen*

### Introduction

Remote sensors are useful decision support tools that can accurately, rapidly, and non-destructively monitor crop growth indicators using light reflectance data off of the crop canopy, producing numbers (indices) that may be related to final yields and grain protein. Promising results have shown that unmanned aerial vehicles (UAVs), and ground-based sensors such as the GreenSeeker (GS) and Crop Circle (CC), produce indices like the Normalized Difference Vegetation Index (NDVI) and Red Edge (RE) as indicators of crop health/vigor and N status. Field studies were conducted to determine the relationship between NDVI and RE to final grain protein of wheat following data collection on multiple sensing dates.

### Materials and methods

Spring wheat was planted at the Carrington Research Extension Center in spring 2018 on dryland and under irrigation. Available soil test N at the irrigated site was 75 lbs N. The trial received N fertilizer (treatments 1 to 6) at rates of 0, 40, 80, 120, 160, and 200 lbs N. Treatments 7 to 10 (0, 40, 80, 120 lbs N) received post-anthesis N as 28% UAN that was premixed with equal amounts of water before spraying at the rate of 30 lbs N. Treatments 11 and 12 received the same N rates (0 and 40 lbs N) as 13 and 14. These last four treatments were to receive mid-season N at the five-leaf stage based on sensor data from the GS and CC.

### Results

Based on the response indices given by the NDVIs of N-fertilized plots divided by NDVIs of the check (unfertilized) plots, midseason N fertilizer was not recommended for both sites.

However, the effect of N became more pronounced later in the growing season, which affected yields and grain protein.

At the dryland site, grain protein was significantly different between N rates; meanwhile, yields were marginally different (Figure 1). At the irrigated site, grain protein and grain yield improved significantly from N application (Figure 2).

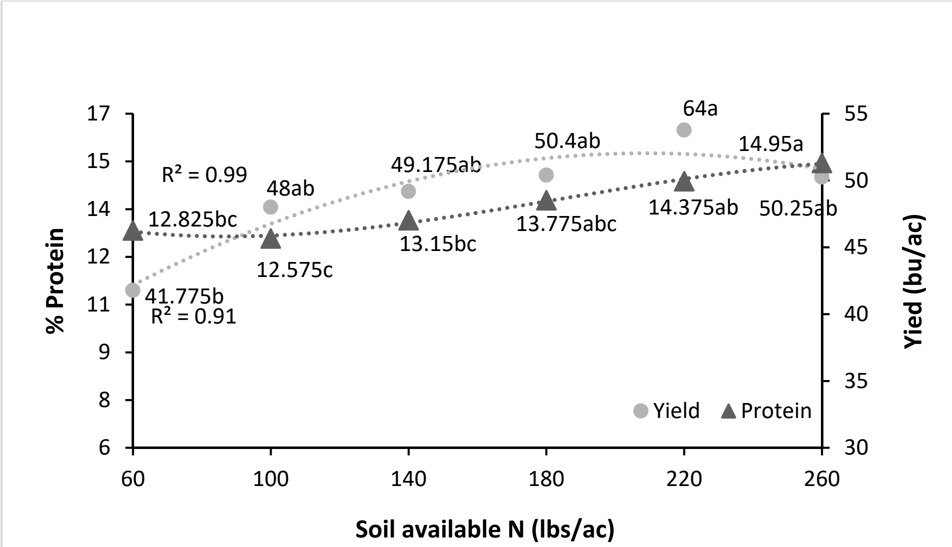



**Figure 1. Grain protein and yield response of wheat to N rates (dryland).**

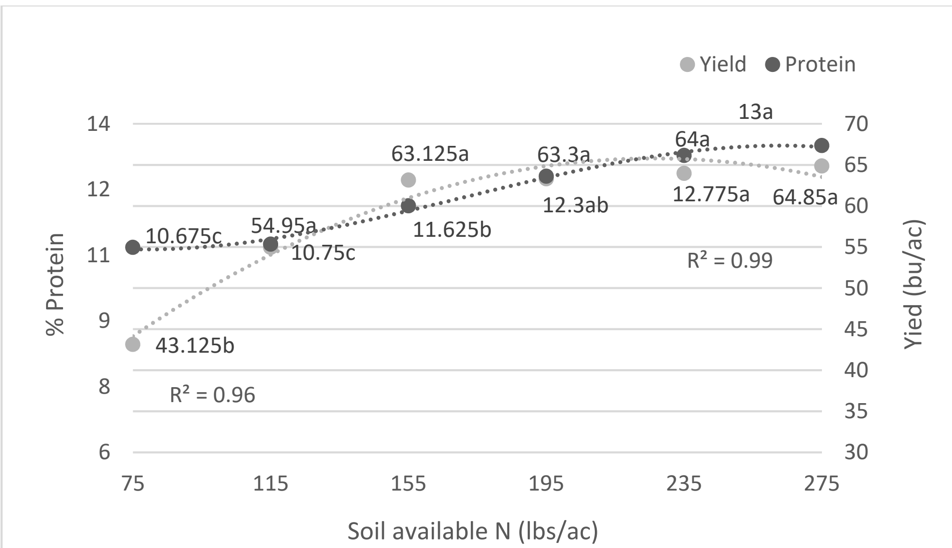



**Figure 2. Grain protein and yield response of wheat to N rates (Irrigated)**

Under dryland, where planting was on May 11, GS NDVI data collected on June 8 (≈ 4 to 5-leaf growth stage), June 13, and 25, did not correlate well with grain protein (Figure 3). But on July 6 (about the watery ripe stage) a significant correlation was observed, where about 57% ($R^2$ = 56.67) of the variation in grain protein could be explained by the NDVI. Grain protein relationship to either UAV-RE or UAV-NDVI was weak for all the three sensing dates starting on June 13, and again on June 26, and July 2.

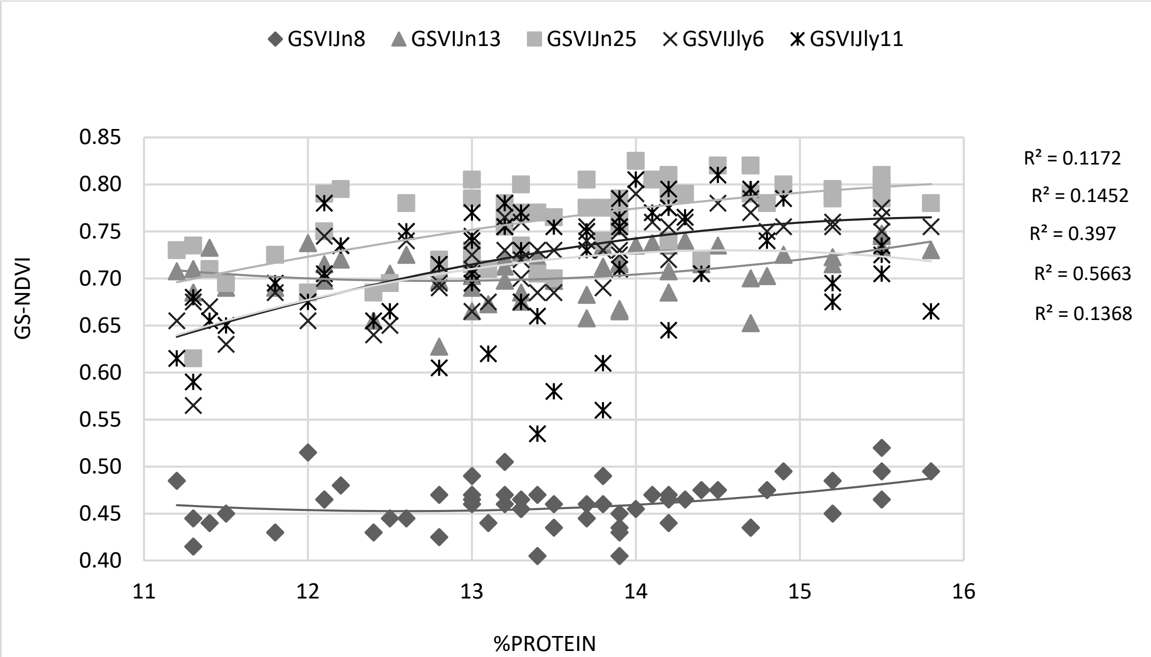



**Figure 3. Relationship between wheat grain protein and GS NDVI at different sensing dates (dryland)**

At the irrigated site, where planting was on May 24, GS NDVI taken on July 6 (at boot swelling) had a good correlation with grain protein, explaining 59% of variation in protein. NDVI and protein relationship was weak on June 25 (6 leaves), and July 11. Meanwhile, protein correlated well with NDVI and NDRE from Crop Circle (CC) at the watery ripe stage on July 11 and two days later, with the UAV NDVI and NDRE (all giving $R^2$ values between 0.56 and 0.59).

Dryland wheat flag leaf N was not different between the check and higher N rates, but increased with N rates under irrigation. Grain protein was enhanced by N application at post-anthesis.

**Summary**

NDVI or NDRE from the sensors showed some positive correlation with grain protein of wheat. Good correlations between protein and sensor indices were observed only after the 5-leaf stage, when it is recommended for any practical mid-season application of N to boost yield of spring wheat. The strength of the relationship was not different between grain protein and Red Edge or between grain protein and NDVI.

## Black and Navy Bean Seed Yield with Row Spacing and Plant Population

*Greg Endres, Hans Kandel, and Mike Ostlie*

A field study, partially funded by Northarvest Bean Growers Association, was conducted to examine the response of black and navy bean to row spacing and plant population. ‘Eclipse’ black and ‘Avalanche’ navy bean were planted in 14-, 21- and 28-inch rows at 100,000, 125,000 and 150,000 pure live seeds (PLS)/acre at Carrington in 2014 and 2016-17. The research continued with black bean in 2018 with slightly lower planting rates. In addition, the two dry bean market classes were planted at the three planting rates at Park River in 2014, and Prosper in 2014 and 2016-17. Averaged across four years and plant populations at Carrington, black bean yield was statistically similar among row spacings (Table 1). Yield tended to improve with 21-inch rows compared to the 14- and 28-inch rows.

**Table 1. Black bean seed yield with row spacing[1], Carrington, 2014 and 2016-18.**

| Row Spacing | Seed Yield (4-year average) |
| --- | --- |
| inch | lb/ac |
| 14 | 1,880 |
| 21 | 2,150 |
| 28 | 1,980 |
| LSD (0.10) | NS |

[1]Variety = 'Eclipse'. Averaged across three plant populations.

Averaged across eight site-years and three rows spacings, black bean planted at the low, medium and high rates produced 99,100, 118,500 and 140,700 plants/acre, respectively (Table 2). Yield increased three percent with the high- versus low-plant population. The intermediate plant population was statistically similar to the high plant population.

**Table 2. Black bean seed yield with plant population, North Dakota, 2014, 2016-18 (8 site-years)[1].**

| Planting Rate | Plant Population | Seed Yield |
| --- | --- | --- |
| PLS/acre (x1000)[2] | number/acre | lb/acre |
| 95-100 | 99,100 | 2,290b |
| 120-125 | 118,500 | **2,330a**b |
| 145-150 | 140,700 | **2,360a** |
| LSD (0.15) | x | 55 |

[1]Variety = 'Eclipse'. Trial locations: Carrington (2014, 2016-18); Prosper (2014, 2016-17); and Park River (2014). Averaged across three row spacings at

[2]PLS = pure live seed.

[ab] Values followed by different letters are signficantly different at $P<0.05$.

Averaged across three years and row spacings at Carrington, navy bean planted at the low, medium and high rates produced an average of 92,600, 116,800 and 139,800 plants/acre, respectively. Navy bean seed yield differed statistically among row spacings and plant populations (Table 3). The greatest yield was achieved with 14-inch rows plus the intermediate and high plant populations.

**Table 3. Navy bean seed yield with row spacing and planting rate, Carrington, 2014, 2016-17 (3 site-years)[1].**

| Row Spacing | Planting Rate (PLSx1000/acre)[2] | | |
|---|---|---|---|
| | 100 | 125 | 150 |
| Inches | Seed Yield (lb/acre) | | |
| 14 | 2580bc | **2660a**b | **2790a** |
| 21 | 2470cd | 2340d | 2340d |
| 28 | 2010e | 2070e | 2120e |
| LSD (0.10) | | 160 | |

[1]Variety = 'Avalanche'.

[2]PLS = pure live seed.

[ab] Values followed by different letters are signficantly different at P<0.05.

In summary, study results indicate that black bean seed yield improved with plant populations greater than 115,000 plants/acre. Narrow (14 inch) rows plus plant population greater than 115,000 plants/acre provided the highest navy bean yield.

**Dry bean planting and in-furrow application of fertilizer (left).**

## CREC Pollinator Project: 2018 Update

*Mike Ostlie, Janet Knodel, and Patrick Beauzay*

Most are aware that insect pollinators, like bees, have a positive effect in agriculture. Yet, there is so much we don't know about their behaviors and preferences.

In 2018 a major research effort was initiated to understand the impact of insect pollinators on agriculture from three perspectives; 1) honeybee visitation and honey production, 2) native pollinator habitat and visitation to crops, and 3) the effect of honeybees and native pollinators on crop yields.

These efforts will be ongoing for the next several years, but there are a few things we've learned in the first year alone.

Hive scales and pollen traps being installed at the CREC.

**Honeybee honey production**. Four beehives were equipped at the CREC with specialized equipment this season. Two hives were equipped with a scale to record honey production and two were equipped with a pollen trap. The pollen trap will enable us to identify which crops the bees are visiting throughout the season. We will do that through analyzing the DNA found in the pollen, in conjunction with the USGS Northern Prairie Wildlife Research Center in Jamestown, ND. The goal of this analysis is to determine what the bees are foraging during the growing season. At the CREC, we grow numerous flowering crops including field peas, lentils, chickpeas, soybeans, dry edible beans, flax, buckwheat, sunflowers, canola, cover crops, and a number of others. If we can align our flowering period with positive or negative pollen hits on some of these crops, we will know what the bees prefer, or whether they forage on some of these crops period. Those results will be available in spring 2019. Figure 1 represents the daily weight changes of one of the bee hives at the CREC. Not surprisingly, late July and early August saw the most rapid increase in honey production, with one July day surpassing a 5 lb increase. That's a lot of honey!

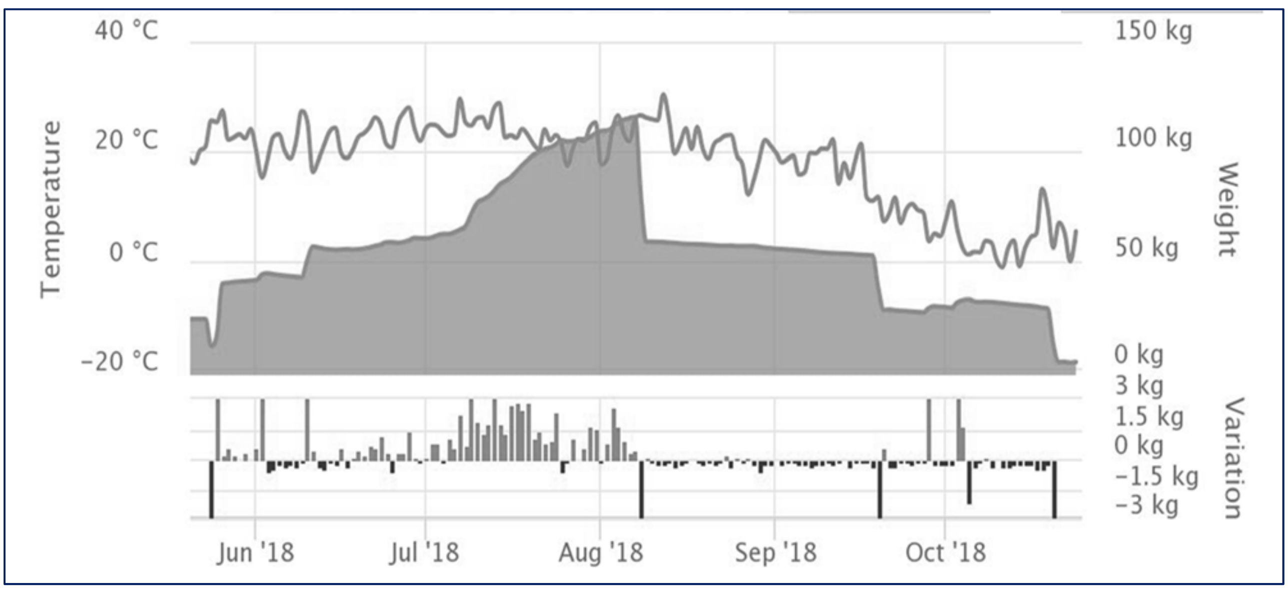



**Figure 1. Daily honey production during the 2018 growing season. Large dips indicate box removal from the hive (honey harvest).**

**Native pollinator visitation**. One conservation practice that is gaining a lot of attention is pollinator habitat planting. In theory this sounds like a good synergy between production agriculture and wildlife preservation. Our main objective is to identify if and how pollinator plantings can be integrated into farming operations. For large scale adoption, a pollinator planting must be easy to establish and easy to maintain. We have started exploring some of these aspects through our own experiences. We are trying to identify a mix of plant species that will emerge the first time it's planted, be competitive with weeds, and be attractive to wildlife. These are lofty goals, but failure to meet these goals means failure of broad appeal.

Precision agriculture plays a key role in the success of future pollinator plantings. Through field mapping (UAV images, yield maps, etc.), low/no productivity areas can be delineated. These areas could instead be repurposed for conservation plantings which may include pollinator habitats. While honeybees can be strategically located to maximize their effectiveness, some native pollinators may only travel a few hundred feet to forage, making placement of habitat extremely important. If native pollinators were found to increase crop yields, this strategy could provide a boost to net yields, even while decreasing farmed acres.

**The effect of honeybees and native pollinators on crop yields**. It is recognized that honeybees increase productivity in many agricultural crops. It is also recognized that bees of all types visit many of our agricultural fields, even in self-pollinated crops like soybeans and wheat. The related questions we are investigating include 1) which species are present and visiting our fields and 2) can pollinators increase crop yields if we managed for them. In 2018 we had one field trial established to begin addressing this. The first crop chosen was flax. Flax flowers profusely but there is mixed evidence about whether bees can increase yield or quality. Our study consisted of three flax varieties with plots being covered with bee exclusion netting or not. The study was conducted in Carrington and Fargo. To identify the visiting insects, traps were set in the flax for one day per week for three weeks during bloom.

Flax yield and test weight were not affected by including insect pollinators in 2018 (Table 1). The only yield differences were between specific varieties. Flax is largely self-pollinated so it is not too surprising to find no yield differences between insect treatments. The study was still able to uncover useful information. For instance, at the Fargo location no bees were observed in the traps, but butterflies were present. There were a number of pollinating insects observed at the Carrington location, including many bee types and butterflies. However, no honeybees were identified in the traps, even with beehives located within a mile of the location. Since it is only a single year of observation, we cannot yet say that honeybees don't visit flax, but it is discouraging evidence for beekeepers.

**Table 1. Performance of three flax varieties as affected by pollinator exclusion.**

| Variety | Insect presence | Begin Bloom | PM | Test Weight | Yield |
|---|---|---|---|---|---|
| | | days | days | lb/bu | bu/ac |
| Omega | Exclusion | 49.8 | 83.3 | 52.2 | 21.5 |
| Carter | | 50.8 | 83.5 | 52.2 | 20.8 |
| Prairie Thunder | | 50.5 | 83.0 | 52.2 | 28.5 |
| Omega | Inclusion | 49.5 | 82.0 | 52.2 | 20.6 |
| Carter | | 50.8 | 84.5 | 52.1 | 20.3 |
| Prairie Thunder | | 50.8 | 82.8 | 52.1 | 26.4 |
| Mean | | 50.3 | 83.2 | 52.2 | 23.0 |
| LSD (0.05) | | 0.6 | 2.3 | NS | 5.0 |

Future research with this project will include continued work with flax and dry edible bean yields in relation to pollinators. It will also include more work into the integration of wildlife habitat in production agriculture, and a closer look at honey production.

# Sulfur Effects on Two Varieties of Malting Barley Grain Yield and Quality

*Jasper M. Teboh, Blaine G. Schatz, Szilvia Yuja, Mike Ostlie, and Tim Indergaard*

## Introduction

Sulfur deficiency in crops has become more widespread in the past 20 years, following reductions in land deposition of atmospheric $SO_2$ (sulfur dioxide) and lower sulfur (S) content as impurities in pesticides. While more extensive research has been conducted to examine the effect of S fertilization on other major crops like corn, wheat, and soybeans in North Dakota, barley has gained limited attention. Because grain protein is the most important quality component of malting barley, where <12% is preferred, and >13% is a serious grain quality defect, the amount of N fertilizer recommended to enhance yields can sometimes be less than adequate to optimize yields because higher amounts can increase grain protein above the desired quality levels. Some farmers anecdotally believe that high residual soil S can significantly enhance grain protein, and therefore lower grain quality. But it is also probable that S enhances grain yields which often may cause dilution, and therefore lower grain protein as has been seen in some wheat studies.

## Objectives

1. Investigate yield and grain quality response to S of two commonly grown malting barley varieties (ND Genesis and Tradition) in North Dakota.
2. Determine if any sulfur effects on barley differ between soil N levels.

## Methods

The trial was conducted at two sites: - the NDSU Carrington Research Extension Center and on a farmer's field near New Rockford. At CREC, flax was the previous crop, soil residual N was 39 lbs N, and SOM was 3.4%. At New Rockford, soybean was previous crop, soil N was 38 lbs, and SOM was 3.1%. Two varieties of malting barley - ND Genesis (two-row), and Tradition (six-row), were evaluated on their yield and grain quality response to four S rates at 0, 10, 20, 30 lbs S/ac applied as ammonium sulfate. These were applied in all combinations with N at 0, 30, and 60 lbs at CREC, and 30, 60, and 90 lbs/ac at New Rockford. An additional 0 lb N rate at 10 lbs S was included at the New Rockford site, to verify if yield would be improved by N at same rate of 10 lbs S. Treatments were replicated four times. Data collected and reported were grain yield, protein, plump and thin.

## Results and discussion

At CREC, yields were significantly different between varieties. Tradition produced 59 bushels, 6 bushels more than ND Genesis. Meanwhile, there was an interaction effect of S and N on yield, which implies yield differences between N treatments depended on the level of S applied. When no N was applied (check), the crop yields were low, with the lowest registered for all S treated plots (Figure 1). Meanwhile, at 30 lbs N (where the crop also suffered from N deficiency), the lowest yield was at 30 lbs S, followed by no S. No evident trend of S effect was observed at 60 lbs N. These results seem to suggest that application of a high rate of S to an N-deficient barley crop could lower yields. Mean grain protein levels among fertilizer rate or variety treatments were <12.5%. Grain protein was significantly greater for Tradition (11.38%) than ND Genesis (10.44%). Protein was not affected by S. Differences were significant only between the check and 60 lbs N. Neither plump nor thin were affected by N or S rates.

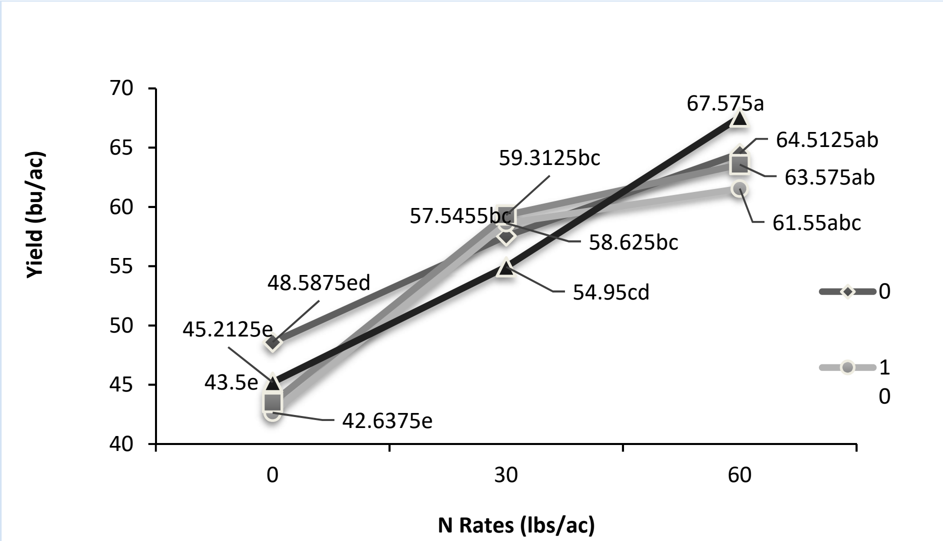



**Figure 1. Interaction of grain yield of barley in response to sulfur at three N rates (CREC site).**
([ab] Values followed by different letters are significantly different at P<0.05.)

At New Rockford, yield differences due to S response were observed between 0 lbs S and 20 lbs S (Figure 2). Yields were not different between varieties (86.5 bushels each), nor between N rates, except between the check (0 lbs N) versus 60 and 90 lbs N. Unlike at CREC, where flax (a non-legume) was the previous crop, N contribution due to soybean effect (contributing an N credit of about 40 lbs according to the N fertilizer recommendations in ND), and probably high N mineralization from soil organic matter contributed towards yields at 30 and at 60 lb N rates. Tradition produced significantly greater grain protein (13.2%) and plump (244.7%) compared to 11.28% protein and 241.6% for plump by ND Genesis.

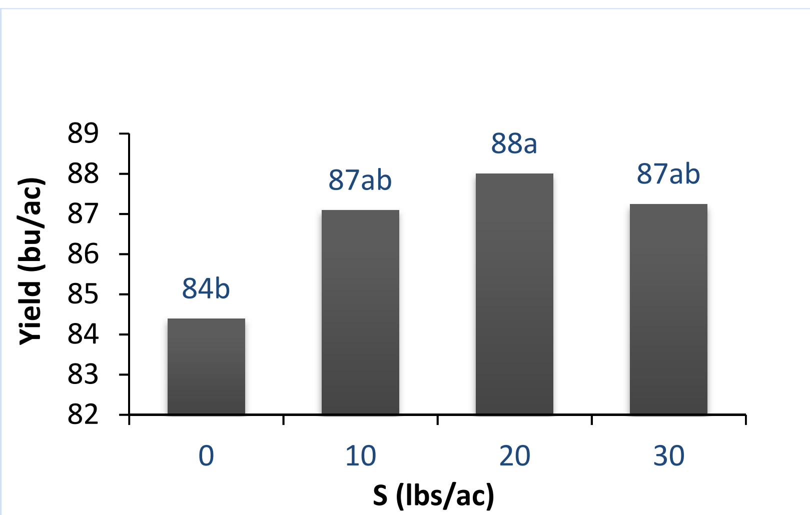



**Figure 2. Yield of barley averaged across two varieties and N rates in response to sulfur (South of New Rockford).**
([ab] Values followed by different letters are significantly different at P<0.05.)


**Summary**
Yields were improved by sulfur application at New Rockford. At Carrington, yields seemed to have been negatively affected by S when barley was severely deficient in N. Tradition had better yields at Carrington, and plump at New Rockford. The grain protein of Tradition was greater at both sites for ND Genesis, which could pose risk of poor quality grain for Tradition if N rates were higher. There was no evidence that the two varieties differed significantly in their response to S.

# Barley Yield and Grain Quality Effects of the Spatial Soil Variability of a Field in Carrington

*Szilvia Yuja and Mike Ostlie*

Barley that is sold for malting must meet strict quality requirements. Using the right management practices like applying the correct rate of fertilizer, good timing of pesticide application, and timing of harvest, can be controlled. Some things like the weather, and the properties of the soil inherent in your field create variability that can supersede management practices. Virtually all fields have some variability in soil properties. Some of it is due to topography and some is due to other soil forming processes. Yield monitors are excellent tools to show these variabilities and where the problem areas might be. Homogeneity of grain quality is important to brewers because grains of differing quality will behave differently during the malting process. With continuous innovations in precision ag, it is now becoming realistic to adjust our management every few feet within a field. For this reason, it may be helpful to identify the soil properties most influential to barley yield and quality.

We have been conducting a barley trial for three years where the trial area falls on an elevation gradient. We did this to be able to apply treatments at different soil health and fertility conditions within the same field. The difference in elevation from the lowest to the highest point is only about 4 feet, yet it was observed that yield is greatly reduced on these little hill tops. Much of the trial area did not receive any treatment, therefore crop outcome would have been the direct result of location. This article discusses observations related to untreated areas only. The trial was established on the same plots in 2016 and 2018, and we have comprehensive soil data from that area. Grain protein and plumpness from untreated plots was only available in 2018.

Based on past observations of crop growth, we assumed that soil fertility would have some correlation to the micro elevation of each point in the field. This was true for some values, like organic matter or pH which followed the contours of the land very closely. For example organic matter correlated well with both elevation and yield (Figure 1). However we noticed that there comes a point on the slope where differences in crop growth become very noticeable compared to the rest of the area. Upon testing soil cores with drops of hydrochloric acid, we found that the transition between a very noticeable fizz to not seeing any reaction at all is abrupt. Carbonates detected around the top of the knoll were noticeably affected by elevation change (Figure 2). The soil data also shows that the calcareousness of the soil has a strong influence on both yield and grain quality above a certain level. Calcium carbonate equivalent (CCE) is the measure of the acid neutralizing capacity of a material relative to calcium carbonate and is expressed as a percentage, where pure calcite is a 100%. The sub-soil in the vicinity of Carrington is high in carbonates. The knoll in question seemed to have lost most of its top soil. Soil loss from a knoll or small hilltop is a natural process that can be exacerbated by frequent tillage. In 2018 and 2016 yield had a strong negative correlation with CCE values above 2%. Below 2% there was no significant effect (Figure 3 and 4). Similarly protein also had a strong positive relationship above 2% (Figure 5). Plumpness correlated negatively with CCE at that level (Figure 6). Both the high pH and the presence of carbonates inhibits phosphorus and micronutrient availability to the plants such as zinc, copper and iron. It is interesting to note that these more calcareous spots also had much higher residual nitrogen which positively correlated with CCE. Bulk fertilizer that was applied in the previous years has likely not been completely removed by the crops due to low yield potential, and the dry weather of recent years did not allow for significant leaching losses. Residual nitrogen correlated negatively with grain plumpness and positively with grain protein. Both of these correlations were much weaker than what the CCE values had with grain quality measures. From this we can infer, that while a higher nitrogen level in the soil may not have been at fault for lower grain plumpness, it also didn’t help. For this reason, it would be advisable to limit nitrogen inputs on these calcareous eroded knolls.

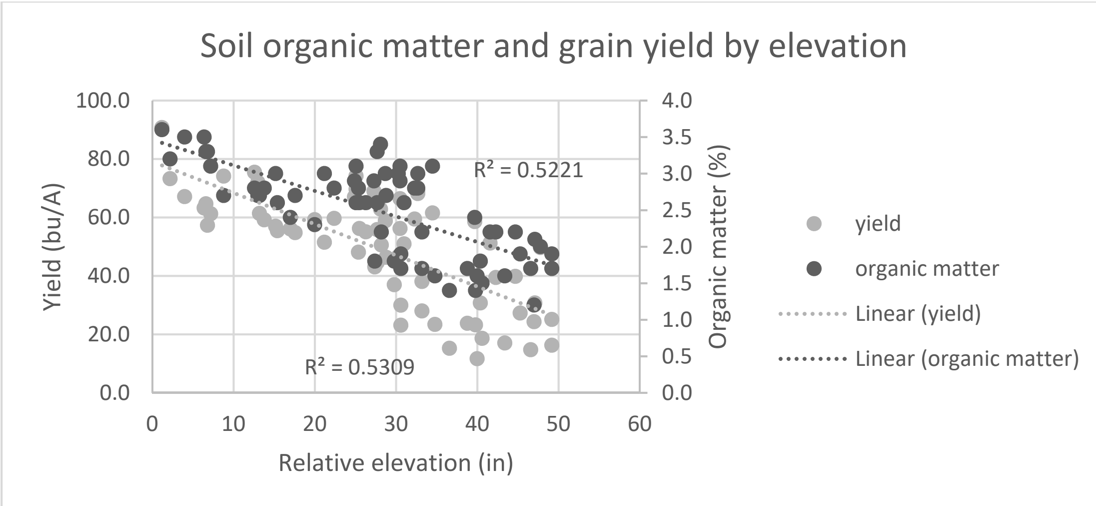



**Figure 1. Soil organic matter content and barley grain yield by elevation relative to the lowest point.**

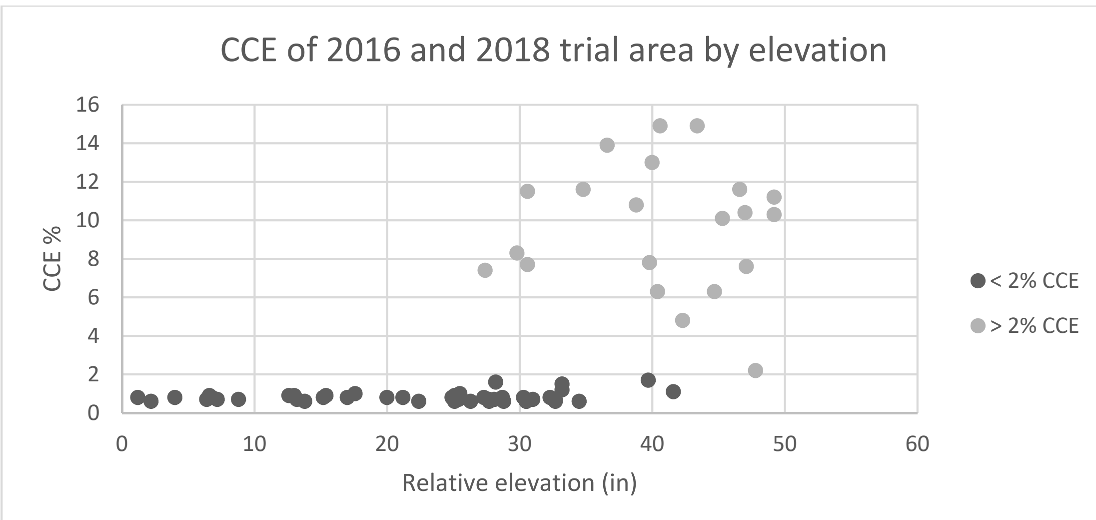



**Figure 2. Calcium carbonate equivalent of soil from the 2016/2018 trial area by elevation relative to the lowest point.**

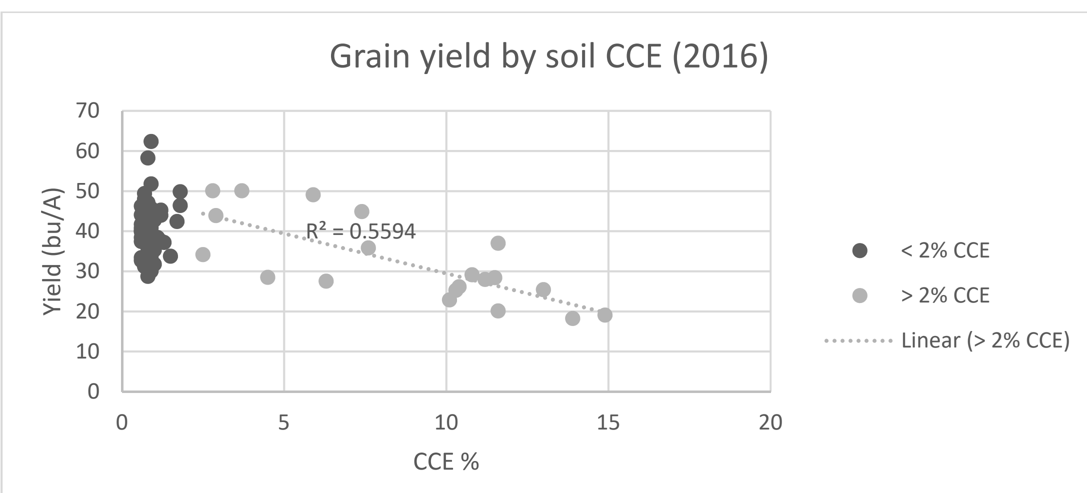



**Figure 3. Barley grain yield by calcium carbonate equivalent levels of soil in 2016.**

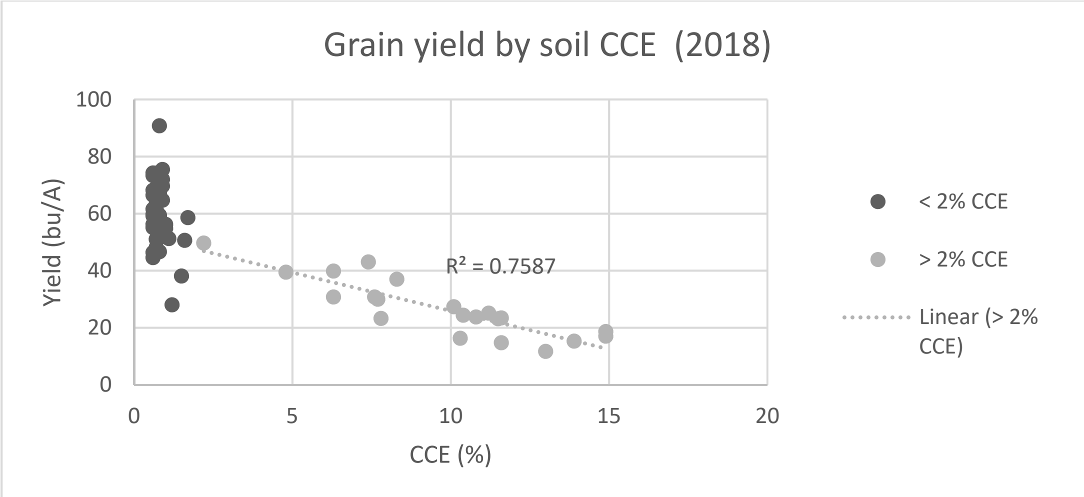



**Figure 4. Barley grain yield by calcium carbonate equivalent levels of soil in 2018.**

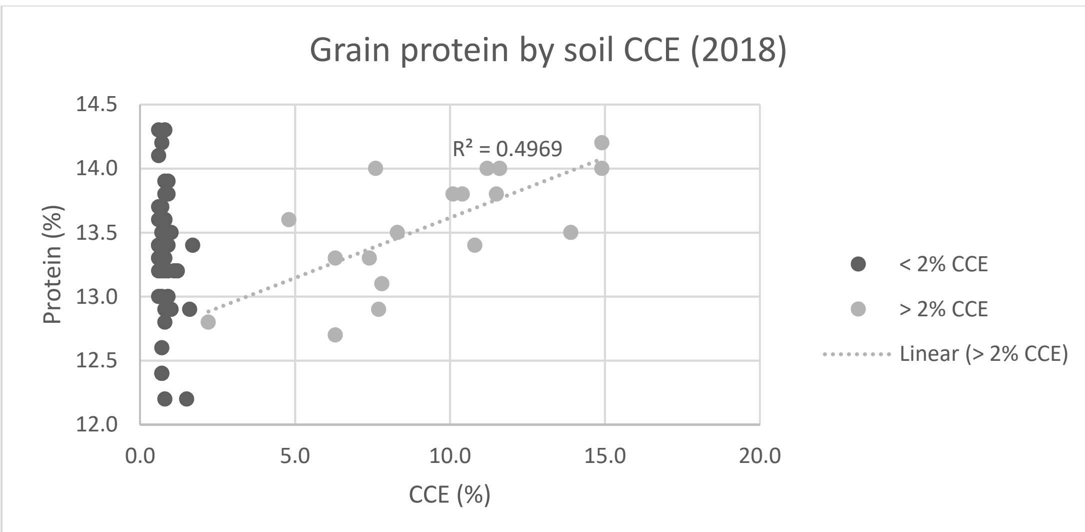



**Figure 5. Barley grain protein by calcium carbonate equivalent levels of soil in 2018.**

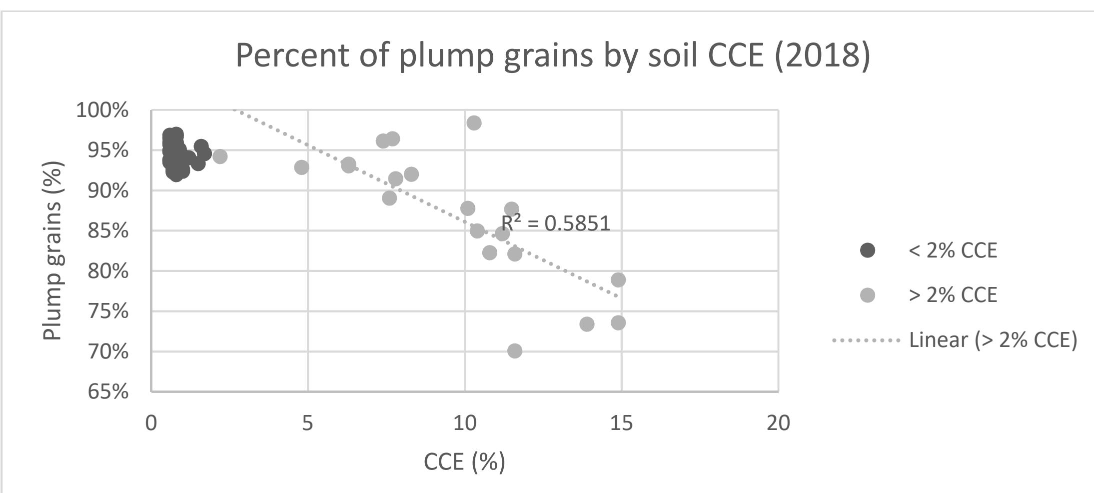



**Figure 6. Percent of plump grains by calcium carbonate equivalent levels of soil in 2018.**

With the advent of new technologies in the field of precision agriculture it will soon become possible to manage problem areas differently than the rest of the field. In our case it could be used to limit nitrogen use, and increase phosphorus and micronutrients. In other cases management can be tailored to saline spots. In any case a producer could, in theory create a soil map of his field and use that data for management purposes for many years to come. Also, given the yield limiting effect of high carbonate content in the soil, it could be important to map CCE in the field, even though it is typically ignored in soil tests.

## Intercropping Organic Peas and Oats for Forage

*Steve Zwinger and Steve Schaubert*

Intercropping is the practice of growing two or more crops together at the same time in the same field. The idea is to find combinations of plants that complement each other or perform better than when planted alone. Intercropping can lead to increased yield and quality compared to mono-cropping. Two types of intercropping are to grow them for grain /seed harvest or to grow them for biomass/forage harvest. Grain harvest can be more challenging, particularly if seed separation is desired, compared to harvesting them together for forage. Other important considerations for intercropping include proper seeding rate/plant density for each component of the mix and variety selection to match maturity dates.

The CREC has trialed numerous pea/oat forage combinations over the years on conventional plot ground. This practice has proven to increase yield and quality of the harvested forage. These two plants grow well together and can complement each other in the production system. Agronomic benefits from this mix include the oats providing support for the pea with the pea providing nitrogen.

A field trial to examine organic intercropping of pea/oat forage was conducted this past growing season at the CREC. The trial objective was to examine pea types along with various seeding rate combinations of pea/oat intercrops in an organic environment. The trial evaluated two pea types, Banjo, a semi-leafless pea, and Protecta, a leafy type field pea. Both of these pea varieties were developed for bio-farming or organic agriculture. Jury was used for the oat variety in this trial. The trial also evaluated various seeding rates or plant densities of the intercrops. The sole rates and the 100% intercrop rates were set at 1,250,000 PLS/ac for the oats and 350,000 PLS for the peas. Table 1 lists the rates used for all of the treatments in PLS per acre along with the plants per square foot for each treatment.

**Table 1. Seeding rates for sole and intercropped treatments.**

| | |
|---|---|
| Sole oats and oat 100% intercrop | = 1,250,000 PLS/ac or 28.7 PLS sqft |
| Sole peas and pea 100% intercrop | = 350,000 PLS/ac or 8.0 PLS sqft |
| Oat 75% intercrop | = 937,500 PLS/ac or 21.5 PLS sqft |
| Pea 75% intercrop | = 262,500 PLS/ac or 6.0 PLS sqft |
| Oat 50% intercrop | = 625,000 PLS/ac or 14.3 PLS sqft |
| Pea 50% intercrop | = 175,000 PLS/ac or 4.0 PLS sqft |

The field trial was planted on May 3 on ground that was previously cropped to einkorn. Peas and oats were sown at the same time with a row spacing of 7”. Peas were inoculated with an OMRI-listed peat-based rhizobia inoculant prior to planting. Stand counts were taken on May 24 to determine plant densities of the seeding rates used. The trial was harvested on June 27 with the oats in the early milk stage and peas in the flat pod stage.

Results gathered show significant differences in forage yield amongst the treatments. Intercropping peas and oats increased forage yield compared to sole treatments of either peas or oats. Intercropped treatments at the highest seeding rates, 100 and 75%, significantly increased forage yield compared to the sole treatments of peas and oats. Protecta pea yielded significantly more than Banjo pea in the sole treatment and in the 50% intercrop treatment. Although the yield differences were not significant with other intercrop treatments, Protecta increased forage yield across all treatments compared to Banjo pea, demonstrating that differences exist between pea varieties. Yield data gathered also show that plant density is important for the performance of this intercrop combination. As plant density was increased, forage yield also increased, indicating that higher densities of the intercrop are needed to maximize forage production.

**Oat-Pea Intercropping Forage** — **Carrington**

| Forage Treatment | Oat Stand | Pea Stand | Days to Oat Head | Days to Pea Bloom | Oat Height | Pea Height | Harvest Moisture | Forage DM Yield |
|---|---|---|---|---|---|---|---|---|
| | sq ft | sq ft | | | inch | inch | % | ton/ac |
| Jury | 26.4 | . | 53.8 | . | 32.4 | . | 74.3 | 1.43 |
| Banjo | . | 7.4 | . | 46.5 | . | 25.1 | 80.7 | 1.26 |
| Protecta | . | 8.5 | . | 45.5 | . | 30.8 | 82.0 | 1.55 |
| Banjo/Jury 100% | 25.0 | 6.8 | 53.5 | 47.8 | 32.8 | 19.7 | 77.4 | 1.74 |
| Protecta/Jury 100% | 23.4 | 8.3 | 53.5 | 46.0 | 33.4 | 23.0 | 77.6 | 1.85 |
| Banjo/Jury 75% | 18.6 | 5.7 | 53.8 | 47.5 | 33.5 | 19.7 | 76.4 | 1.73 |
| Protecta/Jury 75% | 18.9 | 6.0 | 53.0 | 45.5 | 34.9 | 20.9 | 77.9 | 1.72 |
| Banjo/Jury 50% | 11.2 | 3.3 | 54.8 | 47.5 | 31.3 | 20.7 | 77.2 | 1.33 |
| Protecta/Jury 50% | 13.0 | 4.6 | 54.8 | 45.5 | 32.1 | 21.6 | 78.3 | 1.56 |
| Mean | 19.5 | 6.3 | 53.9 | 46.5 | 32.9 | 22.7 | 78.0 | 1.57 |
| C.V. (%) | 11.4 | 14.7 | 0.9 | 1.8 | 6.4 | 11.2 | 1.2 | 9.2 |
| LSD 0.05 | 3.3 | 1.4 | 0.7 | 1.2 | 3.1 | 3.7 | 1.3 | 0.21 |

## Crop Rotation Effects on Corn with a Focus on Buckwheat as the Previous Crop

*Mike Ostlie, Eric Eriksmoen, Jasper M. Teboh, and Steve Zwinger*

Buckwheat is a specialty crop grown in North Dakota. It has long been used as a grain crop for non-gluten flour, noodles, and groats, while the hulls can be used for various purposes including pillow stuffing. Buckwheat is often used as a cover crop in mixes or alone. It establishes quickly, and can be very competitive with weeds. Buckwheat is also believed to increase available soil phosphorous (P) for the subsequent crop. Evidence for this has been documented in lab or greenhouse studies, but field research of the P effect from buckwheat has not occurred. Past research has shown that buckwheat could increase available P because it accumulates more P in the crop residue than it does the seed, which is fairly unique. Most crops will export more P (with high P content in harvested grain) than is retained in the field through residue.

In 2016 a large research project was initiated to test whether buckwheat as a previous crop can substitute or supplement a P application. The trial was initiated in Carrington and Minot. Sites were chosen for their likelihood of eliciting a P response, and no P was added to the sites during the experiment. This was a two-year trial, with year one consisting of either buckwheat (harvested for grain), spring wheat, soybeans, or sugarbeet, and year two consisting of corn as a test crop. Buckwheat was split into three plant population treatments of either 25, 50, or 75 lbs of seed/ac. The comparative crops were chosen based on differences in mycorrhizal association; Spring wheat > soybean > sugarbeet. Sugarbeets and buckwheat are not mycorrhizae hosts. Mycorrhizal fungi are often associated with P uptake in plants and are important to corn productivity. The trial was repeated once at each location. Year one for both sites was in 2016 and 2017, and year two (corn only) was in 2017 and 2018. Each treatment was replicated four times. Extensive soil and tissue sampling was conducted to determine P import/export rates and soil P balance. The focus for this report is the effect of the previous crop, including soil P balance, on corn.

Previous crop affected corn performance (Table 1). In all environments, corn yields and test weight were generally lower following buckwheat than wheat or soybeans. Corn performance also varied by buckwheat population. The high rate of buckwheat performed similar to soybean and sugarbeet as a previous crop, and the middle buckwheat rate was still similar to sugarbeet. The low rate of buckwheat caused corn yields to be lower than any other crop. When evaluating soil P and P found in crop residue, buckwheat and sugarbeets theoretically left the highest amount of P in the soil. Our testing confirmed that on a per acre basis, buckwheat was the only crop in this study that had a higher amount of P in the straw than in the grain. Soybeans had the highest percent export with nearly 10:1 lb P in the grain compared to straw. Yet, the P left in the buckwheat straw was not affecting corn yields, even under low soil P conditions.

**Table 1. Corn performance and predicted P amount as a result of previous crop in the rotation.**

| Previous crop[1] | Test Weight | Corn Yield | Predicted Phosphorous[2] |
|---|---|---|---|
| | | | ppm |
| Buckwheat 25 | 55.7 | 97.8 | 11.7 |
| Buckwheat 50 | 55.7 | 100.9 | 14.6 |
| Buckwheat 75 | 56.6 | 106.5 | 10.7 |
| Spring Wheat | 57.3 | 116.8 | 6.1 |
| Soybean | 57.0 | 111.1 | 4.9 |
| Sugarbeet | 57.1 | 109.2 | 9.7 |
| LSD (0.10) | 0.7 | 8.7 | 3.3 |

[1]25, 50, and 75 indicate the buckwheat seeding rate in lb/ac

[2]soil test P + P content in biomass from the previous crop in the rotation

**Terminating a buckwheat cover crop.**

There is a good chance that the lack of mycorrhizal association is the more important rotational effect compared to P export rates. This would explain why sugarbeet and buckwheat sometimes had a similar yield influence on corn. One of the goals of the study was to determine if P mining could be accomplished by using different buckwheat populations. In our study, the middle seeding rate theoretically left the largest contribution of P in the soil, yet the corn yield response was nil, even compared to the other buckwheat treatments. The reasons for lack of P response warrants further study, perhaps through mycorrhizal inoculation to corn or maybe a crop other than corn is best to utilize any extra P in the soil. Regardless, it appears that corn may not be a good choice to follow a buckwheat grain crop. Using buckwheat as a cover crop prior to corn may yield different results.

# How Much Does a Rye Cover Crop Deplete Soil Moisture - 2018 Research Results

*Szilvia Yuja and Mike Ostlie*

**Introduction**

Rye use for a cover crop prior to soybeans is a new trend that is being adopted in North Dakota. Rye makes up for a lot of weaknesses that soybeans have in a cropping system. Some of the primary benefits include reducing soil erosion, increased weed control, additional grazing/forage material, utilization of excess soil moisture by rye allowing soybean to be planted timely, and allowing soybeans to be planted further into former saline regions. The concept of this system is that winter rye is planted the fall before soybeans. The rye is terminated prior to or shortly after soybean planting. In the spring, prior to soybean planting, the rye is suppressing weeds, reducing wind and water erosion (after soybean planting too), and putting out roots and using water (in saline areas). Rye is best terminated with glyphosate.

Rye provides selective weed suppression, meaning that it is more effective against some species than others. Rye is particularly effective at suppressing kochia (up to 70% control in a heavy kochia infestation), and also does well against pigweed species, ragweed, and yellow foxtail. Rye has very little or no suppression of mint species (like lanceleaf sage), or most legumes. Thus, soybeans are not influenced by the presence of rye, except when moisture is limiting. We have seen in past studies that when soil moisture conditions are limiting and the rye is left growing too long, the soil profile can be depleted enough to seriously harm the soybean crop. In 2017 a producer came to us with the question that cuts to the heart of this issue. He simply asked: how much water is the rye using?

For this reason, in 2018 we started a trial that was designed to monitor soil moisture status in growing rye plots using a hydroprobe. This is an indirect method of monitoring crop water use because by themselves values obtained like this do not tell us what the cause of the change in moisture status is. In order to be able to attribute soil moisture depletion to crops we used rainfall data from the nearby NDAWN station and moisture data collected from bare ground plots scattered throughout the trial area. The data from the bare ground plots was meant to establish a baseline soil moisture status whose changes were affected only by climatic factors and soil physical properties. In this trial we had plots that were planted to rye or soybean only, and we also had plots where soybean was planted into growing rye, which was terminated at different dates.

For simplicity's sake and because we only have one year of data, detailed discussion of results are confined to the soil moisture changes attributable to rye in comparison with bare ground and soybean only plots.

**Description of trial area**

Bare ground at field capacity held 6.89 inches of water per 2 feet. Soil moisture at the end of season in soybean plots was 3.23 inches per 2 feet. It is safe to say that the soil profile was depleted of available water at that time by the soybean since the optimum soybean water use exceeds what our local climate can supply. The estimated field capacity and permanent wilting point volumetric moisture content values for a loam soil are estimated at 28% (6.72 in/2ft) and 14% (3.36 in/2ft) respectively (Saxton and Rawls 2006). These estimates are very close to the values obtained from our trial area.

**Rye crop water use**

At the first moisture reading in the spring, the soil under bare ground held 5.4 inches of moisture (22.5% volumetric water content) in the 2-feet soil profile. That corresponds to around 55% of the plant available water that the soil of that trial area is capable of holding. This means that we already started the spring with a moisture deficit. Rye plots were very similar in moisture status, because the rye was too young to significantly contribute to moisture depletion. Rye plots held 4.18 inches of moisture when the rye stopped using water. Rainfall during the rye growth period was 2.726 inches. The bare ground plots held 6.47 inches of water at rye maturity. Which means that 1.65 inches of water would have been lost from the profile despite the absence of crops. It is assumed that in the rye-planted plots some of the amount of water that was lost from the bare ground plots, due mostly to evaporation, would have been captured by the rye plants. For this reason, using bare ground as a reference and looking at starting and end points of the rye's life cycle can only give us a range of how much water the rye has used this growing season. On the low end, if we assume that all of the 1.65 inches of water that was lost from the bare ground plots was also lost from the rye plots we get a crop water use of 2.29 inches. On the high end if we assume that those 1.65 inches were entirely used by the rye, we get 3.94 inches of water use. So to sum it up our **rye used somewhere between 2.3 and 4 inches of water this year**. While we can only provide a range for the physiological crop water use of the plants with our methods, we can provide exact values regarding the soil's moisture status and plant-available water content. The maximum plant available water is the difference between how much the soil can hold at field capacity and how much water is held at the permanent wilting point, which is a value at which water is no longer accessible to the plants. There is a visual demonstration of the following results in Figure 1. **At the time when the rye had reached maturity and stopped using water, the soil had 26% plant available water. As a comparison, soybean plots at the same time had 76% and bare ground had 89%.** The soybean at that time was at the beginning stages of its growth. Ultimately soybeans depleted the soil much more than the rye, but peak water use didn't start for those plants until sometime after the rye growth period. On a wet year the rye and soybean can be allowed to grow together with no yield reduction. However in our graph we can see that 2018 was not such a year. Rye-planted plots maintained their water deficit throughout the season, well after the rye was harvested. There was a series of rain events around rye maturity that brought the bare ground areas up to field capacity but not the rye plots. This does not mean rye should not have been used as a cover crop this year. On the graph we can see that major crop water use of rye didn't start until soybean planting. Our yield data also showed that terminating at or before soybean planting did not significantly affect yields. This trial will run for at least another year, after which yield data will be reported in detail.

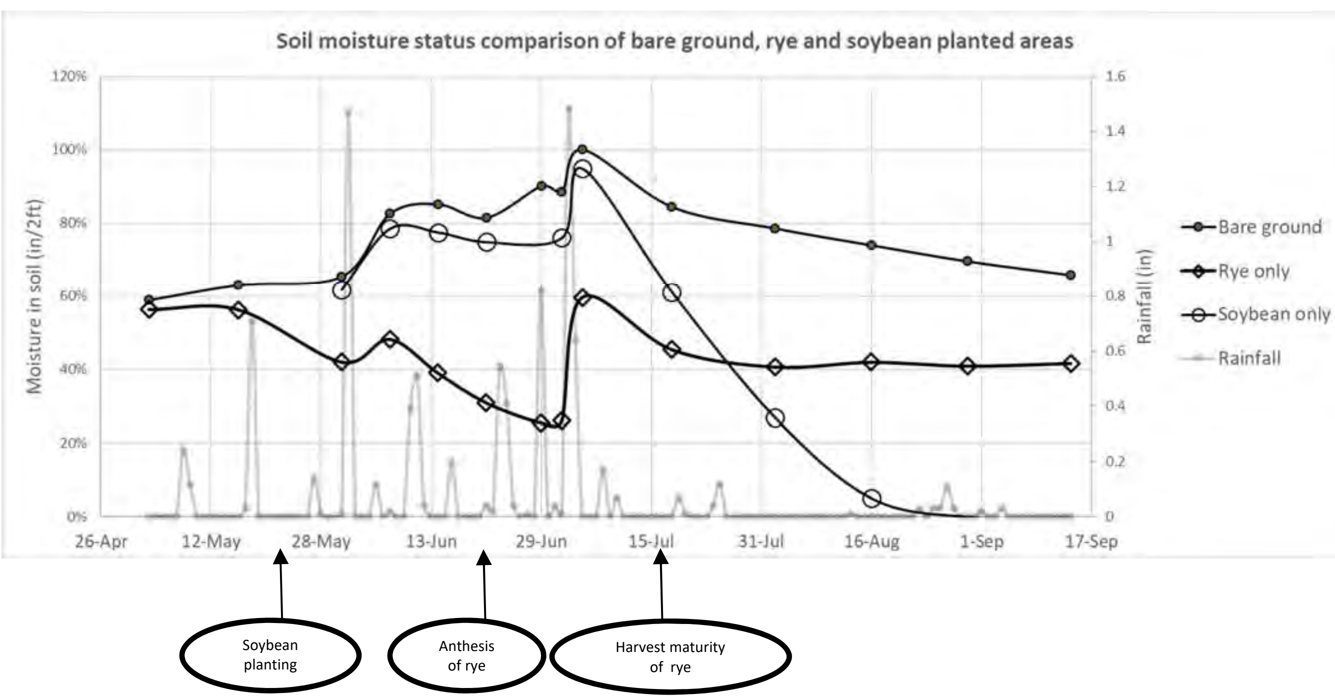



**Figure 1. Plant available water status comparison of bare ground, rye and soybean planted areas**

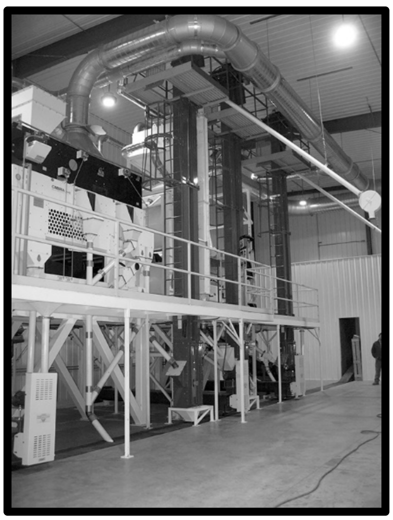
## Literature Cited

Saxton, K.E. and Rawls, W.J. (2006) Soil Water Characteristic Estimates by Texture and Organic Matter for Hydrologic Solutions. Soil Science Society of America Journal, 70, 1569-1578.

## New Seed Conditioning Facility Begins Operation

*Blaine G. Schatz*

In October of 2018, the Carrington Research Extension Center commenced operation of a new seed plant for cleaning and conditioning foundation-grade seedstocks produced by the CREC. The new seed plant replaces the original seed cleaning facility that was constructed in 1963. The foundation seed program of the CREC is part of the overall NDSU Foundation Seedstocks project. The overall project includes seed production and conditioning capabilities at the Agronomy Seed Farm and four Research Extension Centers. The CREC foundation seedstocks program produces and processes a large volume and diverse number of crops and crop varieties annually. In recent years, the program has conditioned 50,000 to 60,000 bushels of seed representing 27 to 35 different varieties among 8 to 12 different crops. Like all stages of foundation seed production, the plant is designed to facilitate the complete clean out of all seeds from all components before the next seedlot is processed. Foundation grade seed is highly pure seed that serves as parent seed for seedsman who wish to grow and sell certified seed as Registered or Certified class. The foundation grade seed produced and conditioned by the CREC is in demand by many constituencies ranging from the large commercial private seedsman of the state to individual farmers and emerging small business interests. In the past five years, the CREC has provided foundation seed to more than 325 different constituents.



The near completion of the new seed plant represents the culmination of more than ten years of effort to secure support for construction of this facility. The State Board of Agricultural Research and Education had ranked new seed cleaning plants at a number of locations among their capital project priorities for multiple legislative sessions. The 64th Legislative Assembly (2015 session) approved $750,000 from general funds and authorized up to $1.5 million from other funds for construction of seed cleaning plants at the Carrington Research Extension Center and the North Central Research Extension Center at Minot. In May of 2016, the SBHE authorized NDSU to proceed with the construction of a seed cleaning facility located at the Carrington REC utilizing the $750,000 from the state general fund and other funds.

The original plant has the basic capacity to process most crops at a rate of 30 bushels per hour. The cleaning equipment and components of seed transfer and distribution in the old plant were spread across five floors that presented worker safety challenges along with minimal capacity for dust control. The new plant is equipped to clean and condition seed at a rate of 300 bushels per hour across equipment aligned on a platform above ground level. The new facility incorporates worker safety features including effective dust control measures with a bag dust system. A programmable logic controller allows automation in start-up and adjustments among the many components of the seed processing line.

The new seed plant has been built in multiple phases, with each phase initiated as funds were available through the general fund appropriation, fund raising efforts and internal resources. Construction of the new seed plant began in the fall of 2016 with construction of the main building. In early 2017, the primary seed cleaning equipment was purchased and additional phases of construction have followed through the completion of the most recent phase that was installation of the dust control system early October. The foundation seed plant when fully complete will be capable of implementing five stages of seed conditioning depending upon the needs of the seedlot. The various processing stages in order are a vibratory pre-cleaner, air screen, indent separator, gravity table, and optical sorter. The first four stages are now fully operational and are being used to condition the 2018 production. The important capabilities provided by an optical sorter are not yet a component of the plants processing sequence. This equipment and its ancillary features will be installed in the future when adequate resources are available.

# 2018 Summary of Extension Integrated Pest Management (IPM) Field Survey in South-Central North Dakota

*Greg Endres and Brittney Aasand*

During the 2018 crop season, an IPM small grain, soybean and sunflower field survey was conducted by NDSU Extension, in cooperation with the North Dakota Department of Agriculture, to identify crop pest presence and agronomic factors. Use of the survey data includes farmer, crop adviser and ag industry education; support for exporting North Dakota crops; and reference for educational and research projects.

State IPM survey coordinators are Janet Knodel, extension entomologist; Patrick Beauzay, State IPM coordinator and entomology research specialist; and Sam Markell and Andrew Friskop, extension plant pathologists. Brittney Aasand, crop scout based at the Carrington Research Extension Center (CREC), surveyed 439 fields in 11 south-central counties: Burleigh, Dickey, Eddy, Emmons, Foster, Kidder, LaMoure, Logan, McIntosh, Stutsman, and Wells.

The small grain survey was conducted in 285 **spring and winter wheat,** and 23 **barley** fields during the last week of May through July, for 20 leaf and head diseases, and six insects. Primary diseases found during the survey were tan spot (wheat), bacterial leaf blight, Fusarium head blight (scab), net and spot blotch (barley), and ergot (wheat). Insects surveyed were grasshoppers, cereal aphids, cereal leaf beetle, wheat stem maggot and sawfly, and barley thrips.

The **soybean** survey was conducted in 100 fields from the last week of June through the first week of August to detect grasshoppers, soybean aphid, bean leaf beetle, and spider mites. Soybean aphids were first detected on July 23 but density per plant was very low throughout the scouting period. Thirty-two percent of the fields were grown on previous soybean ground. Twenty-seven percent of fields were grown in 30-inch rows; 24 percent were solid seeded; and the balance were in intermediate spaced rows (15 or 22 inch).

The survey included 31 **sunflower** fields inspected during the last week of June through the first week of August for grasshoppers, red sunflower seed weevils, downy mildew, sunflower rust, and verticillium wilt. Seed weevils were found in 7 of 31 fields. Downy mildew was found in 2 fields. Corn was the most common crop that preceded sunflower (68 percent of total fields) followed by wheat (32 percent).

Maps displaying summaries of the state survey results by crop and pest are available at the following website: www.ag.ndsu.edu/ndipm

**Crop scout, Brittney Aasand, places insect traps.**

Also, insect traps were placed in four **wheat** fields (CREC, Medina, McHenry, and Wishek area) to sample for two exotic insects (ND Dept. of Ag). Sunflower moth, banded sunflower moth (BSM) and *Cochylis arthuri* (CA) pheromone traps were located at the CREC during mid-June through the first 10 days of August to monitor the presence of these **sunflower** insects. BSM and CA were first detected in early July, while the sunflower moth appeared mid-July, and all moth types were present through the balance of the monitoring period. BSM had the highest trap counts. In addition, a Swede midge trap was placed in a CREC **canola** trial (NDSU Dept. of Entomology). Also, soil samples for nematodes were collected from 11 **wheat** fields (one per county) for the ND Dept. of Ag.

Details from the field surveys may be obtained by contacting the CREC.

## Northern-Hardy Fruit Evaluation Project: Highlights of Our Thirteenth Year

*Kathy Wiederholt*

The Northern Hardy Fruit Evaluation Project celebrated its 13th year at the Carrington Research Extension Center in 2018. The project brought information to over 1,100 people through tours, meetings, video conference programs and personal phone calls; in our 13 years we have reached approximately 11,800 people. We responded to five calls about starting orchards this year. In addition to constituents in North Dakota, calls came from Minnesota, Montana, Pennsylvania, Michigan, New Jersey and Rhode Island.

Fall 2017 was dry with no rain falling after September 26, although temperatures still averaged 60°F. Winter and spring 2018 were slightly below average for temperature. Summer temperatures were slightly warmer than average while the season's rainfall was 6.71" below average. Most of our summer rain fell between June 1 and July 3. Many areas of North Dakota received plentiful rain this season but the storms skirted Carrington.

Last year, our aronia aborted its crop due to drought stress. This year, some varieties had over 25 pounds of fruit per plant, which was more than the plants could ripen. The fruit was able to sweeten but much of it was small and of low quality due to high tannin levels. Of 455 pounds harvested, 132 pounds of larger fruit remained after screening to remove the small, poor quality, berries.

**Notable events in the fruit orchard:**

Because of the lack of rainfall, fruit-eating birds in the area moved on and did not cause crop losses in either juneberries or later haskaps.

Work continues to select Japanese haskap plants that hold their fruit better in windy conditions. We have 52 selections under evaluation, of which, 21 were planted in fall 2017 and 13 were new this fall. Fruiting will occur in 2020 and 2021.

The cherry shrubs were kept so that an NDSU graduate student could finish their project. The plants will be removed as soon as possible to decrease spotted winged drosophila numbers in the orchard.

Juneberry harvest was impacted by hot, dry, breezy weather. Veraison began June 25 and harvest began July 5. Fruit began to shrivel and fall within five days and we rushed to get the best berries off the plants. The late-ripening variety 'Smoky,' was picked July 11-12 and was discarded after weighing due to extreme 'raisining' of the fruit.

The fruit project manager attended the Midwest Aronia Association annual meeting in Omaha, NE. Through these contacts, we invited Dave VanderWerf, an Iowa aronia grower, to be the featured speaker at the 2018 Field Day fruit tour. In the afternoon, he lectured on aronia marketing.

One pear cultivar, 'Schroeder Hardy ND,' had fruit this year. The cultivar 'Ayers' is not winter hardy enough and will be removed. All the trees continue to be trained to widen their branch angles.

| Northern Hardy Fruit Project - Yearly Production Records | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | No. of plants | 2015 | | 2016 | | 2017 | | 2018 | |
| | | | Date | pounds | Date | pounds | Date | pounds | Date | pounds |
| **Aronia** | Nero | 4 | 31-Aug | 25.7 | 9/3-6 | 54.5 | 9/12-13 | 12.6 | 9/10-11 | 105.8 |
| | Raintree Seedling | 4 | 28-Aug | 17.8 | 2-Sep | 52.1 | x | x | 12-Sep | 70.3 |
| | Raintree Select | 4 | 1-Sep | 21.4 | 6-Sep | 60.0 | 9/13-19 | 7.4 | 8/31-9/5 | 94.2 |
| | Viking | 4 | 1-Sep | 19.7 | 9/2-7 | 63.2 | 12-Sep | 4.5 | 8/22-9/5 | 105.7 |
| | McKenzie | 4 | 2-Sep | 0.9 | 7-Sep | 42.0 | 11-Sep | 5.1 | 8/28-30 | 78.0 |
| | Galicjanka | 4 | | | 6-Sep | 3.6 | 5-Sep | 1.0 | 27-Aug | 29.0 |
| | | | | **85.5** | | **275.4** | | **30.6** | | **483.0** |
| | | | *Freeze, hail, wind - All* | | | | *Crop aborted* | | *Overcropped* | |
| **Hardy Cherries** | SK Carmine Jewel | 12 | x | x | 13-Jul | 93.1 | 19-Jul | 306.4 | 12-Jul | loss |
| | SK Crimson Passion | 12 | x | x | 13-Jul | 32.2 | 20-Jul | 129.3 | 13-Jul | loss |
| | | | | **0.0** | | **125.3** | | **435.7** | | **x** |
| | ***2014** - CJ crop apx. 7lb per shrub prior to Field Day tasting.* | | | | *Hail, SWD 70% loss* | | | | *All lost to SWD* | |
| | Evans / Bali | 3 | x | **0.0** | 19-Jul | **17.3** | 8/1-2 | loss | 7/20 | loss |
| | *Reduced to 2 trees in 2013* | | | | *Hail, SWD 70% loss* | | *SWD infested (all)* | | *SWD infested (all)* | |
| **Black Currant** | *Ben Sarek* | 12 | x | x | x | x | *Removed* | x | *Removed* | x |
| ***Variety Trial*** | *Black Down* | 16 | x | x | 7/22-28 | 36.7 | x | x | x | x |
| | *Hilltop Baldwin* | 16 | x | x | 25-Jul | 17.5 | *Removed* | x | *Removed* | x |
| | *Swedish Black* | 11 | x | x | 15-Jul | x | *Removed* | x | *Removed* | x |
| | *Titania* | 15 | x | x | 25-Jul | 20.1 | x | x | 18-Jul | 2.6 |
| | *Whistler* | 12 | x | x | 7/27-28 | 53.0 | x | x | 7/31 | 6.3 |
| | | | | **0.0** | | **127.3** | | **0.0** | | **8.9** |
| *Whistler replaced Ben Sarek 2011* | | | *Freeze, hail, wind - All* | | *Hail, SWD ≥50% loss* | | *Pruned out bearing canes* | | *Recovery year* | |
| **Black Currant** | *Blackcomb* | 15 | | | 1-Aug | 6.3 | 31-Jul | 67.2 | 7-Aug | 60.9 |
| ***New*** | *Cheakamus* | 15 | | | 28-Jul | 6.7 | 28-Jul | 79.7 | 31-Jul | 79.8 |
| ***Variety Trial*** | *Stikine* | 15 | | | 1-Aug | 0.1 | 26-Jul | 115.4 | 7/18-24 | 52.2 |
| | *Tahsis* | 15 | | | 28-Jul | 2.8 | 26-Jul | 77.6 | 26-Jul | 83.5 |
| | *Tiben* | 15 | | | 1-Aug | 3.8 | 8-Aug | 88.0 | 6-Aug | 82.2 |
| | *Tofino* | 14 | | | 10-Aug | 3.0 | 8/1-4 | 45.9 | 8-Aug | 14.3 |
| | *Nechako -2 ft space* | 7 | | | 15-Aug | 2.5 | 11-Aug | 21.5 | 9-Aug | 12.7 |
| | *Nechako -3 ft space* | 7 | | | 15-Aug | 3.5 | 11-Aug | 26.6 | 9-Aug | 18.6 |
| | | | | | | **28.7** | | **521.9** | | **404.2** |
| *Whistler replaced Ben Sarek 2011* | | | | | *hail, SWD ≥50% loss* | | *some SWD* | | *some SWD* | |
| **Black Currant** | Ben Lomand | 4 | x | x | 26-Jul | 8.3 | x | x | 25-Jul | 4.9 |
| | Blackcomb | 4 | x | x | 26-Jul | 21.4 | x | x | 1-Aug | 17.6 |
| | Champion | 4 | x | x | 26-Jul | 6.7 | x | x | 25-Jul | 11.5 |
| | Consort | 4 | x | x | x | x | x | x | x | x |
| | Minaj Smyriou | 4 | x | x | 26-Jul | 3.2 | x | x | 18-Jul | 5.5 |
| | | | | **0.0** | | **39.6** | | **0.0** | | **39.5** |
| *Blackcomb replaced Consort 2011* | | | | | *hail, SWD ≥50% loss* | | *Pruned out bearing canes* | | *Recovery year* | |
| **Red Currant** | Jhonkheer Van Tets | 4 | x | x | 21-Jul | 42.9 | 21-Jul | 46.1 | 25-Jul | 3.2 |
| | Red Lake | 4 | x | x | x | x | 21-Jul | 18.4 | removed | removed |
| | Redstart | 4 | x | x | x | x | x | x | *SWD* | x |
| | Rosetta | 4 | x | x | 26-Jul | 20.9 | 3-Aug | 70.5 | *SWD* | x |
| | Rovada | 4 | x | x | 27-Jul | 52.3 | 31-Jul | 83.6 | 7/25-8/1 | 12.4 |
| | | | | **0.0** | | **116.1** | | **218.6** | | **15.6** |
| | | | | | *SWD loss* | | | | *Pruned for Borer 2018* | |
| **White Currant** | Blanka | 4 | x | x | 22-Jul | 15.0 | x | x | x | x |
| | Swedish White | 4 | x | x | 21-Jul | 20.5 | x | x | x | x |
| | | | | **0.0** | | **35.5** | | **0.0** | | **0.0** |
| | | | *Freeze, hail, wind - All* | | *SWD loss* | | *Removed plants 2017* | | *Removed plants 2017* | |

| Northern Hardy Fruit Project - Yearly Production Records | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | No. of | 2015 | | 2016 | | 2017 | | 2018 | |
| | | plants | Date | pounds | Date | pounds | Date | pounds | Date | pounds |
| **Ore. Honeyberry** | 22-37 | 3/ 2 2016 | 7-Jul | 1.8 | 1-Jul | 5.8 | *did not pick* | x | 6/26-28 | 5.9 |
| | 41-100 | 3/ 1 2016 | 7-Jul | 1.8 | 30-Jun | 3.0 | *did not pick* | x | 7-Jul | x |
| | 43-87 | 3/ 2 2016 | 1-Jul | 2.0 | 30-Jun | 1.2 | *did not pick* | x | 6/22-28 | 7.9 |
| | 43-97 | 3/ 2 2016 | 9-Jul | 2.3 | 5-Jul | 3.6 | *did not pick* | x | 28-Jun | x |
| | 45-57 | 3/ 1 2016 | 9-Jul | 1.6 | 5-Jul | 1.2 | *did not pick* | x | 28-Jun | 4.1 |
| | 85-26 | 3/ 2 2016 | 7-Jul | 8.3 | 5-Jul | 8.8 | *did not pick* | x | 7/2-5 | 3.2 |
| | 20-04 | 3 | | | 30-Jun | 3.8 | 7-Jul | 12.8 | 26-Jun | 3.2 |
| | 21-20 | 3 | | | 6-Jul | 1.9 | 12-Jul | 4.3 | 2-Jul | 5.9 |
| | 22-14 | 3 | | | 6-Jul | 2.8 | 7-Jul | 8.2 | 28-Jun | 6.5 |
| | 22-26 | 3 | | | 6-Jul | 3.4 | 7-Jul | 12.0 | 26-Jun | 8.9 |
| | 41-75 | 3 | | | 6-Jul | 3.7 | 7/4-6 | 15.7 | 6/27-7/2 | 15.8 |
| | 44-19 | 3 | | | 6-Jul | 2.2 | 12-Jul | 9.4 | 2-Jul | 7.1 |
| | 57-49 | 3 | | | 6-Jul | 4.6 | 11-Jul | 13.0 | 2-Jul | 10.1 |
| | 88-92 | 3 | | | 30-Jun | 2.0 | 4-Jul | 6.3 | 27-Jun | 6.2 |
| | 88-102 | 2 | | | 30-Jun | 0.9 | 4-Jul | 5.8 | 26-Jun | 4.7 |
| | 108-23 | 3 | | | 30-Jun | 4.8 | 7/6-7 | 17.0 | 26-Jun | 8.9 |
| | 131-08 | 3 | | | 6-Jul | 2.8 | 12-Jul | 10.8 | 5-Jul | 8.7 |
| | 142-30 | 3 | | | 6-Jul | 1.9 | 10-Jul | 6.8 | 28-Jun | 5.7 |
| | 78-89 | 2 | | | | | 7-Jul | 0.8 | 5-Jul | 3.5 |
| | | | | **17.8** | | **58.4** | | **122.9** | | **116.3** |
| | | | | | | | *Excellent Bbee popl.* | | | |
| **Rus. Honeyberry** | Berry Blue | 4 | 30-Jun | 7.5 | 21-Jun | 12.4 | 28-Jun | 23.6 | *did not pick* | x |
| | Blue Belle | 4 | 6/22-25 | 12.4 | 13-Jun | 10.1 | 19-Jun | 21.8 | *did not pick* | x |
| | Blue Moon | 4/ **2** 2016 | x | x | x | x | *did not pick* | x | *removed* | removed |
| | Blue Velvet | 4/ **2** 2016 | x | x | 1-Jul | 1.8 | *did not pick* | x | *removed* | removed |
| | Kamchatka | 4 | 25-Jun | 7.4 | 15-Jun | 9.2 | *did not pick* | x | *did not pick* | x |
| | Cinderella | 4 | 22-Jun | 1.3 | 14-Jun | 6.0 | *did not pick* | x | *removed* | removed |
| | | | | **28.6** | | **39.5** | | **45.4** | | **0.0** |
| | | | | | | | *Excellent Bbee popl.* | | | |
| **Haskaps** | Borealis | 4/ **2** 2016 | 7-Jul | 0.8 | 30-Jun | 0.7 | 26-Jun | 9.6 | 22-Jun | 0.2 |
| **- Canadian** | Tundra | 5/ **3** 2016 | 1-Jul | 2.8 | 27-Jun | 2.8 | 27-Jun | 17.7 | 21-Jun | 4.8 |
| | Indigo Gem (9-15) | 5/ **4** 2016 | 1-Jul | 6.1 | 22-Jun | 12.4 | 27-Jun | 20.9 | 21-Jun | 3.6 |
| | Indigo Treat (9-91) | 5/ **2** 2016 | 7-Jul | 0.2 | 27-Jun | 0.5 | 29-Jun | 6.9 | 21-Jun | 3.7 |
| | Aurora | 1 | | | | | | | | 0.3 |
| | | | | **9.9** | | **16.4** | | **55.1** | | **12.6** |
| | | | | | *Reduced plant numbers* | | *Excellent Bbee popl.* | | | |
| **Juneberry** | *Honeywood* | 20 | 7/16-20 | 19.5 | 7/9-12 | 144.6 | 7/10-11 | 166.2 | 7/10 | 68.3 |
| ***Variety Trial*** | *JB30* | 20 | 7/9-10 | 25.4 | 7/6-7 | 174.3 | 7/5-7 | 133.4 | 7/5-9 | 60.8 |
| | *Martin* | 20 | 7/9-10 | 32.5 | 7/5-7 | 131.4 | 7/5-6 | 101.0 | 7/5-9 | 68.6 |
| | *Smoky* | 20 | 7/16-19 | 71.8 | 7/8-12 | 147.3 | 7/13-14 | 154.1 | 7/11-12 | 115.9 |
| | Thiessen | 20 | 7/9-13 | 35.4 | 7/5-8 | 164.9 | 7/5-6 | 142.2 | 7/6-9 | 60.0 |
| | | | | **184.6** | | **762.5** | | **696.9** | | **373.6** |
| | | | *Freeze, hail, wind - All* | | *Some SWD after 7/8* | | | | *Only 2 of 4 rows picked* | |
| ***The Project was planted in 2007, except Juneberries 2006.*** | | | | | | | | | | |

**Aronia flowering in the orchard.**

# Impacts of Bunk Management on Animal Performance and Hydrogen Sulfide Concentrations of Steers Fed 25% Modified Distillers Grains with Solubles

*Bryan Neville and Leslie Lekatz*

## Introduction

The focus of this project was to examine the impact of bunk management strategy on animal performance, carcass characteristics, and hydrogen sulfide gas concentration in beef steers fed 25% modified distillers grains with solubles. Distillers grains are a main component of feedlot diets, with over 70% of surveyed nutritionists indicating that they include some form of distillers grains in rations at ranges of 10-30% (Samuelson et al., 2016). The amount of sulfur present in ethanol by-products has led to concern over the occurrence of polioenchephalomalacia (also known as polio or PEM), a neurological condition resulting from either thiamine deficiency or sulfur toxicity.

There seems to be a general consensus that the greatest risk to cattle for developing PEM is during the time of dietary adaptation to finishing rations, although it could occur at any time. During dietary adaption to high-grain finishing rations, roughage steadily decreases and concentrates (corn, byproduct feeds, or other grains) increase. This adaptation period presents challenges for other metabolic disorders as well, including acidosis and bloat. One of the hypotheses proposed for the onset of sulfur induced-PEM in feedlot cattle is through the production of hydrogen sulfide gas in the rumen.

The impacts of bunk management on feeding behavior and ruminal pH have been evaluated (Schwartzkopf-Genswein et al., 2003). However, continued research into the link between bunk management, animal feeding behavior, ruminal pH, and incidence of PEM, especially during dietary adaptation, is still needed.

## Methods

The objective of this study was to evaluate the impacts of bunk management on animal performance, carcass characteristic, and hydrogen sulfide gas concentrations in beef steers fed modified distillers grains with solubles. One hundred thirty-nine steers (average weight = 970 ± 16.6 lb) were allocated to 16 pens and assigned to one of two treatments: 1) Control – (i.e. slick bunk management) bunks managed to be devoid of feed 1 hour prior to feeding, and 2) Long – bunks managed to still have greater than 1 inch of feed remaining at the time of feeding. Treatments were applied during a 28-day adaptation period, during which time steers were adapted to a common finishing ration containing 25% modified distillers grains with solubles (DM basis). Animal performance data including body weight, average daily gain, dry matter intake, and feed-to-gain ratio were collected throughout the study. Upon reaching market readiness, steers were shipped to a commercial abattoir for harvest and subsequent carcass characteristic data collection.

Ruminal hydrogen sulfide gas was collected by rumenocentesis from two steers from each of three pens per treatment on days 0, 7, 14, and 28, which correspond to days of diet transition. Ruminal hydrogen sulfide collections occurred 4 hours after feeding. Procedures for sampling rumen hydrogen sulfide gas were previously outlined by Gould et al. (1997) and modified by Neville et al. (2010, 2012). Two 120 ml samples of rumen gas were withdrawn from the rumen gas cap with 100 ml of each sample subsequently drawn through colorimetric detector tubes (Gastec, Kanawaga, Japan) by use of a volumetric gas sampling pump to acquire a measurement of ruminal gas cap hydrogen sulfide; for each steer at each sampling point, duplicate measurements were taken and the average value used for any calculations.

## Results

We found that steers fed under long-bunk management ate 2.4 pounds more feed per day compared to steers on the slick-bunk treatment (27.5 vs 25.1 pounds/day; Table 1). However, daily gain and feed efficiency were similar across treatment during the 28 days of adaptation. No differences in performance or carcass characteristics were observed over the entire feeding period between the treatments. This outcome was not unexpected as for the majority of the feeding period cattle were, in fact, treated the same.

**Table 1. Impacts of bunk management on feedlot performance of steers fed 25% MDGS (DM Basis).**

| | Control | Long | SE | *P* -value |
|---|---|---|---|---|
| **Adaptation, d 0-28** | | | | |
| Initial BW (d 0), lbs | 973.9 | 966.1 | 16.6 | 0.75 |
| BW (d 28), lbs | 1120.4 | 1122.9 | 18.1 | 0.92 |
| ADG, lbs/d | 5.23 | 5.6 | 0.16 | 0.13 |
| DMI, lbs/d | 25.07 | 27.51 | 0.42 | 0.001 |
| Feed:Gain, lbs | 4.8 | 4.95 | 0.14 | 0.47 |
| | | | | |
| **Overall, d 0-97** | | | | |
| Final BW, lbs | 1395.9 | 1389.8 | 18.6 | 0.82 |
| ADG, lbs/d | 4.35 | 4.37 | 0.07 | 0.89 |
| DMI, lbs/d | 28.07 | 29.09 | 0.47 | 0.14 |
| Feed:Gain, lbs | 6.46 | 6.67 | 0.11 | 0.18 |
| | | | | |
| **Carcass Characteristics** | | | | |
| HCW, lbs | 834.3 | 833.9 | 12.6 | 0.98 |
| Marbling | 517 | 515 | 13.9 | 0.91 |
| Yeild Grade | 3.29 | 3.37 | 0.09 | 0.53 |
| Back Fat, in | 0.52 | 0.55 | 0.04 | 0.55 |
| Ribeye area, $in^2$ | 13.59 | 13.54 | 0.12 | 0.78 |

The resulting hydrogen sulfide concentrations over this dietary transition period (Figure 1) indicate that bunk management may play a role in hydrogen sulfide production. Peak concentrations of hydrogen sulfide gas were found on day 14. At that time, hydrogen sulfide concentrations in cattle managed with long bunks were approximately 1000 ppm greater than slick-bunk managed cattle. If we consider that hydrogen sulfide being inhaled following eructation is the mechanism by which PEM occurs, then increased concentrations of hydrogen sulfide would ‘in theory’ increase the potential risk of PEM. However, much more research is needed to fully understand this mechanism. Interestingly, following adaptation, cattle were transitioned back to control or slick-bunks resulting in hydrogen sulfide concentrations again being similar between the two groups (data not shown). While maybe not an expected outcome of our research, these preliminary results call into question whether hydrogen sulfide (and risk of PEM) may in fact be manipulated through bunk management.

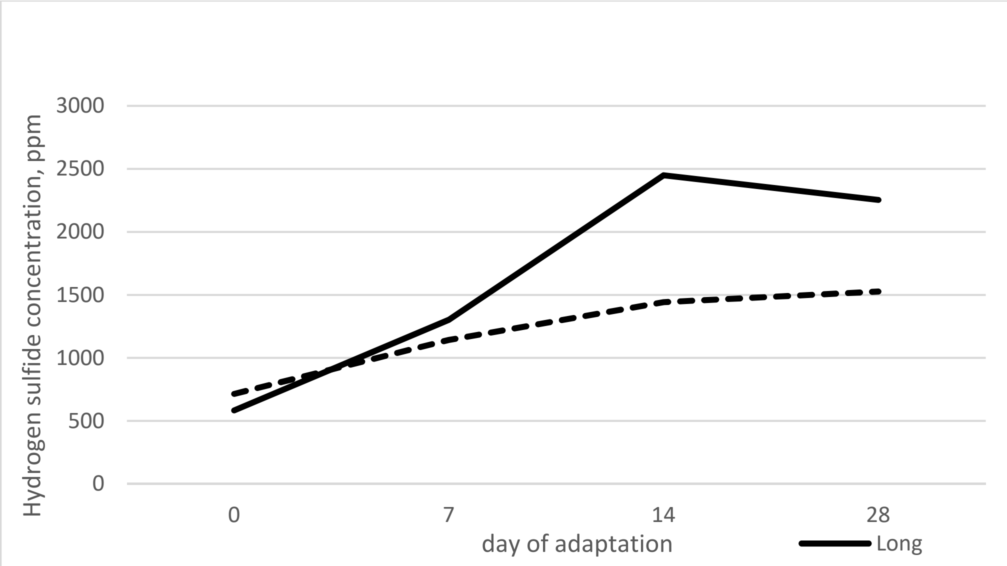



**Figure 1. Hydrogen sulfide gas concentrations of steers fed 25% mDGS under different bunk management strategies.**

To truly be able to make broader recommendations about bunk management during adaptation to finishing diets further research is needed. Specifically, research determining how bunk management impacts hydrogen sulfide gas production in the rumen and subsequently if hydrogen sulfide concentration alters rates of PEM. Our next step will be a study that uses greater concentrations of MDGS to see if greater sulfur concentrations in the ration amplify the magnitude of hydrogen sulfide differences observed in different bunk management scenarios.

**Acknowledgements**
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# Feeding North Dakota-born Calves to Finish in North Dakota – DFCS

*Karl Hoppe*

Over two decades ago, CREC Researchers and Extension Specialists sought to reverse the perspective that it was too cold in North Dakota to feed cattle to slaughter weight. The number of cattle fed to finish in North Dakota has increased since then. However, of the almost 900,000 calves raised in North Dakota, only about 120,000 calves are fed to finish.

Documenting cattle performance has stimulated cattle producers to feed cattle in North Dakota. Knowing the genetic performance of calves born and raised in North Dakota helps reduce the economic risk in feeding cattle to finish.

The Dakota Feeder Calf Show Feedout project was developed to discover the actual final value of spring-born beef steer calves, provide comparisons between herds, and benchmark feeding and carcass performance.

For the 2017-18 feeding period, cattle consigned to the feedout project were delivered to the Carrington Research Extension Center Livestock Unit on October 17, 2017. Prior to shipment, calves were vaccinated, implanted with Synovex-S, dewormed and injected with a prophylactic long-acting antibiotic. Calves were then 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 re-implanted with Synovex-Choice on January 3, 2018.

The cattle were harvested on May 17, 2018 (139 head). The cattle were sold to Tyson Fresh Meats, Dakota City, Neb., on a grid basis, with premiums and discounts based on carcass quality. Carcass data were collected after harvest.

Cattle consigned to the Dakota Feeder Calf Show feedout project averaged 634.19 pounds upon delivery. After an average 207-day feeding period, cattle averaged 1,311.1 pounds (at plant, shrunk weight). Death loss was 2.11 percent (three head) during the feeding period.

Average daily feed intake per head was 32.0 pounds on an as-fed basis and 21.1 pounds on a dry-matter basis. Pounds of feed required per pound of gain were 10.2 on an as-fed basis and 6.74 pounds on a dry-matter basis.

The overall feed cost per pound of gain was $0.474. The overall yardage cost per pound of gain was $0.111. The combined cost per pound of gain, including feed, yardage, veterinary, trucking and other expenses except interest, was $0.748.

Calves were priced by weight upon delivery to the feedlot. The pricing equation ($ per 100 pounds = (-0.069506177* initial calf weight, pounds) + 212.8378297) 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 1.4 percent Prime, 79.8 percent Choice or better (including 17.9 percent Certified Angus Beef), 18.7 percent Select, 0 percent Standard and 0 percent other, and USDA Yield Grades at 4.3 percent YG1, 48.2 percent YG2, 38.1 percent YG3, 8.6 percent YG4 and 0.71 percent YG5.

Carcass value per 100 pounds (cwt) was calculated using the actual base carcass price plus premiums and discounts for each carcass. The grid price received for May 17, 2018, was $195.04 Choice YG3 base with premiums: Prime $20, CAB $6, YG1 $6.50 and YG2 $3, and discounts: Select minus $12, Standard (no roll) minus $15, YG4 minus $8, YG5 minus $20 and carcasses greater than 1,050 pounds minus $20.

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

**Table 1. Feeding performance - 2017-2018 Dakota Feeder Calf Show Feedout**

| Pen of three | 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 | 8-Mar-17 | 3.652 | 1582.5 | 3.788 | 587.7 | 3.151 | $ 168.46 |
| 2 | 1-Apr-17 | 3.547 | 1453.2 | 3.928 | 630.0 | 4.045 | $ 209.07 |
| 3 | 12-Mar-17 | 3.120 | 1339.5 | 3.388 | 457.3 | 2.426 | $ 195.77 |
| 4 | 21-Mar-17 | 3.318 | 1393.2 | 3.623 | 575.0 | 3.355 | $ 185.29 |
| 5 | 9-Apr-17 | 3.441 | 1382.2 | 3.682 | 498.0 | 3.134 | $ 179.11 |
| **Average Top 5 herds** | 22-Mar-17 | 3.416 | 1430.115 | 3.682 | 549.600 | 3.222 | $ 187.54 |
| 6 | 28-Mar-17 | 3.335 | 1380.6 | 3.529 | 451.3 | 2.693 | $ 166.13 |
| 7 | 10-Apr-17 | 3.097 | 1240.1 | 3.310 | 611.0 | 2.752 | $ 70.78 |
| 8 | 22-Apr-17 | 3.257 | 1265.4 | 3.319 | 527.3 | 3.080 | $ 114.21 |
| 9 | 9-Apr-17 | 3.385 | 1358.5 | 3.495 | 486.7 | 3.396 | $ 153.14 |
| 10 | 26-Mar-17 | 3.589 | 1489.4 | 3.459 | 444.7 | 3.837 | $ 227.75 |
| 11 | 3-Apr-17 | 3.332 | 1356.9 | 3.383 | 456.3 | 3.001 | $ 118.02 |
| 12 | 22-Apr-17 | 3.659 | 1423.2 | 3.655 | 477.3 | 3.526 | $ 124.89 |
| 13 | 11-Apr-17 | 3.466 | 1385.3 | 3.319 | 404.3 | 2.585 | $ 102.28 |
| 14 | 7-Apr-17 | 3.267 | 1317.5 | 3.369 | 458.7 | 2.542 | $ 47.28 |
| 15 | 12-Mar-17 | 2.862 | 1229.1 | 2.951 | 439.3 | 2.115 | $ 52.10 |
| 16 | 13-Apr-17 | 3.553 | 1413.7 | 3.689 | 414.7 | 2.970 | $ 85.27 |
| 17 | 2-Apr-17 | 2.986 | 1221.2 | 3.114 | 470.3 | 2.777 | $ 80.78 |
| 18 | 1-Apr-17 | 2.966 | 1214.9 | 3.051 | 498.0 | 2.912 | $ 68.03 |
| 19 | 18-Apr-17 | 3.316 | 1303.3 | 3.357 | 551.0 | 3.271 | $ 32.97 |
| 20 | 7-Apr-17 | 3.291 | 1326.9 | 3.004 | 449.3 | 3.431 | $ 159.66 |
| 21 | 16-Apr-17 | 3.455 | 1361.6 | 3.414 | 442.3 | 2.819 | $ 51.54 |
| 22 | 16-Apr-17 | 3.375 | 1330.1 | 3.382 | 420.0 | 2.970 | $ 87.48 |
| 23 | 13-Apr-17 | 3.258 | 1295.4 | 3.480 | 436.0 | 3.100 | $ 61.53 |
| 24 | 24-Apr-17 | 2.968 | 1148.6 | 2.940 | 515.7 | 3.251 | $ 58.11 |
| 25 | 18-Apr-17 | 3.448 | 1353.7 | 3.086 | 525.7 | 3.659 | $ 80.04 |
| 26 | 10-Mar-17 | 2.901 | 1254.3 | 3.024 | 450.7 | 2.797 | $ 27.41 |
| 27 | 13-Apr-17 | 3.131 | 1244.9 | 2.978 | 477.7 | 3.337 | $ 71.77 |
| 28 | 12-Apr-17 | 3.231 | 1289.1 | 3.184 | 481.0 | 2.999 | $ 6.68 |
| 29 | 9-Mar-17 | 2.851 | 1233.8 | 3.046 | 425.7 | 2.753 | $ 20.96 |
| 30 | 17-Apr-17 | 3.591 | 1410.6 | 3.755 | 566.3 | 4.806 | $ 65.82 |
| 31 | 4-Mar-17 | 3.003 | 1315.9 | 2.967 | 414.7 | 2.614 | $ 8.43 |
| 32 | 16-Apr-17 | 3.003 | 1184.9 | 2.842 | 462.7 | 3.122 | $ (15.02) |
| **Average bottom 5 herds** | 30-Mar-17 | 3.136 | 1286.9 | 3.159 | 470.1 | 3.259 | $ 17.37 |
| **Overall average - pens of three** | 4-Apr-17 | 3.270 | 1328.1 | 3.328 | 484.6 | 3.101 | 95.80 |
| Standard deviation | 15.0 | 0.2 | 93.2 | 0.3 | 59.6 | 0.5 | 64.5 |
| number | 32 | 32 | 32 | 32 | 32 | 32 | 32 |

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

The top-profit pen-of-three calves with superior genetics returned $227.75 per head, while the bottom pen-of-three calves returned $-15.02 per head. The average of the five top-scoring pens of steers averaged $187.54 per head, while the average of the bottom five scoring pens of steers averaged $17.37 per head.

For the pen-of-three competition, average profit was $95.80 per head. The spread in profitability between the top and bottom five herds was $170.16 per head for 2017-18 feeding period. Over the past 10 years, this spread has averaged $166.52 per head (Table 2).

**Table 2. Dakota Feeder Calf Show Feedout Profit Spread between Top 5 and Bottom 5 herds**

| Ave Feeding Profit or Loss per Head Year | Average Top 5 Herds | Average Bottom 5 Herds | Profitability Spread |
|---|---|---|---|
| 2008-2009 | $ 64.79 | $ (16.93) | $ 81.72 |
| 2009-2010 | $ 371.02 | $ 177.66 | $ 193.36 |
| 2010-2011 | $ 239.53 | $ 129.84 | $ 109.69 |
| 2011-2012 | $ 179.78 | $ 38.29 | $ 141.49 |
| 2012-2013 | $ 54.90 | $ (37.05) | $ 91.95 |
| 2013-2014 | $ 441.30 | $ 292.37 | $ 148.93 |
| 2014-2015 | $ 188.11 | $ (114.72) | $ 302.83 |
| 2015-2016 | $ (5.03) | $ (205.24) | $ 200.21 |
| 2016-2017 | $ 739.62 | $ 514.77 | $ 224.85 |
| 2017-2018 | $ 187.54 | $ 17.37 | $ 170.17 |
| Average | $ 246.16 | $ 79.64 | $ 166.52 |

**Calves consigned to the Dakota Feeder Calf Show Feedout project.**

Understanding cattle performance and profitability helps producers decide to feed cattle to harvest weight in North Dakota and also to consider genetic purchases for the cow herd.

## North American Manure Expo...What's in a NAME?

*Mary Keena*

North Dakota State University Extension had the honor of co-hosting the 2018 North American Manure Expo (NAME) on August 15-16 in Brookings, South Dakota. NDSU Extension co-hosted NAME with South Dakota State University, University of Minnesota, University of Nebraska – Lincoln and Iowa State University.

NAME was launched in 2001 in Wisconsin by (what eventually became) the Professional Nutrient Applicators Association of Wisconsin and the University of Wisconsin Extension Nutrient Management

Team. The event was put together at the request of custom manure applicators who wanted to see similar equipment go head-to-head with competitors. The event has evolved to include three main attractions: an industry trade show, manure technology demonstrations and educational seminars and demonstrations.

NAME is an annual, international event that is hosted in a new location each year. It has been hosted in Wisconsin, Michigan, Minnesota, Missouri, Ohio, Iowa, Nebraska, and Pennsylvania and now South Dakota in the U.S. and Guelph, Ontario, Canada. There were 1,300 people in attendance this year over the two-day event with demographics spanning eight countries including the United States, Canada, England, Belgium, China, the Netherlands, Australia, and New Zealand.

Photo courtesy of Robert Meinen, Pennsylvania State University

**North American Manure Expo attendees participating in the educational seminars.**

Day one includes tours and agitation demonstrations while day two focuses on educational seminars, the trade show and spreader demonstrations. NDSU Extension had the opportunity to chair the educational seminar committee. Two hundred ninety-two people attended the educational seminars. The seminars provide a chance to share the latest information regarding technology and equipment, manure-related research, as well as treatment options and management practices that continue to evolve. Preliminary results from a follow-up survey of NAME attendees show that 87% of 141 respondents either agreed or strongly agreed that attending the 2018 NAME made them more aware of how manure impacts soil health. The educational seminar committee considers this a success as several of the topics presented pertained to the use of manure as a fertilizer and its effects on soil health and the environment. Furthermore, 86% of 136 respondents have used what they learned during NAME to do their job better and 88% of 137 respondents said they have shared knowledge they gained with others after NAME, meaning the education and resources are reaching far more than just on-site attendees.


Photo courtesy of Robert Meinen, Pennsylvania State University

**Spreaders ready for demonstrations at the North American Manure Expo.**

In addition to professional manure applicators, others attending NAME include dairy, livestock and poultry producers; handlers of both liquid and solid manures; crop consultants and nutrient management specialists; compost managers; custom operators; agricultural support industry; Extension and government agency personnel.

Comments from attendees included:

- "Keep up the great work. The show continues to be on the cutting edge of technology year after year. Thank you!" – NAME attendee
- "Speakers were diverse.  Good job keeping topics and schedule moving.  There were six in my group, so we split up, to take almost all of them [educational seminars] in.  I know my employees got a lot out of attending as well." – NAME attendee

The 2019 North American Manure Expo will be held in Fair Oaks, Indiana on July 31 and August 1. More information can be found at www.manureexpo.org.

## Weather Summary

**Monthly Temperatures (°F) and Normals**

| | Max Temp | | | | Min Temp | | | | Monthly Avg. Temp | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | 2018 | Norm* | 2017 | 2016 | 2018 | Norm* | 2017 | 2016 | 2018 | Norm* | 2017 | 2016 |
| Apr | 44 | 55 | 54 | 51 | 23 | 31 | 31 | 31 | 33 | 37 | 43 | 41 |
| May | 75 | 68 | 69 | 70 | 46 | 43 | 41 | 43 | 61 | 54 | 55 | 56 |
| June | 79 | 76 | 77 | 76 | 57 | 53 | 52 | 53 | 68 | 63 | 65 | 65 |
| July | 81 | 82 | 83 | 81 | 56 | 58 | 58 | 57 | 68 | 65 | 71 | 69 |
| Aug | 81 | 81 | 77 | 80 | 52 | 55 | 52 | 54 | 67 | 65 | 64 | 67 |
| Sept | 67 | 71 | 70 | 70 | 42 | 45 | 46 | 47 | 55 | 58 | 58 | 58 |
| Avgs: | 71 | 72 | 72 | 71 | 48 | 47 | 47 | 48 | 59 | 57 | 59 | 59 |

*Normals = 1981-2010 averages

**Monthly Precipitation (in) and Normals**

| | 2018 Monthly Precipitation* | | | | |
|---|---|---|---|---|---|
| Month | NDAWN | NOAA | Normal[1] | 2017 | 2016 |
| Apr | 0.06 | 0.24 | 1.17 | 1.43 | 2.73 |
| May | 1.28 | 1.34 | 2.76 | 0.94 | 1.14 |
| June | 4.63 | 4.96 | 3.77 | 3.62 | 1.76 |
| July | 2.65 | 2.82 | 3.39 | 1.13 | 4.52 |
| Aug | 0.24 | 0.31 | 2.31 | 3.45 | 3.66 |
| Sept | 0.75 | 0.89 | 1.91 | 2.68 | 1.78 |
| Totals: | 9.61 | 10.56 | 15.31 | 13.26 | 15.60 |

[1] Normals = 1981-2010 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 | 2018 | Norm* | 2017 | 2016 | 2018 | Norm* | 2017 | 2016 | 2018 | Norm* | 2017 | 2016 |
| Apr | 225 | 357 | 341 | 318 | --- | --- | --- | --- | --- | --- | --- | --- |
| May | 872 | 736 | 718 | 761 | 575 | 386 | 395 | 438 | 431 | 282 | 290 | 314 |
| June | 1085 | 982 | 976 | 982 | 725 | 626 | 619 | 625 | 544 | 448 | 447 | 458 |
| July | 1130 | 1182 | 1198 | 966 | 758 | 810 | 826 | 774 | 573 | 624 | 625 | 579 |
| Aug | 1070 | 1119 | 1004 | 1269 | 704 | 747 | 632 | 717 | 515 | 561 | 456 | 534 |
| Sept | 685 | 775 | 785 | 789 | 383 | 437 | 442 | 456 | 273 | 320 | 314 | 319 |
| Totals | 5026 | 5155 | 5022 | 5085 | 3145 | 3006 | 2914 | 3010 | 2336 | 2235 | 2132 | 2204 |

*Normals = 1981-2010 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 |
|---|---|---|---|---|---|---|
| 2016 | Oct 19 | 29 | 2306 | Oct 24 | 22 | 2963 |
| 2017 | Sept 29 | 31 | 2121 | Oct 9 | 27 | 2740 |
| 2018 | *Sept 28 | 27 | 2336 | **Sept 28 | 27 | 3142 |

*Normal Corn GDD for date = 2227 **Normal Sunflower GDD for date = 2763

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

Normals=1981-2010 averages Source: NDAWN

## Agronomic Research Trials

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**

Barley: Cover crop timing – year one cover crop treatments
Corn: Evaluating P influence of previous crop (buckwheat); *State Board of Agricultural Research and Education (SBARE)*
Dry bean: Pinto bean with rye cover; *Northarvest Bean Growers Assoc.*
Forages: Enhancing corn silage through intercropping
Oats: Organic cover crop timimg; *General Mills*
Oats: Organic legume interseeding; *General Mills*
Soybean: Winter rye cover crop; *North Dakota Soybean Council*
Soybean: Winter rye removal by soil moisture status; *North Dakota Soybean Council*
Wheat: Cover crop timing – year two test crop
Wheat: Legume interseeding

**Soil Fertility and Crop Performance**

Barley: Effect of phosphorus fertilization on yield of barley; *SBARE/North Dakota Barley Council*
Barley: Effect of phosphorus fertilization on yield of barley, New Rockford; *SBARE/North Dakota Barley Council*
Barley: Sulfur and N fertilization effect on malting barley grain yield and quality; *SBARE/North Dakota Barley Council*
Barley: Sulfur and N fertilization effect on malting barley grain yield and quality, New Rockford; *SBARE/North Dakota Barley Council*
Canola: Evaluating N need for canola with groundbased remote sensors – dryland
Canola: Evaluating N need for canola with groundbased remote sensors - irrigated
Canola: Evaluation of cybelion as a growth regulator for canola; *PlantResponse Biotech, Inc.*
Canola: Evaluation of neptunion as a growth regulator for canola; *PlantResponse Biotech, Inc.*
Canola: Evaluation of the use of Anuvia fertilizer products for canola; *Anuvia*
Corn: Corn yield response to foliar application of a nutrition formulation -ProAqua Pulse; *Compass Minerals*
Corn: Effect of split application of zinc on corn yields; *AdvanSix*
Corn: Impact of zinc fertilizer sources on corn yields; *AdvanSix*
Corn: Mycorryzal inoculation to corn; *Valent*
Corn: Response to P, Zn, and S fertilizer
Corn: Sulfur and nitrogen ineraction effect on corn yield and grain quality
Corn: Sulfur and nitrogen ineraction effect on corn yield and grain quality - Oakes; *Cooper (Oakes Irrigation Research Site (OIRS))*
Corn: Sulfur response under irrigation water with high sulfate content
Dry Bean: Dry bean yield response to foliar application of a nutrition formulation -ProAqua Pulse; *Compass Minerals*
Dry bean: Pinto bean response to P, Zn and S fertilizer; *Northarvest Bean Growers Assoc.*
Lentil: Granular inoculant promoters for lentils; *Loveland Products*
Soybean: Effect of phosphorus fertilizer in soybeans at three planting dates – dryland; *North Dakota Soybean Council*
Soybean: Effect of phosphorus fertilizer in soybeans at three planting dates - irrigated; *North Dakota Soybean Council*
Soybean: Effect of phosphorus fertilizer in soybeans at three planting dates - Oakes; *North Dakota Soybean Council/Cooper (OIRS)*

Soybean: Liquid inoculant promoters in soybean; *Loveland Products*
Soybean: Response to sulfur; *North Dakota Soybean Council*
Soybean: Seed inoculation techniques; *North Dakota Soybean Council/Goos (Soil Science)*
Soybean: Seed nodulation enhancement; *Loveland Products*
Soybean: Impact of potassium (K) on soybean yeild, K removal and soil residual potassium levels; *North Dakota Soybean Council*
Wheat: Distillers grain as a P fertilizer source for wheat
Wheat: Evaluation of the use of Anuvia fertilizer products for wheat; *Anuvia*
Wheat: Phosphorus fertilization effects on four wheat varieties - dryland
Wheat: Phosphorus fertilization effects on four wheat varieties - irrigated
Wheat: Polyhalite as a potassium fertilizer for wheat - Dazey; *Sirius Minerals*
Wheat: Polyhalite as a potassium fertilizer for wheat - dryland; *Sirius Minerals*
Wheat: Polyhalite as a potassium fertilizer for wheat - irrigated; *Sirius Minerals*
Wheat: Polyhalite as a potassium fertilizer for wheat - Oakes; *Sirius Minerals/Cooper (OIRS)*
Wheat: Post-anthesis application of N for protein boost - dryland
Wheat: Post-anthesis application of N for protein boost - irrigated
Wheat: Predicting protein content of wheat using sensors - dryland
Wheat: Predicting protein content of wheat using sensors - irrigated
Wheat: Predicting protein content of wheat using sensors - Oakes; *Cooper (OIRS)*

**Crop Management**
Barley: Cropping systems experiment - rotation, tillage, and fertility
Barley: Optimizing barley quality across a pH and organic matter gradient; *Precison Ag/SBARE/North Dakota Barley Council*
Corn: Cropping systems experiment - rotation, tillage, and fertility
Corn: Impact of carbonated water on corn yield and soil CO2 flux; *Knorr Farms/ North American Coal/Great River Energy*
Dry bean: Black rows and population; *Northarvest Bean Growers Assoc.*
Dry bean: Pinto rows and population; *Northarvest Bean Growers Assoc.*
Field Pea: Cropping systems experiment - rotation, tillage, and fertility
Field Pea: Enhancing field pea protein through management factors
Field Pea: Organic seeding rate trial
Flax: Impact of harvest management on flax performance; *Ameriflax*
Honey: Honey production and pollen diversity from CREC honeybees; *Otto (U.S. Geological Survey)*
Misc: Intercropping legumes; *Jacobs (Williston REC)*
Oats: Organic alfalfa establishment with oats as nurse crop/genetics and harvest timing; *General Mills*
Oats: Organic harrowing trial; *General Mills*
Oats: Organic intercropping with pea types and rates for grain production; *General Mills*
Sorghum: Sorghum planting date; *Johnson (Plant Sciences)/SBARE*
Soybean: Cropping systems experiment - rotation, tillage, and fertility
Soybean: Soybean harvest at different levels of maturity - dryland
Soybean: Soybean harvest at different levels of maturity - irrigated
Sunflower: Cropping systems experiment - rotation, tillage, and fertility
Wheat: Cropping systems experiment - rotation, tillage, and fertility
Wheat: Wheat performance assessment after carinata as a previous crop; *Agrisoma*
Winter Wheat: Cropping systems experiment - rotation, tillage, and fertility

**Entomology**
Canola: Flea beetle management in canola 1 (L1-01) Late season; *Monsanto*
Canola: Flea beetle management in canola 2 (L1-02); *Monsanto*
Canola: Flea beetle management in canola 3 (L1-04); *Monsanto*
Flax: Effect of insect pollinators on flax yield; *Ameriflax/Knodel (Entomology)*

**Forage Production**
Forages: Forage/cover crop pea variety trial; *Pulse USA*
Forages: Organic intercropping with pea types and rates for forage production; *General Mills*

**Product Evaluation**
Corn: Biological in-furrow corn products to enhance P uptake; *Ag Concepts*
Corn: Comparison of corn fungicide seed treatments under general agronomic conditions; *Valent*
Corn: In-furrow and foliar corn safeners; *Italpollina*
Dry Bean: Biostimulant application to pinto beans; *P.I. Bioscience Limited*
Dry Bean: EnVigor applications at bloom in dry bean; *Ag Concepts*
Field Pea: Evaluation of granular inoculant with nodulation promoters; *Loveland Products*
Field Pea: Evaluation of inoculant products in field pea; *Rizobacter*
Field Pea: Evaluation of XiteBio products; *XiteBio Technologies Inc.*
Soybean: Bacterial biostimulants for soybeans; *Albaugh*
Soybean: Determine relative performance of soybean seed treatments to competivie standards; *Valent*
Soybean: EnVigor applications to soybeans at bloom; *Ag Concepts*
Soybean: Soybean biostimulant safeners applied POST; *Italpollina*
Sunflower: Avian repellent efficacy in sunflower; *Klug (USDA)*
Sunflower: Evaluation of seed coating on stand establishment and yield in sunflower; *Germains*
Sunflower: Xanthion appliction in-furrow; *BASF*
Wheat: Determine relative performance of spring wheat seed treatments to competivie standards; *Valent*
Wheat: Evaluation of foliar product treatments in wheat; *Elemental Enzymes*
Wheat: Minimizing wheat drought stress through biologicals 1 (693-01); *P.I. Bioscience Limited*
Wheat: Minimizing wheat drought stress through biologicals 2 (691-01); *P.I. Bioscience Limited*
Wheat: PGR applications for lodging resistance; *AMVACr*

**Plant Pathology**
Barley: Fungicide applications for disease control in barley
Canola: White mold fungicide efficacy evaluation; *BASF/Nichino/Syngenta*
Canola: White mold fungicide efficacy evaluation; *BASF*
Chickpea: Ascochyta fungicide efficacy evaluation; *North Dakota Crop Protection Product Harmonization Board*
Chickpea: Ascochyta fungicide efficacy evaluation; *BASF*
Chickpea: Ascochyta fungicide efficacy evaluation, QoI resistance; *BASF*
Chickpea: Ascochyta fungicide efficacy evaluation; *Syngenta*
Chickpea: Evaluation of breeding lines for Ascochyta disease resistance; *McPhee (Montana State Univ.)*
Chickpea: Impact of spray droplet size on fungicide efficacy for Ascochyta
Chickpea: Rhizoctonia seed treatment efficacy evaluatio; *Valent USA*
Dry Bean: Anthracnose fungicide efficacy evaluation; *BASF*
Dry Bean: Anthracnose fungicide efficacy evaluation, QoI resistance; *BASF*
Dry Bean: Efficacy of peroxide products for control of white mold; *Northarvest Bean Growers Assoc./North Dakota Crop Protection Product Harmonization Board*
Dry Bean: Impact of acidifying adjuvants on fungicide efficacy for white mold, pinto beans; *Northarvest Bean Growers Assoc./North Dakota Crop Protection Product Harmonization Board*
Dry Bean: Impact of adjuvants on efficacy of the fungicide Endura for Sclerotinia, Palomino pinto; *Northarvest Bean Growers Assoc./North Dakota Crop Protection Product Harmonization Board*
Dry Bean: Impact of adjuvants on efficacy of the fungicide Topsin for Sclerotinia, Palomino pinto; *Northarvest Bean Growers Assoc./North Dakota Crop Protection Product Harmonization Board*
Dry Bean: Impact of row spacing and seeding rate on dry bean agronomic performance under white mold pressure; *North Dakota Dept. of Agriculture/USDA Specialty Crop Block Grant NDDoA/USDA SCBG)*

Dry Bean: Impact of row spacing and seeding rate on dry bean agronomic performance under white mold pressure, Oakes; *Cooper (OIRS)/NDDoA/USDA SCBG)*
Dry Bean: Impact of spray droplet size on fungicide efficacy for Sclerotinia, XR nozzles, Palomino pinto; *Northarvest Bean Growers Assoc./North Dakota Crop Protection Product Harmonization Board*
Dry Bean: Impact of spray droplet size on fungicide efficacy for white mold, XR nozzles, black beans; *North Dakota Soybean Council*
Dry Bean: Impact of spray droplet size on fungicide efficacy for white mold, XR nozzles, navy beans; *North Dakota Soybean Council*
Dry Bean: Impact of spray pattern on fungicide efficacy for Sclerotinia, TJ nozzles, Palomino pinto; *Northarvest Bean Growers Assoc./North Dakota Crop Protection Product Harmonization Board*
Dry Bean: Impact of spray pattern on fungicide efficacy for Sclerotinia, AIXR nozzles, Palomino pinto; *Northarvest Bean Growers Assoc./North Dakota Crop Protection Product Harmonization Board*
Dry Bean: Impact of spray volumes on fungicide efficacy for Sclerotinia, Palomino pinto; *Northarvest Bean Growers Assoc./North Dakota Crop Protection Product Harmonization Board*
Dry Bean: Impact of spray droplet size on fungicide efficacy for Sclerotinia, XR nozzles, Rosie kidney; *Northarvest Bean Growers Assoc./North Dakota Crop Protection Product Harmonization Board*
Dry Bean: Optimizing the use of drop nozzles for fungicide applications targeting white mold, Rosie kidney; *Northarvest Bean Growers Assoc./North Dakota Crop Protection Product Harmonization Board*
Dry Bean: Seed treatment study; *Albaugh*
Dry Bean: Seed treatment development; *McGregor*
Dry Bean: Seed treatment development, biostimulants; *McGregor*
Dry Bean: White mold fungicide efficacy evaluation, kidney bean; *BASF*
Dry Bean: White mold fungicide efficacy evaluation, pinto bean; *BASF*
Dry Bean: White mold fungicide efficacy evaluation; *Nichino*
Dry Bean: White mold fungicide efficacy evaluation; *Bayer CropScience*
Dry Bean: White mold fungicide efficacy evaluation, registered products; *Bayer CropScience*
Dry Bean: White mold fungicide efficacy evaluation; *Gowan Corp.*
Dry Bean: White mold mold fungicide efficacy evaluation; *OroAgri*
Dry Bean: White mold fungicide efficacy evaluation; *Syngenta*
Dry Bean: White mold resistance screening nursery; *Steadman (Univ. of Nebraska – Lincoln)/USDA National Sclerotinia Initiative*
Durum: Quantifying the response to fungicides for management of Fusarium head blight; *Ransom (Plant Science)/U.S. Wheat and Barley Scab Initiative*
Durum: Uniform fungicide efficacy trial; *USDA Wheat and Barley Scab Initiative/Friskop (Plant Pathology)*
Field Pea: Aphanomyces seed treatment evaluation; *Valent USA*
Field Pea: Ascochyta fungicide efficacy evaluation; *North Dakota Crop Protection Product Harmonization Board*
Field Pea: Ascochyta fungicide efficacy evaluation; *BASF*
Field Pea: Ascochyta fungicide efficacy evaluation, QoI resistance; *BASF*
Field Pea: Ascochyta fungicide efficacy evaluation; *Valent USA*
Field Pea: Bacterial blight management; *Northern Pulse Growers Assoc./North Dakota Crop Protection Product Harmonization Board*
Field Pea: Bacterial blight management, Oakes; *Cooper (OIRS)/Northern Pulse Growers Assoc./North Dakota Crop Protection Product Harmonization Board*
Field Pea: Crop rotation study; *Northern Pulse Growers Assoc,*
Field Pea: Evaluation of seed treaments for management of Fusarium root rot; *Albaugh*
Field Pea: Fusarium seed treatment evaluation; *Valent USA*
Field Pea: Impact of crop residues on Aphanomyces root rot; *NDDoA/USDA SCBG*
Field Pea: Impact of crop residues on Fusarium root rot; *NDDoA/USDA SCBG*
Field Pea: Impact of herbicides on Aphanomyces root rot; *NDDoA/USDA SCBG*
Field Pea: Impact of herbicides on Fusarium root rot; *NDDoA/USDA SCBG*
Field Pea: Impact of planting date on Aphanomyces root rot, no-till production; *NDDoA/USDA SCBG*

Field Pea: Impact of planting date on Aphanomyces root rot, conventional till; *North Dakota Crop Protection Product Harmonization Board*
Field Pea: Impact of planting date on Fusarium root rot, no-till production; *NDDoA/USDA SCBG*
Field Pea: Impact of planting date on Fusarium root rot, conventional till; *Northern Pulse Growers Assoc.*
Field Pea: Powdery mildew fungicide efficacy evaluation; *Nichino*
Field Pea: Rhizoctonia seed treatment evaluation; *Valent USA*
Lentil: Anthracnose fungicide efficacy evaluation; *BASF*
Lentil: Anthracnose fungicide efficacy evaluation, QoI resistance; *BASF*
Lentil: Anthracnose fungicide efficacy evaluation; *Gowan Corp.*
Lentil: Anthracnose fungicide efficacy evaluation - Omega rate response
Lentil: Aphanomyces seed treatment evaluation; *Valent USA*
Lentil: Efficacy of fungicides for white mold management, CDC Impress; *BASF*
Lentil: Efficacy of fungicides for white mold management, CDC Imvincible; *BASF*
Lentil: Evaluation of breeding lines for Anthracnose disease resistance; *Stefaniac (North Central REC)*
Lentil: Fusarium seed treatment efficacy evaluation; *Bayer CropScience/North Dakota Crop Protection Product Harmonization Board*
Lentil: Impact of planting date on Fusarium root rot, no-till production; *North Dakota Crop Protection Product Harmonization Board*
Lentil: Impact of planting date on Fusarium root rot, conventional till; *North Dakota Crop Protection Product Harmonization Board*
Lentil: Impact of spray droplet size on fungicide efficacy for Sclerotinia, XR nozzles, medium-seeded lentil; *North Dakota Crop Protection Product Harmonization Board*
Lentil: Impact of spray pattern on fungicide efficacy for Sclerotinia, TJ nozzles, medium-seeded lentil; *North Dakota Crop Protection Product Harmonization Board*
Lentil: Impact of spray pattern on fungicide efficacy for Sclerotinia, AIXR nozzles, medium-seeded lentil; *North Dakota Crop Protection Product Harmonization Board*
Lentil: Impact of spray volumes on fungicide efficacy for Sclerotinia, medium-seeded lentil; *North Dakota Crop Protection Product Harmonization Board*
Lentil: Rhizoctonia seed treatment efficacy evaluation; *North Dakota Crop Protection Product Harmonization Board*
Safflower: Efficacy of foliar fungicides for management of Alternaria blight; *BASF*
Soybean: Fungicide efficacy vs. application method for Sclerotinia, Oakes; *Cooper (OIRS)/North Dakota Soybean Council*
Soybean: Impact of adjuvants on fungicide efficacy for control of white mold; *North Dakota Soybean Council*
Soybean: Impact of droplet size on fungicide efficacy for head rot, XR nozzles, Oakes; *Cooper (OIRS)/North Dakota Soybean Council*
Soybean: Impact of drop nozzle height on fungicide efficacy for Sclerotinia; *North Dakota Soybean Council*
Soybean: Impact of spray droplet size on fungicide efficacy for Sclerotinia, XR nozzles, 18x06N soybean; *North Dakota Soybean Council*
Soybean: Impact of spray pattern on fungicide efficacy for Sclerotinia, TJ nozzles; *North Dakota Soybean Council*
Soybean: Impact of spray pattern on fungicide efficacy for Sclerotinia, AIXR nozzles; *North Dakota Soybean Council*
Soybean: Impact of soybean maturity on susceptibility to white mold and associated yield loss; *North Dakota Soybean Council*
Soybean: Impact of infection timing on severity of white mold and associated yield loss; *North Dakota Soybean Council*
Soybean: Impact of soybean maturity on susceptibility to white mold and associated yield loss
Soybean: Impact of spray droplet size on fungicide efficacy for Sclerotinia, XR nozzles, 17X09N soybean; *North Dakota Soybean Council*

Soybean: Impact of spray droplet size on fungicide efficacy for Sclerotinia, XR nozzles, DSR-0988 soybean; *North Dakota Soybean Council*
Soybean: Impact of soybean maturity on susceptibility to white mold and associated yield loss
Soybean: Optimizing the deployment of drop nozzles for fungicide applications targeting white mold. Oakes; *Cooper (Oakes Irrigation Research Site)/North Dakota Soybean Council*
Soybean: Optimizing fungicide applications for Sclerotinia through drop nozzles; *North Dakota Soybean Council*
Soybean: Plant health, fungicide efficacy evaluation - Revysol; *BASF*
Soybean: Plant health, fungicide efficacy evaluation - Priaxor; *BASF*
Soybean: Sclerotinia fungicide efficacy evaluation; *Syngenta*
Soybean: Sclerotinia fungicide efficacy vs. application methods; *North Dakota Soybean Council*
Soybean: White mold fungicide efficacy evaluation - impact of fungicide formulations; *DuPont*
Soybean: White mold fungicide efficacy evaluation - impact of fungicide mixtures; *DuPont*
Soybean: White mold fungicide efficacy evaluation; *AMVAC Corp.*
Sunflower: Evaluation of a bee-vectored biological control agent for managing head rot; *BVT Inc.*
Sunflower: Evaluation of fungicide efficacy and residual for head rot, Oakes; *Cooper (Oakes Irrigation Research Site)/North Dakota Dept. of Agriculture/USDA Specialty Crop Block Grant*
Sunflower: Head rot fungicide efficacy, applications made during mid-bloom; *North Dakota Dept. of Agriculture/USDA Specialty Crop Block Grant*
Sunflower: Head rot fungicide efficacy, applications made during late bloom; *North Dakota Dept. of Agriculture/USDA Specialty Crop Block Grant*
Sunflower: Head rot fungicide efficacy, applications made during early bloom; *North Dakota Dept. of Agriculture/USDA Specialty Crop Block Grant*
Sunflower: Head rot optimizing fungicide applications through boom-mounted nozzles; *North Dakota Dept. of Agriculture/USDA Specialty Crop Block Grant*
Sunflower: Head rot optimizing fungicide applications through drop nozzles; *North Dakota Dept. of Agriculture/USDA Specialty Crop Block Grant*
Sunflower: Head rot - fungicide efficacy; *North Dakota Crop Protection Product Harmonization Board*
Sunflower: Head rot resistance screening nursery; *Underwood (USDA Sunflower Research Unit)*
Sunflower: Head rot resistance screening nursery - commercial hybrids
Sunflower: Optimizing fungicide applications for head rot with boom-mounted nozzles, Oakes; *Cooper (Oakes Irrigation Research Site)/North Dakota Dept. of Agriculture/USDA Specialty Crop Block Grant*
Sunflower: Optimizing fungicide applications for head rot with drop nozzles, Oakes; *Cooper (Oakes Irrigation Research Site)/North Dakota Dept. of Agriculture/USDA Specialty Crop Block Grant*
Sunflower: Phomopsis and Phoma fungicide evaluation (2); *Markell (Plant Pathology)*
Sunflower: Rust fungicide evaluation(2); *Markell (Plant Pathology)*
Sunflower: Rust fungicide efficacy evaluation; *BASF/ North Dakota Crop Protection Product Harmonization Board*
Sunflower: USDA saturated soil study; *Hulke (USDA)*
Sunflower: USDA saturated soil study - dryland comparison; *Hulke (USDA)*
Wheat: Evaluation of wheat fungicide systems - seed treatment and foliar timings; *BASF*
Wheat: Management of FHB and leaf diseases in wheat with Prosaro (3); *Bayer CropScience*
Wheat: Spring wheat leaf and head disease fungicide evaluation; *Bayer CropScience*
Wheat: Leaf rust nursery; *Green (Plant Sciences)*
Wheat: Stripe rust nusery; *Green (Plant Sciences)*
Wheat: Integrated scab fungicide management trial; *USDA Wheat and Barley Scab Initiative/Friskop (Plant Pathology)*
Wheat: Seed treatment evaluation; *BASF*
Wheat: Seed treatment evaluation; *Bayer CropScience*
Wheat: Seed treatment study; *Syngenta*
Wheat: Seed treatment evaluation; *Valent USA*

**Seed Increase**
Wheat: Experimental hard red spring wheat increase; *Foundation Seedstocks*

**Germplasm Evaluation/Cultivar Development**
Alfalfa: Dryland conventional variety trial; *Industry/Eriksmoen (North Central REC)*
Alfalfa: Dryland Roundup Ready variety trial; *Industry/Eriksmoen (North Central REC)*
Barley: Barley breeder nurseries (3); *Horsley (Plant Sciences)*
Barley: Drill strip demonstration plots
Barley: Dryland variety trial
Barley: Recrop/direct seed variety trial
Barley: Irrigated variety trial
Barley: Barnes County (Dazey) variety trial
Barley: Tri-County (Wishek) variety trial
Barley: Organic variety trial
Buckwheat: Organic variety trial
Canola: Breeder's nursery; *Rahman (Plant Sciences)*
Canola: Clearfield and Sulfonyurea performance tests; *Industry*
Canola: Conventional canola performance test; *Industry*
Canola: Roundup Ready performance test; *Industry*
Canola: Hybrid yield evaluation I; *Cibus*
Canola: Hybrid yield evaluation II; *Cibus*
Canola: Hybrid yield evaluation IV; *Cibus*
Canola: Hybrid yield evaluation V; *Cibus*
Canola: Mycogen cultivar evaluation - mega plots; *Dow AgroSciences*
Chickpea: Variety trial; *Stefaniak (North Central REC)*
Corn: Corn plant population by hybrid maturity
Corn: Dryland hybrid performance test; *Industry*
Corn: Dryland hybrid performance test - conventional lines; *Industry*
Corn: Fingal hybrid performance test; *Industry*
Corn: Irrigated hybrid performance test; *Industry*
Corn: Oakes dryland hybrid performance test; *Industry*
Corn: Oakes irrigated hybrid performance test; *Industry*
Dry Bean: Breeder's nursery block; *Osorno (Plant Sciences)*
Dry Bean: Dryland variety trial; *Osorno (Plant Sciences)*
Dry Bean: Irrigated variety trial; *Osorno (Plant Sciences)*
Durum: Dryland variety trial
Durum: Recrop/direct seed variety trial
Durum: Barnes County (Dazey) variety trial
Durum: Organic variety trial
Durum: Drill strip demonstration plots
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
Fababean: Dryland variety trial; *Industry*
Fababean: Irrigated variety trial; *Industry*
Fababean: Organic variety trial; *Industry*
Field Pea: Breeder nursery 1801 - advanced pea yield trial; *Stefaniak (North Central REC)*
Field Pea: Breeding program nursery; *Legume Logic*
Field Pea: Variety trial; *Industry*
Field Pea: Organic variety trial/nursery; *Industry*
Field Pea: Western Regional Nursery; *Stefaniak (North Central REC)*
Flax: Breeder's nursery; *Rahman (Plant Sciences)*
Flax: Variety trial

Flax: Organic variety trial
Forages: Winter rye forage variety trial
Forages: Winter triticale forage trial; *Industry*
Lentil: Breeders nursery, advanced green lentil yield trial; *Stefaniak (North Central REC)*
Lentil: Variety trial
Oats: Drill strip demonstration plots
Oats: Dryland variety trial
Oats: Midseason Oat Nursery; *McMullen (Plant Sciences)*
Oats: Breeder's nursery; *McMullen (Plant Sciences)*
Oats: Organic advanced yield trial; *Richter (General Mills)*
Oats: Organic rust sentinel evaluation; *Richter (General Mills)*
Oats: Organic variety trial
Rye: Winter rye variety trial
Rye: Organic winter rye variety trial
Safflower: Variety trial
Sorghum: Sorghum germplasm screening
Soybean: Dryland conventional and Liberty Link performance test; *Industry*
Soybean: Dryland Roundup Ready performance test; *Industry*
Soybean: Irrigated conventional performance test; *Industry*
Soybean: Irrigated Roundup Ready performance test; *Industry*
Soybean: Barnes County (Dazey) conventional performance test; *Industry*
Soybean: Barnes County (Dazey) Roundup Ready performance test; *Industry*
Soybean: Tri-County (Wishek) conventional performance test; *Industry*
Soybean: Tri-County (Wishek) Roundup Ready performance test; *Industry*
Soybean: Oakes irrigated conventional and Liberty Link performance test; *Industry*
Soybean: Oakes irrigated Roundup Ready performance test; *Industry*
Soybean: LaMoure conventional performance test; *Industry/Helms (Plant Sciences)*
Soybean: Organic variety trial
Soybean: Agronomic performance trial - Carrington; *Bayer US Agronomics*
Soybean: Agronomic performance trial - Dazey; *Bayer US Agronomics*
Soybean: Agronomic performance trial - Fingal; *Bayer US Agronomics*
Soybean: Agronomic performance trial - Oakes; *Bayer US Agronomics*
Soybean: Agronomic performance trial - Wishek; *Bayer US Agronomics*
Soybean: Breeders Nursery: Expt. 18C18 Glyphosate Tolerant; *Helms (Plant Sciences)*
Soybean: Breeders Nursery: Expt. 18C19 Glyphosate Tolerant; *Helms (Plant Sciences)*
Soybean: Breeders Nursery: Expt. 18C20 Glyphosate Tolerant; *Helms (Plant Sciences)*
Soybean: Breeders Nursery: Expt. 18C21 Advanced Glyphosate Dryland; *Helms (Plant Sciences)*
Soybean: Breeders Nursery: Expt. 18C22 Advanced Conventional; *Helms (Plant Sciences)*
Soybean: Breeders Nursery: Expt. 18C23 Tofu Conventional; *Helms (Plant Sciences)*
Soybean: Breeders Nursery: Expt. 18C24 Natto Conventional; *Helms (Plant Sciences)*
Soybean: Breeders Nursery: Expt. 18D21 Glyphosate Tolerant - Dazey; *Helms (Plant Sciences)*
Soybean: Breeders Nursery: Expt. 18R21 Advanced Glyphosate - Irrigated; *Helms (Plant Sciences)*
Soybean: Evaluation of soybean genetics - early versus modern varieties
Soybean: Soybean strip trial by trait; *Monsanto*
Spelt: Organic spring variety trial
Sunflower: Non-oil sunflower hybrid performance test; *Industry*
Sunflower: Oil sunflower hybrid performance test; *Industry*
Sunflower: Sunflower hybrid nursery - confection type; *SunOpta*
Sunflower: Sunflower hybrid nursery - oil type; *SunOpta*
Sunflower: USDA stalkrot nursery; *Underwood (USDA)*
Triticale: Winter triticale variety trial; *Husker Genetics*
Winter Wheat: Elite breeder's Nursery; *Marais (Plant Sciences)*
Winter Wheat: Variety trial
Wheat: Dryland variety trial

Wheat: Recrop/direct seed variety trial
Wheat: Irrigated variety trial
Wheat: Barnes County (Dazey) variety trial
Wheat: Tri-County (Wishek) variety trial
Wheat: Organic variety trial
Wheat: Drill strip demonstration plots
Wheat: Saline wheat variety trial; *Green (Plant Sciences)*
Wheat: Spring wheat breeder elite nurseries; *Green (Plant Sciences)*
Wheat: Uniform Regional Spring Wheat Nursery; *Garvin (USDA)*

**Weed Science**
Barley: Barley grass weed management; *Jenks (North Central REC)/North Dakota Barley Council*
Corn: Acuron rates for weed control in corn; *Syngenta*
Corn: Corn herbicide cover crop sensitivity; *DowDupont*
Corn: Using UASs for site-specific weed management in corn; *North Dakota Corn Utilization Council*
Corn: Weed management programs; *Monsanto*
Dry Bean: Pinto bean response to herbicide drift
Field Pea: Herbicide ratios for field pea safety;*Nichino America*
Flax: Flax herbicide tolerance evaluation; *Jenks (North Central REC)*
Misc: Burndown with Vida combinations in fallow; *Gowan*
Misc: Herbicide site of action demonstration
Safflower: PPI combinations for safflower; *Gowan*
Soybean: Weed control programs for Liberty Link soybeans; *BASF*
Soybean: Comparing Engenia to Xtendimax; *BASF*
Soybean: Comparing Engenia to Xtendimax on sandy soils; *BASF*
Soybean: DT weed management programs; *Syngenta*
Soybean: DT soybean Engenia applications for residual weed control; *BASF*
Soybean: Glyphosate + glufosinate for weed control in a stacked soybean
Soybean: Glyphosate resistant kochia management in soybeans; *Valent*
Soybean: Managing corn volunteers with Adama Arrow clethodim; *Winfield Solutions*
Soybean: Managing corn volunteers with Albaugh clethodim; *Winfield Solutions*
Soybean: Managing corn volunteers with Assure II; *Winfield Solutions*
Soybean: PRE programs for DT soybeans; *BASF*
Soybean: Residual herbicide impact on fall-seeded cover crops; *North Dakota Soybean Council/Howatt (Plant Sciences)*
Soybean: Response to POST herbicides
Soybean: Sequential vs. single Engenia program; *BASF*
Soybean: Simulated dicamba drift injury on soybeans; *North Dakota Soybean Council/Howatt (Plant Sciences)*
Wheat: Broadleaf weed control with E004; *Arysta*
Wheat: Evaluating Opensky in spring wheat; *Dow*
Wheat: Grass weed control with E003; *Arysta*
Wheat: Weed control with Varro herbicide; *Bayer CropScience*
Wheat: Wheat and durum desiccation; *Howatt (Plant Sciences)*

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

| Variety | Days to Head | Plant Lodge | Plant Height | Grain Protein 2018 | Grain Protein 3-yr. Avg. | 1000 KWT | Test Weight | Grain Yield 2018 | Grain Yield 2-yr. Avg. | Grain Yield 3-yr. Avg. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 to 9 | inch | % | % | gram | lb/bu | bu/ac | bu/ac | bu/ac |
| SY Ingmar | 50.3 | 1.5 | 26.1 | 15.8 | 15.7 | 35.2 | 63.5 | 74.2 | 65.6 | 56.4 |
| SY Soren | 49.8 | 0.8 | 26.7 | 15.3 | 15.6 | 33.7 | 63.5 | 65.5 | 62.8 | 53.6 |
| Linkert | 50.3 | 1.0 | 26.4 | 15.5 | 15.8 | 37.8 | 63.4 | 63.5 | 60.3 | 51.2 |
| Barlow | 49.3 | 2.0 | 31.0 | 14.6 | 15.0 | 33.2 | 63.9 | 66.4 | 61.7 | 52.7 |
| Elgin-ND | 49.5 | 2.0 | 31.2 | 14.0 | 14.6 | 32.3 | 62.9 | 62.6 | 60.1 | 52.1 |
| SY Valda | 52.0 | 1.5 | 26.7 | 13.2 | 14.4 | 33.6 | 62.7 | 71.9 | 69.4 | 57.5 |
| Glenn | 49.5 | 2.5 | 30.7 | 15.0 | 14.9 | 33.9 | 64.8 | 59.7 | 58.1 | 49.2 |
| Prosper | 51.8 | 2.0 | 30.2 | 14.2 | 14.4 | 39.6 | 63.3 | 74.4 | 68.8 | 55.5 |
| Faller | 52.8 | 1.8 | 30.7 | 13.7 | 14.3 | 37.2 | 63.3 | 75.8 | 67.2 | 54.8 |
| Bolles | 54.3 | 0.5 | 29.6 | 16.1 | 16.5 | 36.7 | 62.8 | 58.6 | 59.3 | 49.0 |
| Rollag | 50.8 | 2.5 | 26.1 | 15.0 | 15.6 | 33.5 | 63.3 | 61.1 | 59.8 | 52.0 |
| Lang-MN | 52.5 | 0.8 | 30.7 | 13.9 | 15.1 | 31.0 | 63.6 | 71.0 | 64.9 | 54.2 |
| ND VitPro | 49.8 | 1.3 | 27.9 | 15.6 | 15.5 | 35.2 | 64.2 | 55.6 | 56.0 | 48.2 |
| Shelly | 53.0 | 1.3 | 28.1 | 13.5 | 14.5 | 34.6 | 63.9 | 74.2 | 70.3 | 56.9 |
| Boost | 53.3 | 1.5 | 29.3 | 14.5 | 15.0 | 34.6 | 62.2 | 66.5 | 63.6 | 54.2 |
| Surpass | 48.5 | 3.0 | 29.9 | 14.1 | 14.7 | 29.7 | 62.5 | 73.4 | -- | -- |
| AAC Brandon | 51.0 | 2.0 | 27.7 | 16.3 | -- | 38.9 | 63.2 | 61.5 | -- | -- |
| AAC Penhold | 53.3 | 1.3 | 28.1 | 14.3 | -- | 39.0 | 63.2 | 72.0 | -- | -- |
| AC Goodwin | 51.5 | 1.5 | 31.4 | 14.0 | -- | 36.9 | 63.8 | 71.4 | -- | -- |
| Ambush | 49.8 | 2.0 | 27.9 | 14.4 | -- | 36.5 | 63.9 | 72.6 | 66.2 | -- |
| Caliber | 51.5 | 0.0 | 24.7 | 15.9 | -- | 35.0 | 63.0 | 61.8 | 58.3 | -- |
| Lanning | 52.8 | 0.8 | 29.4 | 14.5 | -- | 36.8 | 61.8 | 62.5 | -- | -- |
| WB9479 | 49.8 | 0.8 | 25.5 | 16.3 | -- | 36.7 | 63.6 | 63.8 | 60.6 | -- |
| WB9590 | 49.3 | 0.8 | 25.3 | 15.4 | -- | 36.5 | 63.2 | 73.7 | 68.6 | -- |
| WB9653 | 51.5 | 1.3 | 26.5 | 13.1 | 14.3 | 33.5 | 62.5 | 80.4 | 72.6 | 60.7 |
| WB9719 | 53.0 | 1.0 | 27.2 | 15.8 | -- | 38.4 | 64.4 | 60.2 | 59.4 | -- |
| TCG Climax | 53.5 | 0.3 | 29.7 | 15.1 | -- | 30.6 | 64.6 | 66.9 | 64.9 | -- |
| TCG Glenville | 48.8 | 0.0 | 25.4 | 17.3 | -- | 37.9 | 63.4 | 53.1 | -- | -- |
| TCG Spitfire | 54.0 | 0.5 | 27.3 | 14.3 | 14.6 | 39.3 | 63.1 | 70.4 | 68.4 | 58.1 |
| MEAN | 51.3 | 1.4 | 28.7 | 14.6 | -- | 35.3 | 63.3 | 68.5 | -- | -- |
| C.V. (%) | 2.4 | 41.4 | 5.9 | 4.2 | -- | 3.9 | 0.6 | 9.3 | -- | -- |
| LSD 0.10 | 1.4 | 0.7 | 2.0 | 0.7 | -- | 1.6 | 0.4 | 7.4 | -- | -- |
| LSD 0.05 | 1.7 | 0.8 | 2.3 | 0.8 | -- | 1.9 | 0.5 | 8.8 | -- | -- |

**Planting Date = April 30 ; Harvest Date = August 6 ; Previous Crop = Canola**

| Variety | Days to Head | Plant Lodge | Plant Height | Grain Protein 2018 | Grain Protein 3-yr. Avg. | 1000 KWT | Test Weight | Grain Yield 2018 | Grain Yield 2-yr. Avg. | Grain Yield 3-yr. Avg. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 to 9 | inch | % | % | gram | lb/bu | bu/ac | bu/ac | bu/ac |
| MS Camaro | 49.5 | 1.3 | 25.8 | 15.4 | -- | 32.6 | 62.8 | 61.7 | 57.4 | -- |
| MS Chevelle | 49.3 | 2.0 | 27.8 | 13.4 | 14.2 | 32.4 | 63.4 | 77.1 | 68.8 | 58.6 |
| MS Barracuda | 48.8 | 1.8 | 26.0 | 14.1 | -- | 37.1 | 63.8 | 67.0 | -- | -- |
| SY 09S0306-24 SS | 51.8 | 1.5 | 28.5 | 15.2 | -- | 36.3 | 63.2 | 65.2 | -- | -- |
| SY 10S0059-28 | 50.0 | 1.5 | 28.1 | 15.6 | -- | 40.8 | 64.2 | 62.4 | -- | -- |
| SY 10S0176-18 CL | 50.8 | 0.5 | 27.4 | 14.2 | -- | 35.6 | 63.9 | 61.1 | -- | -- |
| SY Rockford | 52.8 | 0.3 | 28.2 | 13.6 | -- | 36.6 | 62.4 | 65.1 | -- | -- |
| HRS 3100 | 51.8 | 0.5 | 27.8 | 14.1 | -- | 34.3 | 62.3 | 70.5 | 64.9 | -- |
| HRS 3419 | 54.8 | 1.3 | 27.4 | 12.9 | 14.0 | 31.7 | 62.7 | 78.6 | 68.6 | 57.5 |
| HRS 3504 | 51.3 | 0.8 | 26.9 | 13.1 | 14.3 | 34.0 | 62.5 | 74.9 | 68.1 | 58.2 |
| HRS 3530 | 53.0 | 2.0 | 32.6 | 14.0 | 14.9 | 35.6 | 62.6 | 72.1 | 65.0 | 51.2 |
| HRS 3616 | 49.8 | 1.3 | 26.2 | 15.0 | 15.5 | 34.4 | 63.1 | 66.0 | 63.5 | 54.8 |
| HRS 3888 | 50.5 | 1.5 | 29.2 | 13.8 | -- | 33.5 | 62.6 | 74.5 | -- | -- |
| LCS Breakaway | 50.3 | 1.5 | 28.6 | 15.0 | 16.0 | 35.9 | 64.3 | 74.0 | 62.2 | 53.4 |
| LCS Cannon | 48.5 | 1.5 | 28.1 | 14.5 | -- | 33.6 | 64.6 | 73.1 | -- | -- |
| LCS Rebel | 50.5 | 2.0 | 30.2 | 14.9 | -- | 36.9 | 63.9 | 71.6 | 64.3 | -- |
| LCS Trigger | 56.8 | 0.8 | 31.2 | 12.1 | -- | 32.6 | 63.0 | 77.8 | 70.7 | -- |
| Prosper/ND VitPro[1] | 50.8 | 1.5 | 31.2 | 14.6 | -- | 37.5 | 63.9 | 72.4 | 66.2 | -- |
| Shelly/Bolles[1] | 54.3 | 0.8 | 30.1 | 14.9 | -- | 35.4 | 63.1 | 70.5 | 67.6 | -- |
| Faller[2] {1.8} | 52.5 | 2.3 | 31.6 | 13.8 | -- | 38.3 | 62.9 | 70.1 | 64.0 | -- |
| Lang-MN[2] {1.8} | 53.5 | 1.0 | 32.8 | 13.6 | -- | 30.2 | 63.9 | 72.0 | -- | -- |
| MEAN | 51.3 | 1.4 | 28.7 | 14.6 | -- | 35.3 | 63.3 | 68.5 | -- | -- |
| C.V. (%) | 2.4 | 41.4 | 5.9 | 4.2 | -- | 3.9 | 0.6 | 9.3 | -- | -- |
| LSD 0.10 | 1.4 | 0.7 | 2.0 | 0.7 | -- | 1.6 | 0.4 | 7.4 | -- | -- |
| LSD 0.05 | 1.7 | 0.8 | 2.3 | 0.8 | -- | 1.9 | 0.5 | 8.8 | -- | -- |

**Planting Date = April 30 ; Harvest Date = August 6 ; Previous Crop = Canola**

** Spring wheat seeding rate used in this trial was 1,400,000 pure live seeds acre$^{-1}$.

[1] Treatments represent an equal mixture of PLS seed (700K:700K) from each variety.

[2] Treatments were planted at a seeding rate of 1,800,000 pure live seeds acre$^{-1}$.

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

| Hard Red Spring Wheat - Direct Seeded Dryland Recrop Elite* | | | | | | | | | | Carrington |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ---- Grain Protein ---- | | | | ---------- Grain Yield ---------- | | |
| Variety | Days to Head | Plant Lodge | Plant Height | 2018 | 3-yr. Avg. | 1000 KWT | Test Weight | 2018 | 2-yr. Avg. | 3-yr. Avg. |
| | | 0 to 9 | inch | ---------- % ---------- | | gram | lb/bu | ---------- bu/ac ---------- | | |
| SY Ingmar | 54.8 | 0.8 | 28.7 | 15.0 | -- | 26.1 | 60.4 | 39.8 | 49.4 | -- |
| SY Soren | 53.8 | 0.8 | 26.0 | 15.8 | 14.6 | 25.5 | 59.7 | 35.9 | 48.5 | 47.3 |
| Linkert | 54.5 | 1.0 | 27.5 | 15.7 | 14.8 | 29.7 | 59.2 | 37.8 | 45.7 | 44.5 |
| Barlow | 52.3 | 2.5 | 29.0 | 15.6 | 14.2 | 25.1 | 59.1 | 31.4 | 42.5 | 41.3 |
| Elgin-ND | 52.0 | 1.8 | 31.0 | 15.0 | 13.9 | 26.5 | 59.1 | 39.6 | 46.6 | 45.1 |
| SY Valda | 53.5 | 1.3 | 27.2 | 14.7 | 13.2 | 27.3 | 59.3 | 40.0 | 47.6 | 47.6 |
| Glenn | 52.8 | 2.3 | 31.3 | 15.1 | 14.3 | 26.6 | 61.8 | 33.4 | 41.5 | 37.9 |
| Prosper | 54.5 | 2.5 | 30.0 | 14.1 | 13.1 | 29.9 | 59.7 | 39.4 | 47.2 | 46.1 |
| Faller | 54.5 | 1.8 | 29.7 | 13.7 | 13.3 | 28.2 | 58.8 | 41.7 | 46.6 | 46.0 |
| Bolles | 54.8 | 1.3 | 28.8 | 16.4 | 15.4 | 28.7 | 59.2 | 38.2 | 45.7 | 41.3 |
| Rollag | 53.5 | 1.8 | 27.8 | 16.5 | 15.0 | 26.6 | 59.3 | 31.0 | 38.2 | 38.4 |
| Lang-MN | 54.5 | 1.0 | 30.0 | 15.4 | 14.3 | 24.6 | 60.0 | 35.2 | 47.9 | 43.5 |
| ND VitPro | 52.0 | 1.8 | 29.1 | 15.0 | 14.3 | 27.7 | 61.3 | 37.0 | 46.2 | 42.5 |
| Shelly | 54.3 | 1.5 | 28.3 | 14.5 | 13.6 | 23.0 | 57.1 | 26.1 | 39.0 | 39.1 |
| Boost | 55.0 | 1.5 | 31.5 | 14.8 | 14.2 | 29.2 | 59.7 | 40.0 | 46.0 | 44.4 |
| Surpass | 52.0 | 1.8 | 27.9 | 14.2 | 13.3 | 25.5 | 59.7 | 35.4 | 43.7 | 42.9 |
| WB9479 | 54.5 | 0.5 | 25.8 | 16.0 | -- | 25.2 | 57.4 | 29.6 | 43.6 | -- |
| WB9590 | 54.5 | 1.5 | 28.6 | 15.7 | -- | 25.5 | 57.4 | 32.4 | 44.3 | -- |
| WB9719 | 54.5 | 1.8 | 29.7 | 14.3 | -- | 26.7 | 61.2 | 36.0 | 51.4 | -- |
| TCG Climax | 57.8 | 0.0 | 29.2 | 15.9 | -- | 23.7 | 60.8 | 39.6 | 48.5 | -- |
| TCG Spitfire | 56.0 | 0.5 | 27.8 | 14.1 | -- | 28.4 | 59.2 | 44.3 | -- | -- |
| HRS 3419 | 56.3 | 1.8 | 30.6 | 13.9 | 13.0 | 24.5 | 58.4 | 45.1 | 54.8 | 51.9 |
| HRS 3530 | 54.5 | 2.5 | 31.4 | 15.2 | 13.8 | 27.6 | 59.1 | 42.7 | 50.7 | 48.8 |
| LCS Rebel | 51.3 | 3.5 | 30.9 | 16.0 | -- | 31.0 | 61.6 | 45.8 | 52.6 | -- |
| LCS Trigger | 57.5 | 1.8 | 32.5 | 12.9 | -- | 27.3 | 59.8 | 52.5 | 57.9 | -- |
| Prosper/ND VitPro | 53.5 | 2.0 | 28.7 | 14.9 | -- | 27.4 | 59.7 | 31.9 | 42.7 | -- |
| MEAN | 54.1 | 1.7 | 29.4 | 15.1 | --- | 27.3 | 59.7 | 38.3 | --- | --- |
| C.V. (%) | 1.7 | 36.8 | 7.5 | 2.4 | --- | 4.9 | 1.1 | 15.8 | --- | --- |
| LSD 0.10 | 1.1 | 0.7 | 2.6 | 0.4 | --- | 1.6 | 0.8 | 7.1 | --- | --- |
| LSD 0.05 | 1.3 | 0.9 | 3.1 | 0.5 | --- | 1.9 | 0.9 | 8.5 | --- | --- |

**Planting Date = May 4 ; Harvest Date = August 15 ; Previous Crop = Spring Wheat**

* This trial was directly planted into an undisturbed wheat stubble.

| Hard Red Spring Wheat | | | | | | | | | | Barnes County - Dazey |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | -- Grain Protein -- | | | | ---------- Grain Yield ---------- | | |
| | Days to | Plant | Plant | | 3-yr. | 1000 | Test | | 2-yr. | 3-yr. |
| Variety | Head | Height | Lodge | 2018 | Avg. | KWT | Weight | 2018 | Avg. | Avg. |
| | | inch | 0 to 9 | --------- % --------- | | gram | lb/bu | ---------- bu/ac ---------- | | |
| SY Ingmar | 46.5 | 30.7 | 0.5 | 15.0 | -- | 29.4 | 60.8 | 72.2 | 76.6 | -- |
| SY Soren | 45.3 | 31.4 | 0.3 | 14.9 | 14.8 | 29.3 | 60.0 | 68.6 | 78.1 | 74.3 |
| Linkert | 45.8 | 34.1 | 0.0 | 15.1 | 14.9 | 33.6 | 60.3 | 66.2 | 73.7 | 75.0 |
| Barlow | 44.8 | 32.9 | 0.5 | 15.4 | 15.2 | 33.0 | 62.1 | 68.1 | 76.3 | 77.4 |
| Elgin-ND | 46.0 | 36.0 | 2.0 | 15.2 | 15.0 | 31.4 | 59.9 | 66.8 | 78.6 | 77.0 |
| SY Valda | 46.8 | 31.9 | 1.3 | 14.4 | 14.0 | 30.9 | 60.1 | 74.8 | 83.5 | 83.3 |
| Glenn | 45.0 | 32.9 | 0.5 | 15.8 | 15.4 | 32.3 | 63.0 | 64.0 | 73.8 | 72.2 |
| Prosper | 47.8 | 35.4 | 1.3 | 14.5 | 14.1 | 37.1 | 60.6 | 76.4 | 85.9 | 84.6 |
| Faller | 48.5 | 35.3 | 1.8 | 14.2 | 13.9 | 36.2 | 60.5 | 75.5 | 83.3 | 83.9 |
| Bolles | 49.8 | 35.0 | 1.0 | 17.0 | 16.6 | 33.0 | 59.3 | 61.0 | 72.3 | 69.6 |
| Rollag | 46.8 | 31.7 | 1.0 | 15.6 | 15.3 | 33.6 | 61.5 | 65.7 | 73.7 | 74.8 |
| Lang-MN | 49.5 | 35.6 | 1.5 | 15.3 | 15.2 | 30.1 | 61.2 | 71.1 | 78.8 | 78.8 |
| ND VitPro | 46.3 | 33.7 | 0.5 | 15.5 | 15.3 | 33.0 | 62.7 | 66.1 | 74.8 | 73.6 |
| Shelly | 47.5 | 33.3 | 0.3 | 14.0 | 13.9 | 33.1 | 61.0 | 76.7 | 86.7 | 85.8 |
| Boost | 48.3 | 38.9 | 0.5 | 14.6 | 14.6 | 32.1 | 59.4 | 72.8 | 79.5 | 77.7 |
| Surpass | 45.0 | 31.0 | 1.8 | 14.8 | 14.5 | 29.9 | 60.0 | 73.8 | 78.7 | 79.9 |
| WB9479 | 45.5 | 29.1 | 0.5 | 15.8 | -- | 33.9 | 60.5 | 72.3 | 81.2 | -- |
| WB9590 | 45.8 | 31.3 | 1.0 | 15.1 | -- | 34.2 | 60.4 | 77.1 | 84.0 | -- |
| WB9719 | 47.8 | 34.3 | 2.5 | 14.5 | -- | 32.9 | 63.1 | 70.8 | 83.6 | -- |
| TCG Climax | 49.3 | 34.7 | 0.5 | 16.1 | -- | 28.6 | 62.5 | 67.9 | -- | -- |
| TCG Spitfire | 48.8 | 32.7 | 1.0 | 13.8 | -- | 34.0 | 60.0 | 74.2 | -- | -- |
| MS Camaro | 46.3 | 32.1 | 0.3 | 14.6 | -- | 29.5 | 60.2 | 70.0 | -- | -- |
| MS Barracuda | 44.0 | 30.9 | 1.3 | 15.0 | -- | 36.1 | 61.2 | 79.3 | -- | -- |
| HRS 3419 | 50.5 | 32.3 | 0.8 | 13.0 | 13.3 | 27.8 | 58.4 | 72.7 | 86.8 | 86.8 |
| HRS 3504 | 46.5 | 30.1 | 0.0 | 13.8 | 13.7 | 29.5 | 58.8 | 72.0 | 80.3 | 79.9 |
| HRS 3530 | 48.3 | 33.0 | 0.8 | 15.6 | 14.8 | 34.1 | 60.6 | 75.9 | 85.0 | 86.4 |
| HRS 3616 | 46.8 | 32.9 | 0.5 | 15.3 | 15.6 | 33.5 | 59.4 | 75.9 | 84.0 | 76.5 |
| HRS 3888 | 46.5 | 32.9 | 0.5 | 14.8 | -- | 31.3 | 58.9 | 73.3 | -- | -- |
| LCS Rebel | 45.0 | 35.8 | 2.0 | 15.1 | -- | 33.8 | 61.9 | 73.4 | 80.9 | -- |
| LCS Trigger | 50.8 | 33.6 | 1.0 | 12.1 | -- | 31.1 | 60.3 | 79.2 | 86.6 | -- |
| MEAN | 46.9 | 33.2 | 0.9 | 14.9 | -- | 32.4 | 60.7 | 71.2 | -- | -- |
| C.V. (%) | 1.4 | 8.9 | 90.2 | 1.5 | -- | 3.2 | 0.6 | 6.5 | -- | -- |
| LSD 0.10 | 0.8 | 3.5 | 0.9 | 0.27 | -- | 1.2 | 0.4 | 5.5 | -- | -- |
| LSD 0.05 | 0.9 | 4.2 | 1.1 | 0.32 | -- | 1.4 | 0.5 | 6.5 | -- | -- |

**Planting Date = May 15 ; Harvest Date = August 21 ; Previous Crop = Soybean**

** Wheat seeding rate used in this trial was 1,400,000 pure live seeds acre$^{-1}$.

| Hard Red Spring Wheat | | | | | | | | | Tri-County - Wishek |
|---|---|---|---|---|---|---|---|---|---|
| | | | --- Grain Protein --- | | | | -------- Grain Yield -------- | | |
| Variety | Days to Head | Plant Height | 2018 | 3-yr. Avg. | 1000 KWT | Test Weight | 2018 | 2-yr. Avg. | 3-yr. Avg. |
| | | inch | ------- % ------- | | gram | lb/bu | ---------- bu/ac ---------- | | |
| SY Ingmar | 53.5 | 30.1 | 16.1 | 14.8 | 31.0 | 61.4 | 63.9 | 52.9 | 61.2 |
| SY Soren | 52.5 | 29.5 | 16.0 | 15.4 | 31.0 | 61.3 | 64.9 | 53.9 | 60.8 |
| Linkert | 52.8 | 28.9 | 16.7 | 15.7 | 36.8 | 61.3 | 53.9 | 45.3 | 57.8 |
| Barlow | 50.8 | 34.1 | 16.1 | 15.4 | 33.0 | 62.1 | 62.4 | 49.4 | 57.8 |
| Elgin-ND | 52.8 | 34.4 | 15.7 | 15.2 | 33.3 | 60.9 | 67.7 | 50.2 | 59.1 |
| SY Valda | 52.0 | 28.3 | 15.3 | 14.6 | 34.6 | 60.4 | 63.9 | 54.7 | 63.4 |
| Glenn | 51.0 | 34.4 | 16.2 | 15.5 | 33.6 | 64.1 | 60.0 | 44.6 | 51.4 |
| Prosper | 54.8 | 32.3 | 15.1 | 14.6 | 39.7 | 61.5 | 63.0 | 49.0 | 61.1 |
| Faller | 55.5 | 30.3 | 15.0 | 14.5 | 40.0 | 61.5 | 66.6 | 48.3 | 61.7 |
| Bolles | 56.8 | 31.5 | 18.6 | 17.7 | 38.2 | 61.0 | 60.6 | 48.8 | 50.7 |
| Rollag | 53.0 | 29.9 | 16.4 | 15.8 | 35.9 | 61.8 | 60.0 | 48.4 | 57.6 |
| Lang-MN | 56.3 | 34.3 | 16.7 | 15.7 | 34.0 | 62.1 | 62.0 | 50.7 | 59.1 |
| ND VitPro | 52.5 | 31.9 | 16.7 | 15.9 | 34.2 | 63.1 | 54.5 | 44.8 | 55.7 |
| Shelly | 55.8 | 30.5 | 15.4 | 14.6 | 35.0 | 62.2 | 66.5 | 54.4 | 60.3 |
| Boost | 56.8 | 31.5 | 16.2 | 15.6 | 35.7 | 60.3 | 57.9 | 46.6 | 54.6 |
| Surpass | 50.3 | 31.7 | 15.5 | 14.7 | 30.3 | 60.3 | 65.7 | 49.9 | 54.6 |
| WB9479 | 52.3 | 27.0 | 17.3 | -- | 34.6 | 61.2 | 56.3 | 46.1 | -- |
| WB9590 | 51.8 | 27.0 | 16.6 | -- | 36.2 | 61.1 | 56.0 | 46.3 | -- |
| WB9719 | 54.3 | 28.7 | 15.1 | -- | 34.4 | 64.0 | 64.2 | 55.5 | -- |
| TCG Climax | 58.0 | 29.1 | 17.5 | -- | 32.9 | 63.3 | 56.7 | -- | -- |
| TCG Spitfire | 55.3 | 28.1 | 15.2 | -- | 36.4 | 60.8 | 59.4 | -- | -- |
| MS Camaro | 51.0 | 26.8 | 16.4 | -- | 33.7 | 62.0 | 52.1 | -- | -- |
| MS Barracuda | 51.5 | 26.6 | 16.6 | -- | 37.1 | 61.7 | 50.5 | -- | -- |
| SY Rockford | 55.3 | 30.9 | 15.9 | -- | 36.8 | 60.1 | 57.8 | -- | -- |
| HRS 3419 | 58.0 | 29.3 | 15.4 | 14.9 | 33.6 | 60.8 | 62.6 | 49.9 | 54.4 |
| HRS 3504 | 53.8 | 28.0 | 14.5 | 14.5 | 33.0 | 60.2 | 60.6 | 49.5 | 58.2 |
| HRS 3530 | 54.8 | 32.3 | 16.1 | 15.5 | 37.4 | 61.0 | 61.5 | 49.5 | 58.8 |
| HRS 3616 | 52.0 | 29.5 | 16.6 | 16.0 | 35.8 | 60.4 | 63.0 | 49.3 | 55.5 |
| HRS 3888 | 53.8 | 28.7 | 15.7 | -- | 34.7 | 60.3 | 61.1 | -- | -- |
| LCS Rebel | 51.5 | 30.5 | 16.2 | -- | 37.9 | 62.4 | 60.2 | 49.7 | -- |
| LCS Trigger | 57.3 | 31.9 | 14.3 | -- | 35.5 | 61.4 | 64.9 | 53.1 | -- |
| Prosper/ND VitPro [1] | 54.0 | 30.9 | 15.8 | -- | 37.6 | 62.3 | 57.2 | 46.9 | -- |
| MEAN | 53.8 | 30.4 | 16.0 | -- | 35.1 | 61.5 | 60.7 | -- | -- |
| C.V. (%) | 1.7 | 5.9 | 2.4 | -- | 3.2 | 0.7 | 10.0 | -- | -- |
| LSD 0.10 | 1.1 | 2.1 | 0.4 | -- | 1.3 | 0.5 | 7.2 | -- | -- |
| LSD 0.05 | 1.3 | 2.5 | 0.5 | -- | 1.6 | 0.6 | 8.5 | -- | -- |

**Planting Date = May 4 ; Harvest Date = August 16 ; Previous Crop = Soybean**

** Plant lodging scores were determined, however there was zero lodging to record.

** Spring wheat seeding rate used in this trial was 1,400,000 pure live seeds acre$^{-1}$

[1] This treatment represent an equal mixture of PLS seed (700K:700K) from each variety at planting.

## Hard Red Spring Wheat - Organic — Carrington

| Variety | Days to Heading | Plant Lodge | Plant Height | 1000 KWT | Grain Protein 2018 | Grain Protein 3-yr. Avg. | Test Weight | Grain Yield 2018 | Grain Yield 3-yr. Avg. |
|---|---|---|---|---|---|---|---|---|---|
| | | 0 to 9 | inch | gram | % | % | lb/bu | bu/ac | bu/ac |
| Glenn | 49.5 | 0.0 | 26.2 | 28.6 | 11.2 | 11.1 | 61.8 | 21.6 | 26.6 |
| Faller | 53.3 | 0.0 | 28.1 | 34.0 | 9.8 | 10.2 | 58.7 | 29.6 | 34.3 |
| Barlow | 49.7 | 0.0 | 27.0 | 29.3 | 11.1 | 11.2 | 59.7 | 29.6 | 31.7 |
| Prosper | 53.3 | 0.0 | 26.0 | 33.9 | 10.1 | -- | 59.3 | 27.8 | -- |
| Elgin-ND | 51.5 | 0.0 | 29.3 | 28.6 | 10.8 | 10.8 | 59.0 | 29.2 | 33.0 |
| Rollag | 50.5 | 0.0 | 26.0 | 29.6 | 11.4 | -- | 59.0 | 27.2 | -- |
| Linkert | 52.0 | 0.0 | 22.7 | 33.4 | 11.8 | -- | 59.0 | 19.6 | -- |
| Bolles | 54.0 | 0.0 | 27.0 | 30.2 | 11.6 | 11.7 | 59.7 | 26.1 | 28.7 |
| Shelly | 54.5 | 0.0 | 23.4 | 28.1 | 9.6 | 10.2 | 59.0 | 22.1 | 30.0 |
| Boost | 54.5 | 0.0 | 27.2 | 31.8 | 11.5 | 11.7 | 58.9 | 25.1 | 28.9 |
| Surpass | 49.3 | 0.0 | 27.4 | 26.8 | 9.3 | 9.6 | 57.5 | 24.8 | 32.0 |
| ND Vitpro | 51.5 | 0.0 | 26.1 | 31.9 | 11.5 | -- | 60.9 | 22.1 | -- |
| SY Soren | 52.3 | 0.0 | 23.4 | 30.1 | 11.8 | -- | 59.8 | 21.2 | -- |
| SY Ingmar | 53.5 | 0.0 | 24.2 | 30.5 | 11.4 | -- | 60.3 | 20.9 | -- |
| SY Valda | 52.4 | 0.0 | 24.7 | 32.7 | 9.8 | -- | 58.9 | 25.2 | -- |
| LCS Rebel | 50.0 | 0.0 | 27.9 | 31.3 | 10.8 | -- | 59.9 | 26.7 | -- |
| TCG Spitfire | 54.3 | 0.0 | 25.9 | 31.4 | 10.5 | -- | 58.8 | 26.7 | -- |
| WB9653 | 53.8 | 0.0 | 25.3 | 31.3 | 9.8 | -- | 57.9 | 29.9 | -- |
| Dapps | 52.3 | 0.0 | 30.0 | 30.0 | 11.8 | 11.8 | 58.7 | 22.8 | 27.4 |
| Mida | 53.7 | 0.7 | 35.3 | 36.8 | 11.5 | -- | 58.5 | 21.0 | -- |
| Ceres | 53.5 | 1.5 | 33.0 | 29.1 | 10.5 | -- | 57.9 | 20.5 | -- |
| FBC Dylan | 51.5 | 0.5 | 25.8 | 30.6 | 9.8 | 10.2 | 58.5 | 25.6 | 30.6 |
| Howard | 51.8 | 0.0 | 26.8 | 31.0 | 10.7 | 10.8 | 59.6 | 23.5 | 31.7 |
| Red Fife | 59.8 | 2.5 | 36.5 | 32.2 | 9.9 | -- | 56.7 | 24.6 | -- |
| Mean | 52.6 | 0.2 | 27.2 | 30.9 | 10.7 | -- | 59.1 | 24.7 | -- |
| C.V. (%) | 1.7 | 158.2 | 6.2 | 4.2 | 3.6 | -- | 0.8 | 19.8 | -- |
| LSD 0.10 | 1.1 | 0.4 | 2.0 | 1.5 | 0.5 | -- | 0.5 | 5.8 | -- |
| LSD 0.05 | 1.3 | 0.5 | 2.4 | 1.8 | 0.6 | -- | 0.6 | 6.9 | -- |

**Planting Date = April 30; Harvest Date = August 6; Previous Crop = Soybeans**

| Hard Red Winter Wheat - Direct Seeded | | | | | | | | | | | Carrington |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ----- Grain Protein ----- | | | | ---------- Grain Yield ---------- | | | |
| Variety | Heading Date | Plant Height | Lodge | 2018 | 3-yr. Avg.[1] | KWT | Test Weight | 2018 | 2-yr. Avg. | 3-yr. Avg.[1] | |
| | | inch | 0 to 9 | ---------- % ---------- | | g/1000 | lb/bu | ---------- bu/ac ---------- | | | |
| Jerry | 6/9 | 34.6 | 2.3 | 14.28 | 14.1 | 33.63 | 59.9 | 68.2 | 57.0 | 59.5 | |
| Decade | 6/9 | 30.2 | 1.0 | 14.90 | 15.0 | 28.52 | 59.6 | 65.4 | 48.4 | 53.6 | |
| Lyman | 6/8 | 31.5 | 3.0 | 14.65 | 15.3 | 35.04 | 61.0 | 74.8 | 54.8 | 55.4 | |
| Ideal | 6/9 | 29.8 | 1.3 | 14.10 | 13.6 | 30.30 | 60.8 | 64.9 | 48.0 | 53.3 | |
| Overland | 6/8 | 30.4 | 1.8 | 14.28 | 14.5 | 31.08 | 60.7 | 67.0 | 53.3 | 54.2 | |
| SY Wolf | 6/9 | 27.2 | 1.0 | 14.55 | 14.1 | 30.35 | 59.7 | 64.3 | 57.2 | 57.1 | |
| WB Matlock | 6/8 | 32.9 | 2.8 | 14.35 | 14.0 | 31.19 | 61.6 | 73.6 | 62.2 | 62.3 | |
| Peregrine | 6/10 | 36.2 | 2.0 | 13.30 | 12.8 | 31.26 | 61.4 | 74.4 | 58.6 | 61.2 | |
| Accipiter | 6/9 | 31.8 | 2.8 | 13.48 | 12.9 | 27.15 | 60.5 | 58.7 | 56.7 | 57.4 | |
| Moats | 6/10 | 33.1 | 2.3 | 14.48 | 13.4 | 30.41 | 60.6 | 70.2 | 59.7 | 60.6 | |
| AAC Wildfire | 6/11 | 32.1 | 0.8 | 14.48 | -- | 28.92 | 59.1 | 70.0 | -- | -- | |
| AC Broadview | 6/8 | 28.3 | 2.8 | 13.48 | 13.1 | 27.17 | 60.3 | 68.0 | 53.2 | -- | |
| AC Emerson | 6/10 | 33.3 | 0.3 | 15.95 | 15.1 | 29.15 | 61.0 | 66.0 | 52.0 | 55.0 | |
| AC Gateway | 6/10 | 29.8 | 0.3 | 15.10 | 14.5 | 30.22 | 61.3 | 68.1 | 54.5 | 55.0 | |
| CDC Chase | 6/9 | 33.9 | 2.3 | 14.35 | 13.4 | 30.30 | 60.9 | 75.3 | 64.5 | 62.2 | |
| Redfield | 6/9 | 29.4 | 2.5 | 14.03 | 13.7 | 31.07 | 61.2 | 74.1 | 64.6 | 62.8 | |
| WB4462 | 6/9 | 30.6 | 1.0 | 13.83 | 14.1 | 29.78 | 61.1 | 71.2 | -- | -- | |
| SY Monument | 6/9 | 27.8 | 1.3 | 13.50 | -- | 29.93 | 58.7 | 64.9 | 47.8 | -- | |
| SY Sunrise | 6/9 | 24.8 | 1.5 | 13.93 | -- | 31.16 | 59.6 | 67.8 | 52.8 | -- | |
| Northern | 6/10 | 29.3 | 1.0 | 14.55 | -- | 28.24 | 58.6 | 63.7 | 55.5 | -- | |
| Loma | 6/11 | 29.0 | 1.3 | 15.25 | -- | 23.73 | 56.2 | 51.8 | 44.3 | -- | |
| Thompson | 6/8 | 33.1 | 0.8 | 14.43 | -- | 29.37 | 60.8 | 69.2 | -- | -- | |
| Oahe | 6/8 | 30.2 | 2.3 | 14.40 | -- | 33.93 | 61.3 | 69.8 | 52.6 | -- | |
| Keldin | 6/10 | 30.5 | 1.8 | 13.75 | -- | 35.25 | 60.5 | 70.7 | 65.6 | -- | |
| AAC Goldrush | 6/10 | 30.9 | 0.3 | 15.38 | -- | 32.03 | 60.5 | 63.0 | -- | -- | |
| Mean | 6/9 | 30.6 | 1.6 | 14.36 | -- | 30.41 | 60.2 | 67.4 | -- | -- | |
| C.V. (%) | 0.5 | 6.1 | 33.7 | 3.3 | -- | 4.50 | 1.6 | 9.6 | -- | -- | |
| LSD (0.10) | 0.9 | 2.2 | 0.6 | 0.56 | -- | 1.62 | 1.1 | 7.6 | -- | -- | |
| LSD (0.05) | 1.1 | 2.6 | 0.8 | 0.66 | -- | 1.94 | 1.3 | 9.1 | -- | -- | |

**Planting Date = September 14, 2017; Harvest Date = July 23, 2018; Previous Crop = Oats**

[1] Three-year average is for 2015, 2017 and 2018 as 2016 trial experienced significant hail.

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

| Durum - Dryland | | | | | | | | | | Carrington |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | --- Grain Protein --- | | | | --------- Grain Yield --------- | | |
| Variety | Days to Head | Plant Lodge | Plant Height | 2018 | 3-yr. Avg.[1] | 1000 KWT | Test Weight | 2018 | 2-yr. Avg. | 3-yr. Avg.[1] |
| | | 0 to 9 | inch | ---------- % | ---------- | gram | lb/bu | ---------- bu/ac | ---------- | |
| Rugby | 55.8 | 3.8 | 41.8 | 13.1 | 14.3 | 38.4 | 63.1 | 54.2 | 51.3 | 47.8 |
| Joppa | 56.0 | 3.3 | 38.2 | 12.6 | 13.7 | 39.3 | 62.9 | 57.4 | 57.1 | 53.4 |
| Divide | 56.8 | 1.5 | 37.9 | 12.6 | 14.2 | 38.2 | 62.3 | 54.2 | 55.6 | 53.3 |
| Carpio | 57.3 | 4.3 | 38.6 | 12.5 | 14.1 | 38.4 | 63.1 | 55.3 | 51.9 | 52.1 |
| Alkabo | 56.3 | 2.3 | 38.6 | 12.8 | 13.8 | 38.9 | 63.1 | 53.1 | 50.3 | 47.4 |
| Tioga | 56.8 | 4.0 | 38.1 | 12.7 | 14.4 | 39.1 | 63.2 | 54.5 | 57.4 | 53.5 |
| Mountrail | 55.8 | 1.8 | 38.4 | 13.4 | 14.2 | 39.5 | 62.3 | 55.0 | 53.3 | 52.4 |
| Grenora | 56.8 | 2.8 | 37.7 | 13.4 | 14.4 | 39.7 | 62.4 | 56.9 | 57.1 | 55.0 |
| VT Peak | 56.3 | 1.8 | 36.3 | 12.9 | 14.2 | 39.1 | 63.7 | 50.9 | 54.1 | 52.3 |
| Lebsock | 55.3 | 2.0 | 35.2 | 13.8 | 14.5 | 39.0 | 63.1 | 46.4 | 53.1 | 51.1 |
| Pierce | 55.3 | 2.0 | 36.1 | 13.6 | 14.0 | 37.4 | 62.4 | 52.1 | 53.6 | 51.3 |
| Maier | 54.5 | 1.5 | 33.5 | 13.8 | 13.9 | 39.7 | 63.0 | 46.4 | 53.9 | 49.1 |
| Ben | 56.5 | 1.0 | 39.3 | 13.2 | 14.4 | 40.2 | 63.0 | 49.5 | 51.2 | 49.5 |
| ND Grano | 57.5 | 2.8 | 40.9 | 13.1 | 14.3 | 38.7 | 63.1 | 58.6 | 60.6 | 57.3 |
| ND Riveland | 56.0 | 2.5 | 40.9 | 13.3 | 14.9 | 40.7 | 62.5 | 59.7 | 55.8 | 53.1 |
| Alzada | 52.3 | 1.8 | 31.2 | 15.2 | 15.3 | 33.9 | 61.7 | 46.0 | 46.4 | 44.9 |
| Strongfield | 56.5 | 3.0 | 39.7 | 13.6 | 15.3 | 36.3 | 62.0 | 54.1 | 52.3 | 50.4 |
| AC Commander | 54.5 | 1.0 | 37.7 | 13.3 | 14.5 | 39.0 | 61.8 | 48.2 | 50.3 | 48.3 |
| CDC Verona | 56.3 | 2.7 | 38.1 | 14.0 | 14.8 | 40.4 | 62.8 | 53.2 | 53.0 | 52.3 |
| TCG-Webster | 52.8 | 2.3 | 31.1 | 12.7 | -- | 38.7 | 62.6 | 49.3 | -- | -- |
| MEAN | 56.3 | 2.4 | 38.3 | 13.2 | -- | 39.4 | 62.8 | 53.8 | -- | -- |
| C.V. (%) | 2.7 | 45.9 | 6.8 | 5.8 | -- | 4.8 | 0.9 | 8.5 | -- | -- |
| LSD 0.10 | 1.8 | 1.3 | 3.0 | 0.9 | -- | 2.2 | 0.7 | 5.3 | -- | -- |
| LSD 0.05 | 2.1 | 1.5 | 3.6 | 1.1 | -- | 2.6 | 0.8 | 6.3 | -- | -- |

**Planting Date = May 1 ; Harvest Date = August 13 ; Previous Crop = Flax**

** Durum seeding rate used in this trial was 1,400,000 pure live seeds acre$^{-1}$.

[1] Three-year average is for 2015, 2017 and 2018 as 2016 trial is not available.

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

## Durum - Dryland Recrop Elite* — Carrington

| Variety | Days to Head | Plant Height | Plant Lodge | Grain Protein 2018 | Grain Protein 3-yr. Avg. | 1000 KWT | Test Weight | Grain Yield 2018 | Grain Yield 2-yr. Avg. | Grain Yield 3-yr. Avg. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | inch | 0 to 9 | % | % | gram | lb/bu | bu/ac | bu/ac | bu/ac |
| Joppa | 57.3 | 33.0 | 2.3 | 13.6 | 13.4 | 28.5 | 58.4 | 31.3 | 41.9 | 42.5 |
| Divide | 58.0 | 33.4 | 1.5 | 15.0 | 14.3 | 31.6 | 59.4 | 36.4 | 41.0 | 39.4 |
| Carpio | 57.3 | 34.5 | 3.0 | 14.7 | 14.0 | 27.9 | 57.8 | 28.1 | 39.1 | 39.9 |
| Alkabo | 56.0 | 32.4 | 2.0 | 14.3 | 13.7 | 26.9 | 57.8 | 27.6 | 36.2 | 37.6 |
| Tioga | 56.3 | 35.5 | 2.5 | 14.0 | 13.8 | 29.3 | 58.1 | 31.8 | 43.2 | 41.6 |
| Mountrail | 56.8 | 32.9 | 2.3 | 14.3 | 13.8 | 26.4 | 56.2 | 25.0 | 38.6 | 39.4 |
| Grenora | 55.0 | 32.6 | 1.0 | 14.6 | 14.0 | 30.2 | 57.8 | 33.8 | 40.6 | 40.8 |
| Lebsock | 55.3 | 32.5 | 1.5 | 14.7 | 14.2 | 28.9 | 58.9 | 31.8 | 39.6 | 38.0 |
| Pierce | 57.5 | 32.9 | 1.8 | 14.7 | 14.1 | 28.3 | 58.7 | 33.3 | 42.5 | 41.9 |
| Ben | 57.3 | 33.9 | 2.3 | 15.2 | 14.8 | 30.1 | 59.2 | 34.7 | 38.6 | 39.0 |
| ND Grano | 57.0 | 32.4 | 1.8 | 15.1 | 14.2 | 25.3 | 56.9 | 35.5 | 44.1 | 43.2 |
| ND Riveland | 57.8 | 35.5 | 3.3 | 13.8 | 13.6 | 28.7 | 57.7 | 35.3 | 42.3 | 41.9 |
| CDC Verona | 56.8 | 35.0 | 1.3 | 15.4 | 14.9 | 29.7 | 59.0 | 35.5 | 42.1 | 40.5 |
| MEAN | 56.8 | 33.5 | 2.0 | 14.5 | -- | 28.4 | 58.1 | 32.0 | -- | -- |
| C.V. (%) | 1.5 | 5.0 | 36.8 | 2.6 | -- | 4.6 | 1.2 | 15.2 | -- | -- |
| LSD 0.10 | 1.0 | 2.0 | 0.9 | 0.45 | -- | 1.6 | 0.9 | 5.8 | -- | -- |
| LSD 0.05 | 1.2 | NS | 1.1 | 0.54 | -- | 1.9 | 1.0 | NS | -- | -- |

**Planting Date = May 4 ; Harvest Date = August 14 ; Previous Crop = Durum**

Durum seeding rate used in this trial was 1,400,000 pure live seeds $acre^{-1}$.

* This trial was directly planted into an undisturbed durum stubble.

**Flax and chickpea intercropping.**

| **Durum - Irrigated** | **Carrington** |
|---|---|

| Variety | Days to Head | Plant Height | Plant Lodge | Grain Protein | 1000 KWT | Test Weight | Grain Yield |
|---|---|---|---|---|---|---|---|
| | | inch | 0 to 9 | % | gram | lb/bu | bu/ac |
| Mountrail | 52.8 | 37.9 | 3.0 | 12.8 | 38.6 | 60.1 | 81.2 |
| Alkabo | 51.5 | 35.0 | 1.3 | 12.7 | 40.2 | 59.8 | 67.0 |
| Divide | 55.3 | 38.7 | 2.8 | 12.1 | 40.5 | 61.0 | 82.6 |
| Carpio | 54.3 | 36.4 | 5.0 | 12.2 | 40.5 | 60.2 | 71.1 |
| Joppa | 53.3 | 37.6 | 2.8 | 12.6 | 39.8 | 60.9 | 85.3 |
| ND Grano | 54.0 | 37.9 | 2.5 | 13.1 | 39.6 | 61.0 | 84.3 |
| ND Riveland | 53.3 | 39.8 | 1.0 | 11.5 | 43.9 | 61.6 | 85.0 |
| MEAN | 54.7 | 38.9 | 2.4 | 12.4 | 41.4 | 60.6 | 79.0 |
| C.V. (%) | 1.4 | 4.6 | 39.2 | 6.2 | 6.1 | 1.5 | 7.7 |
| LSD 0.10 | 0.9 | 2.1 | 1.1 | 0.9 | 3.0 | 1.1 | 7.2 |
| LSD 0.05 | 1.1 | 2.5 | 1.3 | 1.1 | 3.6 | 1.3 | 8.6 |

**Planting Date = May 14 ; Harvest Date = August 22 ; Previous Crop = Soybean**

| **Durum** | **Barnes County - Dazey** |
|---|---|

| Variety | Days to Head | Plant Height | Plant Lodge | Grain Protein | 1000 KWT | Test Weight | Grain Yield |
|---|---|---|---|---|---|---|---|
| | | inch | 0 to 9 | % | gram | lb/bu | bu/ac |
| Joppa | 51.0 | 39.5 | 2.0 | 13.5 | 38.5 | 60.7 | 68.3 |
| Divide | 52.3 | 40.7 | 2.5 | 14.3 | 39.0 | 60.0 | 56.1 |
| Carpio | 52.0 | 40.2 | 2.5 | 13.9 | 40.5 | 60.7 | 64.9 |
| Alkabo | 50.3 | 40.5 | 1.0 | 13.6 | 40.3 | 61.3 | 71.5 |
| Tioga | 52.3 | 40.8 | 2.3 | 14.1 | 40.1 | 60.1 | 61.7 |
| Mountrail | 50.8 | 37.2 | 1.5 | 13.8 | 37.9 | 60.1 | 69.5 |
| Grenora | 50.3 | 38.0 | 2.5 | 13.3 | 39.1 | 60.4 | 75.9 |
| Lebsock | 50.5 | 38.8 | 2.8 | 13.5 | 38.3 | 61.3 | 69.8 |
| ND Grano | 51.8 | 38.5 | 2.5 | 13.6 | 38.3 | 61.6 | 72.4 |
| ND Riveland | 51.8 | 40.0 | 1.3 | 13.5 | 42.1 | 61.0 | 70.1 |
| MEAN | 51.3 | 39.4 | 2.1 | 13.7 | 39.4 | 60.7 | 68.0 |
| C.V. (%) | 1.2 | 4.3 | 30.7 | 2.9 | 2.7 | 0.7 | 7.6 |
| LSD 0.10 | 0.7 | 2.1 | 0.8 | 0.5 | 1.3 | 0.5 | 6.3 |
| LSD 0.05 | 0.9 | NS | 0.9 | 0.6 | 1.6 | 0.6 | 7.5 |

**Planting Date = May 15 ; Harvest Date = August 21 ; Previous Crop = Soybean**

Durum seeding rate used in this trial was 1,400,000 pure live seeds acre$^{-1}$.

| Durum - Organic | | | | | | | | | Carrington |
|---|---|---|---|---|---|---|---|---|---|
| | | | | --- Grain Protein --- | | | | ------ Grain Yield ------ | |
| Variety | Days to Heading | Plant Height | Plant Lodge | 2018 | 3-yr. Avg. | 1000 KWT | Test Weight | 2018 | 3-yr. Avg. |
| | | inch | 0 to 9 | ---------- % | ---------- | gram | lb/bu | ---------- bu/ac | ---------- |
| Maier | 52.0 | 22.6 | 0.8 | 10.1 | -- | 36.7 | 58.7 | 29.1 | -- |
| Mountrail | 52.8 | 22.0 | 0.3 | 9.9 | 9.6 | 36.5 | 59.1 | 28.3 | 23.5 |
| Alkabo | 51.8 | 23.2 | 0.0 | 10.3 | -- | 38.2 | 59.1 | 32.7 | -- |
| Divide | 52.8 | 23.6 | 0.0 | 10.1 | 9.7 | 38.6 | 58.8 | 32.7 | 25.1 |
| Grenora | 51.8 | 23.8 | 0.3 | 10.4 | -- | 40.1 | 58.7 | 33.2 | -- |
| Tioga | 52.3 | 26.2 | 0.3 | 10.1 | 9.6 | 40.1 | 58.9 | 32.4 | 25.3 |
| Carpio | 53.0 | 24.4 | 0.5 | 10.2 | 9.9 | 39.7 | 58.6 | 30.5 | 23.5 |
| Joppa | 52.0 | 25.4 | 0.0 | 9.8 | 9.4 | 38.6 | 59.1 | 33.3 | 26.4 |
| VT Peak | 51.8 | 24.2 | 0.0 | 10.6 | -- | 42.1 | 60.7 | 32.0 | -- |
| ND Grano | 52.8 | 24.2 | 0.0 | 10.0 | -- | 36.8 | 59.7 | 31.1 | -- |
| ND Riveland | 52.3 | 26.8 | 0.0 | 10.1 | -- | 41.2 | 59.6 | 40.8 | -- |
| Mean | 52.3 | 24.2 | 0.2 | 10.1 | -- | 39.0 | 59.2 | 32.4 | -- |
| C.V. (%) | 1.5 | 7.7 | 191.5 | 2.1 | -- | 3.5 | 0.7 | 11.9 | -- |
| LSD 0.10 | 0.9 | 2.2 | 0.4 | 0.2 | -- | 1.6 | 0.4 | 4.6 | -- |
| LSD 0.05 | 1.1 | 2.7 | 0.5 | 0.3 | -- | 2.0 | 0.5 | 5.6 | -- |

**Planting Date = May 2; Harvest Date = August 8; Previous Crop = Cover Crop (field pea, crimson clover, radish, and turnip)**

**Honey bee hives equipped with scales and pollen traps.**

| **Barley - Dryland** | | | | | | | | | | | **Carrington** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | -- Grain Protein -- | | | ------ Grain Yield ------ | | |
| Variety | Days to Head[1] | Plant Lodge | Plant Height | Plump >6/64 | Thin <5/64 | 2018 | 3-yr. Avg. | Test Weight | 2018 | 2-yr. Avg. | 3-yr. Avg. |
| | | 0 to 9 | inch | % | % | ------- % ------- | | lb/bu | --------- bu/ac --------- | | |
| **Six Row** | | | | | | | | | | | |
| Lacey | 51.0 | 1.0 | 30.8 | 94.9 | 0.3 | 11.7 | 13.5 | 46.6 | 110.1 | 104.3 | 88.4 |
| Tradition | 50.3 | 0.5 | 34.4 | 96.3 | 0.3 | 11.5 | 13.4 | 46.1 | 106.9 | 103.2 | 85.2 |
| Stellar-ND | 51.0 | 1.3 | 33.5 | 95.9 | 0.4 | 11.9 | 13.0 | 44.5 | 113.2 | 108.8 | 90.8 |
| Celebration | 50.8 | 2.5 | 33.2 | 95.6 | 0.4 | 12.1 | 14.3 | 45.0 | 106.1 | 100.5 | 86.1 |
| Quest | 51.0 | 0.8 | 33.3 | 92.8 | 0.4 | 12.0 | 13.9 | 44.4 | 110.8 | 106.5 | 87.0 |
| Innovation | 50.3 | 0.5 | 31.3 | 97.5 | 0.2 | 11.2 | 13.7 | 45.7 | 108.3 | 101.1 | 85.7 |
| **Two Row** | | | | | | | | | | | |
| Conlon | na | 3.8 | 30.4 | 97.9 | 0.2 | 11.6 | 13.2 | 47.5 | 103.4 | 95.0 | 80.9 |
| Pinnacle | na | 3.3 | 30.8 | 91.5 | 1.0 | 10.9 | 12.3 | 43.1 | 83.6 | 92.5 | 80.3 |
| ND Genesis | na | 4.5 | 32.1 | 85.0 | 1.4 | 11.4 | 12.5 | 43.0 | 89.8 | 96.6 | 82.3 |
| AAC Synergy | na | 2.3 | 31.3 | 93.9 | 0.6 | 11.4 | 13.2 | 46.0 | 113.2 | 115.3 | 93.1 |
| Sirish | na | 2.8 | 27.8 | 92.0 | 0.4 | 11.1 | 13.4 | 44.1 | 94.8 | 95.1 | 81.2 |
| ABI Balster | na | 2.0 | 29.2 | 88.5 | 1.2 | 11.5 | 13.7 | 45.1 | 104.5 | 107.6 | 90.3 |
| ABI Growler | na | 2.5 | 31.2 | 86.2 | 1.0 | 11.8 | 14.3 | 43.4 | 93.2 | 94.4 | 80.4 |
| LCS Genie | na | 3.3 | 29.0 | 89.2 | 1.2 | 10.8 | 13.3 | 43.5 | 90.2 | 95.5 | 80.9 |
| LCS Odyssey | na | 4.5 | 27.7 | 92.6 | 0.6 | 10.8 | 13.2 | 41.9 | 86.6 | 93.5 | 80.1 |
| Explorer | na | 3.5 | 27.6 | 88.9 | 0.8 | 11.0 | | 44.8 | 101.6 | 103.7 | -- |
| MEAN | 50.6 | 2.0 | 30.9 | 93.7 | 0.6 | 11.1 | -- | 45.0 | 102.4 | -- | -- |
| C.V. (%) | 1.1 | 44.9 | 5.0 | 2.9 | 53.7 | 5.0 | -- | 1.8 | 7.0 | -- | -- |
| LSD 0.10 | 0.7 | 1.0 | 1.8 | 3.2 | 0.3 | 0.7 | -- | 1.0 | 8.5 | -- | -- |
| LSD 0.05 | 0.8 | 1.2 | 2.2 | 3.9 | 0.4 | 0.8 | -- | 1.2 | 10.1 | -- | -- |

**Planting Date = April 30; Harvest Date = July 26; Previous Crop = Canola**

** Barley seeding rate used in this trial was 1,100,000 pure live seeds acre$^{-1}$.

[1] Days to Head; na, data not available, most 2-row varieties did not fully head, the base of the head did not clear the flag leaf collar.

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

| Barley - Dryland Recrop Elite* | | | | | | | | | | | Carrington |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | --- Grain Protein --- | | | ---------- Grain Yield ---------- | | |
| Variety | Days to Head | Plant Height | Plant Lodge | Plump >6/64 | Thin <5/64 | 2018 | 3-yr. Avg. | Test Weight | 2018 | 2-yr. Avg. | 3-yr. Avg. |
| | | inch | 0 to 9 | % | % | ---------- % ---------- | | lb/bu | ---------- bu/ac ---------- | | |
| **Six Row** | | | | | | | | | | | |
| Lacey | 56.5 | 29.9 | 3.5 | 74.9 | 2.2 | 14.6 | 13.2 | 48.6 | 66.8 | 56.1 | 53.8 |
| Tradition | 56.8 | 31.2 | 3.5 | 75.1 | 2.4 | 13.8 | 12.6 | 47.7 | 62.2 | 55.9 | 54.0 |
| Stellar-ND | 57.5 | 30.9 | 5.0 | 72.1 | 3.3 | 14.2 | 13.3 | 47.3 | 57.3 | 48.2 | 47.0 |
| Celebration | 56.8 | 29.9 | 2.8 | 80.9 | 2.2 | 15.0 | 13.8 | 47.3 | 67.6 | 58.5 | 58.9 |
| Quest | 58.3 | 33.5 | 4.0 | 73.7 | 3.1 | 13.9 | 12.9 | 48.1 | 65.3 | 54.6 | 53.9 |
| Innovation | 57.8 | 27.8 | 4.3 | 70.4 | 3.0 | 14.4 | 13.2 | 46.2 | 60.0 | 56.7 | 55.6 |
| **Two Row** | | | | | | | | | | | |
| Pinnacle | 58.0 | 31.5 | 7.5 | 55.1 | 8.2 | 14.3 | 12.7 | 44.7 | 43.5 | 43.4 | 50.5 |
| ND Genesis | 62.8 | 31.4 | 3.8 | 74.8 | 3.1 | 14.3 | 12.3 | 46.2 | 57.6 | 50.4 | 50.2 |
| AAC Synergy | 62.0 | 31.6 | 1.3 | 91.2 | 1.0 | 13.4 | 12.4 | 49.9 | 79.8 | 69.4 | 67.6 |
| Sirish | 62.8 | 29.2 | 6.3 | 78.0 | 2.8 | 14.8 | 13.0 | 46.3 | 50.1 | 44.4 | 49.1 |
| ABI Balster | 61.5 | 30.1 | 2.3 | 81.5 | 2.7 | 15.1 | 13.3 | 47.5 | 60.2 | 56.4 | 58.3 |
| ABI Growler | 62.0 | 29.1 | 4.3 | 71.9 | 4.1 | 15.1 | 13.8 | 45.9 | 60.1 | 52.5 | 51.3 |
| LCS Odyssey | 62.5 | 29.1 | 6.8 | 72.1 | 4.7 | 14.4 | 12.1 | 44.0 | 40.9 | 49.7 | 54.3 |
| Explorer | 58.3 | 26.7 | 6.8 | 83.8 | 1.9 | 14.9 | -- | 47.9 | 59.7 | 53.6 | -- |
| MEAN | 59.5 | 30.1 | 4.4 | 75.4 | 3.2 | 14.4 | -- | 47.0 | 59.4 | -- | -- |
| C.V. (%) | 1.3 | 4.7 | 18.2 | 8.1 | 27.1 | 3.3 | -- | 1.8 | 10.3 | -- | -- |
| LSD 0.10 | 0.9 | 1.7 | 1.0 | 7.3 | 1.0 | 0.6 | -- | 1.1 | 7.3 | -- | -- |
| LSD 0.05 | 1.1 | 2.0 | 1.2 | 8.8 | 1.2 | 0.7 | -- | 1.2 | 8.8 | -- | -- |

**Planting Date = May 4 ; Harvest Date = August 7 ; Previous Crop = Barley**

Barley seeding rate used in this trial was 1,100,000 pure live seeds acre$^{-1}$.

* This trial was directly planted into an undisturbed wheat stubble.

| Barley | | | | | | | | | | | Barnes County - Dazey |
|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | | | | -- Grain Protein -- | | | ------- Grain Yield ------- | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Variety | Days to Head | Plant Height | Plant Lodge | Plump >6/64 | Thin <5/64 | 2018 | 3-yr. Avg. | Test Weight | 2018 | 2-yr. Avg. | 3-yr. Avg. |
| | | inch | 0 to 9 | % | % | --------- % --------- | | lb/bu | ---------- bu/ac ---------- | | |
| **Six Row** | | | | | | | | | | | |
| Lacey | 44.0 | 33.7 | 5.8 | 87.8 | 2.4 | 14.2 | 14.4 | 45.4 | 110.8 | 106.2 | 111.5 |
| Tradition | 44.3 | 33.3 | 5.5 | 89.2 | 2.1 | 13.5 | 13.8 | 45.1 | 110.8 | 114.4 | 112.5 |
| Stellar-ND | 44.0 | 33.3 | 6.0 | 88.0 | 2.0 | 13.8 | 13.7 | 44.2 | 103.3 | 107.4 | 113.2 |
| Celebration | 44.3 | 31.1 | 6.5 | 90.0 | 1.8 | 14.5 | 15.1 | 44.4 | 106.2 | 112.2 | 115.0 |
| Quest | 44.8 | 31.5 | 7.8 | 77.9 | 5.1 | 14.3 | 14.5 | 42.5 | 85.9 | 96.9 | 96.2 |
| Innovation | 44.3 | 33.9 | 3.5 | 91.8 | 1.1 | 13.9 | 14.0 | 45.5 | 119.3 | 120.2 | 121.9 |
| **Two Row** | | | | | | | | | | | |
| Pinnacle | 45.3 | 31.9 | 7.8 | 80.9 | 4.9 | 12.7 | 12.8 | 38.6 | 63.0 | 84.8 | 82.3 |
| ND Genesis | 48.0 | 29.9 | 6.8 | 89.7 | 2.5 | 13.9 | 12.5 | 44.5 | 91.5 | 100.1 | 105.6 |
| AAC Synergy | 47.5 | 31.7 | 5.8 | 90.7 | 2.5 | 13.5 | 13.7 | 45.4 | 100.8 | 103.3 | 108.2 |
| Sirish | 47.5 | 29.3 | 5.5 | 93.8 | 1.2 | 12.8 | 13.9 | 45.0 | 98.6 | 98.2 | 95.2 |
| ABI Balster | 47.5 | 28.9 | 5.8 | 89.2 | 2.8 | 14.6 | 14.7 | 45.1 | 88.7 | 100.5 | 98.2 |
| ABI Growler | 46.8 | 29.1 | 7.0 | 87.0 | 3.7 | 14.0 | 14.8 | 43.8 | 95.8 | 96.9 | 92.4 |
| LCS Odyssey | 48.0 | 27.8 | 8.0 | 88.8 | 2.4 | 12.4 | 13.2 | 40.4 | 75.0 | 83.3 | 82.9 |
| Explorer | 45.8 | 28.5 | 6.0 | 92.0 | 1.7 | 13.0 | -- | 45.4 | 108.0 | 109.4 | -- |
| MEAN | 45.8 | 31.0 | 6.3 | 88.3 | 2.6 | 13.6 | -- | 43.9 | 97.0 | -- | -- |
| C.V. (%) | 1.4 | 4.5 | 19.0 | 3.7 | 40.9 | 5.8 | -- | 2.8 | 13.7 | -- | -- |
| LSD 0.10 | 0.7 | 1.7 | 1.4 | 3.9 | 1.3 | 0.9 | -- | 1.4 | 15.8 | -- | -- |
| LSD 0.05 | 0.9 | 2.0 | 1.7 | 4.7 | 1.5 | 1.1 | -- | 1.7 | 19.0 | -- | -- |

**Planting Date = May 15 ; Harvest Date = August 10 ; Previous Crop = Soybean**

** Barley seeding rate used in this trial was 1,100,000 pure live seeds acre$^{-1}$.

| **Barley** | | | | | | | | | | **Tri-County - Wishek** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | -- Grain Protein -- | | | ------- Grain Yield ------- | | |
| Variety | Plant Lodge | Plant Height | Plump >6/64 | Thin <5/64 | 2018 | 3-yr. Avg. | Test Weight | 2018 | 2-yr. Avg. | 3-yr. Avg. |
| | 0 to 9 | inch | % | % | ------- % ------- | | lb/bu | -------- bu/ac -------- | | |
| **Six Row** | | | | | | | | | | |
| Lacey | 0.8 | 31.1 | 93.7 | 0.4 | 13.9 | 13.8 | 47.4 | 102.4 | 69.2 | 76.5 |
| Tradition | 1.0 | 32.5 | 96.2 | 0.2 | 14.3 | 13.9 | 47.9 | 95.6 | 66.6 | 76.9 |
| Stellar-ND | 1.5 | 30.7 | 96.0 | 0.3 | 13.3 | 13.4 | 46.9 | 97.8 | 61.7 | 72.2 |
| Celebration | 1.8 | 29.3 | 94.9 | 0.5 | 15.2 | 14.6 | 46.3 | 97.2 | 63.7 | 79.5 |
| Quest | 1.8 | 31.7 | 92.4 | 0.6 | 14.3 | 13.7 | 46.1 | 86.8 | 60.8 | 72.8 |
| Innovation | 1.5 | 32.1 | 92.8 | 0.6 | 14.9 | 14.2 | 47.1 | 98.8 | 66.6 | 77.8 |
| **Two Row** | | | | | | | | | | |
| Pinnacle | 2.8 | 30.1 | 92.6 | 0.9 | 12.9 | 12.6 | 46.3 | 73.1 | 51.9 | 67.0 |
| ND Genesis | 2.5 | 29.3 | 92.2 | 0.7 | 14.2 | 13.1 | 45.5 | 76.0 | 55.0 | 70.5 |
| AAC Synergy | 1.5 | 28.9 | 95.7 | 0.4 | 13.6 | 13.7 | 48.3 | 94.2 | 62.3 | 79.5 |
| Sirish | 1.3 | 27.0 | 94.7 | 0.5 | 14.9 | 14.3 | 46.0 | 72.6 | 52.8 | 66.6 |
| ABI Balster | 1.5 | 27.6 | 92.0 | 0.9 | 15.0 | 14.2 | 46.3 | 80.4 | 55.5 | 71.6 |
| ABI Growler | 1.5 | 27.2 | 93.1 | 0.6 | 14.6 | 14.2 | 45.6 | 74.8 | 54.0 | 70.1 |
| LCS Odyssey | 2.8 | 27.8 | 93.5 | 0.9 | 14.0 | 13.4 | 44.5 | 68.0 | 51.6 | 64.3 |
| Explorer | 0.8 | 26.6 | 95.3 | 0.5 | 14.3 | -- | 47.3 | 83.6 | 61.7 | -- |
| MEAN | 1.6 | 29.4 | 93.9 | 0.6 | 14.3 | -- | 46.5 | 85.8 | -- | -- |
| C.V. (%) | 88.7 | 4.6 | 2.4 | 57.2 | 3.5 | -- | 2.4 | 15.1 | -- | -- |
| LSD 0.10 | NS | 1.6 | 2.7 | 0.4 | 0.6 | -- | 1.3 | 15.4 | -- | -- |
| LSD 0.05 | NS | 1.9 | NS | NS | 0.7 | -- | 1.6 | 18.5 | -- | -- |

**Planting Date = May 4; Harvest Date = August 2; Previous Crop = Soybean**

** Barley seeding rate used in this trial was 1,100,000 pure live seeds $acre^{-1}$.

| Barley - Organic | | | | | | | | | Carrington |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | --- Grain Protein --- | | | -------- Grain Yield -------- | |
| Variety | Days to Head | Plant Height | Plump >6/64 | Thin <5/64 | 2018 | 3-yr. Avg. | Test Weight | 2018 | 3-yr. Avg. |
| | | inch | % | % | ---------- % ---------- | | lb/bu | --------- bu/ac ---------- | |
| **Six Row** | | | | | | | | | |
| Lacey | 51.8 | 24.6 | 93.4 | 0.6 | 9.0 | -- | 45.2 | 59.2 | -- |
| Tradition | 52.3 | 26.3 | 92.1 | 0.5 | 9.4 | 9.8 | 45.1 | 50.9 | 55.5 |
| Stellar-ND | 54.0 | 26.0 | 93.0 | 0.6 | 8.8 | 9.4 | 44.0 | 52.0 | 59.5 |
| Celebration | 54.8 | 26.1 | 91.9 | 0.4 | 9.5 | -- | 43.7 | 53.4 | -- |
| Quest | 54.0 | 25.1 | 87.6 | 0.7 | 9.3 | 9.7 | 43.9 | 50.3 | 58.0 |
| Innovation | 53.8 | 23.3 | 96.5 | 0.2 | 9.1 | -- | 44.0 | 53.9 | -- |
| **Two Row** | | | | | | | | | |
| Conlon | 53.0 | 23.1 | 97.8 | 0.3 | 8.5 | 9.5 | 45.4 | 52.0 | 56.5 |
| Rawson | 58.3 | 24.2 | 98.3 | 0.2 | 9.2 | 9.6 | 43.9 | 56.1 | 58.4 |
| Pinnacle | 55.0 | 23.5 | 86.2 | 2.1 | 8.3 | 8.7 | 43.3 | 46.8 | 61.4 |
| ND Genesis | 59.5 | 24.1 | 88.5 | 1.2 | 8.5 | 8.9 | 42.5 | 52.3 | 62.9 |
| ABI Balster | 62.0 | 22.1 | 89.4 | 1.0 | 8.1 | -- | 43.2 | 59.5 | -- |
| ABI Growler | 61.5 | 22.3 | 85.2 | 1.4 | 8.6 | -- | 40.0 | 49.4 | -- |
| Mean | 55.8 | 24.2 | 91.6 | 0.8 | 8.9 | -- | 43.7 | 53.0 | -- |
| C.V. (%) | 2.4 | 7.0 | 3.3 | 38.8 | 4.5 | -- | 1.9 | 11.7 | -- |
| LSD 0.10 | 1.6 | 2.0 | 3.6 | 0.4 | 0.5 | -- | 1.0 | 7.4 | -- |
| LSD 0.05 | 1.9 | 2.4 | 4.4 | 0.5 | 0.6 | -- | 1.2 | 8.9 | -- |

**Planting Date = April 30; Harvest Date = July 24; Previous Crop = Cover Crop (lentil, crimson clover, turnip, and radish)**

**Corn plant population by maturity date study.**

| **Oat - Dryland** | | | | | | | **Carrington** |
|---|---|---|---|---|---|---|---|
| | | | | | | ------ Grain Yield ------ | |
| Variety | Days to Head | Plant Height | Plant Lodge | Grain Protein | Test Weight | 2018 | 3-yr. Avg. [1] |
| | | inch | 0 to 9 | % | lb/bu | -------- bu/ac -------- | |
| Beach | 54.8 | 38.3 | 3.8 | 14.2 | 37.3 | 127.8 | 121.6 |
| CS Camden | 54.5 | 37.7 | 2.8 | 12.1 | 35.5 | 149.5 | -- |
| CDC Dancer | 56.3 | 39.6 | 3.0 | 11.6 | 36.2 | 147.7 | 129.7 |
| Deon | 55.5 | 38.9 | 2.3 | 12.7 | 37.6 | 149.5 | 134.5 |
| Hayden | 53.8 | 36.1 | 4.3 | 12.0 | 37.1 | 142.0 | -- |
| HiFi | 56.8 | 37.4 | 3.3 | 11.3 | 36.6 | 140.2 | 116.4 |
| Hytest | 55.8 | 39.4 | 4.0 | 14.3 | 38.1 | 136.9 | 115.9 |
| Jury | 57.5 | 37.9 | 4.0 | 11.2 | 36.9 | 142.2 | 118.2 |
| Killdeer | 55.5 | 34.6 | 3.0 | 11.1 | 36.2 | 149.4 | 128.2 |
| Legget | 59.5 | 36.7 | 3.3 | 12.4 | 37.1 | 135.6 | 117.7 |
| Minstrel CDC | 55.5 | 39.1 | 1.5 | 9.9 | 35.5 | 140.8 | 125.8 |
| Otana | 54.0 | 37.5 | 5.5 | 12.3 | 37.0 | 154.5 | 118.6 |
| Newburg | 55.0 | 41.2 | 4.3 | 11.4 | 36.6 | 141.9 | 112.3 |
| AC Pinnacle | 54.3 | 41.7 | 4.5 | 11.2 | 37.1 | 148.8 | 129.1 |
| Rockford | 56.0 | 38.1 | 3.0 | 11.2 | 38.0 | 140.8 | 124.2 |
| Souris | 54.5 | 36.4 | 2.5 | 11.2 | 36.8 | 146.6 | 122.9 |
| Stallion | 58.8 | 36.0 | 6.0 | 12.5 | 36.6 | 152.0 | 127.1 |
| Paul | 55.3 | 39.5 | 3.0 | na | 43.0 | 105.6 | 72.6 |
| MEAN | 55.7 | 38.5 | 3.4 | 11.9 | 37.2 | 139.7 | -- |
| C.V. (%) | 4.1 | 5.5 | 38.3 | 4.9 | 3.2 | 13.3 | -- |
| LSD 0.10 | 2.7 | 2.5 | 1.5 | 0.7 | 1.4 | 21.8 | -- |
| LSD 0.05 | NS | 3.0 | 1.8 | 0.8 | 1.7 | 26.2 | -- |

**Planting Date = April 30 ; Harvest Date = August 7 ; Previous Crop = Carinata**

** Oat seeding rate used in this trial was 1,000,000 pure live seeds acre$^{-1}$.

[1] Three-year average is for 2014, 2017 and 2018 as 2016 trial experienced significant hail.

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

| Oat - Organic | | | | | | | Carrington |
|---|---|---|---|---|---|---|---|
| | | | | | | --------- Grain Yield --------- | |
| | Days to | Plant | Plant | Grain | Test | | 3-yr. |
| Variety | Heading | Height | Lodge | Protein | Weight | 2018 | Avg. |
| | | inch | 0 to 9 | % | lb/bu | ---------- bu/ac ---------- | |
| Paul | 58.0 | 29.7 | 0.5 | 10.1 | 43.6 | 57.0 | 44.4 |
| Killdeer | 53.5 | 28.0 | 0.5 | 9.2 | 36.5 | 83.0 | 71.5 |
| HiFi | 56.8 | 28.9 | 0.0 | 10.1 | 37.6 | 76.0 | 71.0 |
| Souris | 54.8 | 27.6 | 1.0 | 9.8 | 36.8 | 78.5 | 66.3 |
| Rockford | 55.0 | 29.7 | 0.3 | 9.4 | 39.0 | 76.2 | 67.2 |
| Newburg | 54.5 | 31.3 | 2.3 | 9.4 | 37.5 | 83.8 | 70.9 |
| Jury | 54.3 | 32.3 | 2.8 | 9.9 | 38.1 | 78.4 | 67.0 |
| Deon | 55.8 | 28.3 | 0.0 | 9.4 | 37.9 | 93.4 | 76.7 |
| CDC Minstrel | 56.8 | 27.8 | 0.0 | 9.9 | 37.4 | 86.4 | 73.6 |
| CDC Dancer | 57.5 | 25.0 | 0.0 | 10.3 | 38.5 | 73.7 | 64.5 |
| AC Pinnacle | 55.5 | 28.5 | 0.0 | 9.2 | 38.5 | 83.8 | 72.7 |
| CS Camden | 56.7 | 28.6 | 0.3 | 9.7 | 37.3 | 87.7 | -- |
| Reins | 49.0 | 25.0 | 0.5 | 9.8 | 36.9 | 70.0 | -- |
| Hayden | 53.8 | 30.5 | 0.5 | 9.4 | 38.2 | 86.2 | -- |
| Jerry | 52.0 | 27.6 | 0.0 | 10.3 | 37.3 | 73.1 | -- |
| Mean | 55.6 | 28.5 | 0.5 | 10.0 | 39.0 | 74.4 | -- |
| C.V. (%) | 1.4 | 8.8 | 95.0 | 4.1 | 0.9 | 16.8 | -- |
| LSD 0.10 | 0.9 | 3.0 | 0.5 | 0.5 | 0.4 | 14.8 | -- |
| LSD 0.05 | 1.1 | 3.6 | 0.6 | 0.6 | 0.5 | 17.8 | -- |

**Planting Date = April 30; Harvest Date = August 7; Previous Crop = Cover Crop (lentil, crimson clover, turnip, and radish)**

| Oat - Organic, Company Nursery | | | | | Carrington |
|---|---|---|---|---|---|
| Variety | Days to Head | Plant Lodge | Plant Height | Test Weight | Grain Yield |
| | | 0 to 9 | inch | lb/bu | |
| Akina | 56.7 | 0.0 | 30.3 | 36.0 | 84.8 |
| Antigo | 48.0 | 1.7 | 30.1 | 38.2 | 79.3 |
| Saddle | 48.3 | 0.0 | 29.7 | 36.3 | 85.4 |
| Leggett | 55.3 | 0.0 | 31.9 | 37.9 | 86.6 |
| Kara | 57.7 | 0.0 | 29.8 | 37.6 | 89.4 |
| Hayden | 54.7 | 0.0 | 31.1 | 37.8 | 84.6 |
| Camden | 57.0 | 0.0 | 31.8 | 36.9 | 98.7 |
| Sumo | 47.3 | 1.3 | 29.7 | 37.2 | 62.6 |
| Summit | 54.0 | 0.3 | 30.8 | 37.2 | 100.2 |
| Ruffian | 58.0 | 0.0 | 32.5 | 36.9 | 99.1 |
| Arborg | 58.0 | 0.0 | 32.3 | 37.5 | 83.0 |
| DEON | 56.0 | 0.0 | 30.8 | 36.9 | 86.9 |
| CDC Norseman | 57.0 | 0.0 | 31.4 | 35.4 | 82.2 |
| Souris | 53.0 | 0.3 | 27.4 | 35.5 | 79.8 |
| Betagene | 53.3 | 0.0 | 27.8 | 35.1 | 70.1 |
| Mean | 54.0 | 0.4 | 30.9 | 37.7 | 84.7 |
| C.V. (%) | 2.0 | 147.6 | 7.6 | 1.0 | 13.5 |
| LSD 0.10 | 1.5 | 0.8 | 3.2 | 0.5 | 15.7 |
| LSD 0.05 | 1.8 | 1.0 | 3.8 | 0.6 | 18.8 |

**Planting Date = April 30; Harvest Date = July 31; Previous Crop = Cover Crop (lentil, crimson clover, turnip, and radish)**


**Organic emmer variety trial.**

| Canola - Clearfield and Sulfonylurea Tolerant Cultivars | | | | | | | | | | | | | | Carrington |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| Brand | Cultivar | Herb. Trait[1] | Oil Type[2] | Blackleg | Days to Bloom | Bloom Duration | Days to PM | Plant Height | Plant Lodge | 1000 KWT | Test Weight | Oil Content | ----- Seed Yield ----- 2018 | 2-yr. Avg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | inch | 0 to 9 | gram | lb/bu | % @ 8.5%M | --------- lb/ac | --------- |
| **Clearfield Type** | | | | | | | | | | | | | | |
| Cargill | V32-1Cl | CL | HO | R | 37.5 | 20.5 | 79.3 | 49.1 | 2.5 | 3.43 | 52.0 | 37.3 | 1656 | 2065 |
| Canterra Seeds | CS2500CCCL | CL | Trad. | R | 38.0 | 19.0 | 78.0 | 50.2 | 1.8 | 3.81 | 51.6 | 38.2 | 1530 | -- |
| **SU Type** | | | | | | | | | | | | | | |
| Cibus | C5522 | SU | Trad. | R | 37.3 | 20.3 | 78.3 | 48.1 | 1.0 | 3.43 | 51.4 | 38.3 | 1282 | 2002 |
| | | | MEAN | | 37.4 | 20.0 | 78.5 | 47.8 | 1.3 | 3.59 | 51.6 | 38.2 | 1514 | -- |
| | | | C.V. (%) | | 1.6 | 4.3 | 1.1 | 5.8 | 73.3 | 7.70 | 1.0 | 2.4 | 13.9 | -- |
| | | | LSD 0.10 | | 0.7 | 1.1 | 1.1 | 3.4 | 1.2 | NS | NS | NS | NS | -- |
| | | | LSD 0.05 | | 0.9 | 1.3 | 1.3 | 4.2 | NS | NS | NS | NS | NS | -- |

**Planting Date = May 22 ; Harvest Date = August 23 ; Previous Crop = Forage Barley**

[1] Herbicide Trait: Herbicide tolerance trait; CL = Clearfield tolerant. SU = SU tolerant.

[2] Oil Type: Trad. = Traditional, and HO = High Oleic

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

| Canola - Roundup Ready Cultivars | | | | | | | | | | | | | | | Carrington |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | --- Seed Yield --- | |
| Brand | Cultivar | Status [1] | Oil Type [2] | Blackleg | Days to Bloom | Bloom Duration | Days to PM | Plant Height | Plant Lodge | 1000 KWT | Test Weight | Oil Content | 2018 | 3-yr. Avg. |
| | | | | | | | | inch | 0 to 9 | gram | lb/bu | % @ 8.5%M | ------ lb/ac ------ | |
| Cargill | 15RH1142 | Exp | Trad | R | 42.8 | 17.3 | 82.0 | 51.2 | 0.0 | 3.31 | 52.8 | 37.3 | 2022 | -- |
| Cargill | 15RH1167 | Exp | HO | R | 43.0 | 16.0 | 80.5 | 48.7 | 0.0 | 3.36 | 52.2 | 39.2 | 2084 | -- |
| Dupont Pioneer | 45M35 | CA | Trad | MR | 40.3 | 16.8 | 78.5 | 47.9 | 0.5 | 3.04 | 52.1 | 39.4 | 1779 | -- |
| Dupont Pioneer | 45CS40 | CA | Trad | R | 40.0 | 17.3 | 77.5 | 44.2 | 1.8 | 2.94 | 52.4 | 37.7 | 1258 | 1979 |
| Dupont Pioneer | 45H33 | CA | Trad | R | 39.0 | 18.0 | 77.5 | 46.0 | 0.5 | 2.99 | 52.0 | 38.9 | 1731 | -- |
| Croplan | HyClass 930 | CA | Trad | R | 37.0 | 17.3 | 75.3 | 43.9 | 2.8 | 3.34 | 51.4 | 39.9 | 1669 | 2131 |
| Croplan | HyClass 955 | CA | Trad | R | 37.3 | 17.3 | 76.5 | 43.8 | 4.3 | 3.34 | 51.2 | 39.3 | 1899 | 2140 |
| Croplan | HyClass 730 | CA | Trad | R | 37.5 | 16.3 | 75.0 | 43.1 | 2.8 | 3.26 | 51.2 | 39.1 | 1617 | -- |
| Brett Young | 6074 RR | CA | Trad | R | 40.5 | 18.3 | 80.0 | 43.2 | 3.5 | 2.93 | 52.2 | 38.6 | 1863 | 2381 |
| Brett Young | 6090 RR | CA | Trad | R | 42.7 | 17.7 | 80.7 | 53.7 | 1.0 | 3.30 | 52.2 | 37.7 | 1536 | -- |
| Brett Young | 4187 RR | CA | Trad | R | 42.0 | 17.3 | 81.5 | 48.2 | 3.5 | 3.35 | 52.0 | 39.6 | 1877 | -- |
| Dekalb | DKL 70-10 | CA | Trad | R | 37.5 | 18.0 | 76.8 | 43.8 | 5.0 | 3.31 | 51.7 | 39.2 | 1863 | 2343 |
| Dekalb | DKL 35-23 | CA | Trad | MR | 36.5 | 16.8 | 74.0 | 43.0 | 3.5 | 3.06 | 51.1 | 38.4 | 1886 | -- |
| Dekalb | DKL 71-14BL | CA | Trad | R | 37.5 | 17.3 | 76.3 | 44.6 | 4.5 | 3.25 | 51.7 | 39.9 | 1500 | 2126 |
| Dekalb | DKL 75-42CR | CA | Trad | R | 38.8 | 17.5 | 77.3 | 46.2 | 3.8 | 3.08 | 51.3 | 41.3 | 1734 | -- |
| Canterra Seeds | CS2300 | CA | Trad | R | 41.8 | 17.5 | 81.5 | 46.3 | 1.0 | 3.53 | 51.2 | 38.9 | 1793 | -- |
| Canterra Seeds | CS2100 | CA | Trad | R | 38.0 | 19.0 | 78.0 | 45.6 | 2.0 | 3.59 | 52.0 | 37.9 | 1724 | 2303 |
| Integra | 7150 | CA | Trad | R | 36.8 | 16.5 | 74.5 | 42.3 | 4.0 | 3.28 | 51.4 | 41.2 | 1742 | 1993 |
| Integra | 7257 | CA | Trad | R | 37.3 | 17.0 | 74.3 | 43.5 | 2.0 | 3.34 | 52.2 | 37.2 | 1716 | 2112 |
| Star Specialty | Star 402 | CA | Trad | R | 37.8 | 17.3 | 76.3 | 43.9 | 3.0 | 3.43 | 50.9 | 41.5 | 1706 | 2147 |
| | | MEAN | | | 39.2 | 17.3 | 77.8 | 45.7 | 2.2 | 3.25 | 51.8 | 39.1 | 1736 | -- |
| | | C.V. (%) | | | 1.8 | 4.0 | 1.9 | 5.9 | 103 | 5.6 | 0.6 | 2.3 | 13.4 | -- |
| | | LSD 0.10 | | | 0.8 | 0.8 | 1.7 | 3.2 | 2.7 | 0.22 | 0.4 | 1.1 | 276 | -- |
| | | LSD 0.05 | | | 1.0 | 1.0 | 2.1 | 3.8 | 3.2 | 0.26 | 0.5 | 1.3 | 330 | -- |

**Planting Date = May 21 ; Harvest Date = August 23 ; Previous Crop = Forage Barley**

[1] Status refers to availability to producers: CA = Commercially available, while EXP = Experimental line.

[2] Oil Type: Trad = Traditional, and HO = High Oleic

| Brand | Hybrid | Hybrid Type[1] | Tech Trait | Plant Ht. | Days to Bloom | Days to PM | Moist. at Harvest | Test Weight | Oil Content[2] | Seed Yield 2018 | Seed Yield 2-yr. Avg. | Seed Yield 3-yr. Avg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | inch | | | % | lb/bu | % | lb/ac | lb/ac | lb/ac |
| Allegiant | 65H81CL | HO | Clearfield | 56.6 | 59.8 | 101.0 | 8.7 | 29.8 | 41.3 | 1483 | -- | -- |
| Allegiant | 70H51CL | HO | Clearfield | 59.5 | 64.8 | 104.5 | 9.5 | 28.6 | 43.1 | 1215 | -- | -- |
| Croplan | 3845 HO | HO | N/A | 55.5 | 62.8 | 102.3 | 8.9 | 31.0 | 40.7 | 1381 | 1715 | -- |
| Croplan | 450 E HO | HO | ExpressSun | 62.2 | 63.3 | 105.8 | 11.1 | 28.9 | 39.9 | 1655 | 1854 | -- |
| Croplan | 455 E HO | HO | ExpressSun | 65.2 | 62.8 | 103.3 | 9.3 | 28.4 | 40.4 | 1373 | 1802 | 1837 |
| Croplan | 545 Cl | NuSun | Clearfield | 55.2 | 63.8 | 101.0 | 8.5 | 28.5 | 41.5 | 1279 | 1913 | 1912 |
| Croplan | 549 CL | NuSun | Clearfield | 69.1 | 62.0 | 100.5 | 8.9 | 29.7 | 41.3 | 1675 | 2188 | 1965 |
| Croplan | 557 CL HO | HO | Clearfield | 58.7 | 63.8 | 102.5 | 8.8 | 28.6 | 40.4 | 1409 | -- | -- |
| Croplan | 568 CL HO | HO | Clearfield | 59.7 | 65.3 | 103.8 | 9.3 | 28.5 | 40.3 | 1165 | 1739 | -- |
| Croplan | 432 E | NuSun | ExpressSun | 61.9 | 59.5 | 101.3 | 9.2 | 29.8 | 39.2 | 1822 | 2333 | 2041 |
| Dupont Pioneer | P63HE90 | HO | ExpressSun | 61.5 | 62.5 | 103.8 | 10.4 | 29.1 | 41.0 | 1532 | 1908 | 1919 |
| Dupont Pioneer | P64HE101 | HO | ExpressSun | 59.6 | 64.5 | 105.3 | 12.4 | 29.0 | 40.2 | 1556 | -- | -- |
| Dupont Pioneer | P64ME01 | NuSun | ExpressSun | 59.5 | 64.0 | 105.0 | 10.5 | 29.8 | 41.5 | 1510 | 1916 | 1914 |
| Dyna-Gro | H42HO18CL | HO | Clearfield | 56.4 | 60.5 | 101.3 | 8.6 | 29.6 | 40.2 | 1305 | -- | -- |
| Dyna-Gro | H44HO12CL | HO | Clearfield | 60.2 | 60.8 | 101.3 | 8.7 | 30.6 | 41.7 | 1307 | -- | -- |
| Dyna-Gro | H45NS16ClL | NuSun | Clearfield | 58.9 | 61.0 | 99.3 | 8.3 | 28.7 | 41.4 | 1330 | -- | -- |
| Dyna-Gro | H48HO15CL | HO | Clearfield | 59.0 | 64.5 | 105.8 | 10.3 | 27.8 | 41.8 | 1365 | -- | -- |
| Dyna-Gro | H49HO19CL | HO | Clearfield | 58.2 | 63.5 | 102.3 | 9.3 | 27.7 | 40.1 | 1552 | -- | -- |
| Dyna-Gro | XH81H51EX | HO | ExpressSun | 47.6 | 50.0 | 99.0 | 8.3 | 26.2 | 35.3 | 818 | -- | -- |
| Dyna-Gro | XH81N46EX | NuSun | ExpressSun | 61.5 | 62.0 | 100.3 | 8.6 | 27.4 | 40.4 | 1225 | -- | -- |
| Dyna-Gro | XH81N48EX | NuSun | ExpressSun | 61.9 | 63.3 | 101.7 | 9.4 | 30.8 | 43.0 | 1366 | -- | -- |
| Dyna-Gro | XH82H63EX | HO | ExpressSun | 66.6 | 63.5 | 105.3 | 11.9 | 30.9 | 40.0 | 1619 | -- | -- |
| | | | MEAN | 61.5 | 62.6 | 102.4 | 9.3 | 29.1 | 40.9 | 1454 | -- | -- |
| | | | C.V. (%) | 10.2 | 1.6 | 1.3 | 6.4 | 2.9 | 2.1 | 15.3 | -- | -- |
| | | | LSD 0.10 | 7.3 | 1.2 | 1.5 | 0.7 | 1.0 | 1.0 | 260 | -- | -- |
| | | | LSD 0.05 | 8.7 | 1.4 | 1.8 | 0.8 | 1.2 | 1.2 | 309 | -- | -- |

**Planting Date = June 5 ; Harvest Date = October 19 ; Previous Crop = Flax**

| Brand | Hybrid | Hybrid Type[1] | Tech Trait | Plant Ht. | Days to Bloom | Days to PM | Moist. at Harvest | Test Weight | Oil Content[2] | Seed Yield 2018 | Seed Yield 2-yr. Avg. | Seed Yield 3-yr. Avg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | inch | | | % | lb/bu | % | lb/ac | lb/ac | lb/ac |
| Dyna-Gro | XH82H65EX | HO | ExpressSun | 62.8 | 61.5 | 100.3 | 8.7 | 27.5 | 39.3 | 1441 | -- | -- |
| LCS | LCSADVX18-001HO | HO | N/A | 66.0 | 64.5 | 101.3 | 8.8 | 27.9 | 40.7 | 1349 | -- | -- |
| LCS | LCSADVX18-002HO | HO | N/A | 70.4 | 62.5 | 100.8 | 8.5 | 29.4 | 40.1 | 1614 | -- | -- |
| LCS | LCSADVX18-003HOCLP | HO | Clearfield Plus | 63.9 | 63.8 | 102.8 | 8.7 | 28.4 | 39.5 | 1457 | -- | -- |
| LCS | LCSADVX18-004HO | HO | N/A | 66.2 | 63.0 | 100.8 | 8.6 | 27.9 | 39.5 | 1362 | -- | -- |
| LCS | LCSADVX18-005LN | Traditional | N/A | 68.1 | 65.0 | 105.3 | 8.8 | 31.1 | 42.8 | 1434 | -- | -- |
| LCS | LCSADVX18-006HO | HO | N/A | 60.2 | 63.0 | 104.5 | 8.9 | 29.3 | 40.6 | 1673 | -- | -- |
| LCS | LCSADVX18-007LN | Traditional | N/A | 68.5 | 62.5 | 101.3 | 8.6 | 29.3 | 41.9 | 1586 | -- | -- |
| LCS | LCSADVX18-008HOCL | HO | Clearfield | 63.0 | 63.3 | 100.8 | 8.3 | 28.4 | 39.5 | 1427 | -- | -- |
| LCS | LCSADVX18-009LN | Traditional | N/A | 65.6 | 61.8 | 97.8 | 8.4 | 28.4 | 40.1 | 1558 | -- | -- |
| LCS | LCSADVX18-010LNCLP | Traditional | Clearfield Plus | 69.1 | 64.3 | 105.8 | 10.2 | 30.8 | 41.8 | 1824 | -- | -- |
| LCS | LCSADVX18-011LN | Traditional | N/A | 64.7 | 62.0 | 99.3 | 8.5 | 28.0 | 41.6 | 1505 | -- | -- |
| LCS | LCSADVX18-012LNCLP | Traditional | Clearfield Plus | 59.3 | 63.0 | 102.3 | 8.6 | 27.3 | 40.2 | 1446 | -- | -- |
| LCS | LCSADVX18-013LN | Traditional | N/A | 66.8 | 62.3 | 97.8 | 8.6 | 28.9 | 41.3 | 1811 | -- | -- |
| Mycogen Seeds | 8H449CLDM | HO | Clearfield | 54.8 | 64.0 | 102.3 | 9.4 | 33.2 | 42.3 | 1173 | 1825 | 1814 |
| Mycogen Seeds | MY8H456CL | HO | Clearfield | 62.1 | 64.5 | 104.8 | 9.5 | 27.3 | 41.7 | 1312 | 1530 | -- |
| Mycogen Seeds | MY8H460CP | HO | Clearfield | 59.4 | 65.0 | 107.0 | 12.3 | 31.5 | 44.5 | 1284 | -- | -- |
| Nuseed | Badger DMR | NuSun | Clearfield | 59.9 | 61.3 | 101.5 | 8.5 | 28.4 | 39.2 | 1749 | 2185 | 2026 |
| Nuseed | Camaro II | NuSun | Clearfield | 61.8 | 62.8 | 101.0 | 9.2 | 30.8 | 42.4 | 1818 | 1975 | 1871 |
| Nuseed | Falcon | NuSun | ExpressSun | 58.5 | 63.8 | 102.3 | 9.2 | 31.8 | 42.5 | 1323 | 1349 | 1407 |
| Nuseed | Hornet | HO | Clearfield | 64.1 | 63.8 | 101.0 | 9.0 | 28.6 | 39.9 | 1510 | 1914 | 1816 |
| Nuseed | N4H302 E | HO | ExpressSun | 63.0 | 62.3 | 100.0 | 8.4 | 28.4 | 39.2 | 1268 | 1855 | -- |
| | | | MEAN | 61.5 | 62.6 | 102.4 | 9.3 | 29.1 | 40.9 | 1454 | -- | -- |
| | | | C.V. (%) | 10.2 | 1.6 | 1.3 | 6.4 | 2.9 | 2.1 | 15.3 | -- | -- |
| | | | LSD 0.10 | 7.3 | 1.2 | 1.5 | 0.7 | 1.0 | 1.0 | 260 | -- | -- |
| | | | LSD 0.05 | 8.7 | 1.4 | 1.8 | 0.8 | 1.2 | 1.2 | 309 | -- | -- |

**Planting Date = June 5 ; Harvest Date = October 19 ; Previous Crop = Flax**

| Brand | Hybrid | Hybrid Type[1] | Tech Trait | Plant Ht. | Days to Bloom | Days to PM | Moist. at Harvest | Test Weight | Oil Content[2] | Seed Yield 2018 | Seed Yield 2-yr. Avg. | Seed Yield 3-yr. Avg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | inch | | | % | lb/bu | % | lb/ac | lb/ac | lb/ac |
| Nuseed | N4HM354 | NuSun | Clearfield | 54.4 | 60.0 | 99.5 | 8.4 | 29.5 | 42.1 | 1637 | 1706 | 1715 |
| Nuseed | N4H470 CL Plus | HO | Clearfield Plus | 60.0 | 63.8 | 101.3 | 8.8 | 28.4 | 41.0 | 1233 | 1747 | -- |
| Nuseed | N5LM307 | NuSun | Clearfield | 63.0 | 60.3 | 101.3 | 9.2 | 27.3 | 39.5 | 1491 | 1567 | 1591 |
| Nutech | 63C4 | NuSun | Clearfield | 56.3 | 60.8 | 100.5 | 8.7 | 29.8 | 42.1 | 1322 | 1735 | 1723 |
| Nutech | 64H6 | HO | ExpressSun | 62.2 | 61.8 | 102.0 | 8.8 | 28.8 | 39.4 | 1590 | -- | -- |
| Nutech | 68H7 | HO | ExpressSun | 65.5 | 63.0 | 104.0 | 11.6 | 31.0 | 40.4 | 1397 | 1511 | 1657 |
| Nutech | 68M5 | NuSun | ExpressSun | 62.2 | 62.8 | 103.8 | 10.4 | 29.5 | 40.4 | 1529 | -- | -- |
| Nutech | 69M2 | NuSun | ExpressSun | 62.1 | 64.0 | 106.0 | 11.3 | 30.0 | 42.4 | 1409 | 1861 | -- |
| Proseed | E 50016 CL | NuSun | Clearfield Plus | 61.1 | 63.8 | 104.3 | 9.0 | 30.0 | 42.6 | 1333 | 1831 | -- |
| Proseed | E-21 CL | NuSun | Clearfield | 65.6 | 62.8 | 106.0 | 11.5 | 28.2 | 41.0 | 1233 | 1502 | -- |
| Proseed | E-31 CL | NuSun | Clearfield | 60.9 | 63.5 | 104.3 | 9.4 | 28.5 | 40.5 | 1560 | 1807 | 1716 |
| Proseed | E-362436 | NuSun | N/A | 67.1 | 60.5 | 101.0 | 9.5 | 31.1 | 41.0 | 1696 | 2055 | -- |
| Proseed | E-71 CL | NuSun | Clearfield | 58.9 | 64.0 | 103.3 | 9.3 | 28.8 | 41.2 | 1586 | 1889 | -- |
| Proseed | E-72 | NuSun | N/A | 61.5 | 63.8 | 102.5 | 9.4 | 29.9 | 42.9 | 1417 | 1663 | -- |
| Proseed | E-73 CL | NuSun | Clearfield | 63.3 | 64.8 | 103.0 | 10.0 | 28.9 | 41.2 | 1499 | 1906 | -- |
| Sunopta | 4415 HO/CLP/DM | HO | Clearfield Plus | 61.7 | 63.3 | 103.3 | 9.2 | 30.3 | 41.5 | 1395 | 1659 | 1669 |
| Sunopta | 4425 CL | NuSun | Clearfield | 64.5 | 62.8 | 105.0 | 8.8 | 29.9 | 39.3 | 1777 | 2022 | 2104 |
| Sunopta | EX721CL | HO | Clearfield | 65.2 | 63.5 | 101.5 | 8.9 | 27.5 | 38.9 | 1471 | -- | -- |
| Sunopta | EX72468CL | NuSun | Clearfield | 64.8 | 65.8 | 106.5 | 10.3 | 26.9 | 42.3 | 1441 | -- | -- |
| Sunopta | EX725 CL | NuSun | Clearfield | 62.0 | 62.8 | 105.3 | 9.9 | 27.8 | 40.9 | 1755 | -- | -- |
| | | | MEAN | 61.5 | 62.6 | 102.4 | 9.3 | 29.1 | 40.9 | 1454 | -- | -- |
| | | | C.V. (%) | 10.2 | 1.6 | 1.3 | 6.4 | 2.9 | 2.1 | 15.3 | -- | -- |
| | | | LSD 0.10 | 7.3 | 1.2 | 1.5 | 0.7 | 1.0 | 1.0 | 260 | -- | -- |
| | | | LSD 0.05 | 8.7 | 1.4 | 1.8 | 0.8 | 1.2 | 1.2 | 309 | -- | -- |

**Planting Date = June 5 ; Harvest Date = October 19 ; Previous Crop = Flax**

[1] Oil Type: HO = High Oleic, NS = NuSun, Trad = Traditional. * Hybrid detail as provided by seed company.

[2] Oils reported at 10% moisture.

| **Non-Oilseed Sunflower** | | | | | | | | | | | | | **Carrington** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Seed Yield | | |
| Brand | Hybrid | Type | Plant Height | Days to Bloom | Days to PM | Seeds >22/64 | Seeds >20/64 | Seeds >18/64 | Harvest Moist. | Test Weight | 2018 | 2-yr. Avg. | 3-yr. Avg. |
| | | | inch | | | % | % | % | % | lb/bu | lb/ac | | |
| Sunopta | 9553 | Traditional | 65.6 | 65.0 | 107.0 | 20.7 | 50.4 | 69.2 | 11.2 | 24.2 | 1620 | 1686 | -- |
| Sunopta | 9510 | Traditional | 67.5 | 63.0 | 103.5 | 2.4 | 33.6 | 66.4 | 10.5 | 24.2 | 1248 | 1525 | -- |
| Red River Commodities | 2215 | Traditional | 64.6 | 63.5 | 105.3 | 3.9 | 33.0 | 65.8 | 10.6 | 24.8 | 2276 | 1976 | 1910 |
| Red River Commodities | 2215 CL | Trad./Clearfield | 65.0 | 66.0 | 107.8 | 2.9 | 24.6 | 56.1 | 11.8 | 24.9 | 1730 | 1727 | 1720 |
| Red River Commodities | 2310 | Traditional | 66.0 | 63.0 | 103.5 | 2.6 | 40.2 | 65.6 | 10.9 | 24.0 | 1431 | -- | -- |
| Red River Commodities | 2414 | Traditional | 71.0 | 65.5 | 106.8 | 15.8 | 43.8 | 69.8 | 11.6 | 24.3 | 1710 | -- | -- |
| Valia Genetics | Valia 41 | Traditional | 64.0 | 66.0 | 108.5 | 12.8 | 31.4 | 54.8 | 12.4 | 26.3 | 1518 | 1747 | -- |
| Valia Genetics | Valia 73 | Traditional | 63.4 | 64.0 | 103.5 | 16.1 | 43.1 | 60.0 | 10.5 | 22.5 | 1202 | -- | -- |
| Valia Genetics | H9811EXP | Traditional | 66.1 | 65.0 | 106.8 | 6.4 | 41.8 | 62.8 | 11.1 | 25.2 | 1730 | -- | -- |
| Nuseed | Panther DMR | NuSun | 57.1 | 58.0 | 98.8 | 0.5 | 16.1 | 59.4 | 9.9 | 24.7 | 1793 | 1845 | 1864 |
| Nuseed | NSKM53777 | NuSun/Clearfield | 56.0 | 60.5 | 105.3 | 1.5 | 24.2 | 59.0 | 10.9 | 24.9 | 1462 | 1587 | -- |
| Nuseed | 4334 | NuSun/Clearfield | 60.9 | 63.8 | 106.8 | 1.2 | 34.5 | 60.9 | 11.0 | 24.6 | 1257 | 1513 | -- |
| Valia Genetics | H9812EXP | Traditional | 69.0 | 64.3 | 105.0 | 11.7 | 46.6 | 63.9 | 10.5 | 23.8 | 1743 | -- | -- |
| | | MEAN | 63.9 | 63.5 | 105.3 | 7.4 | 34.8 | 61.6 | 11.0 | 24.7 | 1601 | -- | -- |
| | | C.V. (%) | 7.8 | 0.6 | 1.1 | 127.0 | 42.0 | 21.6 | 5.1 | 2.5 | 15.1 | -- | -- |
| | | LSD 0.10 | 6.0 | 0.4 | 1.4 | 11.2 | 17.4 | NS | 0.7 | 0.7 | 289 | -- | -- |
| | | LSD 0.05 | 7.2 | 0.5 | 1.7 | 13.5 | 21.0 | NS | 0.8 | 0.9 | 347 | -- | -- |

**Planting Date = June 5 ; Harvest Date = October 29 ; Previous Crop = Flax**

| **Flax** | | | | | | | | | **Carrington** |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | ---------- Seed Yield ---------- | | |
| Variety | Days to Bloom | Days to PM | Plant Height | Plant Lodge | Oil Content | Test Weight | 2018 | 2-yr. Avg. | 3-yr. Avg. |
| | | | inch | 0 to 9 | % (9%M) | lb/bu | ---------- bu/ac ---------- | | |
| Bison | 47.8 | 80.8 | 31.6 | 0.3 | 42.5 | 54.3 | 32.6 | -- | -- |
| Carter | 49.3 | 82.5 | 28.3 | 0.5 | 42.9 | 54.5 | 28.4 | 26.7 | 24.8 |
| CDC Bethune | 49.5 | 83.0 | 32.7 | 1.0 | 43.2 | 53.6 | 36.4 | 33.9 | 28.1 |
| CDC Glas | 49.0 | 80.5 | 29.7 | 1.3 | 43.1 | 53.3 | 34.1 | 32.4 | 27.5 |
| CDC Neela | 47.8 | 81.8 | 29.0 | 0.8 | 44.0 | 55.0 | 35.7 | 31.3 | 27.4 |
| CDC Sanctuary | 48.0 | 81.8 | 31.4 | 0.5 | 42.8 | 54.2 | 34.5 | 32.2 | 27.7 |
| CDC Sorrel | 48.0 | 79.8 | 29.4 | 1.8 | 43.2 | 53.6 | 36.2 | 34.7 | 29.3 |
| Gold ND | 50.8 | 85.0 | 33.0 | 1.0 | 43.1 | 54.7 | 32.9 | 30.7 | 27.4 |
| ND Hammond | 48.3 | 82.0 | 30.3 | 0.3 | 42.1 | 53.9 | 35.5 | 33.4 | -- |
| Nekoma | 50.0 | 83.0 | 32.4 | 0.8 | 43.5 | 54.7 | 34.2 | 31.6 | 28.1 |
| Omega | 47.8 | 78.3 | 28.9 | 0.8 | 42.4 | 54.7 | 30.0 | 29.0 | 23.7 |
| Pembina | 49.3 | 82.0 | 33.5 | 0.3 | 43.8 | 54.5 | 34.9 | 30.9 | 26.3 |
| Prairie Blue | 45.3 | 74.5 | 28.3 | 0.0 | 43.6 | 54.4 | 40.3 | 32.8 | 26.5 |
| Prairie Sapphire | 48.8 | 76.5 | 29.2 | 0.8 | 42.0 | 54.4 | 34.2 | 31.3 | 26.8 |
| Prairie Thunder | 48.0 | 81.3 | 27.7 | 0.3 | 43.4 | 54.9 | 35.5 | 34.5 | 29.3 |
| Rahab 94 | 49.3 | 81.8 | 32.1 | 0.3 | 44.1 | 54.5 | 36.0 | 33.4 | 28.4 |
| Webster | 48.8 | 82.8 | 32.5 | 0.0 | 44.2 | 54.3 | 37.1 | 34.5 | 30.3 |
| York | 49.3 | 82.0 | 29.1 | 0.0 | 42.1 | 55.1 | 34.2 | 33.8 | 27.4 |
| MEAN | 48.9 | 81.5 | 30.6 | 0.5 | 43.4 | 54.3 | 34.3 | -- | -- |
| C.V. (%) | 1.3 | 2.5 | 5.0 | 189 | 3.2 | 0.4 | 12.5 | -- | -- |
| LSD 0.10 | 0.7 | 2.4 | 1.8 | NS | 1.6 | 0.28 | NS | -- | -- |
| LSD 0.05 | 0.9 | 2.8 | 2.2 | NS | 2.0 | 0.34 | NS | -- | -- |

**Planting Date = May 16 ; Harvest Date = August 23 ; Previous Crop = Forage Barley**

* All varieties were planted at adjusted seeding rates to attain the planting of 3.2 million PLS/acre

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

## Flax - Organic Carrington

| Variety | Days to Bloom | Days to PM | Plant Height | Oil Content | Test Weight | Seed Yield 2018 | Seed Yield 2-yr. Avg. | Seed Yield 3-yr. Avg. |
|---|---|---|---|---|---|---|---|---|
| | | | inch | % | lb/bu | bu/ac | | |
| Omega | 39.0 | 80.3 | 26.1 | 43.4 | 51.2 | 13.8 | 14.0 | 11.5 |
| Carter | 43.0 | 82.8 | 27.3 | 42.3 | 51.5 | 15.4 | 15.3 | 13.3 |
| Gold ND | 44.0 | 84.8 | 31.5 | 43.1 | 51.6 | 19.3 | 17.3 | 14.3 |
| Pembina | 42.0 | 82.3 | 31.1 | 42.0 | 50.9 | 15.5 | 14.3 | 12.4 |
| York | 43.3 | 85.8 | 28.4 | 41.5 | 51.9 | 19.4 | 16.7 | 13.9 |
| Neela | 41.8 | 83.0 | 27.8 | 41.9 | 50.5 | 19.5 | 17.7 | -- |
| Prairie Thunder | 42.3 | 81.5 | 26.2 | 42.0 | 51.1 | 16.0 | 13.6 | 12.3 |
| CDC Melyn | 45.0 | 87.8 | 30.8 | 43.6 | 50.8 | 15.9 | 13.8 | -- |
| Neche | 43.0 | 86.5 | 29.4 | 42.1 | 51.2 | 15.8 | -- | -- |
| Mean | 42.6 | 83.8 | 28.7 | 42.5 | 51.2 | 16.7 | -- | -- |
| C.V. (%) | 1.0 | 0.7 | 4.3 | 2.0 | 0.6 | 17.3 | -- | -- |
| LSD 0.10 | 0.5 | 0.7 | 1.5 | 1.0 | 0.4 | 3.5 | -- | -- |
| LSD 0.05 | 0.6 | 0.8 | 1.8 | 1.2 | 0.4 | 4.2 | -- | -- |

**Planting Date = May 22; Harvest Date = August 24; Previous Crop = Oats**

**Flax breeder nursery.**

| **Safflower** | | | | | | | | | | | **Carrington** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | ---- Seed Yield ---- | |
| Variety | Oil Type | Plant Stand[1] | Days to Bloom | Days to PM | Plant Height | Plant Lodge | 1000 KWT | Oil Content | Test Weight | 2018 | 3-yr. Avg. |
| | | % | | | inch | 0 to 9 | grams | % | lb/bu | -------- lb/ac -------- | |
| Cardinal | Linoleic | 92 | 63.7 | 100.7 | 24.7 | 1.7 | 32.7 | 34.0 | 41.7 | 2111 | 2099 |
| Finch | Oleic | 65 | 65.0 | 101.3 | 22.0 | 2.0 | 29.9 | 32.1 | 41.4 | 1481 | 1769 |
| Hybrid 200 | Oleic | 82 | 64.0 | 102.3 | 22.8 | 3.3 | 40.3 | 28.4 | 40.0 | 2093 | 2023 |
| Hybrid 446 | Oleic | 78 | 63.3 | 99.0 | 22.3 | 3.7 | 42.6 | 27.9 | 40.8 | 2215 | -- |
| Hybrid 1601 | Oleic | 93 | 62.7 | 102.0 | 24.7 | 3.0 | 40.8 | 32.8 | 37.5 | 2803 | 2699 |
| MonDak | Oleic | 93 | 64.3 | 100.0 | 23.6 | 1.0 | 34.9 | 31.7 | 39.6 | 2371 | 2363 |
| Montola 2003 | Oleic | 95 | 64.3 | 100.0 | 22.0 | 1.7 | 28.2 | 32.6 | 38.8 | 2074 | 2159 |
| NutraSaff | Linoleic | 88 | 63.7 | 101.3 | 25.5 | 1.0 | 30.6 | 41.9 | 36.5 | 1512 | 1613 |
| Rubis Red | Linoleic | 80 | 64.0 | 100.0 | 23.6 | 3.3 | 37.5 | 28.2 | 44.6 | 2162 | -- |
| Chickadee | Oleic | 90 | 63.7 | 102.0 | 23.4 | 3.0 | 31.3 | 33.6 | 41.2 | 2306 | -- |
| MEAN | | 86 | 63.9 | 100.9 | 23.5 | 2.4 | 34.9 | 32.3 | 40.2 | 2113 | -- |
| C.V. (%) | | 7.2 | 0.9 | 1.5 | 5.5 | 34.6 | 3.9 | 1.7 | 0.9 | 7.8 | -- |
| LSD 0.10 | | 8.7 | 0.9 | NS | 1.8 | 1.2 | 1.9 | 0.8 | 0.5 | 232 | -- |
| LSD 0.05 | | 10.5 | 1.0 | NS | 2.2 | 1.4 | 2.3 | 0.9 | 0.7 | 281 | -- |

**Planting Date = May 17 ; Harvest Date = September 10 ; Previous Crop = Field Pea**

[1] Plant Stand: Percent of full stand; soil crusting after planting resulted in emerged stands that differred among varieties.

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

| **Einkorn - Organic** | | | | | | | **Carrington** |
|---|---|---|---|---|---|---|---|
| | | | | | | ---------- Grain Yield ---------- | |
| Variety | Days to Head | Plant Lodge | Plant Height | 1000 KWT | Test Weight | 2018 | 3-yr. Avg. |
| | | 0-9 | inch | gram | lb/bu | ---------- lb/ac ---------- | |
| TM 23 | 53.0 | 0.5 | 28.7 | 22.3 | 30.1 | 1776 | 1822 |
| PI 538722 | 54.0 | 2.3 | 34.0 | 22.0 | 29.7 | 1895 | -- |
| WB Apline | 61.8 | 2.3 | 38.2 | 26.0 | 29.9 | 1801 | -- |
| Mean | 56.3 | 1.7 | 33.6 | 23.5 | 29.9 | 1824.0 | -- |
| C.V. (%) | 0.5 | 38.7 | 3.7 | 8.2 | 7.1 | 13.7 | -- |
| LSD 0.10 | 0.4 | 0.9 | 1.7 | 2.6 | NS | NS | -- |
| LSD 0.05 | 0.5 | 1.1 | 2.2 | 3.3 | NS | NS | -- |

**Planting Date = May 2; Harvest Date = August 8; Previous Crop = Cover Crop (field pea, crimson clover, radish, and turnip)**

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

| **Emmer - Organic** | | | | | | **Carrington** |
|---|---|---|---|---|---|---|
| Variety | Days to Heading | Plant Lodge | Plant Height | 1000 KWT | Test Weight | Grain Yield |
| | | 0 to 9 | inch | gram | lb/bu | lb/ac |
| Vernal | 53.8 | 1.3 | 32.6 | 59.8 | 37.2 | 2362 |
| Lucille | 54.5 | 1.0 | 32.3 | 64.9 | 37.0 | 2272 |
| ND Common | 54.5 | 2.8 | 32.1 | 60.1 | 38.3 | 2323 |
| Yaroslav | 54.0 | 4.3 | 31.7 | 61.8 | 37.4 | 2323 |
| Mean | 54.2 | 2.3 | 32.2 | 61.7 | 37.4 | 2320.0 |
| C.V. (%) | 1.0 | 20.7 | 5.9 | 5.7 | 1.9 | 9.3 |
| LSD 0.10 | 0.7 | 0.6 | NS | 4.6 | 0.9 | NS |
| LSD 0.05 | NS | 0.8 | NS | NS | 1.1 | NS |

**Planting Date = May 2; Harvest Date = July 31; Previous Crop = Cover Crop (field pea, crimson clover, radish, and turnip)**

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

| **Winter Rye** | | | | | | | | | | | **Carrington** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | --- Grain Yield --- | |
| Variety | Vigor[1] | Winter Survival | Jday of Head | Early Height[2] | Plant Height[2] | Plant Lodge | Ergot Sclerotia[3] | 1000 KWT | Test Weight | 2018 | 3-yr. Avg. |
| | 1-10 | % | | inch | inch | 0 to 9 | % | gram | lb/bu | ----- bu/ac ----- | |
| Hancock | 2.3 | 66.3 | 155.3 | 8.3 | 36.9 | 1.3 | 0.70 | 27.5 | 51.1 | 44.1 | 51.6 |
| Spooner | 1.0 | 38.8 | 154.3 | 9.0 | 38.2 | 2.3 | 0.42 | 27.0 | 49.7 | 36.6 | 46.4 |
| Rymin | 8.0 | 91.3 | 155.5 | 8.9 | 34.5 | 0.8 | 0.32 | 30.7 | 52.2 | 61.2 | 61.1 |
| ND Dylan | 8.5 | 95.0 | 154.5 | 8.3 | 38.0 | 2.0 | 0.18 | 24.9 | 51.0 | 60.2 | 62.5 |
| Dacold | 6.5 | 85.8 | 159.0 | 8.5 | 38.6 | 1.8 | 0.29 | 24.6 | 48.4 | 52.9 | 54.6 |
| Aroostok | 3.8 | 71.0 | 149.3 | 11.2 | 37.8 | 5.3 | 0.81 | 20.8 | 50.0 | 29.1 | 36.4 |
| Hazlet | 8.0 | 90.8 | 155.8 | 8.4 | 32.9 | 1.3 | 0.29 | 29.7 | 51.9 | 55.1 | 58.1 |
| Wheeler | 4.8 | 81.3 | 158.0 | 9.2 | 39.9 | 0.0 | 5.03 | 33.0 | 46.3 | 18.0 | 17.3 |
| Brasetto | 8.3 | 91.8 | 155.3 | 8.4 | 28.8 | 0.0 | 0.35 | 23.2 | 48.8 | 58.8 | -- |
| Mean | 6.0 | 80.8 | 154.4 | 9.1 | 36.3 | 1.8 | 0.88 | 26.4 | 50.0 | 46.3 | -- |
| C.V. (%) | 18.4 | 10.8 | 0.5 | 14.0 | 3.7 | 30.3 | 45.2 | 4.1 | 0.9 | 11.7 | -- |
| LSD 0.10 | 1.3 | 10.5 | 1.0 | 1.5 | 1.6 | 0.6 | 0.48 | 1.3 | 0.6 | 6.5 | -- |
| LSD 0.05 | 1.6 | 12.7 | 1.2 | 1.8 | 2.0 | 0.7 | 0.58 | 1.6 | 0.7 | 7.8 | -- |

**Planting Date = September 21, 2017 ; Harvest Date = July 23 ; Previous Crop = Oats**

[1] Vigor: 1 = worst and 10 = best

[2] Early height taken May 17 and plant height taken at harvest.

[3] Ergot = ergot sclerotia bodies in a processed sample expressed as percent by weight.

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

| Winter Rye - Organic | | | | | | | | | | Carrington |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | --- Grain Yield --- | |
| Variety | Vigor[1] | Winter Survival | Jday of Head | Early Height[2] | Plant Height[2] | Plant Lodge | 1000 KWT | Test Weight | 2018 | 2-yr. Avg. |
| | 1-10 | % | | inch | inch | 0 to 9 | gram | lb/bu | ------ bu/ac ------ | |
| Hancock | 5.5 | 67.5 | 151.0 | 12.2 | 43.4 | 2.5 | 30.5 | 53.4 | 66.6 | 68.8 |
| Spooner | 1.8 | 38.8 | 150.3 | 12.9 | 42.9 | 1.8 | 30.3 | 52.5 | 55.4 | 58.3 |
| Rymin | 8.5 | 93.8 | 152.5 | 11.1 | 39.9 | 1.8 | 34.0 | 54.7 | 74.7 | 79.2 |
| ND Dylan | 9.3 | 97.8 | 150.8 | 11.8 | 44.6 | 3.8 | 27.4 | 53.4 | 71.3 | 73.0 |
| Dacold | 8.0 | 88.5 | 156.0 | 11.7 | 45.5 | 4.3 | 26.7 | 51.8 | 66.8 | 69.8 |
| Aroostok | 6.3 | 72.5 | 146.3 | 14.4 | 43.4 | 5.0 | 22.8 | 52.5 | 47.0 | 46.4 |
| Hazlet | 8.8 | 91.3 | 152.5 | 11.9 | 39.7 | 2.0 | 33.5 | 54.4 | 76.0 | 77.6 |
| Wheeler | 1.0 | 32.5 | 157.5 | 10.9 | 47.6 | 0.3 | 35.7 | 46.9 | 22.4 | 23.1 |
| Brasetto | 8.8 | 95.0 | 152.8 | 10.8 | 33.4 | 0.0 | 28.9 | 52.5 | 85.5 | 84.0 |
| Mean | 6.7 | 77.6 | 151.5 | 12.2 | 42.4 | 2.5 | 24.4 | 52.5 | 62.9 | -- |
| C.V. (%) | 13.4 | 9.0 | 0.3 | 10.9 | 4.3 | 27.9 | 3.6 | 0.9 | 5.5 | -- |
| LSD 0.10 | 1.1 | 8.4 | 0.6 | 1.6 | 2.2 | 0.8 | 1.3 | 0.6 | 4.2 | -- |
| LSD 0.05 | 1.3 | 10.0 | 0.7 | 1.9 | 2.7 | 1.0 | 1.5 | 0.7 | 5.0 | -- |

**Planting Date = September 22, 2017 ; Harvest Date = July 23 ; Previous Crop = Cover Crop (Field Pea, Lentil, Radish and Rapeseed)**

[1] Vigor: 1 = worst and 10 = best

[2] Early height taken May 17 and plant height taken at harvest.

| Spelt - Organic | | | | | | Carrington |
|---|---|---|---|---|---|---|
| Variety | Days to Heading | Plant Lodge | Plant Height | 1000 KWT | Test Weight | Grain Yield |
| | | 0 to 9 | inch | gram | lb/bu | lb/ac |
| CDC Zorba | 57.0 | 0.0 | 37.4 | 58.0 | 26.0 | 2389 |
| 94-288 | 50.0 | 2.0 | 27.7 | 59.9 | 22.8 | 2113 |
| SK3P | 51.8 | 0.8 | 37.5 | 61.5 | 31.6 | 1809 |
| Mean | 52.5 | 1.0 | 34.0 | 59.9 | 26.9 | 2074 |
| C.V. (%) | 0.6 | 27.4 | 4.1 | 10.1 | 5.4 | 7.0 |
| LSD 0.10 | 0.4 | 0.4 | 2.0 | NS | 2.1 | 207.0 |
| LSD 0.05 | 0.6 | 0.5 | 2.5 | NS | 2.6 | 264.1 |

**Planting Date = May 2; Harvest Date = August 8; Previous Crop = Cover Crop (field pea, crimson clover, radish, and turnip)**

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

| Variety | Heading Date | Plant Height | Lodge | KWT | Test Weight | Grain Protein | ----- Grain Yield ----- 2018 | 3-yr. Avg. |
|---|---|---|---|---|---|---|---|---|
| | | in | 0-9 | g/1000 | lb/bu | % | ------- bu/ac ------- | |
| NT09404 | 6/11 | 36.0 | 2.3 | 31.0 | 45.2 | 17.9 | 38.0 | -- |
| NE96T441 | 6/12 | 44.9 | 2.0 | 40.6 | 49.7 | 17.8 | 60.6 | -- |
| NT11406 | 6/11 | 35.1 | 1.5 | 32.8 | 49.8 | 17.5 | 58.2 | 55.5 |
| NT13443 | 6/10 | 43.3 | 3.8 | 41.6 | 50.2 | 19.2 | 53.6 | -- |
| NT13416 | 6/11 | 41.7 | 3.0 | 38.2 | 49.3 | 18.8 | 46.2 | -- |
| NT12414 | 6/11 | 32.3 | 2.8 | 30.0 | 47.6 | 17.7 | 42.8 | -- |
| NT11428 | 6/11 | 41.9 | 3.3 | 34.7 | 48.1 | 17.8 | 40.3 | 50.2 |
| NT09423 | 6/10 | 34.8 | 2.3 | 31.7 | 49.2 | 18.0 | 49.8 | 52.0 |
| NT07403 | 6/4 | 31.9 | 3.3 | 31.0 | 50.0 | 17.3 | 42.1 | 44.7 |
| NT12434 | 6/11 | 29.6 | 1.8 | 33.3 | 46.3 | 17.9 | 49.6 | -- |
| NT12403 | 6/8 | 32.8 | 2.0 | 34.2 | 50.6 | 17.2 | 46.3 | -- |
| Mean | 6/10 | 36.8 | 2.6 | 34.45 | 48.7 | 17.91 | 48.0 | -- |
| C.V. (%) | 0.9 | 10.4 | 39.9 | 5.1 | 3.2 | 3.7 | 17.5 | -- |
| LSD (0.10) | 2.0 | 4.6 | 1.2 | 2.10 | 1.9 | 0.80 | 10.1 | -- |
| LSD (0.05) | 2.0 | 5.5 | 1.5 | 2.53 | 2.3 | 0.97 | 12.1 | -- |

**Planting Date = October 11, 2017; Harvest Date = July 31; Previous Crop = Oats**

Plant Lodge: 0 = no lodging; 9 = plants lying flat.

**Scarlet Runner bean grown in the greenhouse for intercropping studies and ornamental use.**

| Soybean - Dryland, Conventional and Liberty Link Varieties | | | | | | | | | | | | | Carrington |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | ------ Seed Yield ------ | | |
| Brand | Variety | Mat. Group[1] | Days to PM[2] | Pod Ht | Plant Ht | Plant Lodge | Seeds/ pound | Seed Protein[3] | Seed Oil[3] | Test Weight | 2018 | 2-yr. Avg. | 3-yr. Avg. |
| | | | | inch | inch | 0 to 9 | | % | % | lb/bu | --------- | bu/ac | --------- |
| NA | RR Check 1 | 00.9 | 98.3 | 3.8 | 32.4 | 0.8 | 3716 | 36.2 | 17.9 | 58.6 | 25.4 | 32.5 | -- |
| NA | RR Check 2 | 00.6 | 97.8 | 3.3 | 29.5 | 1.0 | 3345 | 36.4 | 18.0 | 58.0 | 22.6 | 32.1 | -- |
| NA | RR Check 3 | 00.8 | 95.8 | 3.4 | 27.8 | 2.8 | 3895 | 37.5 | 17.5 | 58.2 | 25.1 | -- | -- |
| NDSU | ND Henson | 0.0 | 97.8 | 3.4 | 28.7 | 1.0 | 4463 | 37.6 | 17.3 | 58.9 | 22.6 | 31.8 | 38.7 |
| NDSU | ND Bison | 0.7 | 104.8 | 3.4 | 25.8 | 0.5 | 4262 | 36.9 | 17.4 | 58.7 | 21.3 | 38.6 | -- |
| NDSU | ND Benson | 0.4 | 105.8 | 3.7 | 28.2 | 0.8 | 4243 | 39.1 | 17.4 | 58.6 | 21.3 | 34.3 | 41.5 |
| NDSU | ND Stutsman | 0.7 | 102.8 | 4.2 | 31.9 | 0.3 | 4446 | 37.5 | 17.3 | 58.9 | 24.8 | 43.5 | 51.1 |
| NA | RR Check 4 | 0.9 | 108.0 | 4.4 | 31.9 | 1.5 | 3249 | 37.9 | 17.6 | 57.4 | 19.6 | 33.9 | -- |
| NDSU | Ashtabula | 0.4 | 99.3 | 4.1 | 33.3 | 1.0 | 4620 | 36.9 | 17.8 | 58.6 | 25.4 | 36.9 | 45.4 |
| NDSU | Sheyenne | 0.7 | 104.5 | 5.1 | 31.6 | 0.5 | 4011 | 38.0 | 17.1 | 58.7 | 27.6 | 42.4 | 49.4 |
| Richland IFC | MK0249 | 0.2 | 106.3 | 4.5 | 25.7 | 0.0 | 5622 | 38.4 | 15.9 | 58.8 | 20.1 | 32.7 | 40.5 |
| Richland IFC | MK0603 | 0.6 | 108.3 | 4.4 | 30.5 | 0.8 | 5600 | 38.7 | 15.0 | 58.3 | 14.8 | 29.5 | 36.6 |
| Richland IFC | MK42 | 00.7 | 105.3 | 4.5 | 29.4 | 0.8 | 3247 | 40.4 | 16.3 | 58.3 | 18.4 | -- | -- |
| Richland IFC | MK0508 | 0.8 | 108.5 | 4.8 | 26.3 | 0.5 | 5308 | 38.5 | 15.8 | 59.2 | 10.5 | 26.0 | 35.2 |
| Richland IFC | MK808CN | 0.8 | 107.0 | 3.1 | 29.8 | 0.3 | 4356 | 37.2 | 17.6 | 58.7 | 15.3 | 35.5 | 43.0 |
| Caldbeck Consulting | ATSOY062234 | | 93.3 | 4.2 | 34.4 | 1.5 | 3589 | 37.1 | 18.3 | 58.0 | 23.2 | -- | -- |
| Caldbeck Consulting | ATSOY111298 | | 105.3 | 3.0 | 30.8 | 0.3 | 3574 | 39.3 | 17.0 | 58.1 | 12.8 | -- | -- |
| Caldbeck Consulting | ATSOY102408 | | 94.0 | 3.7 | 34.4 | 2.3 | 3461 | 37.8 | 18.0 | 58.6 | 23.4 | -- | -- |
| Caldbeck Consulting | ATSOY0825X2 | | 94.5 | 2.9 | 24.9 | 0.5 | 4156 | 39.9 | 15.2 | 59.5 | 18.1 | -- | -- |
| Caldbeck Consulting | ATSOY082500 | | 90.0 | 2.5 | 30.7 | 2.7 | 4169 | 38.6 | 17.3 | 59.0 | 14.9 | -- | -- |
| Caldbeck Consulting | ATSOY080668 | | 93.3 | 3.1 | 30.2 | 0.0 | 4240 | 35.9 | 18.5 | 57.8 | 23.1 | -- | -- |
| Caldbeck Consulting | ATSOY110978 | | 93.8 | 3.3 | 30.7 | 0.8 | 3348 | 36.6 | 18.7 | 58.3 | 21.9 | -- | -- |
| Caldbeck Consulting | ATSOY121302 | | 87.8 | 4.2 | 28.5 | 3.8 | 4662 | 34.7 | 19.0 | 57.5 | 25.3 | -- | -- |
| Thunder | 5803 LL | 0.3 | 106.3 | 5.2 | 27.3 | 1.3 | 3826 | 38.4 | 17.7 | 57.9 | 21.5 | -- | -- |
| Thunder | 5605 LLN | 0.5 | 106.0 | 4.8 | 24.6 | 1.0 | 4132 | 38.8 | 17.5 | 58.5 | 16.8 | -- | -- |
| Thunder | 5707 LLN | 0.7 | 106.3 | 2.8 | 25.0 | 1.0 | 3540 | 38.0 | 16.0 | 58.8 | 16.2 | -- | -- |
| | MEAN | | 101.5 | 3.9 | 29.0 | 0.9 | 4237 | 38.0 | 17.2 | 58.5 | 19.9 | -- | -- |
| | C.V. (%) | | 1.2 | 36.6 | 11.4 | 64.2 | 4.6 | 1.6 | 2.1 | 0.6 | 26.6 | -- | -- |
| | LSD 0.10 | | 1.4 | NS | 3.9 | 0.7 | 231 | 0.7 | 0.4 | 0.4 | 6.2 | -- | -- |
| | LSD 0.05 | | 1.7 | NS | 4.6 | 0.8 | 276 | 0.9 | 0.5 | 0.5 | 7.5 | -- | -- |

**Planting Date = May 23 ; Harvest Date = September 17 ; Previous Crop = Spring Wheat**

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

[2] Days to PM: average of 102 = September 2.

[3] Seed oil and protein contents reported at 13% moisture.

Plant Lodge: 0 = no lodging; 9 = plants lying flat.

| Soybean - Dryland, Roundup Ready Varieties | | | | | | | | | | | | Carrington (Page 1 of 2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | -- Seed Yield -- | |
| | | Maturity | Days | Pod | Plant | Plant | Test | Grain | Grain | Seeds/ | | 2-yr. |
| Brand | Variety | Group[1] | to PM | Height | Height | Lodge | Weight | Protein[2] | Oil[2] | Pound | 2018 | Avg. |
| | | | | in. | in. | 0-9 | lb/bu | % | % | | ----- bu/ac ----- | |
| Channel | 0218R2X | 0.2 | 105.8 | 4.4 | 32.4 | 1.8 | 57.9 | 36.9 | 17.9 | 3698 | 31.3 | 44.2 |
| Channel | 0518R2X | 0.5 | 109.3 | 7.0 | 27.9 | 0.8 | 58.2 | 38.5 | 17.0 | 3743 | 32.2 | 44.9 |
| Channel | 0619R2X | 0.6 | 109.0 | 4.4 | 26.3 | 0.8 | 58.0 | 39.1 | 16.8 | 4161 | 29.2 | -- |
| Nutech | 6026 | 0.2 | 110.3 | 5.1 | 26.0 | 2.3 | 58.0 | 37.6 | 17.4 | 3352 | 30.3 | -- |
| Dairyland | DSR-0450R | 0.4 | 104.0 | 4.0 | 29.7 | 1.0 | 58.2 | 38.7 | 17.1 | 3721 | 27.5 | -- |
| Nutech | 6097R2 | 0.9 | 107.3 | 4.1 | 28.5 | 1.5 | 58.0 | 36.3 | 18.2 | 3886 | 27.4 | 48.2 |
| LG Seeds | LGS0111RX | 0.1 | 103.0 | 3.9 | 32.5 | 1.0 | 58.0 | 38.4 | 17.0 | 3935 | 30.7 | -- |
| LG Seeds | LGS0355RX | 0.3 | 105.5 | 4.4 | 28.1 | 1.0 | 58.5 | 37.9 | 16.7 | 4244 | 31.1 | -- |
| LG Seeds | LGS0400RX | 0.4 | 107.5 | 3.5 | 28.7 | 2.3 | 58.3 | 37.9 | 17.0 | 3852 | 29.8 | -- |
| LG Seeds | LGS0550RX | 0.5 | 106.5 | 3.7 | 28.9 | 2.8 | 58.2 | 39.1 | 17.0 | 4215 | 30.5 | -- |
| REA | RX0228 | 0.2 | 103.8 | 3.7 | 33.2 | 1.3 | 58.1 | 37.1 | 17.6 | 3920 | 26.8 | 41.1 |
| REA | RX0516 | 0.5 | 107.8 | 5.3 | 30.1 | 2.8 | 57.9 | 38.4 | 17.2 | 3768 | 42.3 | -- |
| REA | RX0628 | 0.6 | 109.8 | 4.0 | 27.7 | 1.3 | 57.5 | 37.5 | 17.2 | 4106 | 32.4 | 41.9 |
| REA | RX0719 | 0.7 | 109.5 | 4.3 | 26.6 | 1.8 | 58.0 | 37.8 | 17.6 | 3768 | 34.0 | -- |
| Thunder | SB8903N | 0.3 | 105.8 | 3.5 | 30.1 | 0.5 | 57.9 | 37.2 | 17.2 | 3915 | 34.5 | -- |
| Thunder | SB8906N | 0.6 | 110.3 | 4.5 | 31.0 | 0.8 | 57.9 | 36.9 | 17.5 | 3938 | 29.9 | -- |
| Thunder | 3907 R2Y | 0.7 | 110.0 | 4.1 | 25.8 | 3.3 | 58.0 | 39.3 | 17.0 | 3570 | 28.4 | -- |
| Proseed | 80-20 | 0.2 | 105.0 | 5.0 | 28.1 | 0.8 | 58.3 | 37.8 | 16.9 | 4231 | 32.6 | -- |
| Proseed | XT60-40 | 0.4 | 108.0 | 5.2 | 27.8 | 1.8 | 58.0 | 38.4 | 17.3 | 4066 | 42.8 | -- |
| Proseed | 30-20 | | 105.3 | 4.9 | 28.5 | 0.3 | 57.3 | 38.4 | 17.7 | 3579 | 37.2 | -- |
| Dairyland | DSR-C999/R2Y | 00.9 | 105.0 | 4.0 | 27.6 | 1.0 | 57.9 | 37.1 | 17.8 | 3694 | 34.2 | -- |
| Dairyland | DSR-0225/R2Y | 0.2 | 100.5 | 4.9 | 34.1 | 0.8 | 58.1 | 36.3 | 18.5 | 4258 | 30.8 | 44.6 |
| Dairyland | DSR-0305/R2Y | 0.3 | 107.0 | 4.0 | 25.8 | 0.8 | 57.8 | 38.0 | 17.4 | 3942 | 31.8 | -- |
| Dairyland | DSR-0418/R2Y | 0.4 | 108.0 | 6.6 | 33.0 | 0.8 | 58.6 | 39.3 | 16.6 | 3795 | 28.7 | 43.6 |
| Dairyland | DSR-0711/R2Y | 0.7 | 109.5 | 5.1 | 29.7 | 0.5 | 58.6 | 37.7 | 16.7 | 4249 | 26.7 | -- |
| Integra | 20215 | 0.2 | 105.0 | 4.3 | 29.1 | 0.5 | 57.6 | 38.0 | 17.5 | 3882 | 44.3 | 51.5 |
| Integra | 20300 | 0.3 | 108.8 | 3.5 | 27.1 | 1.5 | 57.7 | 37.6 | 17.5 | 3722 | 31.1 | 42.7 |
| Integra | 50309N | 0.3 | 105.0 | 3.9 | 31.1 | 1.5 | 58.1 | 37.3 | 16.9 | 4145 | 36.7 | -- |
| Integra | 50539N | 0.5 | 109.3 | 4.5 | 26.5 | 1.0 | 57.9 | 38.5 | 17.3 | 4178 | 27.5 | -- |
| Peterson Farms Seed | 17X04N | 0.4 | 107.0 | 4.2 | 29.0 | 0.8 | 57.9 | 37.9 | 17.7 | 3911 | 29.4 | 43.3 |
| Peterson Farms Seed | 19X03N | 0.3 | 105.5 | 3.1 | 31.6 | 1.3 | 58.5 | 37.6 | 17.0 | 4134 | 38.1 | -- |
| Peterson Farms Seed | 18X06N | 0.6 | 107.0 | 3.6 | 28.1 | 1.3 | 58.0 | 37.8 | 17.4 | 4115 | 31.1 | 43.5 |
| Mean | | | 107.4 | 4.5 | 29.3 | 1.4 | 58.1 | 37.9 | 17.2 | 3977 | 30.4 | -- |
| C.V. (%) | | | 1.6 | 33.6 | 10.0 | 78.1 | 0.6 | 1.3 | 1.9 | 5.9 | 24.5 | -- |
| LSD 0.10 | | | 2.1 | 1.7 | 3.4 | 1.2 | 0.4 | 0.6 | 0.4 | 275 | 8.7 | -- |
| LSD 0.05 | | | 2.4 | 2.1 | 4.1 | 1.4 | 0.5 | 0.7 | 0.5 | 327 | 10.3 | -- |

**Planting Date = May 22; Harvest Date = Sept 18; Previous Crop = Spring Wheat**

| **Soybean - Dryland, Roundup Ready Varieties** | | | | | | | | | | | | **Carrington (Page 2 of 2)** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Brand | Variety | Maturity Group[1] | Days to PM | Pod Height | Plant Height | Plant Lodge | Test Weight | Grain Protein[2] | Grain Oil[2] | Seeds/ Pound | 2018 | 2-yr. Avg. |
| | | | | in. | in. | 0-9 | lb/bu | % | % | | | |
| Dyna-Gro | S03XT29 | 0.3 | 105.8 | 5.4 | 32.9 | 2.0 | 58.4 | 38.0 | 16.5 | 4280 | 33.9 | -- |
| Dyna-Gro | S04XT77 | 0.4 | 108.5 | 3.7 | 26.8 | 2.0 | 58.0 | 38.3 | 17.4 | 3932 | 32.7 | 47.5 |
| Dyna-Gro | S05XT88 | 0.5 | 110.3 | 4.0 | 27.9 | 1.8 | 58.0 | 38.7 | 17.2 | 4105 | 27.6 | 42.0 |
| Dyna-Gro | S06XT59 | 0.6 | 112.0 | 5.1 | 29.3 | 1.5 | 57.5 | 36.9 | 17.2 | 3728 | 26.0 | 39.2 |
| Legacy Seeds | LS-0337N RR2X | 0.3 | 107.5 | 2.9 | 27.3 | 1.3 | 58.1 | 38.3 | 17.4 | 4037 | 27.6 | 45.2 |
| Legacy Seeds | LS-0334 RR2 | 0.3 | 110.0 | 6.6 | 28.8 | 1.8 | 57.8 | 38.5 | 17.1 | 3887 | 32.8 | 45.5 |
| Legacy Seeds | LS-0438 RR2X | 0.4 | 108.8 | 3.5 | 29.7 | 2.5 | 57.9 | 38.9 | 17.1 | 4122 | 33.8 | 46.9 |
| Legacy Seeds | LS-0638N RR2X | 0.6 | 111.5 | 4.3 | 30.4 | 1.0 | 57.8 | 37.5 | 16.8 | 3867 | 28.1 | 42.7 |
| Legacy Seeds | LS-0738N RR2X | 0.7 | 110.5 | 5.2 | 28.5 | 1.8 | 58.6 | 38.3 | 16.6 | 4322 | 26.7 | 41.2 |
| Legend Seeds | LS01X850 | 0.1 | 105.0 | 3.8 | 32.8 | 1.0 | 58.7 | 37.1 | 17.1 | 4303 | 34.7 | 46.1 |
| Legend Seeds | LS 03X852N | 0.3 | 105.3 | 3.3 | 29.4 | 1.8 | 58.5 | 37.7 | 16.8 | 4313 | 29.2 | -- |
| Legend Seeds | LS 05X865N | 0.5 | 106.8 | 4.3 | 28.0 | 1.8 | 58.1 | 38.9 | 17.1 | 4456 | 35.7 | -- |
| Legend Seeds | LS 06X950N | 0.6 | 109.3 | 4.7 | 31.6 | 0.3 | 57.9 | 37.2 | 17.4 | 3812 | 30.9 | -- |
| Dairyland | DSR-0509R | 0.5 | 108.5 | 6.3 | 28.7 | 0.8 | 58.5 | 37.0 | 17.6 | 3518 | 35.7 | -- |
| Prairie Brand | PB-0578R2 | 0.5 | 106.5 | 6.2 | 29.8 | 1.8 | 59.1 | 39.1 | 16.4 | 4039 | 22.6 | 38.9 |
| Dairyland | DSR-0777/R2Y | 0.7 | 110.8 | 4.8 | 29.6 | 2.8 | 58.0 | 37.8 | 17.3 | 3886 | 24.4 | -- |
| Dairyland | DSR-0988/R2Y | 0.9 | 112.3 | 7.0 | 28.9 | 2.3 | 57.7 | 37.6 | 17.0 | 3977 | 24.3 | -- |
| Northstar | NS 60264NXR2 | 0.2 | 105.0 | 4.0 | 31.4 | 0.5 | 58.7 | 37.7 | 16.7 | 4242 | 27.3 | -- |
| Northstar | NS 60442NXR2 | 0.3 | 106.3 | 3.4 | 27.8 | 1.3 | 58.3 | 38.2 | 17.5 | 4234 | 30.8 | 42.8 |
| Northstar | NS 60513 NXR2 | 0.5 | 108.8 | 3.4 | 28.6 | 2.5 | 58.3 | 39.1 | 17.1 | 4235 | 24.2 | 43.5 |
| Northstar | NS 60823NXR2 | 0.8 | 109.8 | 6.5 | 27.2 | 2.5 | 58.1 | 38.5 | 16.7 | 4115 | 30.6 | -- |
| Northstar | NS 60743NXR2 | 0.7 | 110.8 | 5.3 | 28.1 | 1.8 | 57.8 | 37.3 | 16.8 | 3829 | 22.8 | -- |
| Hefty | 02X7 | 0.2 | 106.0 | 4.5 | 37.2 | 1.3 | 58.2 | 36.9 | 18.2 | 3941 | 29.4 | -- |
| Hefty | 03X7 | 0.3 | 108.5 | 4.2 | 29.9 | 0.8 | 58.2 | 38.1 | 17.1 | 3456 | 25.3 | 41.5 |
| Hefty | 04X8 | 0.4 | 109.0 | 3.3 | 27.5 | 1.5 | 58.0 | 39.5 | 16.9 | 4042 | 29.7 | -- |
| Hefty | 02X9 | 0.5 | 105.8 | 3.7 | 29.2 | 0.8 | 58.2 | 37.7 | 16.7 | 4278 | 27.6 | -- |
| Hefty | 06X8 | 0.6 | 111.8 | 3.7 | 28.8 | 1.5 | 57.6 | 37.3 | 16.9 | 3716 | 26.8 | -- |
| NDSU | ND18008GT | 00.8 | 101.3 | 2.7 | 30.0 | 0.5 | 58.6 | 37.1 | 17.8 | 4190 | 28.7 | 36.6 |
| NDSU | ND17009GT | 00.9 | 103.3 | 4.8 | 31.7 | 1.0 | 59.5 | 39.8 | 16.5 | 3979 | 31.3 | 40.2 |
| Norcan Seeds | Nor06 | 0.6 | 104.0 | 4.1 | 28.0 | 1.0 | 58.2 | 37.9 | 18.0 | 4442 | 22.8 | -- |
| Norcan Seeds | Nor08 | 0.8 | 102.8 | 3.1 | 30.8 | 0.8 | 58.3 | 38.0 | 18.0 | 4635 | 24.4 | -- |
| Proseed | XT7060 | | 110.8 | 6.0 | 30.1 | 1.8 | 57.9 | 37.4 | 16.7 | 3965 | 26.6 | -- |
| Mean | | | 107.4 | 4.5 | 29.3 | 1.4 | 58.1 | 37.9 | 17.2 | 3977 | 30.4 | -- |
| C.V. (%) | | | 1.6 | 33.6 | 10.0 | 78.1 | 0.6 | 1.3 | 1.9 | 5.9 | 24.5 | -- |
| LSD 0.10 | | | 2.1 | 1.7 | 3.4 | 1.2 | 0.4 | 0.6 | 0.4 | 275 | 8.7 | -- |
| LSD 0.05 | | | 2.4 | 2.1 | 4.1 | 1.4 | 0.5 | 0.7 | 0.5 | 327 | 10.3 | -- |

**Planting Date = May 22; Harvest Date = Sept 18; Previous Crop = Spring Wheat**

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

[2] Seed oil and protein contents reported at 13% moisture.

## Soybean - Irrigated, Conventional Varieties — Carrington

| Brand | Variety | Mat. Group[1] | Days to PM[2] | Pod Ht | Plant Ht | Plant Lodge | Seeds/ pound | Seed Oil[3] | Seed Protein[3] | Test Weight | --- Seed Yield --- 2018 | 3-yr. Avg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | inch | inch | 0 to 9 | | % | % | lb/bu | ------ bu/ac ------ | |
| NDSU | ND Henson | 0.0 | 104.3 | 3.3 | 28.7 | 1.0 | 3117 | 19.4 | 35.1 | 58.0 | 53.8 | 49.1 |
| NDSU | ND Bison | 0.7 | 115.8 | 3.8 | 28.8 | 0.0 | 2739 | 18.4 | 35.1 | 57.6 | 54.8 | 50.5 |
| NDSU | ND Benson | 0.4 | 115.5 | 3.8 | 29.9 | 0.5 | 3073 | 18.4 | 37.2 | 57.4 | 51.9 | 50.1 |
| NDSU | ND Stutsman | 0.7 | 115.3 | 4.2 | 34.8 | 0.8 | 2962 | 18.9 | 34.1 | 57.6 | 58.8 | 55.0 |
| NDSU | Ashtabula | 0.4 | 110.3 | 3.3 | 31.0 | 0.5 | 3079 | 19.6 | 34.5 | 57.3 | 54.4 | 49.6 |
| NDSU | Sheyenne | 0.7 | 117.0 | 4.0 | 36.1 | 1.0 | 2876 | 18.7 | 34.7 | 57.8 | 57.0 | 51.9 |
| | MEAN | | 111.8 | 3.7 | 31.7 | 0.7 | 2964 | 18.7 | 35.4 | 57.6 | 53.3 | -- |
| | C.V. (%) | | 1.3 | 29.5 | 6.9 | 70 | 2.7 | 1.1 | 1.1 | 0.4 | 7.2 | -- |
| | LSD 0.10 | | 1.7 | NS | 2.6 | 1.0 | 93 | 0.2 | 0.4 | 0.3 | 4.6 | -- |
| | LSD 0.05 | | 2.0 | NS | 3.1 | 1.2 | 112 | 0.3 | 0.5 | 0.4 | 5.5 | -- |

**Planting Date = May 23 ; Harvest Date = October 23 ; Previous Crop = Field Pea**

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

[2] Days to PM: average of 112 = September 12.

[3] Seed oil and protein contents reported at 13% moisture.

**UAS-view of the crane moving the seed mill dust system into place.**

| Brand | Variety | Mat. Group[1] | Days to PM[2] | Pod Ht | Plant Ht | Plant Lodge | Seeds/ pound | Seed Oil[3] | Seed Protein[3] | Test Weight | ------ Seed Yield ------ 2018 | 2-yr. Avg. | 3-yr. Avg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | inch | inch | 0 to 9 | | % | % | lb/bu | --------- | bu/ac | --------- |
| Dairyland | DSR-0509R | 0.2 | 120.8 | 3.7 | 37.7 | 2.0 | 2140 | 18.1 | 35.9 | 57.6 | 66.8 | -- | -- |
| Dairyland | DSR-0305/R2Y | 0.3 | 118.5 | 3.3 | 38.6 | 3.5 | 2719 | 18.1 | 35.7 | 56.9 | 79.0 | -- | -- |
| Dairyland | DSR-0450R | 0.4 | 116.8 | 2.4 | 40.0 | 2.0 | 2555 | 17.8 | 36.8 | 57.6 | 65.8 | -- | -- |
| Dairyland | DSR-0418/R2Y | 0.4 | 121.3 | 4.1 | 39.9 | 3.0 | 2343 | 17.1 | 37.4 | 58.3 | 72.8 | 66.9 | -- |
| Dairyland | DSR-0509R | 0.5 | 122.0 | 3.8 | 38.1 | 2.5 | 2138 | 18.0 | 35.7 | 57.4 | 72.0 | -- | -- |
| Dairyland | DSR-0418/R2Y | 0.5 | 119.5 | 3.5 | 38.3 | 2.3 | 2381 | 17.2 | 37.1 | 58.2 | 71.8 | -- | -- |
| Dairyland | DSR-0711/R2Y | 0.7 | 123.3 | 3.7 | 39.6 | 2.0 | 2559 | 18.2 | 35.0 | 57.0 | 75.8 | -- | -- |
| Dairyland | DSR-0777/R2Y | 0.7 | 126.8 | 3.0 | 40.8 | 3.8 | 2633 | 17.5 | 36.1 | 57.6 | 76.9 | -- | -- |
| Dairyland | DSR-0988/R2Y | 0.9 | 128.0 | 4.8 | 41.5 | 4.0 | 2922 | 17.4 | 35.6 | 57.5 | 71.6 | -- | -- |
| Dyna-Gro | S03XT29 | 0.3 | 118.5 | 2.9 | 38.6 | 3.0 | 3033 | 17.6 | 35.3 | 57.5 | 76.7 | -- | -- |
| Dyna-Gro | S04XT77 | 0.4 | 116.5 | 2.9 | 38.1 | 1.3 | 2574 | 17.4 | 37.4 | 56.9 | 70.9 | 67.3 | 63.0 |
| Dyna-Gro | S05XT88 | 0.5 | 118.3 | 2.7 | 38.9 | 3.0 | 2571 | 17.9 | 36.9 | 56.5 | 81.7 | 72.4 | -- |
| Dyna-Gro | S06XT59 | 0.6 | 127.0 | 2.2 | 40.2 | 3.0 | 2899 | 17.0 | 35.9 | 57.3 | 71.3 | -- | -- |
| Integra | 50309N | 0.3 | 116.0 | 2.8 | 38.4 | 3.5 | 2977 | 17.7 | 35.3 | 57.2 | 79.0 | -- | -- |
| Integra | 50539N | 0.5 | 121.3 | 3.9 | 37.5 | 2.3 | 2644 | 18.0 | 36.5 | 56.4 | 80.9 | -- | -- |
| Legacy Seeds | LS-0337N RR2X | 0.3 | 115.5 | 3.1 | 37.6 | 2.0 | 2628 | 17.6 | 37.2 | 56.9 | 79.2 | 71.3 | -- |
| Legacy Seeds | LS-0334 RR2 | 0.3 | 125.5 | 3.4 | 38.3 | 2.0 | 2806 | 17.8 | 36.4 | 57.2 | 77.6 | 72.2 | 72.1 |
| Legacy Seeds | LS-0438 RR2X | 0.4 | 119.3 | 2.7 | 36.5 | 2.0 | 2646 | 18.1 | 36.2 | 56.5 | 78.9 | 72.3 | -- |
| Legacy Seeds | LS-0638N RR2X | 0.6 | 125.3 | 3.1 | 39.8 | 3.3 | 2919 | 17.3 | 35.2 | 56.8 | 72.0 | 66.0 | -- |
| Legacy Seeds | LS-0738N RR2X | 0.7 | 126.3 | 4.1 | 40.6 | 2.5 | 2612 | 16.9 | 36.9 | 56.7 | 75.9 | 70.3 | -- |
| LG Seeds | LGS0355RX | 0.3 | 117.5 | 3.2 | 37.7 | 3.0 | 3007 | 17.6 | 35.4 | 57.3 | 67.1 | -- | -- |
| LG Seeds | LGS0550RX | 0.5 | 120.3 | 3.3 | 36.0 | 2.3 | 2614 | 17.8 | 36.7 | 56.7 | 77.3 | -- | -- |
| LG Seeds | LGS0774RX | 0.7 | 126.5 | 3.9 | 39.0 | 3.3 | 2916 | 17.2 | 35.4 | 57.4 | 69.4 | -- | -- |
| LG Seeds | LGS0886RX | 0.8 | 126.5 | 3.7 | 40.9 | 2.8 | 2748 | 16.7 | 37.6 | 57.2 | 72.7 | -- | -- |
| NDSU | ND18008GT | 00.8 | 108.5 | 2.9 | 39.0 | 1.5 | 2869 | 18.4 | 36.8 | 57.5 | 65.5 | -- | -- |
| NDSU | ND17009GT | 00.9 | 109.8 | 2.4 | 39.1 | 2.5 | 2679 | 18.3 | 37.3 | 59.0 | 64.2 | -- | -- |
| Nutech | 6097R2 | 0.9 | 122.5 | 3.0 | 37.5 | 2.8 | 2490 | 19.6 | 33.2 | 56.8 | 85.8 | 77.8 | 69.3 |
| Peterson Farms Seed | 19X03N | 0.3 | 117.5 | 2.6 | 38.5 | 2.5 | 3044 | 17.8 | 35.2 | 57.3 | 73.2 | -- | -- |
| Peterson Farms Seed | 17X04N | 0.4 | 115.3 | 2.7 | 38.0 | 1.3 | 2631 | 17.5 | 36.9 | 56.8 | 77.8 | 70.6 | 66.1 |
| Peterson Farms Seed | 18X06N | 0.6 | 123.5 | 3.2 | 40.1 | 3.3 | 2741 | 17.3 | 37.6 | 57.0 | 70.7 | 67.3 | -- |
| Proseed | 80-20 | 0.2 | 116.8 | 3.1 | 39.1 | 3.5 | 3000 | 17.7 | 35.3 | 57.3 | 78.7 | -- | -- |
| Proseed | 30-20 | 0.2 | 113.8 | 3.9 | 40.6 | 2.0 | 2494 | 18.0 | 36.2 | 56.6 | 74.9 | -- | -- |
| Proseed | XT60-40 | 0.4 | 116.5 | 3.0 | 37.2 | 2.3 | 2562 | 17.5 | 37.0 | 56.5 | 75.7 | -- | -- |
| | MEAN | | 119.8 | 3.2 | 39.0 | 2.7 | 2685 | 17.7 | 36.3 | 57.2 | 74.2 | -- | -- |
| | C.V. (%) | | 2.1 | 30.7 | 5.0 | 35.3 | 2.5 | 1.4 | 1.2 | 0.4 | 7.9 | -- | -- |
| | LSD 0.10 | | 3.0 | 1.2 | 2.3 | 1.1 | 77 | 0.29 | 0.5 | 0.28 | 6.8 | -- | -- |
| | LSD 0.05 | | 3.5 | 1.4 | 2.7 | 1.3 | 92 | 0.34 | 0.6 | 0.34 | 8.1 | -- | -- |

**Planting Date = May 23 ; Harvest Date = October 23 ; Previous Crop = Faba Bean**

| Brand | Variety | Mat. Group[1] | Days to PM[2] | Pod Ht | Plant Ht | Plant Lodge | Seeds/ pound | Seed Oil[3] | Seed Protein[3] | Test Weight | ------ Seed Yield ------ 2018 | 2-yr. Avg. | 3-yr. Avg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | inch | inch | 0 to 9 | | % | % | lb/bu | --------- bu/ac --------- | | |
| REA | RX0228 | 0.2 | 114.5 | 2.9 | 42.4 | 2.3 | 2593 | 18.3 | 35.5 | 57.7 | 66.6 | 62.7 | -- |
| REA | RX0516 | 0.5 | 121.3 | 2.8 | 36.2 | 3.3 | 2729 | 16.7 | 37.3 | 57.5 | 76.7 | -- | -- |
| REA | RX0628 | 0.6 | 123.3 | 3.4 | 41.0 | 2.8 | 2735 | 17.7 | 36.5 | 56.3 | 69.8 | 66.3 | -- |
| REA | RX0719 | 0.7 | 123.3 | 4.3 | 38.6 | 2.5 | 2677 | 17.6 | 37.0 | 56.9 | 77.4 | -- | -- |
| REA | RX0929 | 0.9 | 127.8 | 4.1 | 40.2 | 3.5 | 2485 | 16.5 | 38.4 | 57.2 | 79.3 | -- | -- |
| Thunder | SB8903N | 0.3 | 117.3 | 2.2 | 39.9 | 3.3 | 2969 | 17.7 | 35.3 | 57.2 | 77.7 | -- | -- |
| Thunder | SB8906N | 0.6 | 123.0 | 3.1 | 41.6 | 3.8 | 2550 | 17.6 | 36.1 | 56.5 | 77.3 | -- | -- |
| Thunder | 3907 R2Y | 0.7 | 125.3 | 3.8 | 38.1 | 3.3 | 2599 | 17.3 | 37.1 | 57.3 | 85.9 | -- | -- |
| | MEAN | | 119.8 | 3.2 | 39.0 | 2.7 | 2685 | 17.7 | 36.3 | 57.2 | 74.2 | -- | -- |
| | C.V. (%) | | 2.1 | 30.7 | 5.0 | 35.3 | 2.5 | 1.4 | 1.2 | 0.4 | 7.9 | -- | -- |
| | LSD 0.10 | | 3.0 | 1.2 | 2.3 | 1.1 | 77 | 0.29 | 0.5 | 0.28 | 6.8 | -- | -- |
| | LSD 0.05 | | 3.5 | 1.4 | 2.7 | 1.3 | 92 | 0.34 | 0.6 | 0.34 | 8.1 | -- | -- |

**Planting Date = May 23 ; Harvest Date = October 23 ; Previous Crop = Faba Bean**

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

[2] Days to PM: average of 120 = September 20.

[3] Seed oil and protein contents reported at 13% moisture.

**Cattle consigned to the North Dakota Angus University project.**

| Soybean - Conventional and Liberty Link Varieties | | | | | | | | | | | | Barnes County - Dazey | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | | | | ------- Seed Yield ------- | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Brand | Variety | Type | Mat. Group[1] | Days to PM[2] | Pod Ht | Plant Ht | Plant Lodge | Seeds/ pound | Seed Oil[3] | Seed Protein[3] | Test Weight | 2018 | 2-yr. Avg. | 3-yr. Avg. |
| | | | | | inch | inch | 0 to 9 | | % | % | lb/bu | ---------- bu/ac | ---------- | |
| NA | RR Check | Conv | 00.9 | 97.8 | 3.9 | 35.5 | 1.0 | 3134 | 18.9 | 34.3 | 56.6 | 60.2 | 55.9 | 57.2 |
| NA | RR Check | Conv | 00.6 | 97.5 | 4.6 | 39.8 | 1.8 | 2973 | 18.8 | 34.9 | 56.1 | 56.9 | 56.3 | 55.5 |
| NA | RR Check | Conv | 00.8 | 98.0 | 4.9 | 32.7 | 0.5 | 3463 | 18.5 | 35.2 | 56.4 | 58.1 | -- | -- |
| NDSU | ND Henson | Conv | 0.0 | 100.3 | 3.1 | 31.7 | 0.8 | 3716 | 18.5 | 36.1 | 57.6 | 57.8 | 56.0 | 57.0 |
| NDSU | ND Bison | Conv | 0.7 | 108.3 | 3.8 | 33.2 | 0.8 | 2848 | 19.0 | 33.7 | 56.4 | 73.4 | 67.3 | 67.4 |
| NDSU | ND Benson | Conv | 0.4 | 107.5 | 4.6 | 36.2 | 1.3 | 3267 | 18.8 | 36.1 | 56.3 | 63.6 | 60.0 | 59.6 |
| NDSU | ND Stutsman | Conv | 0.7 | 108.8 | 5.2 | 40.9 | 1.8 | 3353 | 19.1 | 33.3 | 56.9 | 62.1 | 62.8 | 65.0 |
| Asgrow | AG 0832 | Conv | 0.9 | 111.5 | 4.7 | 39.5 | 1.3 | 2423 | 18.8 | 35.6 | 55.2 | 73.2 | 68.0 | 69.8 |
| NDSU | Ashtabula | Conv | 0.4 | 104.0 | 4.8 | 38.7 | 1.3 | 3556 | 19.0 | 34.8 | 56.5 | 59.4 | 55.9 | 57.3 |
| NDSU | Sheyenne | Conv | 0.7 | 106.5 | 5.3 | 44.2 | 1.8 | 3123 | 18.5 | 34.8 | 56.6 | 67.3 | 61.7 | 62.2 |
| Richland IFC | MK0249 | Conv | 0.2 | 106.5 | 3.9 | 35.5 | 1.5 | 4590 | 17.7 | 34.9 | 56.0 | 54.1 | 52.1 | 53.9 |
| Richland IFC | MK0603 | Conv | 0.6 | 113.8 | 3.1 | 35.9 | 1.8 | 4574 | 16.7 | 36.7 | 55.2 | 54.5 | 49.4 | 50.9 |
| Richland IFC | MK42 | Conv | 00.7 | 108.3 | 4.1 | 34.4 | 1.8 | 2468 | 17.5 | 37.7 | 56.7 | 63.1 | -- | -- |
| Richland IFC | MK0508 | Conv | 0.8 | 113.0 | 4.8 | 36.6 | 3.0 | 4355 | 17.0 | 36.4 | 57.0 | 58.3 | 53.7 | 52.5 |
| Richland IFC | MK808CN | Conv | 0.8 | 110.5 | 4.6 | 41.6 | 2.8 | 3116 | 19.0 | 34.4 | 56.5 | 72.2 | 64.3 | 64.0 |
| Richland IFC | MK1016 | Conv | 1.0 | 111.0 | 4.5 | 39.7 | 2.5 | 4786 | 17.0 | 36.6 | 56.7 | 58.4 | 52.8 | 52.9 |
| Richland IFC | MK9101 | Conv | 1.0 | 113.3 | 3.8 | 39.5 | 1.5 | 2194 | na | na | 56.3 | 64.6 | 56.6 | 56.5 |
| Richland IFC | MK146 | Conv | 1.1 | 113.5 | 3.9 | 35.0 | 0.8 | 2586 | 17.6 | 37.9 | 55.3 | 70.3 | -- | -- |
| Richland IFC | MK41 | Conv | 1.1 | 108.8 | 2.5 | 35.4 | 2.0 | 2802 | 17.1 | 36.8 | 56.4 | 64.3 | 59.5 | 62.9 |
| Thunder | 5605 LLN | LL | 0.5 | 110.3 | 3.6 | 33.3 | 1.3 | 2576 | 19.3 | 35.5 | 55.8 | 72.1 | -- | -- |
| Thunder | 5707 LLN | LL | 0.7 | 111.8 | 5.1 | 36.8 | 1.0 | 2447 | 17.6 | 34.6 | 56.9 | 72.5 | -- | -- |
| Integra | 30808N | LL | 0.8 | 111.8 | 2.6 | 35.8 | 1.0 | 2648 | 17.7 | 34.2 | 56.7 | 72.7 | -- | -- |
| | MEAN | | | 107.6 | 4.2 | 37.0 | 1.5 | 3222 | 18.4 | 35.3 | 56.5 | 65.1 | -- | -- |
| | C.V. (%) | | | 1.4 | 32.4 | 7.9 | 75.0 | 4.6 | 1.8 | 1.7 | 1.1 | 8.1 | -- | -- |
| | LSD 0.10 | | | 1.8 | NS | 3.4 | NS | 175 | 0.4 | 0.7 | 0.7 | 6.1 | -- | -- |
| | LSD 0.05 | | | 2.1 | NS | 4.1 | NS | 209 | 0.5 | 0.8 | 0.8 | 7.3 | -- | -- |

**Planting Date = May 21 ; Harvest Date = September 25 ; Previous Crop = Spring Wheat**

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

[2] Days to PM: average of 108 = September 6.

[3] Seed oil and protein contents reported at 13% moisture.

| Soybean - Dryland, Roundup Ready Varieties | | | | | | | | | | | | | Barnes County - Dazey |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | ------ Seed Yield ----- | | |
| Brand | Variety | Mat. Group[1] | Days to PM[2] | Pod Ht | Plant Ht | Plant Lodge | Seeds/ pound | Seed Oil[3] | Seed Protein[3] | Test Weight | 2018 | 2-yr. Avg. | 3-yr. Avg. |
| | | | | inch | inch | 0 to 9 | | % | % | lb/bu | --------- bu/ac -------- | | |
| Channel | 0619R2X | 0.6 | 109.8 | 2.4 | 34.6 | 2.7 | 2932 | 18.5 | 35.5 | 56.2 | 70.7 | -- | -- |
| Channel | 0819R2X | 0.8 | 111.3 | 3.1 | 35.8 | 1.7 | 2674 | 17.8 | 36.0 | 56.4 | 72.8 | -- | -- |
| Channel | 1017R2X | 1.0 | 112.3 | 3.0 | 35.8 | 2.3 | 2533 | 18.2 | 35.3 | 56.7 | 71.9 | 64.4 | -- |
| Dairyland | DSR-0509R | 0.5 | 111.3 | 2.4 | 34.8 | 3.0 | 2681 | 19.3 | 34.3 | 56.8 | 66.6 | -- | -- |
| Dairyland | DSR-0418/R2Y | 0.5 | 111.3 | 3.3 | 37.2 | 2.7 | 2771 | 18.3 | 35.4 | 57.7 | 69.4 | -- | -- |
| Dairyland | DSR-0711/R2Y | 0.7 | 110.8 | 2.6 | 35.6 | 3.7 | 2882 | 19.2 | 33.8 | 56.7 | 71.2 | -- | -- |
| Dairyland | DSR-0777/R2Y | 0.7 | 112.3 | 2.8 | 37.2 | 2.7 | 2876 | 18.5 | 35.2 | 56.8 | 73.4 | -- | -- |
| Dairyland | DSR-0988/R2Y | 0.9 | 113.6 | 2.9 | 37.9 | 3.2 | 2690 | 18.1 | 35.2 | 57.0 | 73.4 | 67.2 | 68.2 |
| Dairyland | DSR-1120/R2Y | 1.1 | 114.5 | 3.7 | 37.6 | 4.0 | 2608 | 19.5 | 34.5 | 56.0 | 71.4 | -- | -- |
| Dairyland | DSR-1313/R2Y | 1.3 | 115.5 | 3.1 | 37.0 | 3.7 | 2789 | 18.5 | 35.8 | 57.1 | 73.9 | -- | -- |
| Dyna-Gro | S06XT59 | 0.6 | 110.3 | 2.6 | 36.4 | 3.0 | 2680 | 18.7 | 33.2 | 56.7 | 69.2 | -- | -- |
| Dyna-Gro | S07XT28 | 0.7 | 110.8 | 2.8 | 36.6 | 2.3 | 2826 | 18.7 | 33.9 | 56.9 | 66.0 | 63.6 | -- |
| Dyna-Gro | S09XT39 | 0.9 | 113.5 | 3.7 | 36.6 | 2.7 | 2785 | 18.2 | 36.1 | 57.2 | 69.9 | -- | -- |
| Integra | 20468 | 0.4 | 108.5 | 2.8 | 35.6 | 3.0 | 2388 | 18.7 | 34.7 | 56.4 | 70.8 | -- | -- |
| Integra | 20775N | 0.7 | 111.3 | 3.3 | 36.8 | 2.3 | 2584 | 18.6 | 34.9 | 56.7 | 67.1 | 64.9 | 67.3 |
| Legacy Seeds | LS-0638N RR2X | 0.6 | 110.0 | 2.6 | 36.8 | 2.7 | 2995 | 18.6 | 33.5 | 56.5 | 70.2 | 65.4 | -- |
| Legacy Seeds | LS-0738N RR2X | 0.7 | 111.5 | 2.8 | 36.0 | 2.3 | 2648 | 18.5 | 35.0 | 56.3 | 71.8 | 66.4 | -- |
| Legacy Seeds | LS-0935N RR2 | 0.9 | 113.8 | 3.1 | 38.2 | 2.7 | 2906 | 18.5 | 34.8 | 56.6 | 75.4 | 68.3 | 69.3 |
| Legacy Seeds | LS-1138N RR2X | 1.1 | 114.5 | 3.1 | 35.0 | 3.3 | 2942 | 18.6 | 35.6 | 56.9 | 75.8 | 68.2 | -- |
| LG Seeds | LGS0550RX | 0.5 | 110.8 | 2.0 | 33.5 | 2.0 | 2763 | 18.8 | 35.9 | 55.8 | 70.2 | -- | -- |
| LG Seeds | LGS0774RX | 0.7 | 111.8 | 3.0 | 36.4 | 3.0 | 2586 | 18.2 | 34.2 | 56.4 | 71.1 | -- | -- |
| LG Seeds | LGS0886RX | 0.8 | 113.0 | 3.1 | 36.1 | 2.7 | 2658 | 17.8 | 36.1 | 56.6 | 67.0 | -- | -- |
| NDSU | ND18008GT | 00.8 | 97.0 | 2.4 | 33.1 | 2.3 | 2683 | 18.8 | 36.0 | 57.4 | 47.0 | -- | -- |
| NDSU | ND17009GT | 00.9 | 102.0 | 3.0 | 36.6 | 2.7 | 2561 | 18.4 | 37.4 | 58.2 | 50.3 | 51.7 | -- |
| Nutech | 6097R2 | 0.9 | 110.3 | 3.3 | 35.2 | 1.7 | 2600 | 20.3 | 32.4 | 56.2 | 73.4 | 66.9 | 65.3 |
| Peterson Farms S | 18X06N | 0.6 | 111.5 | 2.4 | 36.0 | 3.0 | 2248 | 18.5 | 35.7 | 56.9 | 67.2 | 62.8 | -- |
| Peterson Farms S | 18X07N | 0.7 | 111.0 | 3.0 | 36.6 | 3.3 | 2525 | 18.4 | 33.9 | 56.6 | 65.9 | 60.8 | -- |
| Peterson Farms S | 18X08N | 0.8 | 111.8 | 2.4 | 36.8 | 3.0 | 2668 | 18.3 | 35.7 | 56.5 | 74.7 | 68.9 | -- |
| Proseed | XT70-70 | 0.7 | 112.0 | 2.8 | 35.6 | 2.7 | 2798 | 18.6 | 34.5 | 56.5 | 68.1 | -- | -- |
| Proseed | XT 80-80 | 0.8 | 111.5 | 2.6 | 36.0 | 2.0 | 3832 | 18.6 | 35.0 | 56.9 | 71.1 | -- | -- |
| Proseed | 30-80 | 0.8 | 111.5 | 3.1 | 37.0 | 2.0 | 3011 | 18.3 | 35.5 | 56.7 | 67.6 | 64.0 | 65.4 |
| Thunder | SB8906N | 0.6 | 110.8 | 2.8 | 37.8 | 2.3 | 3299 | 18.8 | 34.8 | 55.8 | 71.7 | -- | -- |
| Thunder | 3907 R2Y | 0.7 | 112.5 | 3.3 | 35.4 | 2.0 | 3841 | 18.4 | 35.9 | 57.2 | 72.0 | -- | -- |
| Thunder | SB8909N | 0.9 | 112.0 | 2.4 | 34.6 | 2.3 | 3146 | 18.6 | 35.0 | 56.9 | 75.4 | -- | -- |
| | MEAN | | 110.6 | 2.8 | 36.1 | 2.7 | 2800 | 18.6 | 34.9 | 56.8 | 68.5 | -- | -- |
| | C.V. (%) | | 1.5 | 24.1 | 5.7 | 41.0 | 3.4 | 1.2 | 1.4 | 0.7 | 6.4 | -- | -- |
| | LSD 0.10 | | 1.9 | 0.8 | 2.4 | NS | 128 | 0.3 | 0.7 | 0.5 | 6.0 | -- | -- |
| | LSD 0.05 | | 2.3 | NS | 2.9 | NS | 154 | 0.4 | 0.8 | 0.6 | 7.1 | -- | -- |

**Planting Date = May 21 ; Harvest Date = October 22 ; Previous Crop = Spring Wheat**

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

[2] Days to PM: average of 111 = September 9.

[3] Seed oil and protein contents reported at 13% moisture.

* Seed yield and quality data not reported from 4th replicate due to damage from previous snow accummulation.

| Soybean - Dryland, Conventional Varieties | | | | | | | | | | | | | Wishek |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | ------- Seed Yield ------- | | |
| Brand | Variety | Mat. Group[1] | Days to PM[2] | Pod Ht | Plant Ht | Plant Lodge | Seeds/ pound | Seed Oil[3] | Seed Protein[3] | Test Weight | 2018 | 2-yr. Avg. | 3-yr. Avg. |
| | | | | inch | inch | 0 to 9 | | % | % | lb/bu | ---------- | bu/ac | ---------- |
| NDSU | ND Henson | 0.0 | 94.3 | 4.7 | 28.8 | 1.8 | 4527 | 16.1 | 39.4 | 58.3 | 34.8 | 37.7 | 44.1 |
| NDSU | ND Bison | 0.7 | 101.8 | 4.9 | 25.6 | 0.0 | 3625 | 17.0 | 37.7 | 56.6 | 38.6 | 41.4 | 45.9 |
| NDSU | ND Benson | 0.4 | 100.3 | 4.5 | 27.0 | 1.0 | 3884 | 16.9 | 39.6 | 55.9 | 35.0 | 37.9 | 41.7 |
| NDSU | ND Stutsman | 0.7 | 97.5 | 4.6 | 29.3 | 2.0 | 4479 | 16.8 | 38.2 | 57.1 | 39.3 | 43.5 | 50.8 |
| NDSU | Ashtabula | 0.4 | 99.0 | 3.8 | 28.4 | 1.0 | 4026 | 17.1 | 38.6 | 56.4 | 33.5 | 37.1 | 42.5 |
| NDSU | Sheyenne | 0.7 | 100.0 | 5.5 | 34.2 | 0.8 | 4072 | 16.3 | 39.0 | 55.5 | 41.6 | 43.8 | 43.7 |
| Richland IFC | MK0603 | 0.6 | 104.3 | 4.1 | 25.9 | 1.3 | 4108 | 15.5 | 40.2 | 55.7 | 35.6 | 34.8 | 41.3 |
| Richland IFC | MK42 | 00.7 | 100.0 | 4.4 | 31.3 | 0.5 | 3096 | 15.4 | 41.6 | 56.9 | 35.9 | 40.6 | 45.7 |
| Richland IFC | MK0508 | 0.8 | 108.5 | 5.7 | 30.6 | 0.5 | 4322 | 15.4 | 39.9 | 55.6 | 34.4 | 34.8 | 41.4 |
| Richland IFC | MK808CN | 0.8 | 102.3 | 4.0 | 32.8 | 0.8 | 3525 | 17.5 | 37.6 | 55.2 | 40.9 | 45.0 | 48.7 |
| Richland IFC | MK1016 | 1.0 | 104.3 | 3.7 | 27.9 | 0.5 | 5476 | 15.6 | 39.4 | 55.6 | 36.1 | 36.2 | 40.4 |
| Richland IFC | MK9101 | 1.0 | 109.0 | 5.6 | 32.5 | 1.8 | 2515 | na | na | 55.9 | 37.3 | 38.7 | 42.5 |
| Richland IFC | MK146 | 1.1 | 108.0 | 3.1 | 25.5 | 2.3 | 2785 | 16.3 | 40.7 | 55.3 | 42.5 | -- | -- |
| Richland IFC | MK41 | 1.1 | 98.3 | 3.9 | 31.4 | 1.3 | 3678 | 14.6 | 41.5 | 57.0 | 34.1 | 38.8 | 44.7 |
| | MEAN | | 100.7 | 4.2 | 28.6 | 1.1 | 3983 | 16.4 | 39.3 | 56.4 | 35.1 | -- | -- |
| | C.V. (%) | | 2.7 | 32.9 | 11.9 | 67.2 | 9.2 | 4.1 | 2.9 | 1.4 | 17.9 | -- | -- |
| | LSD 0.10 | | 3.2 | NS | 4.0 | 0.9 | 434 | 0.8 | 1.4 | 0.9 | 7.4 | -- | -- |
| | LSD 0.05 | | 3.9 | NS | 4.8 | 1.1 | 519 | 0.9 | 1.6 | 1.1 | NS | -- | -- |

**Planting Date = May 25 ; Harvest Date = September 26 ; Previous Crop = Spring Wheat**

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

[2] Days to PM: average of 101 = September 3.

[3] Seed oil and protein contents reported at 13% moisture.

| Soybean - Dryland, Roundup Ready Varieties | | | | | | | | | | | | Wishek |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | -- Seed Yield -- | |
| Brand | Variety | Mat. Group[1] | Days to PM[2] | Pod Ht | Plant Ht | Plant Lodge | Seeds/ pound | Seed Oil[3] | Seed Protein[3] | Test Weight | 2018 | 3-yr. Avg. |
| | | | | inch | inch | 0 to 9 | | % | % | lb/bu | ----- bu/ac ----- | |
| Channel | 0819R2X | 0.8 | 105.5 | 4.1 | 27.0 | 1.0 | 3097 | 16.9 | 38.4 | 57.5 | 40.3 | -- |
| Channel | 1117R2X | 1.1 | 108.0 | 3.4 | 26.8 | 1.0 | 2845 | 18.0 | 37.1 | 57.1 | 40.9 | -- |
| Channel | 1219R2X | 1.2 | 105.3 | 3.0 | 28.7 | 1.5 | 3571 | 17.9 | 36.9 | 57.5 | 42.7 | -- |
| Dairyland | DSR-1509R | 1.4 | 110.0 | 4.6 | 24.5 | 1.5 | 3067 | 16.6 | 39.4 | 57.5 | 30.7 | -- |
| Legacy Seeds | LS-0738N RR2X | 0.7 | 104.5 | 4.3 | 28.1 | 1.0 | 3123 | 17.5 | 38.0 | 57.6 | 39.2 | -- |
| Legacy Seeds | LS-0935N RR2 | 0.9 | 107.3 | 4.9 | 28.2 | 1.0 | 2885 | 17.7 | 37.2 | 56.8 | 48.5 | 51.6 |
| Legacy Seeds | LS-1138N RR2X | 1.1 | 108.0 | 4.8 | 27.4 | 1.3 | 2783 | 17.7 | 38.4 | 57.2 | 44.2 | -- |
| LG Seeds | LGS0774RX | 0.7 | 106.8 | 2.5 | 27.0 | 2.3 | 2956 | 17.0 | 37.7 | 57.2 | 39.3 | -- |
| LG Seeds | LGS0886RX | 0.8 | 106.0 | 4.5 | 26.9 | 1.0 | 3043 | 17.0 | 38.8 | 57.7 | 38.2 | -- |
| LG Seeds | C1000RX | 1.0 | 108.8 | 5.0 | 23.9 | 1.5 | 2671 | 17.4 | 38.8 | 57.3 | 36.1 | -- |
| LG Seeds | C1337RX | 1.3 | 108.8 | 4.1 | 29.1 | 1.3 | 2901 | 17.6 | 37.5 | 57.2 | 40.4 | -- |
| LG Seeds | LGS1575RX | 1.5 | 109.8 | 3.5 | 29.0 | 1.3 | 2899 | 16.9 | 38.1 | 56.6 | 44.9 | -- |
| NDSU | ND17009GT | 00.9 | 92.5 | 4.7 | 28.7 | 1.0 | 3561 | 16.6 | 40.4 | 59.1 | 33.4 | -- |
| Nutech | 6097R2 | 0.9 | 103.5 | 2.9 | 27.5 | 1.3 | 3058 | 19.1 | 35.8 | 57.3 | 40.8 | 47.9 |
| Nutech | 6136X | 1.3 | 107.8 | 4.8 | 26.5 | 1.3 | 2461 | 17.9 | 37.7 | 56.9 | 34.7 | -- |
| Peterson Farms Seed | 18X08N | 0.8 | 105.3 | 4.2 | 26.9 | 1.0 | 2905 | 17.5 | 38.1 | 57.7 | 40.7 | -- |
| Proseed | XT70-60 | 0.7 | 104.3 | 3.6 | 29.5 | 1.0 | 3167 | 17.8 | 36.1 | 57.1 | 41.1 | -- |
| Proseed | XT 80-80 | 0.8 | 106.3 | 4.6 | 30.4 | 1.0 | 2897 | 17.3 | 38.6 | 57.7 | 45.1 | -- |
| Proseed | 30-80 | 0.8 | 106.8 | 4.9 | 30.1 | 1.8 | 2890 | 17.5 | 37.8 | 57.1 | 40.8 | -- |
| REA | RX0516 | 0.5 | 99.8 | 4.3 | 27.1 | 0.8 | 3129 | 17.4 | 38.0 | 57.6 | 37.7 | -- |
| REA | RX0628 | 0.6 | 103.3 | 3.7 | 26.2 | 0.8 | 3090 | 17.5 | 38.3 | 56.8 | 38.1 | -- |
| REA | RX0719 | 0.7 | 102.3 | 4.6 | 25.2 | 1.3 | 3004 | 18.1 | 37.4 | 57.1 | 38.4 | -- |
| REA | RX0929 | 0.9 | 105.8 | 3.5 | 30.4 | 1.0 | 2919 | 16.9 | 38.4 | 57.2 | 49.0 | -- |
| REA | RX1027 | 1.0 | 107.3 | 4.2 | 28.6 | 1.0 | 2868 | 17.2 | 37.8 | 57.5 | 43.2 | -- |
| | MEAN | | 104.7 | 4.1 | 28 | 1.2 | 3053 | 17.4 | 38.0 | 57.4 | 39.9 | -- |
| | C.V. (%) | | 1.3 | 30.7 | 10.4 | 68.8 | 4.2 | 2.0 | 1.8 | 0.8 | 15.1 | -- |
| | LSD 0.10 | | 1.6 | NS | 3.4 | NS | 150 | 0.4 | 0.8 | 0.5 | 7.1 | -- |
| | LSD 0.05 | | 1.9 | NS | NS | NS | 179 | 0.5 | 1.0 | 0.6 | 8.5 | -- |

**Planting Date = May 25 ; Harvest Date = October 16 ; Previous Crop = Spring Wheat**

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

[2] Days to PM: average of 105, equates to September 7.

[3] Seed oil and protein contents reported at 13% moisture.

## Soybean - Irrigated, Conventional Varieties — Dickey County - Oakes

| Brand | Variety | Mat Group[1] | Days to PM Mat. | Plant Lodge[2] | Seeds/ Pound | Seed Oil | Seed Protein | Test Wt | 2018 | 2-yr. Avg. | 3-yr. Avg. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | ---------- Seed Yield ----- | | |
| | | | | 0 to 9 | | % | % | lb/bu | ---------- bu/ac ---------- | | |
| **Conventional** | | | | | | | | | | | |
| NDSU | ND Bison | 0.7 | 109.8 | 2.5 | 2480 | 18.2 | 34.2 | 56.9 | 76.7 | 74.6 | -- |
| NDSU | ND Benson | 0.4 | 108.0 | 1.3 | 2805 | 18.2 | 35.7 | 56.0 | 64.2 | 63.0 | -- |
| NDSU | ND Stutsman | 0.7 | 110.0 | 4.0 | 2596 | 18.4 | 33.7 | 57.0 | 84.0 | 85.4 | -- |
| NDSU | Ashtabula | 0.4 | 105.8 | 6.0 | 2730 | 19.6 | 33.0 | 55.4 | 63.3 | 64.3 | -- |
| NDSU | Sheyenne | 0.7 | 110.3 | 5.0 | 2553 | 18.1 | 34.4 | 56.9 | 74.7 | 76.6 | -- |
| Richland IFC | MK0603 | 0.6 | 111.0 | 7.0 | 4788 | 16.3 | 35.9 | 56.4 | 59.1 | 57.3 | 51.9 |
| Richland IFC | MK42 | 0.7 | 109.8 | 7.5 | 2207 | 17.4 | 37.1 | 56.7 | 65.2 | -- | -- |
| Richland IFC | MK0508 | 0.8 | 111.0 | 7.3 | 5264 | 17.0 | 33.7 | 57.7 | 48.8 | 47.7 | 45.6 |
| Richland IFC | MK808CN | 0.8 | 110.5 | 6.8 | 2959 | 19.1 | 33.1 | 57.0 | 60.6 | 60.7 | 56.1 |
| Richland IFC | MK1016 | 1.0 | 110.8 | 5.0 | 4988 | 16.2 | 36.5 | 57.7 | 60.4 | 56.2 | 48.8 |
| Richland IFC | MK9101 | 1.0 | 112.0 | 4.5 | 2004 | 19.5 | 34.3 | 56.3 | 68.9 | 67.9 | 61.3 |
| Richland IFC | MK146 | 1.1 | 112.8 | 4.8 | 2454 | 17.8 | 37.0 | 56.8 | 80.2 | -- | -- |
| Richland IFC | MK41 | 1.1 | 107.0 | 6.8 | 2232 | 17.3 | 36.9 | 56.4 | 76.7 | 75.8 | 69.3 |
| **Liberty Link** | | | | | | | | | | | |
| Integra | 31228NLL | 1.2 | 119.3 | 5.5 | 2040 | 17.7 | 36.5 | 56.3 | 88.4 | -- | -- |
| | Mean | | 109.9 | 5.3 | 3081 | 17.9 | 35.0 | 56.7 | 67.9 | -- | -- |
| | C.V (%) | | 1.1 | 17.3 | 3.1 | 1.5 | 1.1 | 0.9 | 8.0 | -- | -- |
| | LSD 0.10 | | 1.4 | 1.1 | 113.9 | 0.3 | 0.4 | 0.6 | 6.3 | -- | -- |
| | LSD 0.05 | | 1.7 | 1.3 | 136.51 | 0.4 | 0.5 | 0.8 | 7.6 | -- | -- |

**Planting Date = May 25; Harvest Date = October 22 and 23; Previous Crop = Field Corn**

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

[2] Plant lodge: 0 = no lodging; 9 = plants lying flat.

[3] Seed oil and protein contents reported at 13% moisture.

| Soybean - Irrigated, Roundup Ready Varieties | | | | | | | | | | | Dickey County - Oakes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | ------- Seed Yield ------- | | |
| Brand | Variety | Mat Group[1] | Days to PM Mat. | Plant Lodge[2] | Seeds/ Pound | Seed Oil[3] | Seed Protein[3] | Test Wt | 2018 | 2-yr. Avg. | 3-yr. Avg. |
| | | | | 0 to 9 | | % | % | lb/bu | ---------- bu/ac ---------- | | |
| Dairyland Seed | DSR-0711/R2Y | 0.7 | 111.8 | 5.3 | 2308 | 18.5 | 34.5 | 55.6 | 78.2 | -- | 63.8 |
| Dairyland Seed | DSR-0988/R2Y | 0.9 | 111.8 | 3.8 | 2744 | 17.9 | 33.9 | 55.9 | 80.3 | 78.1 | 68.4 |
| Dairyland Seed | DSR-1120/R2Y | 1.1 | 114.0 | 4.8 | 2203 | 19.0 | 34.2 | 57.2 | 88.3 | 77.9 | 68.1 |
| Dairyland Seed | DSR-1313/R2Y | 1.3 | 114.5 | 4.3 | 2530 | 18.2 | 34.7 | 56.8 | 87.8 | 79.0 | 72.6 |
| Dyna-Gro | S09XT39 | 0.9 | 111.0 | 2.0 | 2684 | 17.5 | 36.3 | 56.7 | 79.3 | -- | -- |
| Dyna-Gro | S11XT78 | 1.1 | 113.8 | 4.3 | 2355 | 17.8 | 35.6 | 56.3 | 61.9 | 63.3 | -- |
| Dyna-Gro | S12XT07 | 1.2 | 117.5 | 6.5 | 2524 | 18.0 | 35.0 | 56.4 | 78.6 | -- | -- |
| Dyna-Gro | S14XT98 | 1.4 | 117.0 | 2.3 | 2582 | 18.1 | 35.1 | 56.0 | 82.8 | -- | -- |
| Integra | 51229N | 1.2 | | 1.5 | 2642 | 18.8 | 34.7 | 49.4 | 72.5 | -- | -- |
| Legacy Seeds | LS-0738N RR2X | 0.7 | 112.5 | 4.8 | 2640 | 17.7 | 35.4 | 55.5 | 80.5 | -- | -- |
| Legacy Seeds | LS-0935N RR2 | 0.9 | 110.8 | 3.5 | 2496 | 18.4 | 34.0 | 56.2 | 81.7 | 77.7 | 70.5 |
| Legacy Seeds | LS-1138N RR2X | 1.1 | 113.3 | 2.8 | 2445 | 18.0 | 35.6 | 56.5 | 82.1 | 77.4 | -- |
| LG Seeds | LGS0886RX | 0.8 | 112.3 | 3.3 | 2725 | 17.1 | 36.6 | 56.2 | 56.0 | -- | -- |
| LG Seeds | LGS0962RX | 0.9 | 110.0 | 2.8 | 2486 | 18.0 | 35.4 | 56.0 | 83.3 | -- | -- |
| LG Seeds | C1000RX | 1.0 | 114.0 | 4.0 | 2408 | 17.8 | 35.7 | 56.3 | 84.2 | -- | -- |
| LG Seeds | C1337RX | 1.3 | 114.8 | 5.5 | 2521 | 18.0 | 35.0 | 56.3 | 81.6 | -- | -- |
| LG Seeds | LGS1575RX | 1.5 | 116.5 | 3.8 | 2786 | 17.8 | 34.6 | 55.9 | 87.7 | -- | -- |
| Nutech | 6097R2 | 0.9 | 113.8 | 4.5 | 2271 | 19.6 | 32.4 | 56.4 | 83.7 | 80.1 | 70.9 |
| Nutech | 6136X | 1.3 | 119.0 | 4.8 | 2328 | 18.6 | 34.1 | 56.2 | 83.6 | -- | -- |
| Dairyland Seed | DSR-1509R | 1.4 | 119.5 | 2.0 | 2631 | 17.1 | 37.3 | 56.2 | 81.3 | -- | -- |
| Peterson Farms See | 18X11N | 1.1 | 115.3 | 4.3 | 2391 | 17.8 | 35.9 | 56.2 | 83.0 | 77.2 | -- |
| Dairyland Seed | DSR-0777/R2Y | 0.7 | 111.0 | 3.8 | 2602 | 18.2 | 34.5 | 56.3 | 79.3 | -- | -- |
| Prairie Brand | PB-0987R2 | 0.9 | 112.0 | 3.0 | 2787 | 18.0 | 33.9 | 56.2 | 85.2 | 77.7 | 69.4 |
| Prairie Brand | PB-1257R2 | 1.2 | 116.0 | 6.8 | 2872 | 18.3 | 33.8 | 56.1 | 84.2 | 78.0 | 71.1 |
| Proseed | XT 71-10 | 1.1 | 113.5 | 3.8 | 2447 | 17.7 | 35.7 | 56.4 | 80.7 | -- | -- |
| Proseed | XT 71-40 | 1.4 | 115.0 | 3.5 | 2507 | 18.2 | 35.0 | 56.2 | 79.5 | -- | -- |
| REA | RX0929 | 0.9 | 112.5 | 4.3 | 2459 | 17.2 | 36.1 | 57.5 | 84.0 | -- | -- |
| REA | RX1027 | 1.0 | 112.0 | 2.3 | 2508 | 17.8 | 35.0 | 55.4 | 79.0 | 76.3 | -- |
| REA | RX1439 | 1.4 | 114.8 | 4.8 | 2439 | 18.3 | 35.5 | 56.0 | 88.9 | -- | -- |
| | Mean | | 113.6 | 3.8 | 2533 | 18.0 | 35.0 | 56.0 | 80.3 | -- | -- |
| | C.V (%) | | 2.0 | 28.1 | 3 | 1.0 | 0.9 | 2.1 | 14.7 | -- | -- |
| | LSD 0.10 | | 2.7 | 1.2 | 99 | 0.2 | 0.4 | 1.4 | 13.8 | -- | -- |
| | LSD 0.05 | | 3.2 | 1.5 | 118 | 0.3 | 0.4 | 1.7 | 16.6 | -- | -- |

**Planting Date = May 25; Harvest Date = October 23; Previous Crop = Field Corn**

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

[2] Plant lodge: 0 = no lodging; 9 = plants lying flat.

[3] Seed oil and protein contents reported at 13% moisture.

| **Soybean - Organic** | | | | | | | | | | **Carrington** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | ---------- Seed Yield ---------- | | |
| Variety | Pod Height | Plant Height | Plant Lodge | Seeds/ Pound | Seed Oil | Seed Protein | Test Weight | 2018 | 2-yr. Avg. | 3-yr. Avg. |
| | inch | inch | 0 to 9 | | % | % | lb/bu | ---------- bu/ac ---------- | | |
| ND Benson | 4.3 | 29.7 | 0.3 | 4597 | 17.0 | 40.0 | 56.2 | 20.8 | 26.7 | 31.8 |
| Ashtabula | 5.2 | 35.7 | 0.5 | 4729 | 17.9 | 36.9 | 55.8 | 25.0 | 28.5 | 30.7 |
| ND Stutsman | 4.4 | 34.5 | 1.0 | 4471 | 17.6 | 37.1 | 56.2 | 25.4 | 31.2 | 34.5 |
| Sheyenne | 4.7 | 34.2 | 0.0 | 4451 | 17.1 | 38.2 | 56.1 | 22.8 | 28.0 | 30.3 |
| ND Bison | 4.5 | 27.7 | 0.0 | 4331 | 17.3 | 37.5 | 55.8 | 20.8 | 29.9 | 33.1 |
| Traill | 4.4 | 32.8 | 1.0 | 3911 | 18.5 | 36.6 | 56.2 | 31.2 | 30.7 | 27.8 |
| ND Henson | 4.6 | 30.0 | 0.3 | 4450 | 17.4 | 37.7 | 56.3 | 27.1 | 29.6 | 31.2 |
| Prosoy | 4.8 | 36.0 | 0.5 | 3651 | 16.2 | 40.5 | 55.3 | 23.1 | 31.6 | 35.2 |
| ND1406HP | 4.1 | 34.2 | 0.5 | 3706 | 16.2 | 40.1 | 55.9 | 28.0 | 31.0 | 31.6 |
| Mean | 4.6 | 32..8 | 0.5 | 4263 | 17.3 | 38.1 | 55.9 | 24.9 | -- | -- |
| C.V. (%) | 17.2 | 6.3 | 108.2 | 6.1 | 2.9 | 1.5 | 0.7 | 16.8 | -- | -- |
| LSD 0.10 | 1.0 | 2.5 | 0.6 | 314 | 0.6 | 0.7 | 0.5 | 5.0 | -- | -- |
| LSD 0.05 | NS | 3.0 | 0.7 | 378 | 0.7 | 0.8 | 0.6 | 6.1 | -- | -- |

**Planting Date = May 22; Harvest Date = September 18; Previous Crop = Oats**

**Planting soybean plots.**

| Soybean - Dryland, Conventional | | | | | | LaMoure County |
|---|---|---|---|---|---|---|
| | | | | | ---------- Seed Yield ---------- | |
| Brand | Variety | Mat. Group[1] | Maturity Date[2] | Lodging Score[3] | 2018 | 3-yr. Avg. |
| | | | % | 1 to 5 | ---------- bu/ac ---------- | |
| Richland IFC | MK1016 | 1.0 | 10-Sep | 3.3 | 39.2 | 46.2 |
| Richland IFC | MK41 | 1.1 | 11-Sep | 3.5 | 48.6 | 58.9 |
| Richland IFC | MK0508 | 0.8 | 12-Sep | 4.0 | 36.6 | 45.7 |
| Richland IFC | MK42 | 00.7 | 13-Sep | 2.2 | 44.9 | 53.8 |
| Richland IFC | MK0603 | 0.6 | 14-Sep | 3.8 | 48.5 | 54.6 |
| Richland IFC | MK808CN | 0.8 | 14-Sep | 3.5 | 53.2 | 57.1 |
| Richland IFC | MK9101 | 1.0 | 15-Sep | 3.0 | 35.5 | 48.4 |
| Richland IFC | MK146 | 1.1 | 20-Sep | 1.8 | 54.5 | -- |
| NDSU | ND Benson | 0.4 | 9-Sep | 1.7 | 48.4 | 53.6 |
| NDSU | ND Stustman | 0.7 | 15-Sep | 2.7 | 59.9 | 65.2 |
| | MEAN | | 15-Sep | 2.7 | 48.8 | -- |
| | C.V. (%) | | 8.8 | 22.8 | 11.0 | -- |
| | LSD 0.10 | | 5.4 | 0.9 | 7.4 | -- |
| | LSD 0.05 | | 6.4 | 1.0 | 8.7 | -- |

**Planting Date = May 10 ; Harvest Date = October 19**

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

[2] Date of 95% brown pods.

[3] Lodging Score: 1 = upright, 3 = leaning 45 degree angle, 5 = flat on ground.

**An UAS-view of plots and weather station, June, 2018.**

| Soybean - Dryland, Roundup Ready Varieties | | | | | | | LaMoure County |
|---|---|---|---|---|---|---|---|

| Brand | Variety | Mat. Group[1] | Maturity Date[2] | Lodging Score[3] | ---------- Seed Yield ---------- 2018 | 2-yr. Avg. | 3-yr. Avg. |
|---|---|---|---|---|---|---|---|
| | | | % | 1 to 5 | ---------- bu/ac ---------- | | |
| Dairyland Seed | DSR-0711/R2Y | 0.7 | 14-Sep | 1.0 | 55.3 | -- | -- |
| Dairyland Seed | DSR-0777/R2Y | 0.7 | 11-Sep | 1.0 | 51.3 | -- | -- |
| Dairyland Seed | DSR-0988/R2Y | 0.9 | 12-Sep | 1.0 | 52.5 | 56.5 | 63.2 |
| Dairyland Seed | DSR-1120/R2Y | 1.1 | 18-Sep | 1.3 | 52.2 | 53.6 | 59.8 |
| Dairyland Seed | DSR-1313/R2Y | 1.3 | 17-Sep | 1.0 | 56.6 | 60.7 | -- |
| Dairyland Seed | DSR-1509R | 1.4 | 17-Sep | 1.0 | 52.7 | -- | -- |
| Dyna-Gro | S07XT28 | 0.7 | 9-Sep | 1.0 | 49.5 | 50.7 | -- |
| Dyna-Gro | S09XT39 | 0.9 | 12-Sep | 1.0 | 46.4 | -- | -- |
| Dyna-Gro | S11XT78 | 1.1 | 13-Sep | 1.0 | 51.9 | 56.6 | -- |
| Integra | 50989N | 0.9 | 11-Sep | 1.0 | 46.3 | -- | -- |
| Legacy Seeds | LS-0738N RR2X | 0.7 | 13-Sep | 1.3 | 50.3 | -- | -- |
| Legacy Seeds | LS-0935N RR2 | 0.9 | 10-Sep | 1.0 | 50.8 | 53.1 | 61.5 |
| Legacy Seeds | LS-1138N RR2X | 1.1 | 15-Sep | 1.0 | 49.9 | 55.7 | -- |
| Legend Seeds | LS 07X852N | 0.7 | 10-Sep | 1.0 | 47.5 | -- | -- |
| Legend Seeds | LS 09X960N | 0.9 | 12-Sep | 1.0 | 48.1 | -- | -- |
| Legend Seeds | LS 12X862N | 1.2 | 14-Sep | 1.0 | 50.8 | -- | -- |
| Legend Seeds | LS 14X862N | 1.4 | 15-Sep | 1.0 | 49.4 | -- | -- |
| LG Seeds | LGS0550RX | 0.5 | 8-Sep | 1.0 | 45.3 | -- | -- |
| LG Seeds | LGS0886RX | 0.8 | 13-Sep | 1.0 | 52.6 | -- | -- |
| LG Seeds | LGS0962RX | 0.9 | 12-Sep | 1.3 | 49.0 | -- | -- |
| LG Seeds | C1000RX | 1.0 | 16-Sep | 1.0 | 53.7 | -- | -- |
| Nutech | 6097R2 | 0.9 | 10-Sep | 1.0 | 52.4 | 54.0 | 63.7 |
| Nutech | 6136X | 1.3 | 13-Sep | 1.0 | 48.5 | -- | -- |
| Peterson Farms Seed | 18X08N | 0.8 | 9-Sep | 1.3 | 43.6 | 47.9 | -- |
| Peterson Farms Seed | 19X10N | 1.0 | 12-Sep | 1.0 | 44.9 | -- | -- |
| Prairie Brand | PB-1257R2 | 1.2 | 15-Sep | 1.7 | 54.1 | -- | -- |
| Proseed | XT 80-80 | 0.8 | 11-Sep | 1.0 | 46.0 | -- | -- |
| Proseed | 30-80 | 0.8 | 11-Sep | 1.7 | 52.4 | 57.1 | -- |
| Proseed | XT 71-10 | 1.1 | 13-Sep | 1.0 | 52.3 | -- | -- |
| | MEAN | | 13-Sep | 1.1 | 50.2 | -- | -- |
| | C.V. (%) | | 4.3 | 23.2 | 7.2 | -- | -- |
| | LSD 0.10 | | 2.5 | 0.4 | 4.9 | -- | -- |
| | LSD 0.05 | | 3.0 | 0.4 | 5.8 | -- | -- |

**Planting Date = May 19 ; Harvest Date = October 19**

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

[2] Date of 95% brown pods.

[3] Lodging Score: 1 = upright, 3 = leaning 45 degree angle, 5 = flat on ground.

| **Dry Edible Bean - Dryland** | | | | | | | | | **Carrington** |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | ---- Grain Yield ---- | |
| | | Days to | Direct | Growth | Seed | Test | Seed | | 3-yr. |
| Treatment | Class | PM | Harvest[1] | Habit[2] | Protein | Weight | Weight | 2018 | Avg. |
| | | | 0-100 | 1-9 | % | lb/bu | g/100 | -------- lb/ac -------- | |
| LaPaz | Pinto | 86.0 | 91.8 | 7.3 | 22.4 | 59.1 | 31.3 | 1825 | 2320 |
| Lariat | Pinto | 86.3 | 94.0 | 7.3 | 21.2 | 57.7 | 32.2 | 1248 | 2455 |
| Stampede | Pinto | 83.3 | 91.3 | 6.8 | 20.4 | 57.5 | 30.2 | 1786 | 2592 |
| Windbreaker | Pinto | 81.5 | 85.0 | 6.0 | 20.2 | 58.0 | 33.1 | 2091 | 2699 |
| Palomino | Pinto | 87.8 | 85.8 | 5.5 | 22.8 | 57.1 | 33.4 | 1789 | 2532 |
| Monterrey | Pinto | 86.3 | 91.8 | 7.3 | 20.1 | 60.4 | 28.6 | 2001 | 2518 |
| HMS Medalist | Navy | 87.8 | 93.0 | 7.3 | 20.5 | 61.9 | 15.7 | 1286 | 2314 |
| Ensign | Navy | 83.8 | 91.0 | 7.3 | 20.2 | 62.0 | 16.6 | 1539 | -- |
| T9905 | Navy | 88.0 | 95.0 | 7.8 | 22.6 | 62.2 | 16.4 | 1534 | 2428 |
| Eclipse | Black | 86.5 | 92.3 | 7.0 | 22.8 | 60.3 | 15.5 | 1397 | 2207 |
| Merlot | Small Red | 87.0 | 92.5 | 7.3 | 20.3 | 59.2 | 30.6 | 1317 | 2073 |
| Loreto | Black | 87.8 | 93.8 | 7.8 | 21.1 | 62.7 | 16.1 | 1548 | 2012 |
| Zorro | Black | 88.0 | 94.0 | 7.5 | 23.7 | 61.9 | 15.6 | 1465 | 2045 |
| Rosetta | Pink | 86.8 | 93.5 | 7.5 | 20.7 | 59.9 | 26.5 | 1477 | 2150 |
| Powderhorn | Great Northern | 84.5 | 93.3 | 7.3 | 21.1 | 58.3 | 28.9 | 1789 | -- |
| Mean | | 86.1 | 91.9 | 7.1 | 21.3 | 59.9 | 24.7 | 1606 | -- |
| C.V. (%) | | 1.9 | 2.8 | 13.3 | 10.1 | 1.3 | 5.2 | 14.0 | -- |
| LSD 0.10 | | 1.9 | 3.1 | 1.1 | 2.57 | 0.9 | 1.6 | 267 | -- |
| LSD 0.05 | | 2.3 | 3.7 | 1.3 | 3.08 | 1.1 | 1.9 | 321 | -- |

**Planting Date: May 25; Harvest Date: Aug 29; Previous Crop: Spring Wheat**

[1]Direct Harvest: A relative score to estimate % beans that would be successfully harvested in a direct/straight harvest system.

[2]Growth Habit: scored on a scale of 1 to 9. 1=longer vine, low stature plant with pods low to the ground; 9=very upright plant with pods held well off the ground.

## Dry Bean - Irrigated | Carrington

| Variety | Class | Days to PM | Direct Harvest[1] | Growth Habit[2] | Test Weight | Seed Weight | Grain Yield 2018 | Grain Yield 3-yr. Avg. |
|---|---|---|---|---|---|---|---|---|
| | | | 0-100 | 1-9 | lb/bu | g/100 | lb/ac | lb/ac |
| LaPaz | Pinto | 88.3 | 81.3 | 3.8 | 61.7 | 33.1 | 3912 | 3576 |
| Lariat | Pinto | 89.8 | 73.8 | 0.8 | 59.7 | 35.0 | 3384 | 3173 |
| Stampede | Pinto | 85.5 | 87.5 | 2.3 | 59.4 | 34.9 | 3656 | 3105 |
| Windbreaker | Pinto | 85.0 | 56.3 | 0.3 | 59.4 | 33.8 | 3517 | 3112 |
| Palomino | Pinto | 90.0 | 77.5 | 2.8 | 58.4 | 37.0 | 3269 | 2965 |
| Monterrey | Pinto | 88.5 | 82.5 | 5.5 | 61.5 | 33.3 | 3614 | 3476 |
| HMS Medalist | Navy | 96.0 | 80.0 | 2.8 | 64.1 | 18.1 | 3315 | 3351 |
| Ensign | Navy | 96.3 | 71.3 | 1.8 | 64.4 | 21.0 | 3613 | -- |
| T9905 | Navy | 96.8 | 85.0 | 3.0 | 64.4 | 20.1 | 3281 | 3375 |
| Eclipse | Black | 92.3 | 87.5 | 6.0 | 63.0 | 16.8 | 2770 | 2918 |
| Merlot | Small Red | 91.5 | 67.5 | 1.8 | 60.8 | 34.1 | 3140 | 3018 |
| Loreto | Black | 95.3 | 78.8 | 2.8 | 64.9 | 19.0 | 3101 | 2987 |
| Zorro | Black | 91.0 | 90.0 | 7.5 | 63.9 | 18.3 | 2968 | 2610 |
| Rosetta | Pink | 88.0 | 78.8 | 3.8 | 61.7 | 31.9 | 3477 | 3396 |
| Powderhorn | Great Northern | 85.8 | 80.0 | 6.0 | 57.6 | 33.5 | 3072 | -- |
| Mean | | 90.7 | 78.5 | 3.4 | 61.6 | 28.0 | 3339 | -- |
| C.V. (%) | | 2.1 | 5.2 | 22.3 | 0.9 | 5.7 | 9.3 | -- |
| LSD (0.10) | | 2.2 | 4.8 | 0.9 | 0.6 | 23 | 369 | -- |
| LSD (0.05) | | 2.7 | 5.8 | 1.1 | 0.8 | 19 | 442 | -- |

**Planting Date = May 25; Harvest Date = September 7; Previous Crop = Field Pea**

[1]Direct Harvest: A relative score to estimate % beans that would be successfully harvested in a direct/straight harvest system.

[2]Growth Habit: scored on a scale of 1 to 9. 1 = longer vine, low stature plant with pods low to the ground; 9 = very upright plant with pods held well off the ground.

## Dry Bean - Dryland — Wishek

| Variety | Market Class | Seeds/ Pound | Seed Weight | Seed Protein | Test Weight | Seed Yield |
|---|---|---|---|---|---|---|
| | | | gram/100 | % | lb/bu | lb/ac |
| LaPaz | Pinto | 1667 | 27.3 | 20.7 | 60.9 | 1215 |
| Lariat | Pinto | 1517 | 30.0 | 20.4 | 58.3 | 1068 |
| Palomino | Pinto | 1483 | 30.7 | 23.2 | 57.4 | 1140 |
| Eclipse | Black | 3049 | 14.9 | 22.8 | 60.5 | 984 |
| Zorro | Black | 3024 | 15.0 | 24.6 | 61.5 | 934 |
| | MEAN | 2148 | 23.6 | 22.3 | 59.7 | 1068 |
| | C.V. (%) | 4.2 | 4.8 | 3.8 | 1.0 | 10.0 |
| | LSD 0.10 | 113 | 1.4 | 1.1 | 0.7 | 135 |
| | LSD 0.05 | 138 | 1.7 | 1.3 | 0.9 | 165 |

**Planting Date = May 25 ; Harvest Date = September 7; Previous Crop = Spring Wheat**

## Dry Bean, Misc - Irrigated — Oakes

| Variety | Market Class | Days to PM | Seeds/ Pound | Seed Weight | Test Weight | Seed Yield 2018 | Seed Yield 3-yr. Avg. |
|---|---|---|---|---|---|---|---|
| | | | | grams/100 | lb/bu | lb/ac | lb/ac |
| Eclipse | Black | 90.8 | 2494 | 18.2 | 63.0 | 2892 | 3426 |
| Merlot | Small Red | 91.5 | 1248 | 36.4 | 60.3 | 3324 | 3573 |
| Loreto | Black | 92.0 | 2391 | 19.0 | 63.7 | 2901 | 3219 |
| Zorro | Black | 89.0 | 2222 | 20.5 | 63.1 | 3856 | 3842 |
| Rosetta | Pink | 90.0 | 1458 | 31.1 | 60.2 | 2722 | 3489 |
| Powderhorn | Great Northern | 79.8 | 1495 | 30.4 | 56.8 | 2203 | -- |
| Mean | | 88.9 | 1884.5 | 25.9 | 61.2 | 2983.0 | -- |
| C.V. (%) | | 1.4 | 3.5 | 3.3 | 0.9 | 12.8 | -- |
| LSD 0.10 | | 1.5 | 81.0 | 1.1 | 0.7 | 475.0 | -- |
| LSD 0.05 | | 1.9 | 98.5 | 1.3 | 0.8 | 577.5 | -- |

**Planting Date = May 30; Harvest Date = September 5 and 12; Previous Crop = Soybeans**

## Dry Bean, Navy - Irrigated — Oakes

| Variety | Days to PM | Seeds/ Pound | Seed Weight | Test Weight | Seed Yield 2018 | Seed Yield 3-yr. Avg. |
|---|---|---|---|---|---|---|
| | | | grams/100 | | lb/ac | lb/ac |
| HMS Medalist | 93.0 | 2894 | 15.7 | 63.9 | 2072 | 2778 |
| Ensign | 92.5 | 2449 | 18.5 | 63.7 | 2350 | 2877 |
| T9905 | 92.8 | 2388 | 19.0 | 64.2 | 2560 | 3082 |
| Mean | 92.8 | 2577.3 | 17.7 | 63.9 | 2327 | -- |
| C.V. (%) | 0.4 | 2.0 | 2.0 | 0.4 | 7.1 | -- |
| LSD 0.10 | 0.5 | 72 | 0.5 | 0.4 | 228 | -- |
| LSD 0.05 | 0.6 | 91 | 0.6 | 0.5 | 287 | -- |

**Planting Date = May 30; Harvest Date = September 5 and 12; Previous Crop = Soybean**

## Dry Bean, Pinto - Irrigated — Oakes

| Variety | Days to PM | Seeds/ Pound | Seed Weight | Test Weight | Seed Yield 2018 | Seed Yield 3-yr. Avg. |
|---|---|---|---|---|---|---|
| | | | grams/100 | lb/bu | lb/ac | lb/ac |
| LaPaz | 87.0 | 1344 | 33.78 | 60.8 | 3144 | 3600 |
| Lariat | 90.0 | 1189 | 38.2 | 60.7 | 3085 | 3342 |
| Stampede | 84.5 | 1376 | 33.0 | 59.0 | 2036 | 2939 |
| Windbreaker | 83.0 | 1240 | 36.6 | 58.5 | 2446 | 3420 |
| Palomino | 92.3 | 1225 | 37.1 | 58.9 | 2742 | 3138 |
| Monterrey | 87.0 | 1376 | 33.0 | 60.6 | 2903 | 3328 |
| Mean: | 87.3 | 1291 | 35.3 | 59.8 | 2726 | -- |
| C.V. (%) | 2.1 | 2.7 | 2.6 | 1.0 | 7.7 | -- |
| LSD 0.10 | 2.31 | 43 | 1.14 | 0.7 | 258 | -- |
| LSD 0.05 | 2.8 | 52 | 1.4 | 0.9 | 314 | -- |

**Planting Date = May 30; Harvest Date = September 5 and 12; Previous Crop = Soybean**

| **Buckwheat - Organic** | | | | | | | **Carrington** |
|---|---|---|---|---|---|---|---|
| | | | | | ---------- Seed Yield ---------- | | |
| Variety | Days to Bloom | Plant Height | 1000 KWT | Test Weight | 2018 | 2-yr. Avg. | 3-yr. Avg. |
| | 10% | inch | gram | lb/bu | ---------- lb/ac ---------- | | |
| Springfield | 28.5 | 42.6 | 35.9 | 48.6 | 1027 | 822 | 774 |
| Horizon | 29.0 | 42.0 | 35.3 | 49.1 | 1128 | 868 | 751 |
| Koma | 28.8 | 38.2 | 29.7 | 50.5 | 708 | 568 | 514 |
| Koto | 27.3 | 40.3 | 35.5 | 50.2 | 1033 | 789 | 640 |
| Manor | 27.0 | 49.1 | 29.6 | 49.1 | 964 | 774 | 651 |
| Mean | 28.1 | 42.4 | 33.2 | 49.5 | 972 | -- | -- |
| C.V. (%) | 2.5 | 3.8 | 1.8 | 0.7 | 15.1 | -- | -- |
| LSD 0.10 | 0.9 | 2.0 | 0.7 | 0.5 | 185.6 | -- | -- |
| LSD 0.05 | 1.1 | 2.5 | 0.9 | 0.6 | 226.9 | -- | -- |

**Planting Date = June 4; Harvest Date = August 30; Previous Crop = Oats**


**Organic buckwheat variety trial**

| **Field Pea** | | | | | | | | | | | | | | | **Carrington (Page 1 of 3)** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | ---- Harvest Ease[1] ---- | | | | | | | ------- Seed Yield ------- | |
| Variety | Brand | Days to Bloom | Bloom Duration | Days to PM | Height at Harvest | Lodge at PM | 2018 | 3-yr. Avg. | Root Disease[2] | Test Weight | 1000 KWT | Seed Protein | | 2018 | 3-yr. Avg. |
| | | | days | | in | 0-9 | ---------- 0 - 9 ---------- | | % affected | lb/bu | g/1000 | % | | ---------- bu/ac ---------- | |
| **Yellow Cotyledon Type** | | | | | | | | | | | | | | | |
| Agassiz | Meridian Seeds | 49.3 | 15.5 | 81.0 | 23.3 | 3.5 | 5.0 | 2.1 | 3.0 | 65.5 | 224 | 24.75 | | 48.4 | 46.4 |
| DS Admiral | Pulse USA | 49.8 | 14.0 | 80.8 | 21.6 | 3.5 | 4.5 | 2.2 | 1.8 | 66.0 | 228 | 23.85 | | 41.8 | 41.5 |
| Spider | Great Northern Ag | 51.3 | 12.8 | 81.3 | 24.4 | 2.3 | 3.8 | 2.8 | 2.8 | 66.3 | 240 | 24.60 | | 50.3 | 38.2 |
| Jetset | Meridian Seeds | 48.8 | 13.0 | 78.3 | 25.1 | 3.3 | 3.8 | 1.7 | 3.0 | 65.8 | 234 | 25.15 | | 49.6 | 40.4 |
| Earlystar | Meridian Seeds | 50.8 | 13.5 | 79.5 | 23.9 | 5.0 | 6.8 | 3.7 | 3.0 | 66.3 | 197 | 23.38 | | 41.1 | 41.8 |
| AAC Carver | Meridian Seeds | 50.8 | 12.8 | 80.0 | 21.0 | 3.3 | 4.0 | 2.2 | 3.3 | 66.3 | 227 | 22.03 | | 41.3 | 39.0 |
| CDC Inca | Meridian Seeds | 52.0 | 12.3 | 81.5 | 23.5 | 2.8 | 3.3 | -- | 3.5 | 65.9 | 217 | 25.08 | | 45.2 | -- |
| CDC Amarillo | Meridian Seeds | 52.0 | 12.5 | 82.3 | 28.4 | 1.8 | 2.8 | 1.3 | 2.5 | 65.7 | 212 | 23.80 | | 47.2 | 41.3 |
| CDC Saffron | Meridian Seeds | 51.3 | 11.3 | 79.3 | 20.2 | 3.8 | 5.3 | 2.9 | 4.3 | 66.1 | 216 | 23.85 | | 42.8 | 39.2 |
| Bridger | Great Northern Ag | 48.5 | 14.5 | 79.3 | 22.9 | 2.0 | 3.3 | 1.8 | 4.5 | 66.5 | 221 | 23.28 | | 47.6 | 40.3 |
| Hyline | Great Northern Ag | 51.8 | 12.5 | 80.8 | 20.5 | 4.0 | 5.0 | 3.7 | 6.0 | 65.9 | 225 | 23.50 | | 36.8 | 37.1 |
| Navarro | Great Northern Ag | 45.5 | 17.5 | 79.0 | 20.5 | 5.8 | 7.3 | 3.5 | 13.0 | 65.6 | 242 | 25.55 | | 34.7 | 35.0 |
| Salamanca | Great Northern Ag | 51.3 | 12.5 | 80.3 | 21.5 | 5.0 | 6.0 | 2.8 | 10.8 | 66.2 | 239 | 26.63 | | 29.0 | 33.3 |
| AAC Asher | Legume Logic | 50.0 | 12.8 | 81.0 | 20.8 | 2.3 | 4.0 | -- | 3.8 | 65.8 | 240 | 23.80 | | 47.0 | -- |
| CDC Dakota | Legume Logic | 54.5 | 9.5 | 82.3 | 25.1 | 1.3 | 2.3 | -- | 1.0 | 65.1 | 204 | 24.80 | | 44.2 | -- |
| AAC Chrome | Legume Logic | 52.0 | 12.3 | 82.0 | 20.8 | 2.3 | 3.5 | -- | 4.5 | 65.8 | 215 | 23.40 | | 44.5 | -- |
| AAC Profit | Birdsall Grain | 53.0 | 11.3 | 81.3 | 24.9 | 2.0 | 3.3 | -- | 9.5 | 65.8 | 207 | 23.03 | | 41.4 | -- |
| Majestic | JB Farms | 51.8 | 12.3 | 81.5 | 25.7 | 1.8 | 2.0 | 0.9 | 3.8 | 65.4 | 228 | 25.40 | | 37.8 | 36.7 |
| LGPN4906 | Limagrain | 47.0 | 16.5 | 80.0 | 23.9 | 1.3 | 2.3 | 1.2 | 1.0 | 65.9 | 234 | 24.25 | | 60.1 | 44.3 |
| LGPN4909 | Limagrain | 46.8 | 16.0 | 80.5 | 21.5 | 2.8 | 4.3 | -- | 3.8 | 65.9 | 257 | 24.28 | | 41.6 | -- |
| LGPN4908 | Limagrain | 46.8 | 16.3 | 80.0 | 22.7 | 2.0 | 2.8 | -- | 5.5 | 65.9 | 240 | 23.83 | | 46.9 | -- |
| LGPN4249 | Limagrain | 50.8 | 13.3 | 81.3 | 28.6 | 3.0 | 4.0 | -- | 6.0 | 64.8 | 267 | 24.78 | | 40.5 | -- |
| Mean | | 50.0 | 13.5 | 80.2 | 22.5 | 3.6 | 4.7 | -- | 5.5 | 65.9 | 224 | 24.22 | | 40.9 | -- |
| C.V. (%) | | 1.6 | 7.1 | 1.3 | 11.4 | 29.2 | 24.3 | -- | 108.5 | 0.5 | 3.5 | 4.6 | | 12.0 | -- |
| LSD (0.10) | | 0.9 | 1.1 | 1.2 | 3.0 | 1.2 | 1.3 | -- | 7.0 | 0.4 | 9 | 1.31 | | 5.7 | -- |
| LSD (0.05) | | 1.1 | 1.3 | 1.5 | 3.6 | 1.4 | 1.6 | -- | 8.4 | 0.5 | 11 | 1.57 | | 6.8 | -- |

**Planting Date = May 2; Harvest Date = July 27; Previous Crop = Spring Wheat**

| Variety | Brand | Days to Bloom | Bloom Duration | Days to PM | Height at Harvest | Lodge at PM | Harvest Ease[1] 2018 | Harvest Ease[1] 3-yr. Avg. | Root Disease[2] | Test Weight | 1000 KWT | Seed Protein | Seed Yield 2018 | Seed Yield 3-yr. Avg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | days | | in | 0 to 9 | 0 - 9 | 0 - 9 | % affected | lb/bu | g/1000 | % | bu/ac | bu/ac |
| **Yellow Cotyledon Type** | | | | | | | | | | | | | | |
| LGPN4912 | Limagrain | 48.5 | 14.3 | 78.5 | 22.1 | 6.0 | 7.0 | -- | 15.5 | 67.0 | 227 | 24.10 | 35.2 | -- |
| LGPN4913 | Limagrain | 49.5 | 14.0 | 79.5 | 22.2 | 4.5 | 4.8 | -- | 7.8 | 66.4 | 237 | 25.38 | 48.6 | -- |
| LGPN4915 | Limagrain | 47.3 | 16.0 | 80.0 | 24.6 | 2.0 | 2.8 | -- | 3.0 | 65.6 | 227 | 26.38 | 49.4 | -- |
| SW Midas | Pulse USA | 51.0 | 12.5 | 79.0 | 24.5 | 2.5 | 3.5 | 2.3 | 3.8 | 65.7 | 200 | 21.93 | 44.2 | 37.7 |
| Korando | Pulse USA | 45.3 | 18.5 | 79.8 | 23.2 | 4.8 | 6.0 | 3.3 | 8.0 | 66.0 | 260 | 25.08 | 36.6 | 37.0 |
| Mystique | Pulse USA | 51.8 | 12.5 | 81.0 | 21.2 | 3.8 | 5.0 | 2.2 | 6.5 | 65.6 | 225 | 24.33 | 30.3 | 36.6 |
| Nette 2010 | Pulse USA | 47.8 | 14.5 | 78.8 | 20.7 | 3.5 | 4.8 | 2.1 | 4.3 | 66.8 | 234 | 22.85 | 38.4 | 39.5 |
| Durwood | Pulse USA | 50.8 | 13.3 | 82.0 | 24.5 | 2.3 | 2.8 | 1.3 | 4.5 | 65.9 | 233 | 24.30 | 40.1 | 39.8 |
| LG Amigo | Pulse USA | 50.3 | 13.0 | 80.8 | 21.1 | 4.5 | 5.8 | -- | 8.8 | 65.3 | 219 | 24.25 | 39.2 | -- |
| LG Sunrise | Pulse USA | 49.5 | 15.0 | 81.5 | 24.2 | 2.0 | 3.0 | -- | 0.3 | 66.3 | 222 | 23.00 | 46.7 | -- |
| Pro 133-6243 | Pulse USA | 46.5 | 16.3 | 79.0 | 22.3 | 5.3 | 6.3 | -- | 10.0 | 66.0 | 250 | 24.88 | 34.1 | -- |
| PG6150 | Pulse USA | 50.0 | 14.0 | 80.3 | 21.7 | 3.3 | 4.0 | -- | 3.0 | 66.3 | 214 | 25.05 | 42.3 | -- |
| PG3308 | Pulse USA | 50.5 | 13.0 | 80.0 | 20.5 | 2.5 | 4.3 | -- | 5.0 | 65.4 | 222 | 24.48 | 48.4 | -- |
| PG2601 | Pulse USA | 50.3 | 13.3 | 79.5 | 20.6 | 2.5 | 3.3 | -- | 2.5 | 66.6 | 216 | 24.75 | 48.0 | -- |
| Salamanca 2/3 rate | | 51.3 | 12.8 | 79.3 | 22.4 | 5.5 | 6.3 | -- | 26.8 | 66.1 | 234 | 25.68 | 26.9 | -- |
| | | | | | | | | | | | | | | |
| **Green Cotyledon Type** | | | | | | | | | | | | | | |
| Cruiser | Pulse USA | 49.3 | 14.0 | 78.5 | 22.4 | 4.5 | 6.3 | 3.3 | 5.0 | 65.1 | 203 | 25.53 | 41.2 | 31.4 |
| CDC Striker | Nodricks Norsask | 49.5 | 13.5 | 79.8 | 19.6 | 5.0 | 7.0 | 5.2 | 2.0 | 66.2 | 199 | 22.70 | 44.6 | 37.1 |
| Arcadia | Pulse USA | 48.8 | 14.0 | 78.8 | 18.7 | 6.3 | 8.0 | 4.9 | 2.3 | 65.9 | 200 | 24.15 | 48.5 | 39.8 |
| AAC Comfort | Meridian Seeds | 53.8 | 10.8 | 82.0 | 23.7 | 2.5 | 3.8 | -- | 5.8 | 64.9 | 212 | 22.98 | 25.9 | -- |
| CDC Greenwater | Meridian Seeds | 52.3 | 12.3 | 83.3 | 25.5 | 1.8 | 2.5 | -- | 1.8 | 65.6 | 236 | 22.98 | 48.9 | -- |
| Shamrock | Great Northern Ag | 52.5 | 11.8 | 82.3 | 24.8 | 2.8 | 3.5 | -- | 3.8 | 65.5 | 230 | 25.15 | 31.1 | -- |
| | | | | | | | | | | | | | | |
| Mean | | 50.0 | 13.5 | 80.2 | 22.5 | 3.6 | 4.7 | -- | 5.5 | 65.9 | 224 | 24.22 | 40.9 | -- |
| C.V. (%) | | 1.6 | 7.1 | 1.3 | 11.4 | 29.2 | 24.3 | -- | 108.5 | 0.5 | 3.5 | 4.6 | 12.0 | -- |
| LSD (0.10) | | 0.9 | 1.1 | 1.2 | 3.0 | 1.2 | 1.3 | -- | 7.0 | 0.4 | 9 | 1.31 | 5.7 | -- |
| LSD (0.05) | | 1.1 | 1.3 | 1.5 | 3.6 | 1.4 | 1.6 | -- | 8.4 | 0.5 | 11 | 1.57 | 6.8 | -- |

**Planting Date = May 2; Harvest Date = July 27; Previous Crop = Spring Wheat**

| Variety | Brand | Days to Bloom | Bloom Duration | Days to PM | Height at Harvest | Lodge at PM | Harvest Ease[1] 2018 | Harvest Ease[1] 3-yr. Avg. | Root Disease[2] | Test Weight | 1000 KWT | Seed Protein | Seed Yield 2018 | Seed Yield 3-yr. Avg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | days | | in | 0-9 | 0 - 9 | 0 - 9 | % affected | lb/bu | g/1000 | % | bu/ac | bu/ac |
| **Green Cotyledon Type** | | | | | | | | | | | | | | |
| Bluemoon | JB Farms | 51.5 | 10.5 | 80.3 | 21.9 | 3.0 | 4.3 | 2.2 | 3.3 | 65.8 | 229 | 23.10 | 39.7 | 37.2 |
| LGPN1125 | Limagrain | 51.8 | 11.3 | 81.3 | 24.4 | 2.3 | 3.0 | -- | 1.8 | 65.4 | 269 | 24.58 | 42.7 | -- |
| LGPN1131 | Limagrain | 48.5 | 14.5 | 79.8 | 22.3 | 2.0 | 3.0 | -- | 5.3 | 65.7 | 252 | 24.90 | 45.4 | -- |
| Pro 121-7126 | Progene | 49.0 | 13.8 | 78.0 | 19.0 | 4.5 | 6.8 | -- | 4.8 | 66.0 | 221 | 22.68 | 38.6 | -- |
| LG Koda | Pulse USA | 52.5 | 10.8 | 78.3 | 21.4 | 5.5 | 7.0 | -- | 22.0 | 66.6 | 199 | 22.25 | 29.6 | -- |
| Majoret | Pulse USA | 52.0 | 12.0 | 81.5 | 20.4 | 4.0 | 4.8 | -- | 3.3 | 66.0 | 221 | 26.25 | 38.8 | -- |
| Viper | Pulse USA | 47.5 | 15.5 | 80.0 | 23.0 | 4.8 | 5.5 | 2.8 | 3.5 | 64.7 | 220 | 26.13 | 30.6 | 32.7 |
| Banner | Pulse USA | 45.8 | 17.0 | 78.3 | 21.3 | 7.0 | 8.0 | -- | 6.8 | 65.9 | 195 | 22.90 | 31.4 | -- |
| Ginny | Pulse USA | 49.3 | 13.3 | 78.5 | 18.1 | 6.3 | 7.5 | -- | 5.3 | 66.1 | 198 | 23.80 | 34.9 | -- |
| Greenwood | Pulse USA | 48.8 | 13.5 | 77.3 | 17.5 | 7.0 | 8.0 | -- | 13.0 | 66.4 | 192 | 23.53 | 29.7 | -- |
| PG7048 | Pulse USA | 51.3 | 13.0 | 81.0 | 20.4 | 4.3 | 5.0 | -- | 3.0 | 65.4 | 197 | 23.73 | 36.8 | -- |
| Mean | | 50.0 | 13.5 | 80.2 | 22.5 | 3.6 | 4.7 | -- | 5.5 | 65.9 | 224 | 24.22 | 40.9 | -- |
| C.V. (%) | | 1.6 | 7.1 | 1.3 | 11.4 | 29.2 | 24.3 | -- | 108.5 | 0.5 | 3.5 | 4.6 | 12.0 | -- |
| LSD (0.10) | | 0.9 | 1.1 | 1.2 | 3.0 | 1.2 | 1.3 | -- | 7.0 | 0.4 | 9 | 1.31 | 5.7 | -- |
| LSD (0.05) | | 1.1 | 1.3 | 1.5 | 3.6 | 1.4 | 1.6 | -- | 8.4 | 0.5 | 11 | 1.57 | 6.8 | -- |

**Planting Date = May 2; Harvest Date = July 27; Previous Crop = Spring Wheat**

[1]Harvest Ease scores: 0 = all plants upright and easy to harvest; 9 = all plants flat on the ground and difficult to harvest

[2]Root disease scores indicate an estimate of the % of plants affected by primarily aphanomyces root rot as rated at end bloom

| **Field Pea - Organic** | | | | | | | | | | | **Carrington** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | --- Seed Yield --- | |
| Variety | Days to Bloom | Bloom Duration | Days to PM | Plant Lodge | Canopy Ht at Harvest | 1000 KWT | Seeds/ Pound | Seed Protein | Test Weight | 2018 | 3-yr. Avg. |
| | | | | 0 to 9 | inch | gram | | % | lb/bu | ------- bu/ac ------- | |
| **Yellow cotyledon type** | | | | | | | | | | | |
| Agassiz | 46.5 | 12.8 | 76.8 | 1.0 | 23.6 | 210 | 2165 | 27.3 | 62.8 | 47.1 | 41.1 |
| DS Admiral | 45.8 | 9.8 | 73.8 | 0.3 | 21.9 | 216 | 2110 | 26.1 | 63.8 | 42.4 | 36.4 |
| Spider | 49.5 | 10.0 | 78.5 | 0.3 | 22.8 | 238 | 1910 | 28.5 | 64.2 | 41.0 | 33.8 |
| PUSA1717 | 50.3 | 9.0 | 79.0 | 0.5 | 22.6 | 218 | 2085 | 30.0 | 63.7 | 44.8 | -- |
| G161526 | 48.7 | 9.5 | 78.8 | 0.7 | 23.7 | 215 | 2116 | 31.0 | 63.7 | 42.9 | -- |
| G161527 | 49.7 | 9.8 | 79.1 | 1.1 | 23.0 | 207 | 2191 | 31.2 | 63.3 | 42.2 | -- |
| Banjo | 47.3 | 10.5 | 76.8 | 1.3 | 23.3 | 215 | 2113 | 28.4 | 64.4 | 49.7 | -- |
| Fiddle | 47.3 | 11.3 | 78.0 | 0.5 | 23.7 | 233 | 1946 | 28.3 | 63.8 | 46.8 | -- |
| Nette 2010 | 44.5 | 11.5 | 73.3 | 0.0 | 21.4 | 242 | 1879 | 25.9 | 64.7 | 53.1 | 44.0 |
| | | | | | | | | | | | |
| **Green cotyledon type** | | | | | | | | | | | |
| Cruiser | 45.3 | 12.3 | 74.8 | 1.5 | 20.1 | 199 | 2277 | 26.3 | 63.0 | 42.8 | 37.7 |
| CDC Striker | 47.3 | 10.3 | 77.0 | 1.0 | 20.6 | 197 | 2315 | 25.9 | 63.6 | 48.1 | 42.0 |
| Arcadia | 48.3 | 10.0 | 77.0 | 0.3 | 18.6 | 190 | 2388 | 25.9 | 63.6 | 42.3 | 40.5 |
| PUSA1721 | 47.3 | 10.0 | 77.8 | 0.5 | 24.6 | 229 | 1997 | 24.0 | 64.9 | 51.6 | -- |
| Flute | 50.5 | 10.3 | 80.0 | 1.0 | 23.9 | 198 | 2291 | 27.2 | 64.0 | 52.6 | -- |
| Majoret | 50.3 | 8.8 | 79.4 | 0.1 | 20.7 | 213 | 2136 | 27.9 | 63.8 | 33.4 | -- |
| Shamrock | 50.8 | 9.3 | 80.3 | 0.3 | 23.7 | 221 | 2057 | 27.1 | 63.8 | 43.7 | -- |
| LG Koda | 49.8 | 9.5 | 78.5 | 0.8 | 22.4 | 205 | 2221 | 24.3 | 64.7 | 48.6 | -- |
| Bluemoon | 47.8 | 8.5 | 78.3 | 0.3 | 21.5 | 246 | 1848 | 28.0 | 63.2 | 55.0 | -- |
| | | | | | | | | | | | |
| Mean | 48.1 | 10.2 | 77.5 | 0.6 | 22.3 | 216 | 2111 | 27.3 | 63.8 | 46.3 | -- |
| C.V. (%) | 1.5 | 11.9 | 1.2 | 107.3 | 9.5 | 3.7 | 3.7 | 1.7 | 0.5 | 10.0 | -- |
| LSD 0.10 | 0.9 | 1.4 | 1.1 | 0.7 | 2.5 | 9.5 | 93 | 0.6 | 0.4 | 5.5 | -- |
| LSD 0.05 | 1.0 | 1.7 | 1.3 | 0.9 | 3.0 | 11.4 | 111 | 0.7 | 0.5 | 6.6 | -- |

**Planting Date = May 2; Harvest Date = July 30; Previous Crop = Oats**

| Faba Bean - Dryland | | | | | | | | | Carrington |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | ---------- Seed Yield ---------- | | |
| Variety | Days to Bloom | Plant Lodge | Plant Height | 1000 KWT | Seed Protein | Test Weight | 2018 | 2-yr. Avg. | 3-yr. Avg. |
| | | 0 to 9 | inch | gram | % | lb/bu | ---------- lb/ac ---------- | | |
| PUSA-FB-1801 | 45.0 | 0.5 | 43.8 | 445 | 23.7 | 61.1 | 1346 | -- | -- |
| PUSA-FB-1802 | 45.3 | 0.3 | 37.5 | 381 | 21.8 | 62.1 | 949 | -- | -- |
| Trumpet | 45.8 | 0.0 | 37.5 | 381 | 23.4 | 61.2 | 1495 | 1794 | 1764 |
| PUSA-FB-1803 | 46.0 | 1.8 | 28.3 | 287 | 19.4 | 58.1 | 975 | -- | -- |
| Fabelle | 44.5 | 0.0 | 41.0 | 416 | 25.7 | 62.0 | 2001 | 1829 | 1774 |
| Tabasco | 45.0 | 1.5 | 37.2 | 378 | 22.4 | 60.4 | 1065 | 1244 | 1292 |
| Laura | 44.0 | 0.0 | 39.9 | 406 | 24.3 | 61.3 | 1464 | -- | -- |
| Boxer | 44.8 | 1.8 | 38.1 | 387 | 22.9 | 60.9 | 1462 | 1599 | 1535 |
| Fanfare | 45.3 | 0.5 | 42.1 | 428 | 24.9 | 61.4 | 1631 | 1680 | 1682 |
| LG Cartouche | 44.3 | 1.5 | 29.0 | 295 | 22.7 | 61.2 | 1253 | 1083 | -- |
| LG Caspian | 43.5 | 0.8 | 40.9 | 415 | 24.4 | 60.8 | 1390 | 1236 | -- |
| Mean | 44.8 | 0.8 | 38.0 | 386 | 23.3 | 61.0 | 1364 | -- | -- |
| C.V. (%) | 2.1 | 128.7 | 14.4 | 14.4 | 7.6 | 0.9 | 37.1 | -- | -- |
| LSD 0.10 | 1.1 | 1.2 | 6.6 | 66.9 | 2.1 | 0.7 | 609.3 | -- | -- |
| LSD 0.05 | 1.4 | 1.4 | 7.9 | 80.6 | 2.6 | 0.8 | 733.7 | -- | -- |

**Planting Date = May 2; Harvest Date - August 14; Previous Crop = Spring Wheat**

This trial was affected by root rot.

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


**Faba bean variety trial.**

| **Faba Bean - Irrigated** | | | | | **Carrington** |
|---|---|---|---|---|---|
| | Days to | 1000 | Seed | Test | Seed |
| Variety | Bloom | KWT | Protein | Weight | Yield |
| | | gram | % | lb/bu | lb/ac |
| Fabelle | 43.8 | 474 | 27.3 | 59.9 | 3171 |
| Tabasco | 45.8 | 341 | 22.0 | 60.1 | 2558 |
| Laura | 44.0 | 468 | 26.4 | 60.6 | 3126 |
| LG Cartouche | 43.8 | 510 | 26.3 | 61.0 | 3254 |
| LG Caspian | 43.5 | 504 | 25.0 | 60.8 | 3083 |
| Mean | 44.2 | 459 | 25.4 | 60.5 | 3038 |
| C.V. (%) | 1.4 | 4.7 | 1.8 | 1.0 | 12.0 |
| LSD 0.10 | 0.8 | 27.4 | 0.6 | 0.7 | 458.1 |
| LSD 0.05 | 0.9 | 33.4 | 0.7 | 0.9 | 560.0 |

**Planting Date = May 2; Harvest Date = August 29; Previous Crop = Spring Wheat**

| **Faba Bean - Organic** | | | | | | | **Carrington** |
|---|---|---|---|---|---|---|---|
| | | | | | | --------- Seed Yield --------- | |
| | Days to | Plant | 1000 | Seed | Test | | 2-yr. |
| Variety | Bloom | Height | KWT | Protein | Weight | 2018 | Avg. |
| | | inch | gram | % | lb/bu | ---------- lb/ac ---------- | |
| Trumpet | 43.3 | 27.4 | 391 | 25.4 | 60.7 | 1777 | 1990 |
| Tabasco | 43.9 | 26.1 | 346 | 23.2 | 60.8 | 1432 | 1672 |
| Boxer | 42.0 | 27.0 | 407 | 26.0 | 60.5 | 1424 | 1798 |
| Fanfare | 44.0 | 28.9 | 430 | 26.4 | 61.6 | 1477 | 1772 |
| LG Cartouche | 41.8 | 29.1 | 464 | 27.2 | 60.3 | 1459 | -- |
| Mean | 42.9 | 27.7 | 410 | 25.8 | 60.8 | 1506 | -- |
| C.V. (%) | 1.5 | 3.4 | 5.5 | 1.4 | 0.7 | 8.8 | -- |
| LSD 0.10 | 0.8 | 1.2 | 28.8 | 0.5 | 0.5 | 169.1 | -- |
| LSD 0.05 | 1.0 | 1.5 | 35.2 | 0.6 | 0.7 | 207.3 | -- |

**Planting Date = May 4; Harvest Date = August 8; Previous Crop = Oats**

| **Chickpea** | | | | | | | | | | | | | **Carrington** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | ----- Seed Yield ----- | |
| Variety | Market Type | Days to Bloom | Days to PM | Plant Height | Seed Size > 10 mm | Seed Size > 9 mm | Seed Size > 8 mm | Seed Size < 8 mm | 1000 KWT | Seeds / Pound | Test Weight | 2018 | 2-yr. Avg. |
| | | | | inch | % | % | % | % | gram | | lb/bu | -------- lb/ac -------- | |
| Sierra | Small Kabuli | 47.8 | 95.8 | 18.7 | 26 | 41 | 22 | 10 | 434 | 1046 | 58.0 | 2043 | 1765 |
| CDC Luna | Small Kabuli | 47.3 | 93.3 | 18.9 | 9 | 36 | 36 | 18 | 366 | 1243 | 60.7 | 2900 | 2548 |
| Sawyer | Small Kabuli | 47.3 | 94.0 | 20.1 | 9 | 29 | 35 | 26 | 389 | 1197 | 59.9 | 2660 | 2134 |
| CDC Frontier | Small Kabuli | 47.5 | 94.3 | 19.5 | 9 | 26 | 32 | 33 | 348 | 1328 | 60.6 | 2980 | 2724 |
| CDC Orion | Small Kabuli | 46.0 | 94.3 | 18.8 | 18 | 37 | 30 | 15 | 393 | 1166 | 59.8 | 3328 | 2640 |
| CDC Anna | Desi | 45.8 | 92.0 | 18.8 | 0 | 1 | 3 | 96 | 190 | 2399 | 60.6 | 2645 | 2578 |
| | MEAN | 47.1 | 93.9 | 19.4 | 11 | 28 | 29 | 32 | 358 | 1358 | 60.1 | 2742 | -- |
| | C.V. (%) | 1.8 | 2.2 | 15.9 | 68.2 | 38 | 28.9 | 58.2 | 10.5 | 11.0 | 1.4 | 13.7 | -- |
| | LSD 0.10 | 1.0 | NS | NS | 9 | 13 | 10 | 22 | 46 | 182 | 1.0 | 457 | -- |
| | LSD 0.05 | 1.3 | NS | NS | 11 | 15 | 12 | 27 | 55 | 220 | 1.2 | 552 | -- |

**Planting Date = May 2 ; Harvest Date = August 23 ; Previous Crop = Spring Wheat**

| Lentil | | | | | | | | | Carrington |
|---|---|---|---|---|---|---|---|---|---|
| Variety | Days to Bloom | Days to PM | Plant Height | Root Disease[1] | Harvest Ease[2] | Seed Protein | 1000 KWT | Test Weight | Grain Yield |
| | | | in | % | 0-9 | % | g/1000 | lb/bu | lb/ac |
| CDC Redberry | 50.8 | 83.3 | 12.8 | 0.0 | 3.5 | 24.0 | 39.6 | 66.6 | 1192 |
| CDC Lemay | 52.0 | 83.8 | 10.8 | 0.3 | 4.0 | 32.6 | 33.0 | 67.5 | 966 |
| CDC Red Rider | 51.0 | 82.8 | 11.5 | 0.0 | 4.8 | 24.3 | 44.1 | 66.4 | 1147 |
| CDC Richlea | 51.5 | 82.3 | 10.2 | 0.3 | 5.0 | 25.5 | 45.9 | 66.0 | 1329 |
| CDC Viceroy | 49.3 | 83.8 | 10.9 | 0.0 | 4.0 | 26.3 | 32.7 | 67.5 | 1686 |
| CDC Rouleau | 52.0 | 80.8 | 10.4 | 0.8 | 5.3 | 24.1 | 34.2 | 66.7 | 1197 |
| Pennel | 49.5 | 82.8 | 10.0 | 0.3 | 5.0 | 25.0 | 49.4 | 64.6 | 781 |
| ND Eagle | 48.3 | 80.3 | 10.6 | 1.0 | 5.3 | 27.4 | 35.7 | 66.7 | 1667 |
| Mean | 50.6 | 82.5 | 10.9 | 0.3 | 4.6 | 26.1 | 39.3 | 66.5 | 1246 |
| C.V. (%) | 0.9 | 1.7 | 12.4 | 183.0 | 22.6 | 7.2 | 5.6 | 0.4 | 18.4 |
| LSD 0.10 | 0.6 | 1.7 | 1.6 | 0.7 | 1.3 | 2.28 | 2.69 | 0.3 | 279 |
| LSD 0.05 | 0.7 | 2.1 | 2.0 | 0.8 | 1.5 | 2.77 | 3.25 | 0.4 | 337 |

**Planting Date = May 2 ; Harvest Date = July 31 ; Previous Crop = Spring Wheat**

[1]Root disease scores indicate an estimate of the % of plants affected by primarily aphanomyces root rot as rated three weeks prior to PM.
[2]Harvest Ease scores: 0 = all plants upright and easy to harvest; 9 = all plants flat on the ground and difficult to harvest.

**Lab preparation for spring planting.**

| Corn - Dryland, Conventional | | | | | | | | | | | | Carrington |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | ------- Grain Yield ------- | |
| Brand | Hybrid[1] | R.M. | Days to Silk | Ear Height | Plant Height | Plant Lodge | Grain Protein | Starch Content | Harvest Moisture | Test Weight | 2018 | 2-yr. Avg. |
| | | | | inch | inch | 0 to 9 | % | % | % | lb/bu | ---------- bu/ac ---------- | |
| Thunder | 2784 | 84 | 71.8 | 29.9 | 101.0 | 0.6 | 10.8 | 70.5 | 15.6 | 55.0 | 151.6 | 151.2 |
| Thunder | 2889 | 89 | 73.5 | 27.6 | 104.1 | 0.8 | 10.9 | 70.7 | 15.7 | 54.3 | 162.2 | -- |
| Proseed | 1083 | 83 | 71.3 | 28.0 | 100.6 | 0.5 | 10.7 | 70.7 | 16.0 | 54.3 | 158.4 | 153.7 |
| Proseed | 1684 | 84 | 72.5 | 30.8 | 94.1 | 1.0 | 10.4 | 70.9 | 14.9 | 53.7 | 161.7 | -- |
| Proseed | 1687 | 87 | 71.3 | 32.2 | 100.5 | 0.5 | 9.9 | 71.5 | 15.6 | 55.8 | 189.9 | -- |
| Proseed | 1689 | 89 | 72.8 | 30.9 | 100.8 | 1.0 | 9.5 | 71.5 | 16.0 | 54.4 | 181.8 | -- |
| Proseed | 1681 | 81 | 67.3 | 32.2 | 95.9 | 1.0 | 10.3 | 70.8 | 15.1 | 56.4 | 168.1 | -- |
| Rob-See-Co | RC3601-Artesian | 86 | 72.5 | 28.9 | 101.1 | 0.8 | 10.2 | 71.1 | 15.8 | 56.1 | 165.3 | -- |
| Dairyland Seed | DS-1686 | 86 | 73.0 | 30.7 | 101.9 | 0.8 | 10.4 | 71.0 | 15.7 | 55.4 | 178.2 | -- |
| Dairyland Seed | DS-1091 | 91 | 73.5 | 30.1 | 103.3 | 3.5 | 10.7 | 70.8 | 15.6 | 56.1 | 164.8 | 155.8 |
| Dyna-Gro | D25CC75 | 85 | 72.5 | 28.0 | 98.9 | 2.0 | 9.8 | 71.4 | 15.7 | 56.2 | 167.7 | -- |
| | MEAN | | 72.0 | 29.9 | 100.2 | 1.1 | 10.3 | 70.9 | 15.6 | 55.2 | 166.7 | -- |
| | C.V. (%) | | 1.2 | 12.7 | 2.3 | 136 | 5.8 | 0.7 | 4.2 | 1.8 | 14.5 | -- |
| | LSD 0.10 | | 1.1 | NS | 2.8 | NS | 0.7 | 0.6 | NS | 1.2 | NS | -- |
| | LSD 0.05 | | 1.3 | NS | 3.3 | NS | 0.9 | NS | NS | 1.4 | NS | -- |

**Planting Date = May 4 ; Harvest Date = November 9 ; Previous Crop = Spring Wheat ; Final plant population = 28,000 plant acre$^{-1}$**

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

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

| Brand | Hybrid | R.M. | Hybrid Traits[1] | Days to Silk | Ear Height | Plant Height | Grain Protein | Starch Content | Harvest Moisture | Test Weight | Grain Yield 2018 | Grain Yield 2-yr. Avg. | Grain Yield 3-yr. Avg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | inch | inch | % | % | % | lb/bu | bu/ac | bu/ac | bu/ac |
| Channel | 182-09VT2P | 82 | VT2P | 68.0 | 30.7 | 90.9 | 10.9 | 69.9 | 15.1 | 54.7 | 109.0 | -- | -- |
| Channel | 187-49VT2P | 87 | VT2P | 71.8 | 30.0 | 95.2 | 11.9 | 69.7 | 15.8 | 54.5 | 77.6 | 126.9 | 139.4 |
| Dairyland Seed | DS-6378 | 78 | RR | 66.0 | 23.4 | 80.7 | 11.0 | 69.8 | 15.5 | 53.7 | 92.4 | -- | -- |
| Dairyland Seed | DS-7781 | 81 | Powercore | 69.0 | 26.2 | 88.6 | 10.8 | 70.7 | 16.2 | 54.3 | 108.2 | -- | -- |
| Dairyland Seed | DS-9085a | 83 | 3000GT | 71.5 | 27.7 | 95.1 | 11.9 | 69.5 | 15.5 | 54.1 | 104.5 | -- | -- |
| Dairyland Seed | RPM-2918AM | 85 | AM | 70.8 | 34.3 | 90.6 | 11.4 | 69.9 | 16.2 | 52.5 | 91.6 | -- | -- |
| Dairyland Seed | DS-9085 | 85 | Agrisure 3122 | 70.8 | 32.4 | 94.6 | 10.7 | 70.8 | 16.5 | 55.5 | 119.0 | -- | -- |
| Dairyland Seed | EXP-08611 | 86 | AM | 70.3 | 32.1 | 92.2 | 11.5 | 69.9 | 16.3 | 53.4 | 90.3 | -- | -- |
| Dairyland Seed | DS-9686 | 86 | 3000GT | 72.3 | 28.2 | 93.6 | 10.8 | 70.9 | 16.6 | 56.1 | 123.2 | 152.1 | 152.5 |
| Dairyland Seed | ESP-08907 | 89 | GTCBLL | 73.5 | 27.6 | 95.8 | 11.8 | 70.4 | 17.3 | 55.0 | 99.0 | -- | -- |
| Dyna-Gro | D22VC62 | 82 | VT2P | 71.5 | 27.9 | 92.5 | 11.5 | 70.1 | 16.0 | 55.7 | 95.9 | -- | -- |
| Dyna-Gro | D25VC66 | 85 | VT2P | 71.8 | 29.1 | 96.9 | 10.6 | 71.1 | 16.6 | 55.5 | 107.3 | -- | -- |
| Dyna-Gro | D27VC47 | 87 | VT2P | 71.3 | 32.5 | 89.4 | 10.3 | 71.2 | 15.7 | 54.4 | 104.0 | -- | -- |
| Dyna-Gro | D27VC87 | 87 | VT2P | 71.5 | 31.3 | 94.8 | 11.1 | 70.5 | 16.2 | 55.9 | 118.3 | -- | -- |
| Funk's Frontiersmen | 87-E7 | 87 | VT2RIB | 70.8 | 32.5 | 95.8 | 11.3 | 70.2 | 16.0 | 55.7 | 116.6 | 145.0 | -- |
| Funk's Frontiersmen | 91-H2 | 91 | VT2RIB | 74.0 | 24.7 | 91.1 | 10.4 | 71.6 | 17.2 | 54.7 | 120.0 | -- | -- |
| Hefty | H3322 | 83 | VT2P | 71.5 | 27.6 | 92.5 | 10.6 | 70.9 | 16.1 | 54.8 | 111.8 | -- | -- |
| Hefty | H3922 | 89 | VT2P | 73.0 | 30.0 | 94.2 | 11.5 | 70.2 | 16.3 | 54.7 | 104.9 | -- | -- |
| Hefty | Exp9022 | 90 | VT2P | 72.8 | 25.1 | 95.7 | 11.1 | 70.8 | 15.6 | 54.5 | 103.4 | -- | -- |
| Innotech | IC 4016-3120 | 90 | Agrisure | 74.8 | 26.5 | 99.5 | 12.0 | 70.6 | 18.7 | 53.9 | 97.7 | -- | -- |
| | | | MEAN | 71.4 | 28.6 | 93.3 | 11.1 | 70.4 | 16.3 | 54.8 | 105.0 | -- | -- |
| | | | C.V. (%) | 1.8 | 16.2 | 4.5 | 6.3 | 1.0 | 5.9 | 1.3 | 11.5 | -- | -- |
| | | | LSD 0.10 | 1.5 | 5.4 | 4.9 | 0.8 | 0.80 | 1.1 | 0.8 | 14.0 | -- | -- |
| | | | LSD 0.05 | 1.8 | NS | 5.9 | 1.0 | 1.00 | 1.3 | 1.0 | 16.7 | -- | -- |

**Planting Date = May 3 ; Harvest Date = October 16 ; Previous Crop = Spring Wheat**

| Brand | Hybrid | R.M. | Hybrid Traits[1] | Days to Silk | Ear Height | Plant Height | Grain Protein | Starch Content | Harvest Moisture | Test Weight | Grain Yield 2018 | Grain Yield 2-yr. Avg. | Grain Yield 3-yr. Avg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | inch | inch | % | % | % | lb/bu | bu/ac | bu/ac | bu/ac |
| Integra | 3282 | 82 | VT2P | 71.0 | 26.1 | 95.5 | 11.6 | 70.0 | 16.2 | 55.6 | 98.2 | -- | -- |
| Integra | 3325 | 83 | AV-3110A | 73.3 | 23.8 | 88.6 | 11.4 | 70.3 | 16.8 | 53.1 | 98.0 | 133.8 | 136.2 |
| Integra | 3537 | 85 | VT2PRIB | 72.0 | 31.5 | 95.3 | 10.8 | 70.8 | 16.8 | 55.3 | 126.5 | 139.9 | 142.6 |
| Integra | 3629 | 86 | VT2PRIB | 72.0 | 28.4 | 95.9 | 11.6 | 69.9 | 16.4 | 55.1 | 111.5 | -- | -- |
| Integra | 3718 | 87 | VT2PRIB | 72.5 | 29.2 | 96.7 | 10.9 | 71.0 | 17.9 | 55.1 | 107.4 | 140.4 | -- |
| Legacy Seeds | L-2817 | 86 | VT2P | 71.8 | 30.1 | 98.6 | 11.4 | 69.9 | 15.9 | 55.8 | 114.4 | 147.2 | -- |
| Legacy Seeds | L-2847 | 87 | VT2P | 72.3 | 31.6 | 99.5 | 11.6 | 70.2 | 16.7 | 54.8 | 106.6 | 142.3 | -- |
| Legacy Seeds | L-2916 | 88 | VT2P | 70.3 | 28.6 | 93.1 | 11.5 | 70.2 | 16.4 | 53.5 | 105.1 | 139.0 | 139.6 |
| Legacy Seeds | L-3017 | 90 | VT2P | 74.0 | 28.8 | 95.5 | 11.6 | 70.0 | 16.9 | 54.2 | 106.3 | 145.9 | -- |
| Legacy Seeds | L-3117 | 91 | VT2P | 73.0 | 26.5 | 90.7 | 10.8 | 71.2 | 17.2 | 54.9 | 102.3 | -- | -- |
| Northstar | NS 84-351 | 84 | 3220A EZ | 72.8 | 24.8 | 91.0 | 11.1 | 70.6 | 16.7 | 55.1 | 109.6 | -- | -- |
| Northstar | NS 85-369 | 85 | GTA | 73.0 | 28.3 | 95.1 | 11.1 | 70.5 | 16.2 | 55.7 | 114.7 | 151.8 | -- |
| Northstar | NS 86-194 | 86 | VT2PRIB | 71.5 | 30.5 | 91.1 | 10.9 | 70.8 | 16.4 | 55.0 | 90.9 | 128.6 | 132.8 |
| Northstar | NS 87-545 | 87 | VT2PRIB | 71.5 | 28.7 | 97.8 | 11.4 | 70.1 | 15.7 | 55.3 | 100.5 | 140.1 | -- |
| Northstar | NS 88-124 | 88 | VT2PRIB | 72.8 | 33.5 | 100.8 | 10.7 | 71.1 | 17.1 | 54.9 | 123.8 | 149.8 | -- |
| Northstar | NS 89-357 | 89 | 3120 EZ | 74.3 | 28.8 | 100.7 | 12.2 | 70.3 | 18.1 | 53.6 | 99.6 | -- | -- |
| Peterson Farms Seed | 71V81 | 81 | | 68.0 | 28.3 | 90.9 | 10.1 | 71.1 | 16.4 | 54.8 | 112.3 | -- | -- |
| Peterson Farms Seed | 76Q86 | 86 | | 72.8 | 26.9 | 91.0 | 11.1 | 70.5 | 16.6 | 53.1 | 107.8 | -- | -- |
| | | | MEAN | 71.4 | 28.6 | 93.3 | 11.1 | 70.4 | 16.3 | 54.8 | 105.0 | -- | -- |
| | | | C.V. (%) | 1.8 | 16.2 | 4.5 | 6.3 | 1.0 | 5.9 | 1.3 | 11.5 | -- | -- |
| | | | LSD 0.10 | 1.5 | 5.4 | 4.9 | 0.8 | 0.80 | 1.1 | 0.8 | 14.0 | -- | -- |
| | | | LSD 0.05 | 1.8 | NS | 5.9 | 1.0 | 1.00 | 1.3 | 1.0 | 16.7 | -- | -- |

**Planting Date = May 3 ; Harvest Date = October 16 ; Previous Crop = Spring Wheat**

| Brand | Hybrid | R.M. | Hybrid Traits[1] | Days to Silk | Ear Height | Plant Height | Grain Protein | Starch Content | Harvest Moisture | Test Weight | Grain Yield 2018 | Grain Yield 2-yr. Avg. | Grain Yield 3-yr. Avg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | inch | inch | % | % | % | lb/bu | bu/ac | bu/ac | bu/ac |
| Proseed | 1283 | 83 | VT2P | 67.8 | 24.4 | 82.0 | 11.0 | 69.8 | 14.8 | 56.2 | 97.6 | -- | -- |
| Proseed | 1483 | 83 | VT2P | 69.8 | 31.4 | 92.1 | 11.3 | 69.8 | 15.3 | 54.5 | 111.6 | 143.1 | 134.5 |
| Proseed | 1385 | 85 | VT2P | 71.0 | 31.3 | 97.1 | 10.4 | 70.9 | 16.5 | 55.9 | 117.3 | 146.4 | 145.8 |
| Proseed | 1787 | 87 | VT2P | 71.3 | 30.9 | 97.3 | 11.0 | 70.6 | 16.2 | 55.5 | 113.2 | -- | -- |
| Proseed | 1689 | 89 | VT2P | 70.8 | 30.9 | 94.0 | 10.7 | 70.9 | 16.5 | 54.5 | 133.6 | -- | -- |
| REA | 1B780 | 79 | VT2P | 69.0 | 25.7 | 89.8 | 10.8 | 70.1 | 16.0 | 54.0 | 109.1 | -- | -- |
| REA | 1B811 | 81 | VT2P | 70.3 | 28.1 | 88.7 | 11.6 | 69.9 | 15.9 | 55.7 | 78.2 | 111.9 | -- |
| REA | 2B861 | 86 | VT2P | 71.3 | 24.1 | 89.7 | 11.2 | 70.4 | 16.4 | 54.7 | 99.1 | 132.8 | -- |
| REA | 2B872 | 87 | VT2P | 71.0 | 25.1 | 89.5 | 10.8 | 70.7 | 16.0 | 55.2 | 104.1 | -- | -- |
| Rob-See-Co | RC3418-3220A | 84 | Agrisure Viptera 3220/ | 72.5 | 23.7 | 92.1 | 11.2 | 70.4 | 16.4 | 55.1 | 128.9 | 145.0 | -- |
| Rob-See-Co | RC3601-3011A | 86 | Agrisure Viptera 3011/ | 72.3 | 28.5 | 91.3 | 11.6 | 69.9 | 15.5 | 55.7 | 91.9 | 134.1 | 138.8 |
| Thunder | 6983 | 83 | VT2P | 71.3 | 28.7 | 88.0 | 10.8 | 70.8 | 16.6 | 54.8 | 96.2 | -- | -- |
| Thunder | 6785 | 85 | VT2P | 71.5 | 28.6 | 89.7 | 11.1 | 70.3 | 16.3 | 54.7 | 86.2 | 115.4 | 120.4 |
| Thunder | 4585 | 85 | RR2 | 71.3 | 28.1 | 95.9 | 10.9 | 70.6 | 16.4 | 54.8 | 103.3 | 138.8 | 137.0 |
| Thunder | 6986 | 86 | VT2P | 71.0 | 30.8 | 89.5 | 11.8 | 70.0 | 16.4 | 54.1 | 87.7 | -- | -- |
| Thunder | 6987 | 87 | VT2P | 70.0 | 27.7 | 94.3 | 11.3 | 70.0 | 15.0 | 55.8 | 88.5 | -- | -- |
| Thunder | 6888 | 88 | VT2P | 71.3 | 33.9 | 98.4 | 11.0 | 70.8 | 17.3 | 55.0 | 122.8 | -- | -- |
| Thunder | 6789 | 89 | VT2P | 70.3 | 26.5 | 93.7 | 10.5 | 71.0 | 16.1 | 54.7 | 130.6 | -- | -- |
| | | | MEAN | 71.4 | 28.6 | 93.3 | 11.1 | 70.4 | 16.3 | 54.8 | 105.0 | -- | -- |
| | | | C.V. (%) | 1.8 | 16.2 | 4.5 | 6.3 | 1.0 | 5.9 | 1.3 | 11.5 | -- | -- |
| | | | LSD 0.10 | 1.5 | 5.4 | 4.9 | 0.8 | 0.80 | 1.1 | 0.8 | 14.0 | -- | -- |
| | | | LSD 0.05 | 1.8 | NS | 5.9 | 1.0 | 1.00 | 1.3 | 1.0 | 16.7 | -- | -- |

**Planting Date = May 3 ; Harvest Date = October 16 ; Previous Crop = Spring Wheat**

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

* Plant lodging scores were not collected as lodging minimally existed.

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

| Brand | Hybrid | R.M. | Hybrid Traits[1] | Days to Silk | Ear Height | Plant Height | Stalk Lodge | Grain Protein | Starch Content | Harvest Moisture | Test Weight | --------- Grain Yield --------- 2018 | 2-yr. Avg. | 3-yr. Avg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | inch | inch | 0 to 9 | % | % | % | lb/bu | ---------- bu/ac ---------- | | |
| Dairyland Seed | DS-6378 | 78 | RR | 67.0 | 28.5 | 83.3 | 0.0 | 8.5 | 73.0 | 19.7 | 53.7 | 165.9 | -- | -- |
| Dairyland Seed | DS-7781 | 81 | Powercore | 67.0 | 32.7 | 89.2 | 0.5 | 9.0 | 72.6 | 19.0 | 54.3 | 199.0 | -- | -- |
| Dairyland Seed | EXP-08407 | 84 | 3010 | 69.5 | 31.7 | 94.8 | 0.3 | 9.2 | 72.8 | 19.3 | 54.7 | 215.3 | -- | -- |
| Dairyland Seed | RPM-2918AM | 85 | AM | 69.3 | 36.0 | 98.6 | 0.5 | 8.7 | 73.2 | 20.4 | 52.8 | 237.7 | -- | -- |
| Dairyland Seed | DS-9085 | 85 | Agrisure 3122 | 69.3 | 35.4 | 103.4 | 0.3 | 8.9 | 73.3 | 20.3 | 54.7 | 243.3 | -- | -- |
| Dairyland Seed | EXP-08611 | 86 | AM | 69.5 | 33.7 | 96.1 | 0.3 | 8.8 | 73.0 | 19.6 | 52.9 | 237.8 | -- | -- |
| Dairyland Seed | DS-9686a | 86 | 3000GT | 69.5 | 37.6 | 100.5 | 0.3 | 8.8 | 73.4 | 20.3 | 54.1 | 256.6 | -- | -- |
| Dairyland Seed | ESP-08907 | 89 | GTCBLL | 71.3 | 36.2 | 102.5 | 0.3 | 9.3 | 73.6 | 21.0 | 53.2 | 241.0 | -- | -- |
| Dyna-Gro | D27VC47 | 87 | VT2P | 69.8 | 37.2 | 94.4 | 0.0 | 8.0 | 74.3 | 20.0 | 54.2 | 233.2 | -- | -- |
| Dyna-Gro | D27VC87 | 87 | VT2P | 69.0 | 32.8 | 103.8 | 0.0 | 8.7 | 72.9 | 19.0 | 54.8 | 247.5 | -- | -- |
| Innotech | IC 4016-3120 | 90 | Agrisure 3120 | 72.0 | 36.6 | 104.7 | 0.0 | 10.0 | 72.7 | 21.1 | 52.6 | 253.0 | -- | -- |
| Integra | 3537 | 85 | VT2PRIB | 70.8 | 36.4 | 101.2 | 0.0 | 8.2 | 73.8 | 20.2 | 54.1 | 259.9 | 232.9 | 208.1 |
| Integra | 3718 | 87 | VT2PRIB | 70.7 | 35.2 | 104.6 | 0.0 | 8.5 | 73.2 | 20.0 | 53.3 | 269.3 | 252.9 | -- |
| Legacy Seeds | L-2817 | 86 | VT2P | 70.0 | 32.9 | 103.0 | 0.3 | 8.5 | 73.4 | 19.4 | 54.4 | 236.3 | 234.6 | -- |
| Legacy Seeds | L-2847 | 87 | VT2P | 70.3 | 35.0 | 102.6 | 0.3 | 8.7 | 73.0 | 20.2 | 53.3 | 266.1 | 243.2 | -- |
| Legacy Seeds | L-2916 | 88 | VT2P | 69.5 | 31.3 | 97.0 | 0.0 | 8.4 | 73.4 | 19.4 | 54.2 | 229.9 | 226.0 | 205.2 |
| Legacy Seeds | L-3017 | 90 | VT2P | 71.3 | 34.3 | 100.3 | 0.0 | 9.4 | 72.4 | 20.0 | 53.4 | 269.1 | 258.6 | -- |
| Legacy Seeds | L-3117 | 91 | VT2P | 71.3 | 32.9 | 96.1 | 0.0 | 8.9 | 73.0 | 20.3 | 53.0 | 249.2 | -- | -- |
| Peterson Farms Seed | 71V81 | 81 | | 68.0 | 30.1 | 85.7 | 0.5 | 8.4 | 73.2 | 18.9 | 55.0 | 242.4 | -- | -- |
| Peterson Farms Seed | 71D83 | 83 | | 67.0 | 27.8 | 89.8 | 0.0 | 9.3 | 72.2 | 19.1 | 55.5 | 197.8 | 193.8 | 170.6 |
| Peterson Farms Seed | 75K85 | 85 | | 69.5 | 36.2 | 101.2 | 0.3 | 8.4 | 73.4 | 20.0 | 54.3 | 260.1 | 234.6 | -- |
| Peterson Farms Seed | 76Q86 | 86 | | 70.0 | 32.5 | 94.9 | 0.3 | 8.6 | 73.3 | 19.1 | 53.3 | 246.2 | -- | -- |
| | MEAN | | | 69.6 | 33.8 | 98.5 | 0.2 | 8.7 | 73.2 | 19.8 | 54.0 | 239.0 | -- | -- |
| | C.V. (%) | | | 0.9 | 7.8 | 3.4 | 239 | 4.4 | 0.6 | 3.5 | 1.5 | 7.5 | -- | -- |
| | LSD 0.10 | | | 0.8 | 3.1 | 4.0 | NS | 0.4 | 0.5 | 0.8 | 1.0 | 21.1 | -- | -- |
| | LSD 0.05 | | | 0.9 | 3.7 | 4.7 | NS | 0.5 | 0.6 | 1.0 | 1.2 | 25.2 | -- | -- |

**Planting Date = May 7 ; Harvest Date = November 20 ; Previous Crop = Faba Bean**

| Brand | Hybrid | R.M. | Hybrid Traits[1] | Days to Silk | Ear Height | Plant Height | Stalk Lodge | Grain Protein | Starch Content | Harvest Moisture | Test Weight | Grain Yield 2018 | Grain Yield 2-yr. Avg. | Grain Yield 3-yr. Avg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | inch | inch | 0 to 9 | % | % | % | lb/bu | bu/ac | bu/ac | bu/ac |
| Proseed | 1283 | 83 | VT2P | 67.0 | 31.9 | 89.8 | 0.3 | 8.9 | 72.5 | 18.8 | 55.9 | 180.4 | -- | -- |
| Proseed | 1483 | 83 | VT2P | 68.5 | 34.6 | 97.2 | 0.3 | 8.8 | 73.1 | 19.6 | 54.7 | 208.5 | 213.2 | 183.2 |
| Proseed | 1385 | 85 | VT2P | 69.8 | 37.2 | 107.3 | 0.3 | 8.8 | 73.0 | 19.2 | 55.0 | 225.7 | 219.2 | 195.4 |
| Proseed | 1787 | 87 | VT2P | 69.8 | 31.9 | 102.0 | 0.3 | 8.4 | 73.7 | 20.2 | 53.7 | 233.8 | -- | -- |
| Proseed | 1689 | 89 | VT2P | 69.8 | 33.9 | 99.8 | 0.0 | 8.4 | 73.4 | 19.5 | 53.9 | 229.0 | -- | -- |
| REA | 2B861 | 86 | VT2P | 69.8 | 35.0 | 99.0 | 0.3 | 8.4 | 73.7 | 20.6 | 53.3 | 245.8 | 227.9 | -- |
| REA | 2B872 | 87 | VT2P | 69.8 | 35.6 | 97.0 | 0.3 | 8.3 | 73.2 | 19.5 | 54.9 | 257.3 | -- | -- |
| REA | 3B891 | 89 | VT2P | 70.8 | 31.5 | 97.9 | 0.3 | 8.1 | 73.6 | 19.9 | 53.7 | 277.4 | -- | -- |
| Rob-See-Co | RC3418-3220A | 84 | Agrisure Viptera 3220A | 71.0 | 27.4 | 96.5 | 0.3 | 9.3 | 72.6 | 19.4 | 54.8 | 232.4 | 217.0 | -- |
| Rob-See-Co | RC3601-3011A | 86 | Agrisure Viptera 3011A | 70.5 | 34.6 | 100.9 | 0.0 | 8.8 | 73.7 | 20.9 | 54.2 | 253.8 | 246.2 | 217.8 |
| Thunder | 6785 | 85 | VT2P | 69.3 | 34.4 | 99.1 | 0.3 | 9.0 | 72.9 | 19.6 | 54.7 | 237.8 | -- | -- |
| Thunder | 4585 | 85 | RR2 | 69.8 | 37.2 | 101.7 | 0.0 | 8.3 | 73.6 | 19.5 | 54.7 | 258.1 | -- | -- |
| Thunder | 6986 | 86 | VT2P | 70.3 | 33.5 | 97.2 | 0.0 | 8.5 | 73.5 | 20.5 | 52.8 | 234.8 | -- | -- |
| Thunder | 6987 | 87 | VT2P | 69.8 | 30.9 | 103.1 | 0.3 | 8.6 | 73.4 | 19.7 | 54.2 | 236.1 | -- | -- |
| Thunder | 6888 | 88 | VT2P | 70.5 | 33.9 | 103.6 | 0.0 | 9.1 | 73.0 | 19.8 | 53.0 | 262.6 | -- | -- |
| Thunder | 6789 | 89 | VT2P | 69.8 | 34.4 | 103.6 | 0.0 | 8.1 | 73.9 | 20.4 | 53.2 | 257.7 | -- | -- |
| | MEAN | | | 69.6 | 33.8 | 98.5 | 0.2 | 8.7 | 73.2 | 19.8 | 54.0 | 239.0 | -- | -- |
| | C.V. (%) | | | 0.9 | 7.8 | 3.4 | 239 | 4.4 | 0.6 | 3.5 | 1.5 | 7.5 | -- | -- |
| | LSD 0.10 | | | 0.8 | 3.1 | 4.0 | NS | 0.4 | 0.5 | 0.8 | 1.0 | 21.1 | -- | -- |
| | LSD 0.05 | | | 0.9 | 3.7 | 4.7 | NS | 0.5 | 0.6 | 1.0 | 1.2 | 25.2 | -- | -- |

**Planting Date = May 7 ; Harvest Date = November 20 ; Previous Crop = Faba Bean**

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

| **Corn - Dryland** | | | | | | | | | | | | | **Fingal (Page 1 of 2)** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | --------- Grain Yield --------- | | |
| Brand | Hybrid | R.M. | Hybrid Traits[1] | Plant Lodge | Ear Height | Plant Height | Grain Protein | Starch Content | Harvest Moist. | Test Weight | 2018 | 2-yr. Avg. | 3-yr. Avg. |
| | | | | 0 to 9 | inch | inch | % | % | % | lb/bu | ---------- bu/ac ---------- | | |
| Channel | 189-03VT2P | 89 | VT2P | 0.0 | 40.9 | 106.1 | 9.1 | 72.8 | 17.4 | 54.4 | 263.7 | -- | -- |
| Channel | 191-25VT2P | 91 | VT2P | 0.3 | 40.9 | 105.9 | 9.7 | 72.7 | 17.8 | 52.9 | 295.4 | -- | -- |
| Channel | 194-49DGVT2P | 94 | DGVT2P | 0.0 | 41.9 | 109.3 | 9.4 | 72.7 | 18.5 | 52.7 | 299.4 | -- | -- |
| Dairyland Seed | DS-9085 | 85 | Agrisure 3122 | 0.0 | 40.4 | 105.5 | 9.0 | 73.4 | 18.3 | 54.1 | 261.3 | -- | -- |
| Dairyland Seed | DS-9686 | 86 | 3000GT | 1.5 | 38.0 | 105.3 | 9.3 | 73.1 | 18.5 | 54.9 | 276.8 | 227.4 | 210.2 |
| Dairyland Seed | ESP-08907 | 89 | GTCBLL | 0.3 | 40.0 | 109.1 | 10.1 | 72.7 | 18.2 | 54.7 | 284.5 | -- | -- |
| Dairyland Seed | DS-7294 | 93 | AM | 2.3 | 44.3 | 108.3 | 10.5 | 72.2 | 18.3 | 53.6 | 254.6 | 230.3 | 216.7 |
| Dairyland Seed | DS-7294a | 94 | Agrisure 3220 | 3.0 | 46.5 | 114.0 | 10.5 | 72.4 | 20.3 | 51.6 | 291.3 | -- | -- |
| Dairyland Seed | RPM-3519AM | 96 | AM | 2.8 | 44.7 | 110.8 | 9.9 | 73.0 | 18.4 | 54.2 | 288.2 | -- | -- |
| Dairyland Seed | RPM-3715AM | 96 | AM | 1.3 | 42.5 | 108.7 | 9.0 | 73.2 | 18.2 | 52.2 | 309.3 | -- | -- |
| Dyna-Gro | D27VC87 | 87 | VT2P | 1.5 | 39.2 | 107.5 | 8.7 | 73.2 | 17.7 | 54.6 | 267.4 | -- | -- |
| Dyna-Gro | D28SS36 | 88 | SS | 0.5 | 42.5 | 103.1 | 9.2 | 73.2 | 18.3 | 52.9 | 263.2 | -- | -- |
| Dyna-Gro | D32VC41 | 92 | VT2P | 0.0 | 40.7 | 105.5 | 10.0 | 72.2 | 18.2 | 52.6 | 259.4 | -- | -- |
| Dyna-Gro | D34VC54 | 94 | VT2P | 0.5 | 39.8 | 106.7 | 9.1 | 73.3 | 18.3 | 52.0 | 291.1 | -- | -- |
| Integra | 3629 | 86 | VT2P | 0.8 | 38.4 | 106.3 | 8.6 | 73.4 | 18.1 | 54.6 | 271.4 | -- | -- |
| Integra | 3718 | 87 | VT2P | 0.8 | 41.5 | 108.3 | 9.1 | 72.9 | 18.1 | 54.1 | 278.2 | -- | -- |
| Integra | 3839 | 88 | VT2P | 0.0 | 39.8 | 104.9 | 8.9 | 73.2 | 18.1 | 54.0 | 278.1 | -- | -- |
| Integra | 4119 | 91 | VT2P | 0.0 | 40.9 | 108.1 | 9.9 | 72.2 | 18.3 | 53.0 | 282.7 | -- | -- |
| Legacy Seeds | L-3017 | 90 | VT2P | 0.3 | 41.5 | 106.4 | 9.7 | 72.4 | 18.0 | 52.9 | 290.6 | 249.6 | -- |
| Legacy Seeds | L-3117 | 91 | VT2P | 0.3 | 38.6 | 100.2 | 8.9 | 73.4 | 18.6 | 53.1 | 280.8 | -- | -- |
| Legacy Seeds | L-3416 | 94 | VT2P | 1.3 | 40.0 | 104.5 | 9.3 | 73.1 | 18.8 | 52.3 | 278.1 | 242.0 | 230.9 |
| Legacy Seeds | L-3517 | 95 | VT2P | 0.3 | 43.9 | 104.7 | 9.8 | 72.8 | 18.9 | 52.0 | 286.0 | 239.9 | -- |
| | | | MEAN | | 40.7 | 106.2 | 9.3 | 72.9 | 18.2 | 53.4 | 280.7 | -- | -- |
| | | | C.V. (%) | | 6.4 | 3.2 | 3.3 | 0.6 | 4.7 | 1.4 | 8.2 | -- | -- |
| | | | LSD 0.10 | | 3.1 | 4.0 | 0.36 | 0.5 | 1.1 | 0.9 | NS | -- | -- |
| | | | LSD 0.05 | | 3.7 | 4.8 | 0.43 | 0.6 | 1.2 | 1.1 | NS | -- | -- |

**Planting Date = May 16 ; Harvest Date = November 14 and 19 ; Previous Crop = Soybean**

| Brand | Hybrid | R.M. | Hybrid Traits[1] | Plant Lodge | Ear Height | Plant Height | Grain Protein | Starch Content | Harvest Moist. | Test Weight | Grain Yield 2018 | Grain Yield 2-yr. Avg. | Grain Yield 3-yr. Avg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 0 to 9 | inch | inch | % | % | % | lb/bu | bu/ac | bu/ac | bu/ac |
| Legacy Seeds | L-3617 | 96 | VT2P | 2.0 | 41.9 | 105.5 | 9.8 | 73.1 | 17.9 | 51.9 | 301.6 | -- | -- |
| Peterson Farms Seed | 74Z87 | 87 | | 0.0 | 36.8 | 107.9 | 8.7 | 73.3 | 17.8 | 54.9 | 290.0 | -- | -- |
| Peterson Farms Seed | 74J89 | 89 | | 0.0 | 41.9 | 107.9 | 9.3 | 73.0 | 18.1 | 53.5 | 290.9 | -- | -- |
| Peterson Farms Seed | 72A91 | 91 | | 0.0 | 42.9 | 108.7 | 9.5 | 72.7 | 17.9 | 53.8 | 287.1 | 237.3 | -- |
| Proseed | 1689 | 89 | VT2P | 0.0 | 38.2 | 103.0 | 8.9 | 73.2 | 18.5 | 53.5 | 272.8 | -- | -- |
| Proseed | 1790 | 90 | VT2P | 0.5 | 42.3 | 103.7 | 9.8 | 72.3 | 18.8 | 52.5 | 270.4 | -- | -- |
| REA | 2B861 | 86 | VT2P | 0.4 | 37.6 | 101.9 | 8.7 | 73.6 | 17.8 | 54.7 | 275.1 | 241.0 | -- |
| REA | 2B872 | 87 | VT2P | 0.3 | 39.2 | 102.0 | 8.6 | 73.0 | 17.4 | 55.3 | 266.8 | -- | -- |
| REA | 3B891 | 89 | VT2P | 1.8 | 38.0 | 101.4 | 8.6 | 73.3 | 18.8 | 53.0 | 286.7 | -- | -- |
| REA | 3B902 | 90 | VT2P | 0.0 | 37.4 | 103.3 | 9.4 | 72.7 | 17.6 | 52.8 | 287.8 | -- | -- |
| REA | 3D910 | 91 | VT2P DroughtGard | 1.3 | 40.8 | 106.4 | 8.9 | 73.1 | 17.8 | 53.3 | 279.6 | -- | -- |
| | | | MEAN | | 40.7 | 106.2 | 9.3 | 72.9 | 18.2 | 53.4 | 280.7 | -- | -- |
| | | | C.V. (%) | | 6.4 | 3.2 | 3.3 | 0.6 | 4.7 | 1.4 | 8.2 | -- | -- |
| | | | LSD 0.10 | | 3.1 | 4.0 | 0.36 | 0.5 | 1.1 | 0.9 | NS | -- | -- |
| | | | LSD 0.05 | | 3.7 | 4.8 | 0.43 | 0.6 | 1.2 | 1.1 | NS | -- | -- |

**Planting Date = May 16 ; Harvest Date = November 14 and 19 ; Previous Crop = Soybean**

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

| **Corn - Dryland** | | | | | | | | | | | | | **Dickey County - Oakes (Page 1 of 2)** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | ----- Grain Yield ----- | |
| | | | | Days | Ear | Plant | Grain | Starch | Oil | Harvest | Test | | 2 yr. |
| Brand | Hybrid | RM | Hybrid Traits[1] | to Silk | Height | Height | Protein | Content | Content | Moisture | Weight | 2018 | Avg. |
| | | | | | inch | inch | % | % | % | % | lb/bu | -------- bu/ac -------- | |
| Channel | 194-49DGVT2P | 94 | DGVT2P | 61.3 | 43.4 | 95.4 | 8.8 | 73.1 | 3.6 | 18.0 | 57.0 | 230.9 | -- |
| Channel | 197-90VT2P | 97 | VT2P | 62.8 | 44.8 | 96.6 | 9.1 | 72.9 | 3.3 | 17.4 | 57.2 | 222.6 | -- |
| Channel | 201-05DGVT2P | 101 | DGVT2P | 63.0 | 39.9 | 92.2 | 8.6 | 74.0 | 2.9 | 19.3 | 55.2 | 223.5 | -- |
| Dairyland Seed | DS-7294a | 94 | Agrisure 3220 | 63.0 | 55.0 | 100.2 | 9.5 | 73.0 | 3.1 | 19.2 | 56.3 | 227.3 | 205.5 |
| Dairyland Seed | DS-7101 | 101 | Powercore | 64.5 | 50.5 | 98.5 | 9.2 | 72.8 | 3.8 | 20.0 | 55.2 | 212.7 | -- |
| Dyna-Gro | D34VC54 | 94 | VT2P | 58.5 | 39.0 | 91.8 | 9.0 | 73.5 | 3.0 | 18.2 | 56.7 | 216.2 | -- |
| Dyna-Gro | D37VC64 | 97 | VT2P | 63.0 | 45.2 | 94.5 | 9.2 | 73.5 | 2.8 | 17.8 | 56.7 | 223.3 | -- |
| Dyna-Gro | D39DC43 | 99 | VT2P | 63.8 | 40.0 | 98.0 | 8.8 | 72.7 | 3.4 | 20.5 | 53.8 | 229.5 | -- |
| Funk's Frontiersmen | 94-D7 | 94 | VT2RIB | 58.8 | 40.2 | 94.5 | 9.1 | 73.7 | 2.9 | 18.1 | 56.4 | 211.3 | 205.8 |
| Funk's Frontiersmen | 95-M9 | 95 | VT2 | 61.8 | 40.3 | 94.7 | 8.9 | 73.2 | 3.4 | 18.6 | 55.7 | 225.5 | -- |
| Funk's Frontiersmen | 97-R8 | 97 | VT2RIB | 62.8 | 43.6 | 93.5 | 9.1 | 74.0 | 2.8 | 17.5 | 56.3 | 214.9 | 201.6 |
| Innotech | IC 4016-3120 | 90 | Agrisure 3120 | 61.5 | 46.7 | 93.2 | 9.6 | 73.3 | 2.9 | 17.9 | 56.5 | 215.1 | -- |
| Innotech | IC4521-3110A | 95 | Agrisure Viptera 3110A | 61.0 | 44.7 | 95.2 | 9.1 | 73.6 | 3.0 | 18.2 | 56.7 | 219.5 | 206.4 |
| Integra | 4509 | 95 | VT2P | 62.5 | 42.7 | 94.0 | 8.8 | 72.8 | 3.5 | 19.0 | 55.3 | 217.7 | -- |
| Integra | 4782 | 98 | VT2P | 62.8 | 43.7 | 94.2 | 9.2 | 73.3 | 2.9 | 18.4 | 56.0 | 221.6 | -- |
| Legacy Seeds | L-3517 | 95 | VT2P | 61.8 | 43.6 | 94.3 | 9.2 | 73.4 | 3.2 | 17.3 | 56.7 | 221.9 | 205.4 |
| Legacy Seeds | L-3617 | 96 | VT2P | 63.0 | 43.2 | 93.2 | 9.1 | 74.0 | 2.7 | 18.2 | 56.2 | 216.4 | -- |
| Legacy Seeds | L-3712 | 96 | VT2P | 61.8 | 41.2 | 93.5 | 9.0 | 73.0 | 3.4 | 18.4 | 56.9 | 221.4 | 209.4 |
| Legacy Seeds | L-3718 | 98 | VT2P | 62.5 | 45.5 | 96.3 | 8.4 | 73.6 | 3.2 | 17.9 | 56.2 | 233.2 | -- |
| Legacy Seeds | L-4118 | 100 | GENSS | 64.5 | 49.1 | 103.5 | 9.4 | 72.8 | 3.5 | 18.0 | 56.6 | 224.0 | -- |
| | MEAN | | | 61.9 | 43.8 | 94.8 | 9.0 | 73.2 | 3.2 | 18.4 | 56.1 | 219.6 | -- |
| | C.V. (%) | | | 1.4 | 4.7 | 2.3 | 2.3 | 0.6 | 5.9 | 3.5 | 1.0 | 5.9 | -- |
| | LSD 0.10 | | | 1.0 | 2.4 | 2.6 | 0.2 | 0.5 | 0.2 | 0.8 | 0.6 | 15.1 | -- |
| | LSD 0.05 | | | 1.2 | 2.9 | 3.1 | 0.3 | 0.6 | 0.3 | 0.9 | 0.8 | 18.1 | -- |

**Planting Date = May 9 and 10; Harvest Date = October 29 and 30; Previous Crop = Soybean**

| Brand | Hybrid | RM | Hybrid Traits[1] | Days to Silk | Ear Height | Plant Height | Grain Protein | Starch Content | Oil Content | Harvest Moisture | Test Weight | ---- Grain Yield ---- 2018 | 2 yr. Avg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | inch | inch | % | % | % | % | lb/bu | -------- bu/ac -------- | |
| Dairyland Seed | RPM-3519AM | 96 | AM | 59.3 | 47.7 | 97.3 | 9.3 | 72.8 | 3.3 | 18.2 | 59.2 | 242.0 | -- |
| Dairyland Seed | EXP-09804 | 98 | | 61.3 | 38.9 | 92.6 | 9.0 | 72.7 | 3.4 | 18.8 | 53.5 | 215.2 | -- |
| Dairyland Seed | RPM-3518AM | 96 | AM | 59.0 | 36.1 | 84.0 | 9.3 | 73.2 | 3.3 | 19.2 | 56.7 | 204.3 | -- |
| Dairyland Seed | RPM-4019AM | 99 | AM | 63.5 | 41.1 | 92.5 | 9.0 | 72.6 | 3.6 | 20.7 | 52.9 | 225.0 | -- |
| Peterson Farms Seed | 78B98 | 98 | | 61.3 | 40.3 | 92.5 | 8.9 | 73.0 | 3.4 | 18.6 | 55.7 | 203.9 | 207.5 |
| Peterson Farms Seed | 79N94 | 94 | | 60.5 | 43.4 | 93.4 | 9.2 | 73.3 | 2.9 | 17.8 | 55.4 | 217.9 | -- |
| Proseed | 1598 | 98 | VT2P | 62.5 | 44.0 | 95.3 | 9.0 | 72.9 | 3.3 | 18.1 | 55.9 | 221.8 | 206.1 |
| Proseed | 16101 | 101 | VT2P | 62.8 | 44.3 | 93.4 | 9.1 | 72.9 | 3.5 | 19.3 | 55.3 | 230.5 | 208.1 |
| Proseed | 1794 | 94 | VT2P | 59.3 | 39.5 | 91.8 | 8.9 | 73.6 | 3.1 | 18.4 | 55.9 | 214.6 | -- |
| REA | 3D910 | 91 | VT2P DroughtGard | 60.3 | 44.4 | 95.8 | 8.8 | 73.9 | 2.8 | 16.5 | 57.0 | 217.3 | -- |
| REA | 3B923 | 92 | VT2P | 61.3 | 41.9 | 94.9 | 8.9 | 73.5 | 3.2 | 17.9 | 56.1 | 222.2 | -- |
| REA | 3B924 | 92 | VT2P | 60.3 | 40.9 | 89.2 | 8.9 | 74.0 | 2.9 | 17.3 | 56.7 | 195.5 | -- |
| Rob-See-Co | RC4343-3220A | 93 | Agrisure Viptera | 63.3 | 55.4 | 98.8 | 9.6 | 73.1 | 3.1 | 18.6 | 56.2 | 217.9 | -- |
| Rob-See-Co | RC4848-3000GT | 98 | Agrisure 3000GT | 62.8 | 52.6 | 98.3 | 9.4 | 72.6 | 3.5 | 19.1 | 55.4 | 210.8 | -- |
| Thunder | 6794 | 94 | VT2P | 60.5 | 40.7 | 94.0 | 8.8 | 73.3 | 3.2 | 19.1 | 56.0 | 225.2 | -- |
| Thunder | 6798 | 98 | VT2P | 63.3 | 44.4 | 96.6 | 9.0 | 73.7 | 3.0 | 17.7 | 55.4 | 201.2 | 199.7 |
| Thunder | 6996 | 96 | VT2P | 63.3 | 44.1 | 96.5 | 9.2 | 72.8 | 3.5 | 18.2 | 57.2 | 221.7 | -- |
| Thunder | 6999 | 99 | VT2P | 63.5 | 43.4 | 97.9 | 8.7 | 73.3 | 3.3 | 17.3 | 56.8 | 231.0 | -- |
| | MEAN | | | 61.9 | 43.8 | 94.8 | 9.0 | 73.2 | 3.2 | 18.4 | 56.1 | 219.6 | -- |
| | C.V. (%) | | | 1.4 | 4.7 | 2.3 | 2.3 | 0.6 | 5.9 | 3.5 | 1.0 | 5.9 | -- |
| | LSD 0.10 | | | 1.0 | 2.4 | 2.6 | 0.2 | 0.5 | 0.2 | 0.8 | 0.6 | 15.1 | -- |
| | LSD 0.05 | | | 1.2 | 2.9 | 3.1 | 0.3 | 0.6 | 0.3 | 0.9 | 0.8 | 18.1 | -- |

**Planting Date = May 9 and 10; Harvest Date = October 29 and 30; Previous Crop = Soybean**

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

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

| | | | | | | | | | | | ----- Grain Yield ----- | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Days | Grain | Content | | | Test | | 2 yr. |
| Brand | Hybrid | RM | Hybrid Traits[1] | to Silk | Protein | Starch | Oil | Moisture | Weight | 2018 | Avg. |
| | | | | | % | % | % | % | lb/bu | --------- bu/ac | --------- |
| Channel | 194-49DGVT2P | 94 | DGVT2P | 58.5 | 8.9 | 72.6 | 4.0 | 18.7 | 56.5 | 241.1 | -- |
| Channel | 197-90VT2P | 97 | VT2P | 58.8 | 9.3 | 72.5 | 3.5 | 17.2 | 57.5 | 260.5 | -- |
| Channel | 201-28VT2P | 101 | VT2P | 60.8 | 8.6 | 73.3 | 3.7 | 17.7 | 56.6 | 258.1 | 282.8 |
| Dairyland Seed | DS-7294a | 94 | Agrisure 3220 | 60.0 | 10.0 | 72.4 | 3.2 | 18.9 | 56.6 | 240.8 | 269.7 |
| Dairyland Seed | DS-7101 | 101 | Powercore | 60.5 | 9.3 | 72.3 | 4.0 | 19.4 | 56.3 | 220.5 | -- |
| Dairyland Seed | DS-7802PE | Other Late | Powercore | 58.0 | 8.4 | 72.8 | 4.1 | 20.1 | 55.2 | 230.1 | -- |
| Dyna-Gro | D34VC54 | 94 | VT2P | 57.3 | 8.7 | 73.5 | 3.2 | 18.3 | 56.0 | 239.2 | -- |
| Dyna-Gro | D37VC64 | 97 | VT2P | 59.8 | 9.3 | 73.1 | 3.2 | 18.4 | 56.0 | 262.8 | -- |
| Dyna-Gro | D39DC43 | 99 | VT2P | 59.8 | 8.8 | 72.4 | 3.8 | 19.6 | 55.1 | 244.7 | -- |
| Innotech | IC4521-3110A | 95 | Agrisure Viptera 3110A | 57.8 | 9.6 | 73.0 | 3.1 | 17.8 | 57.7 | 241.9 | 262.8 |
| Innotech | IC4759-3110 | 97 | Agrisure 3110 | 58.0 | 9.3 | 73.4 | 3.2 | 18.1 | 57.4 | 233.9 | -- |
| Integra | 4509 | 95 | VT2P | 58.5 | 8.4 | 73.1 | 3.7 | 18.8 | 55.6 | 249.0 | -- |
| Integra | 4782 | 98 | VT2P | 60.3 | 9.1 | 73.2 | 3.2 | 18.3 | 56.0 | 254.2 | -- |
| Legacy Seeds | L-3517 | 95 | VT2P | 59.8 | 9.3 | 72.7 | 3.6 | 17.9 | 57.2 | 240.8 | 269.7 |
| Legacy Seeds | L-3617 | 96 | VT2P | 59.0 | 9.1 | 73.6 | 3.0 | 17.3 | 57.1 | 249.7 | -- |
| Legacy Seeds | L-3712 | 96 | VT2P | 59.0 | 9.0 | 72.6 | 3.7 | 18.6 | 56.0 | 233.0 | 254.4 |
| Legacy Seeds | L-3718 | 98 | VT2P | 58.8 | 8.3 | 72.9 | 3.6 | 18.8 | 55.4 | 270.6 | -- |
| Legacy Seeds | L-4118 | 100 | GENSS | 60.3 | 9.6 | 72.3 | 3.8 | 17.7 | 56.4 | 261.5 | -- |
| Dairyland Seed | RPM-3519AM | 96 | AM | 56.8 | 9.6 | 72.3 | 3.6 | 18.3 | 58.3 | 234.9 | -- |
| Dairyland Seed | RPM-3715AM | 96 | AM | 58.3 | 8.8 | 73.0 | 3.4 | 19.2 | 54.0 | 268.9 | -- |
| Dairyland Seed | EXP-09804 | 98 | | 57.8 | 8.7 | 72.4 | 3.7 | 18.7 | 53.9 | 275.4 | -- |
| | MEAN | | | 58.8 | 9.0 | 72.8 | 3.6 | 18.5 | 56.2 | 247.3 | -- |
| | C.V. (%) | | | 2.0 | 2.7 | 0.6 | 6.2 | 3.1 | 1.3 | 8.2 | -- |
| | LSD 0.10 | | | 1.4 | 0.3 | 0.5 | 0.3 | 0.7 | 0.9 | 23.6 | -- |
| | LSD 0.05 | | | 1.7 | 0.3 | 0.6 | 0.3 | 0.8 | 1.0 | 28.2 | -- |

**Planting Date = May 11; Harvest Date = October 31; Previous Crop = Soybeans**

| Brand | Hybrid | RM | Hybrid Traits[1] | Days to Silk | Grain Protein | Content Starch | Content Oil | Moisture | Test Weight | Grain Yield 2018 | Grain Yield 2 yr. Avg. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | % | % | % | % | lb/bu | bu/ac | bu/ac |
| Dairyland Seed | RPM-4019AM | 99 | AM | 60.0 | 9.1 | 71.8 | 4.0 | 20.2 | 53.6 | 269.8 | -- |
| Dairyland Seed | RPM-3518AM | 96 | AM | 55.5 | 9.1 | 72.5 | 3.9 | 19.9 | 55.8 | 259.0 | -- |
| Peterson Farms Seed | 76S92 | 92 | | 59.5 | 9.0 | 72.8 | 3.7 | 18.0 | 57.0 | 222.9 | 242.8 |
| Peterson Farms Seed | 76Y96 | 96 | | 59.8 | 9.2 | 72.8 | 3.6 | 18.3 | 56.7 | 238.4 | -- |
| Peterson Farms Seed | 78B98 | 98 | | 58.3 | 8.8 | 72.3 | 3.6 | 19.0 | 55.7 | 251.4 | 267.9 |
| Peterson Farms Seed | 79N94 | 94 | | 56.5 | 9.3 | 72.8 | 3.5 | 18.1 | 55.7 | 217.8 | -- |
| Proseed | 1598 | 98 | VT2P | 60.5 | 8.9 | 72.7 | 3.5 | 18.0 | 55.9 | 266.1 | 277.7 |
| Proseed | 16101 | 101 | VT2P | 60.0 | 9.2 | 72.1 | 4.0 | 20.5 | 54.8 | 250.5 | 277.4 |
| Proseed | 1794 | 94 | VT2P | 55.8 | 8.7 | 73.2 | 3.4 | 18.5 | 55.7 | 220.8 | -- |
| REA | 3B902 | 90 | VT2P | 57.0 | 9.0 | 73.5 | 3.3 | 17.4 | 56.3 | 227.4 | -- |
| REA | 3B923 | 92 | VT2P | 56.3 | 8.7 | 73.0 | 3.6 | 17.9 | 56.7 | 205.5 | -- |
| REA | 4B965 | 97 | VT2P | 59.0 | 8.7 | 73.0 | 3.8 | 18.9 | 56.0 | 253.3 | -- |
| REA | 4B973 | 97 | VT2P | 59.8 | 9.6 | 72.4 | 3.7 | 18.1 | 56.7 | 268.4 | 274.3 |
| REA | 5A983 | 98 | SmartStax | 60.3 | 9.4 | 72.6 | 3.7 | 18.0 | 58.1 | 237.6 | -- |
| REA | 5D023 | 102 | DroughtGard | 61.0 | 8.6 | 72.2 | 3.9 | 20.1 | 54.0 | 259.9 | -- |
| Rob-See-Co | RC4343-3220A | 93 | Agrisure Viptera 322 | 59.3 | 10.0 | 72.6 | 3.2 | 18.4 | 57.3 | 238.6 | -- |
| Rob-See-Co | RC4688-3120 | 96 | Agrisure 3120 | 59.0 | 8.5 | 74.4 | 2.9 | 17.7 | 57.3 | 259.1 | -- |
| Thunder | 6794 | 94 | VT2P | 56.5 | 8.7 | 72.9 | 3.6 | 19.0 | 55.7 | 228.6 | -- |
| Thunder | 6798 | 98 | VT2P | 59.5 | 8.7 | 73.0 | 3.4 | 17.4 | 56.3 | 253.9 | -- |
| Thunder | 6996 | 96 | VT2P | 58.5 | 9.5 | 72.2 | 3.9 | 17.6 | 57.6 | 261.3 | -- |
| Thunder | 6999 | 99 | VT2P | 60.3 | 8.7 | 72.6 | 3.8 | 18.4 | 55.4 | 285.3 | -- |
| | MEAN | | | 58.8 | 9.0 | 72.8 | 3.6 | 18.5 | 56.2 | 247.3 | -- |
| | C.V. (%) | | | 2.0 | 2.7 | 0.6 | 6.2 | 3.1 | 1.3 | 8.2 | -- |
| | LSD 0.10 | | | 1.4 | 0.3 | 0.5 | 0.3 | 0.7 | 0.9 | 23.6 | -- |
| | LSD 0.05 | | | 1.7 | 0.3 | 0.6 | 0.3 | 0.8 | 1.0 | 28.2 | -- |

**Planting Date = May 11; Harvest Date = October 31; Previous Crop = Soybeans**

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

** Ear and Plant Height were not taken do to extensive goose neck in some plots.

**Alfalfa - Conventional** **Carrington**

| | | 1st cutting | | | 2nd cutting | | | Total DM Yield | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Brand | Variety | Plant Height | Harvest Moisture | Dry Matter Yield | Plant Height | Harvest Moisture | Dry Matter Yield | 2018 | 2017 | 2016 | 2015 | Yield % of Vernal |
| | | inch | % | ton/ac | inch | % | ton/ac | ton/ac | ton/ac | ton/ac | ton/ac | |
| Allied | Ladak II | 18.0 | 72.5 | 1.15 | 19.9 | 80.1 | 0.92 | 2.07 | 1.00 | 3.65 | 2.80 | 109 |
| Allied | FSG329 | 18.3 | 72.6 | 1.15 | 20.0 | 80.4 | 0.97 | 2.12 | 0.98 | 3.78 | 2.33 | 105 |
| Croplan | LegenDairy | 16.5 | 73.9 | 1.10 | 19.8 | 80.3 | 0.98 | 2.08 | 1.05 | 3.62 | 2.64 | 107 |
| Dow | AFX 469 | 17.6 | 73.4 | 0.97 | 19.8 | 79.6 | 0.91 | 1.87 | 0.78 | 3.09 | 2.56 | 95 |
| Dow | AFX 429 | 17.1 | 73.8 | 0.90 | 19.1 | 79.8 | 0.89 | 1.79 | 0.93 | 3.38 | 2.51 | 99 |
| Dow | 4A420 | 17.0 | 72.7 | 1.15 | 20.3 | 80.5 | 0.99 | 2.14 | 1.03 | 3.72 | 2.31 | 105 |
| Dow | HybrilForce-3400 | 17.1 | 73.0 | 1.21 | 21.0 | 80.4 | 0.96 | 2.17 | 1.19 | 3.69 | 2.69 | 112 |
| Dow | AFX 457 | 17.5 | 74.2 | 0.96 | 19.5 | 81.6 | 0.84 | 1.79 | 0.87 | 3.72 | 2.60 | 103 |
| Dyna-Gro | DG4210 | 17.3 | 74.0 | 1.04 | 20.3 | 79.9 | 0.98 | 2.02 | 0.81 | 3.61 | 2.56 | 103 |
| Integra | 8420 | 17.2 | 71.8 | 1.06 | 19.7 | 79.9 | 0.90 | 1.96 | 0.91 | 3.45 | 2.49 | 101 |
| Legend | Crave | 19.5 | 72.0 | 1.31 | 20.0 | 80.5 | 0.97 | 2.29 | 1.07 | 3.77 | 2.41 | 109 |
| Millborn | Persist III | 17.6 | 72.8 | 1.24 | 20.1 | 80.3 | 0.97 | 2.21 | 0.99 | 3.69 | 2.72 | 110 |
| Millborn | Phirst Extra hybrid | 17.8 | 71.1 | 1.24 | 20.2 | 79.5 | 0.95 | 2.19 | 1.13 | 3.48 | 2.49 | 106 |
| Pioneer | 55Q27 | 17.8 | 73.6 | 1.05 | 19.6 | 79.6 | 0.94 | 1.99 | 1.00 | 3.36 | 2.35 | 99 |
| Pioneer | 55V50 | 16.3 | 72.5 | 1.12 | 20.1 | 80.0 | 0.96 | 2.08 | 0.92 | 3.64 | 2.56 | 105 |
| Pioneer | 54B66 | 17.5 | 72.6 | 1.20 | 20.1 | 80.1 | 0.93 | 2.13 | 0.88 | 3.39 | 2.51 | 102 |
| | Vernal | 17.1 | 72.4 | 1.16 | 19.7 | 79.8 | 0.90 | 2.06 | 0.83 | 3.47 | 2.38 | 100 |
| | Mean | 17.5 | 72.9 | 1.12 | 19.9 | 80.1 | 0.94 | 2.06 | 0.96 | 3.56 | 2.52 | -- |
| | C.V. (%) | 9.1 | 1.7 | 12.4 | 4.5 | 0.9 | 7.5 | 7.6 | 16.5 | 6.9 | 8.3 | -- |
| | LSD 0.10 | 1.9 | 1.5 | 0.16 | 1.1 | 0.9 | 0.08 | 0.12 | 0.19 | 0.29 | 0.25 | -- |
| | LSD 0.05 | 2.3 | 1.8 | 0.20 | 1.3 | 1.0 | 0.10 | 0.22 | 0.23 | 0.35 | 0.30 | -- |

**Planting Date = May 21, 2015; Harvest Dates = 1st cutting = June 14; 2nd cutting = July 9**

| **Alfalfa - Roundup Ready** | | | | | | | | | | | | **Carrington** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ------------ 1st cutting ----------- | | | ------------ 2nd cutting --------- | | | ------------ Total DM Yield ------------ | | | | |
| | | Plant | Harvest | Dry Matter | Plant | Harvest | Dry Matter | | | | | Yield % |
| Brand | Variety | Height | Moisture | Yield | Height | Moisture | Yield | 2018 | 2017 | 2016 | 2015 | of Vernal |
| | | inch | % | ton/ac | inch | % | ton/ac | ton/ac | ton/ac | ton/ac | ton/ac | |
| Allied | 428 | 16.7 | 71.8 | 1.07 | 19.6 | 79.3 | 1.05 | 2.12 | 0.80 | 3.93 | 2.34 | 94 |
| Croplan | Presteez | 15.9 | 73.0 | 0.95 | 19.4 | 80.1 | 0.89 | 1.84 | 0.74 | 3.56 | 2.23 | 86 |
| Croplan | Stratica | 18.6 | 72.8 | 1.12 | 20.1 | 79.7 | 0.99 | 2.11 | 0.69 | 3.66 | 2.25 | 89 |
| Integra | 8444 | 16.8 | 72.2 | 0.92 | 19.8 | 79.4 | 0.93 | 1.85 | 0.79 | 3.44 | 2.25 | 86 |
| Legend | MegaMaxx | 17.2 | 72.4 | 1.11 | 19.5 | 84.4 | 0.74 | 1.86 | 0.78 | 3.82 | 2.20 | 89 |
| Monsanto | DKA40-51 | 17.3 | 72.7 | 0.96 | 19.6 | 79.4 | 0.92 | 1.88 | 0.83 | 3.82 | 2.22 | 90 |
| Monsanto | DKA44-16 | 18.2 | 70.7 | 1.14 | 20.1 | 79.4 | 0.95 | 2.10 | 0.91 | 3.86 | 2.24 | 93 |
| Pioneer | 54QR04 | 16.5 | 72.3 | 1.10 | 19.5 | 80.1 | 1.02 | 2.12 | 0.79 | 3.98 | 2.28 | 94 |
| | Vernal | 18.1 | 71.7 | 1.35 | 18.3 | 79.9 | 0.96 | 2.31 | 1.03 | 4.03 | 2.37 | 100 |
| | Mean | 17.3 | 72.2 | 1.08 | 19.5 | 80.2 | 0.94 | 2.02 | 0.82 | 3.79 | 2.26 | -- |
| | C.V. (%) | 11.2 | 1.3 | 15.9 | 4.0 | 3.8 | 17.0 | 13.0 | 13.1 | 7.2 | 7.9 | -- |
| | LSD 0.10 | 2.3 | 1.1 | 0.21 | 1.0 | 3.7 | 0.20 | 0.32 | 0.13 | 0.33 | NS | -- |
| | LSD 0.05 | NS | 1.3 | 0.25 | 1.1 | 4.5 | 0.23 | 0.38 | 0.16 | 0.40 | NS | -- |

**Planting Date = May 21, 2015; Harvest Dates = 1st cutting = June 14; 2nd cutting = July 9**

| **Cool-Season Pea Forage** | | | | | | | | | | | | | | | | | | | | **Carrington** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variety | Days to Bloom | Vine Length | Plant Canopy Height | Plant Lodge | Harvest Moisture | - Forage DM Yield - 2018 | 2-yr. Avg. | CP | ADF | NDF | TDN | Ash | Ca | P | Mg | K | S | RFV | RFQ |
| | | inch | inch | 0 to 9 | % | -------- ton/ac -------- | | % | % | % | % | % | % | % | % | % | % | | |
| Flex | 49.8 | 45.5 | 26.6 | 6.3 | 87.7 | 1.36 | 1.8 | 18.3 | 35.8 | 45.3 | 62.5 | 11.4 | 1.21 | 0.35 | 0.29 | 3.69 | 0.28 | 126 | 149 |
| Icicle | 53.5 | 33.7 | 21.4 | 3.0 | 88.1 | 1.15 | 1.6 | 20.4 | 31.2 | 40.5 | 65.8 | 11.1 | 1.22 | 0.38 | 0.30 | 3.55 | 0.30 | 149 | 177 |
| 4010 | 46.8 | 46.9 | 29.5 | 5.8 | 87.8 | 1.46 | 2.0 | 18.4 | 33.8 | 42.9 | 63.9 | 10.4 | 1.20 | 0.33 | 0.30 | 3.02 | 0.29 | 136 | 157 |
| Fergie | 43.3 | 41.0 | 26.1 | 5.3 | 85.0 | 1.10 | 1.5 | 16.4 | 37.3 | 48.2 | 59.7 | 10.5 | 1.11 | 0.32 | 0.29 | 3.17 | 0.25 | 116 | 126 |
| PUSA-FP-1701 | 41.8 | 44.6 | 34.6 | 3.0 | 85.2 | 1.86 | | 16.4 | 34.6 | 45.3 | 62.1 | 9.5 | 1.17 | 0.31 | 0.30 | 2.83 | 0.23 | 127 | 141 |
| Mean | 47.0 | 42.3 | 27.6 | 4.7 | 86.7 | 1.39 | -- | 18.0 | 34.6 | 44.5 | 62.8 | 10.6 | 1.18 | 0.34 | 0.29 | 3.25 | 0.27 | 131 | 150 |
| C.V. (%) | 1.1 | 4.8 | 7.7 | 17.2 | 1.1 | 12.2 | -- | 8.5 | 5.8 | 5.7 | 2.7 | 3.4 | 5.2 | 6.9 | 2.3 | 5.1 | 7.2 | 8.3 | 8.8 |
| LSD 0.10 | 0.7 | 2.5 | 2.7 | 1.0 | 1.2 | 0.21 | -- | 2.3 | 3.0 | 3.9 | 2.6 | 0.5 | 0.09 | 0.04 | 0.01 | 0.25 | 0.03 | 17 | 20 |
| LSD 0.05 | 0.8 | 3.1 | 3.3 | 1.2 | 1.4 | 0.26 | -- | 2.9 | 3.8 | 4.8 | 3.2 | 0.7 | 0.11 | 0.04 | 0.01 | 0.31 | 0.04 | 21 | 25 |

**Planting Date = May 14 ; Harvest Date = July 6; Previous Crop = Oats**

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

| **Winter Rye Forage** | | | | | | | | | **Carrington** |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | ---- Forage DM Yield ---- | |
| | Harvest | Winter | | Jday of | Plant | Plant | Harvest | | 2-yr. |
| Variety | Date | Survival | Vigor | Heading | Lodge | Height | Moisture | 2018 | Avg. |
| | | % | 1-10 | | 0 to 9 | inch | % | ---------- ton/ac | ---------- |
| Rymin | 7-Jun | 92.3 | 8.3 | 154.8 | 0.0 | 30.1 | 74.9 | 1.55 | 1.9 |
| ND Dylan | 7-Jun | 94.8 | 9.5 | 153.0 | 0.0 | 36.4 | 74.8 | 1.70 | 2.2 |
| Dacold | 13-Jun | 88.3 | 6.3 | 159.0 | 0.0 | 42.8 | 73.0 | 1.82 | 2.1 |
| Aroostook | 1-Jun | 88.8 | 7.3 | 148.5 | 0.0 | 32.1 | 74.7 | 0.94 | 1.4 |
| Wheeler | 13-Jun | 84.3 | 7.0 | 157.8 | 0.0 | 40.0 | 71.5 | 1.63 | 1.8 |
| Mean | | 91.0 | 8.0 | 153.3 | 0.0 | 36.3 | 74.0 | 1.49 | -- |
| C.V. (%) | | 2.7 | 7.7 | 0.4 | NA | 4.5 | 1.4 | 10.4 | -- |
| LSD 0.10 | | 3.0 | 0.8 | 0.8 | NS | 2.0 | 1.3 | 0.19 | -- |
| LSD 0.05 | | 3.7 | 0.9 | 1.0 | NS | 2.5 | 1.6 | 0.23 | -- |

**Planting Date = September 22; Harvest Date = June 1-13; Previous Crop = Oats**

**Forage harvest.**

| Winter Triticale Forage | | | | | | | | | | | | | | | | | | | Carrington |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variety | Harvest Date | Winter Survival | Jday of Heading | Plant Height | Harvest Moisture | Forage DM Yield | CP | ADF | NDF | TDN | Ash | Ca | P | Mg | K | S | RFV | RFQ |
| | | % | | inch | % | ton/ac | % | % | % | % | % | % | % | % | % | % | | |
| NT09404 | | 90.0 | 162.3 | 37.0 | 70.5 | 1.81 | 14.4 | 32.1 | 54.5 | 57.5 | 9.5 | 0.46 | 0.29 | 0.23 | 2.21 | 0.18 | 109 | 140 |
| NE96T441 | | 92.5 | 165.8 | 43.6 | 77.0 | 1.94 | 15.8 | 32.3 | 55.6 | 57.6 | 10.6 | 0.49 | 0.31 | 0.23 | 2.66 | 0.20 | 107 | 138 |
| NT11406 | | 92.5 | 162.5 | 33.9 | 71.0 | 1.57 | 15.1 | 30.7 | 54.0 | 58.4 | 10.1 | 0.48 | 0.29 | 0.22 | 2.15 | 0.19 | 112 | 144 |
| NT13443 | | 85.0 | 161.8 | 43.1 | 70.4 | 1.80 | 14.9 | 33.3 | 54.7 | 56.2 | 10.3 | 0.47 | 0.29 | 0.22 | 2.25 | 0.19 | 107 | 134 |
| NT13416 | | 81.3 | 162.5 | 39.0 | 70.6 | 1.34 | 15.3 | 32.8 | 55.4 | 56.9 | 10.5 | 0.48 | 0.29 | 0.22 | 2.25 | 0.20 | 106 | 135 |
| NT12414 | | 91.3 | 162.3 | 31.6 | 71.4 | 1.73 | 14.4 | 32.3 | 54.5 | 56.9 | 10.2 | 0.49 | 0.28 | 0.22 | 2.12 | 0.18 | 109 | 137 |
| NT11428 | | 92.5 | 163.3 | 40.2 | 74.0 | 1.85 | 14.9 | 32.3 | 55.2 | 57.7 | 10.2 | 0.47 | 0.30 | 0.22 | 2.29 | 0.19 | 107 | 140 |
| NT09423 | | 93.8 | 162.3 | 32.7 | 72.6 | 1.72 | 14.9 | 31.9 | 56.1 | 57.5 | 9.8 | 0.43 | 0.29 | 0.21 | 2.27 | 0.18 | 106 | 140 |
| NT07403 | | 85.0 | 158.5 | 31.1 | 68.6 | 1.41 | 15.0 | 31.2 | 52.2 | 58.4 | 10.2 | 0.51 | 0.29 | 0.23 | 2.00 | 0.19 | 115 | 144 |
| NT12434 | | 91.3 | 163.8 | 31.3 | 74.2 | 1.41 | 16.2 | 31.9 | 54.9 | 58.0 | 10.6 | 0.46 | 0.32 | 0.23 | 2.48 | 0.21 | 109 | 139 |
| NT12403 | | 82.5 | 162.5 | 34.4 | 72.9 | 1.25 | 13.7 | 34.6 | 56.9 | 55.8 | 9.4 | 0.45 | 0.27 | 0.21 | 2.21 | 0.18 | 101 | 131 |
| Mean | | 88.9 | 162.5 | 36.2 | 72.1 | 1.62 | 15.0 | 32.3 | 54.9 | 57.4 | 10.1 | 0.47 | 0.29 | 0.22 | 2.26 | 0.19 | 108 | 138 |
| C.V. (%) | | 5.7 | 0.5 | 6.8 | 3.0 | 20.5 | 6.1 | 2.5 | 1.7 | 1.4 | 5.0 | 9.6 | 5.8 | 8.0 | 7.2 | 6.9 | 2.6 | 2.1 |
| LSD 0.10 | | 6.1 | 1.0 | 3.0 | 2.6 | 0.40 | 1.3 | 1.1 | 1.3 | 1.2 | 0.7 | 0.06 | 0.02 | NS | 0.23 | 0.02 | 4 | 4 |
| LSD 0.05 | | 7.3 | 1.1 | 3.6 | 3.2 | 0.48 | 1.6 | 1.4 | 1.6 | 1.4 | 0.9 | 0.08 | 0.03 | NS | 0.28 | 0.02 | 5 | 5 |

**Planting Date = October 11; Harvest Date = June 21; Previous Crop = Oats**

| Variety | Harvest Date | Winter Survival | Jday of Heading | Plant Height | Harvest Moisture | Forage DM Yield | CP | ADF | NDF | TDN | Ash | Ca | P | Mg | K | S | RFV | RFQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TriCal Exp 30917 | 12-Jun | 78.8 | 158.0 | 30.3 | 76.6 | 1.50 | 15.3 | 34.4 | 57.0 | 55.8 | 10.2 | 0.48 | 0.30 | 0.21 | 2.53 | 0.20 | 101 | 129 |
| TriCal Gainer 154 | 7-Jun | 93.8 | 153.3 | 31.2 | 75.7 | 1.53 | 15.0 | 33.3 | 56.7 | 57.2 | 10.1 | 0.45 | 0.30 | 0.21 | 2.56 | 0.18 | 103 | 136 |
| TriCal Flex 719 | 13-Jun | 93.8 | 160.8 | 37.7 | 75.7 | 2.07 | 14.4 | 36.1 | 60.3 | 53.6 | 10.6 | 0.44 | 0.29 | 0.19 | 2.74 | 0.18 | 94 | 120 |
| TriCal Exp 08TF01 | 13-Jun | 92.5 | 163.0 | 34.7 | 76.9 | 2.02 | 15.1 | 35.4 | 59.5 | 54.6 | 10.6 | 0.45 | 0.30 | 0.19 | 2.90 | 0.19 | 96 | 123 |
| Mean | | 89.7 | 158.8 | 33.5 | 76.2 | 1.78 | 15.0 | 34.8 | 58.4 | 55.3 | 10.4 | 0.46 | 0.30 | 0.20 | 2.68 | 0.19 | 99 | 127 |
| C.V. (%) | | 7.9 | 0.4 | 3.4 | 1.6 | 11.1 | 2.9 | 2.1 | 1.3 | 1.6 | 3.7 | 6.7 | 3.2 | 3.4 | 3.5 | 4.0 | 2.1 | 3.5 |
| LSD 0.10 | | 9.2 | 0.7 | 1.5 | NS | 0.26 | 0.7 | 1.2 | 1.2 | 1.4 | NS | NS | NS | 0.01 | 0.15 | 0.01 | 3 | 7 |
| LSD 0.05 | | 11.3 | 0.9 | 1.8 | NS | 0.31 | NS | 1.5 | 1.5 | 1.8 | NS | NS | NS | 0.01 | 0.19 | 0.02 | 4 | 9 |

**Planting Date = September 22; Harvest Date = June 7-13; Previous Crop = Oats**

## NDSU Carrington Research Extension Center Staff

### Experiment Station

| | |
|---|---|
| Blaine Schatz | Director/Agronomist |
| Mike Ostlie | Agronomist |
| Michael Wunsch | Plant Pathologist |
| Jasper Teboh | Soil Scientist |
| Paulo Flores | Precision Agriculture Spec. |
| Bryan Neville | Animal Scientist |
| Steve Zwinger | Research Specialist/Agronomy |
| Dave Copenhaver | Research Specialist/Seedstocks |
| Ezra Aberle | Research Specialist/Agronomy |
| Szilvia Yuja | Research Specialist/Soils |
| Suanne Kallis | Research Specialist/Pathology |
| Tim Indergaard | Research Technician/Agronomy |
| Todd Ingebretson | Research Technician/Agronomy |
| Rick Richter | Research Technician/Seedstocks |
| Tim Schroeder | Research Technician/Livestock |
| Steve Schaubert | Research Technician/Agronomy |
| Scott Fetch | Research Technician/Seedstocks |
| Billy Kraft | Research Technician/Pathology |
| Chad Richter | Research Technician/Seedstocks |
| Tom Smith | Research Technician/Agronomy |
| Dave Widmer | Research Technician/Agronomy |
| Jesse Nelson | Research Technician/Livestock |
| Bobbie Jo Manikowski | Research Technician/Livestock |
| Kathy Wiederholt | Fruit Project Manager |
| Sam Richter | Seasonal Research Assistant |
| Myrna Friedt | Administrative Assistant |
| Kelly Bjerke | Laboratory Technician |
| Cassidy VandeHoven | Laboratory Technician |
| Jacie Volk | Administrative Assistant |
| Kalie Anderson | Part-time Program Assist. |
| Vern Anderson | Animal Scientist - Emeritus |
| Tami Snow | Part-time Custodian/Grounds |

### Extension Service

| | |
|---|---|
| Greg Endres | Area Specialist/Cropping Systems |
| Karl Hoppe | Area Specialist/Livestock Systems |
| Paulo Flores | Precision Agriculture Spec. |
| Mary Berg | Environmental Management Spec. |
| Linda Schuster | Administrative Secretary |
| Jacie Volk | Admin. Assist./Central District |

### North Dakota Forest Service

| | |
|---|---|
| Gerri Makay | Community Forestry Specialist |

### North Dakota Farm Business Management Education Program

| | |
|---|---|
| Joel Lemer | Instructor/Coordinator |
| Steve Metzger | Instructor - Retired |

### Oakes Irrigation Research Site

| | |
|---|---|
| Kelly Cooper | Research Agronomist |
| Seth Nelson | Research Specialist/Agronomy |
| Heidi Eslinger | Research Technician |

Throughout the year, the Center hires individuals on a part-time basis to help in the research effort. Many of these are students and local residents. We would like to acknowledge the following who helped at some time during the year: Brittney Aasand, Aiden Aberle, Eric Allmaras, Madeline Allmaras, Ryan Allmaras, Taylor Braaten, Harley Burgard, Trace Beumer, Harley Burgard, Reed Edwardson, Chanda Engel, Spencer Eslinger, Jane Forde, Savanna Friedt, Allison Fugle, Kiara Geiszler, Lucas Geiszler, Wallace Geske, Adam Gorseth, Spencer Grager, Jesse Hafner, Christine Halvorson, Carsyn Hilbert, Alexa Holth, Cassidy Holth, Emma Janz, Ronald Jordan, Mathias Kubal, Marlys Lange, Brandon Larson, Nicolas Lyman, Betty Montgomery, Ashley Neumiller, Sean Nichols, Sylvie Pate, Travis Pedersen, Laura Sauer, Cole Solwey, Kylie Solwey, Tyler Scanson, Mikayla Schuldheisz, KayCee Schulz, Kaitlyn Thompson, McCoy VandeHoven, Chase Wells, Gage Wells, Elizabeth Widmer, Dakota Wolfe, and Larissa Wolff.

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