

# **2021 Minnesota Canola Production Center (CPC)**

***Cooperative Project with the Minnesota  
Canola Council and the University of  
Minnesota***

**2021 Research Summary Report**

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## Acknowledgements

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The efforts of many individuals, companies, organizations, and agencies make it possible to conduct this field research in support of the canola industry. The products, services, information, and financial support provided by local and regional sponsors are, in large part, responsible for the success of the CPC. This generous support has made the Minnesota CPC a research project that benefits, not only canola growers in Minnesota, but canola growers in the entire region.

A special thank you goes to Northern Resources Cooperative for providing the land for canola research trials in 2021.

## **SITE INFORMATION - 2021 MN Canola Production Center (CPC)**

**Location:** North of Northern Resources Cooperative along MN Hwy 11

**Cooperator:** Northern Resources Cooperative

**Previous Crop:** Spring wheat

### **Soil Test Results:**

Nitrogen - 0-6'	9 ppm
Nitrogen - 6-24"	12 ppm
Phosphorous -	6 ppm
Potassium -	148 ppm
Target Yield Goal	2,500#/ac
Fertilizer Applied (#/ac):	N - 140; P - 40; K - 40; S - 20s
%Organic Matter:	3.9
Soil pH:	8.2

**Tillage Operations:** A single pass with a chisel plow in the fall of 2020, followed by two passes of a vertical tillage tool (joker) in the spring of 2021. All plots were rolled after seeding to improve seed-soil contact.

**Fertilizer Applied:** All small plot trials received 140-40-40-20S except the fertility trials. The fertility trials had variable N rates, sources and timings as listed on trial protocols.

**Seeding Method:** Small plot trials were seeded on May 12, with a 5' Hege plot seeder.

**Herbicides Applied:** Section 3 at 4 oz/ac + 1% crop oil + Grizzly Too 1.5 oz/ac was applied to the entire area for general grass and flea beetle control on 5/28/2021. The herbicides listed below were applied to the appropriate canola varieties.

A) Liberty Link (LL) hybrids - Liberty 280SL @ 28 fl. oz/ac + 2Pts./ac AmSol (1.5#AMS) on 6/10/21

B) Roundup Ready (RR) and Truflex hybrids - Roundup Power Max @ 16 fl. oz/ac + 1Pt./ac.AmSol (.75#AMS) on 6/10/21.

**Fungicides applied:** Proline at 5.7 oz/ac was applied to all plots at first petal drop (approximately 30% bloom) for white mold control.

**Comments:** Precipitation in the fall of 2020 and winter and early spring of 2021 was below average at both field locations for the 2021 canola CPC. The National Weather Service had much of NW MN in a moderate drought during the summer of 2020 and into winter of 2021. By the end of June, the moderate drought had changed to severe drought and by the end of July much of the area was in a severe drought. Weather records have been recorded at the Northwest Research & Outreach Center in Crookston since 1890. Weather records indicate the first half of 2021 was the second driest and the first nine months were the driest ever recorded. The lack of precipitation was compounded by over 21 days of daily high temperatures over 90F.

In 2021, two locations were used for small plot replicated trials. The majority of the canola research trials were conducted at the Northern Resources (NR) site, approximately 1 mile west of Roseau along Highway 11. The other location was the U of MN - Magnusson Research Farm (MF) which is located approximately 6 miles NW of Roseau. The weather conditions were conducive for early canola planting in 2021. Canola was planted into moist soil on May 7<sup>th</sup> at the MF location and into dry soil on May 12<sup>th</sup> at the NR location. Canola at the MF location had good emergence and early season vigor. However, dry soil at the NR site resulted in erratic early emergence. A couple rainfall events on May 20 and 21 totaled over 0.5 inches of rain which aided in canola seed emergence at the NR location. Daily high temperatures during the first week to 10 days of canola flowering was 10 to 15 degrees warmer than average, with the remainder of the flowering period slightly warmer than average. (Source: NDAWN). The number of flowering days ranged from 15 to 20 days, (Table 1).

Early season canola stands and emergence were good at the MF and emergence at NR tended to even out after a 0.5 inch of rain on May 21<sup>st</sup>. Early season vigor was better at MF than NR site which was directly related to the level of soil moisture. With the canola planting in May, the emergence of canola and flea beetle occurred at the same time. Consequently, many canola fields developed flea beetle populations above threshold levels and required a post emergence insecticide treatment.

The less than average rainfall coupled with the above daily high temperatures took its toll on canola growth and development in late June and July, especially at the NR location. The extended hot and dry conditions resulted in low white mold development and other diseases. However, reduced branching, number and size of pods were observed in canola at the NR location during late flowering and pod filling stage of growth. Thousand Kernel Weight (TKW) of selected canola varieties indicated an average 21% reduction in canola seed weight in 2021 vs 2020, (Table 1). Further, this reduction in TKW was responsible for a loss in canola yield of 400#/ac in 2021.

## **The public canola trials conducted at the CPC in 2021 included:**

- Small plot canola variety trials
- Small plot canola shatter trial
- Small plot fertility nitrogen source, rate and timing trial
- Small plot wide row fertility trial
- Small plot micronutrient trial
- Small plot soil applied herbicide trial
- Small plot winter canola trial

## **Variety and Systems Trial**

### **Objective:**

To evaluate agronomic characteristics of canola varieties with different herbicide production systems (Liberty Link (LL) and Roundup Ready (RR) grown in the environmental conditions of northern Minnesota.

### **Background:**

Canola varieties with new and emerging technologies traits have given canola growers several options for weed control. Yield, lodging resistance, maturity, and crop quality are important traits for growers to consider when making canola variety selections. Canola seed companies were invited to submit current and pending varieties for entry in the trial for comparison in a small plot replicated research trial.

### **Methods:**

All varieties were seeded at 12 PLS/ft.<sup>2</sup> on 5/12/21. The experimental design was a randomized complete block (RCB) with four replications. Fertilizer applied to the entire area was 140-40-40-20s. Individual plot size was 6 x 27' and end-trimmed to a harvest area of 5 x 20'. The LL and RR canola varieties were seeded in separate blocks with buffers to reduce potential herbicide drift. A post emergence grass herbicide (Section 3) was applied at 4 ounces/ac for grass control to all plots on 5/28/21. Grizzly Too was added to Section at 1.5 oz/ac for flea beetle control. Roundup and Liberty herbicides were applied on 6/10/21. Proline at 5.7oz/ac was applied to all plots at first petal drop (approximately 30% bloom) for white mold control. Canola was swathed on 8/4/21 and harvested on 8/25/21. Harvested canola was cleaned and weighted and a sub-sample taken from each plot for moisture, percent oil content and other quality factors. Canola yields are adjusted to 8.5% moisture. Additional data collected included; early season vigor and percent ground cover, beginning and end of bloom, plant height and lodging.

### **Results:**

A total of 21 canola lines were evaluated at the CPC in 2021 (Table 1). A breakdown of the canola varieties: 12 LL and 9 RR canola varieties were entered in this small plot replicated research trial. In 2021, canola yields ranged from 1,446 to 2,329 #/ac with a trial average of 1,825 #/ac. A CV of 9.7% suggest a good level of confidence in this data

set. The RR and LL varieties were seeded in separate blocks and in 2021 the LL block was on lighter soil compared to the RR varieties. For this reason, yield comparisons can be made within the LL and RR, but not between LL and RR as soil moisture was a confounding factor in this trial. As an example, the average canola yield for the RR varieties was 1,999 #/ac compared the LL varieties of 1,695 #/ac. Relative yields of some of the same varieties in the last few years had the means of LL varieties yielding better than RR lines. Further, the number of days in bloom averaged 18.2 vs 16.5, for RR and LL, respectively.

The hot and dry weather conditions caused a reduction in TKW in 2021 compared to 2020 (Table 1). Seed from selected canola varieties were evaluated for seed weight. The data analysis indicated that TKW averaged 21% less in 2021 than 2020. An average 21% reduction in seed weight alone would result in an average 400#/ac reduction in canola yield in 2021.

Due to the hot dry weather conditions of 2021 canola plants had to rely upon stored soil moisture for mid-late season plant growth, development, and yield. Soils that had the capacity to store moisture had better canola yields in 2021 than soils that didn't have the capacity to store soil moisture.

## **Canola Variety - Shatter Trial**

### **Objective**

The ability of canola plant to hold pods and not dehisce (shatter) seed, is a desirable trait in many current canola varieties, especially when considering direct harvest. The option to direct harvest canola will eliminate a pass across the field which will save time, reduce production costs, and increase canola acreage where swathers are not available.

### **Background:**

In the last couple years, canola producers have expressed an interest in direct harvest of canola. In 2016, the CPC conducted the first trial to evaluate canola seed shattering and pod drop in the environmental conditions of northern Minnesota. Canola seed companies that entered canola varieties in the variety trial were invited to enter selected varieties in the canola shatter trial.

### **Methods:**

In 2021, thirteen canola lines were submitted for testing using the canola shatter trial protocol developed in 2016. Canola varieties were seeded in 12 inch rows at 9PLS/ft<sup>2</sup> on May 12<sup>th</sup>. Plots were maintained using best management practices in the same manner as the variety and systems trial. On August 4<sup>th</sup>, two plastic 7" x 13" collection trays were placed between rows (center of plot and 3 feet in from the edge) of each variety. One pan was placed in the front and one in the back of each plot for a total of eight trays/variety. Seed trays were inspected at weekly intervals with the seeds and pods collected from the trays at four dates (8/12, 8/18, 8/23 and 8/30). Canola seed loss/ac was calculated from both the seed that shattered directly to the ground (seed),

seed contained in the pods and broken branches with pods which dropped from the plants into the collection pans.

### **Results:**

Collection trays were placed between the canola rows on August 4<sup>th</sup> which would be the approximate date of swathing. Eight days (August 12) after trays were placed between canola rows was the first date canola seeds and pods were observed in the collection pans (Table 3). Canola seeds and pods were collected from the pans at three other dates (8/18, 8/23 and 8/30). Total canola seed collection (seeds and pods) on 8/30 (four weeks from swathing) ranged from 133 to 1076 #/ac. Results from this trial indicate that canola varieties exhibit a wide range of the ability to hold seed and pods. When considering a direct harvest strategy select a canola variety that will reduce the probability of seed shatter, pod drop and branches that break from plant and fall to the ground.

Weather conditions recorded at the NDAWN station at the U of MN - Magnusson Research Farm (Fox) during the four weeks of this shatter trial had reported maximum wind speeds of over 20 mph on seventeen days and a recorded wind speed of over 35 mph on (8/21). Measurable rainfall was recorded on 8/11, 8/20, and 8/27. More canola seeds, pods and branches were collected in the shatter pans in the first two collection dates than in previous years. The data in 2021 suggests that in years of hot and dry weather canola growers should consider direct harvest a couple weeks earlier than years of normal rainfall and temperatures. The incorporation of pod shatter reduction technology will allow more canola growers to consider a direct harvest strategy for their farms.

## **Seed Treatment Trial**

### **Objective:**

To evaluate canola growth, development and yield from various seed treatments applied to the canola seed for the control of flea beetles and diseases.

### **Background:**

Flea beetles cause the most damage of any insect pest in canola. The black crucifer beetle has been the most common flea beetle pest in canola. However, in the last few years, a shift in flea beetle population has been observed in North Dakota and Minnesota. The striped flea beetle has been observed in the canola growing regions of North Dakota and Minnesota. Although at low levels compared to the crucifer beetle, the striped flea beetle seems to be increasing as a percent of the total flea beetle population. Field observations indicate that the current insecticide seed treatments are not as effective in flea beetles' control as post emergence insecticides have been used as a rescue treatment. This trial was initiated to evaluate several canola seed treatments for the control of flea beetles, diseases, and increased plant vigor in canola.

### **Methods:**

Two canola varieties Star 402 and DTKFLL21SC RR were seeded at 12 PLS/ft.<sup>2</sup> on 5/7 at the U of MN Magnusson Research Farm (MF) and on 5/12/21 at the Northern Resources (NR) location. The experimental design was a randomized complete block (RCB) with four replications. Fertilizer applied to the entire area was 140-40-40-20s. Individual plot size was 6 x 27', end end-trimmed to a harvest area of 5 x 20'. A post emergence grass herbicide (Section 3) was applied for grass control to all plots on 5/28/21. Roundup was applied for weed control on 6/10/21. Proline at 5.7 oz/ac was applied to all plots at first petal drop (approximately 30% bloom) for white mold control. Canola was swathed on 8/4/21 and harvested on 8/25/21 at NR and swathed on 8/3 and harvest on 9/1 at MF. Harvested canola was cleaned and weighted and a sub-sample taken from each plot for moisture, percent oil content and other quality factors. Canola yields are adjusted to 8.5% moisture. Additional data collected included early season stand count, early season vigor and percent ground cover, beginning and end of bloom, plant height, and lodging.

### **Results:**

Canola yields were higher at the MF than NR. This is most likely due to two factors: an earlier seeding date at MF and less water holding capacity in the soil at the NR location. The 2021 season was one of extended hot and dry weather in June and July. Crops growing in soils that had more water holding capacity had higher yields than crops growing in soils that have a shallow soil profile and lower water holding capacity. Canola yields ranged from 1,930 to 2,487 #/ac at MF and 951 to 1,322 #/ac at NR (Table 3). Treatment differences were not observed from the Star 402 treatments at MF. However, canola yields were 400 #/ac higher from Prosper Evergol+Fortenza+Buteo Start compared to the untreated at MF. The Star 402 treatments were not harvested at NR due to bird predation and extreme drought. Further, drought had an impact on the harvested canola at NR as the canola yields were less than 50% of the long-term average at the CPC, trial results are not reliable. The results from the MF indicate that choice of seed treatment can influence flea beetle control and canola seed yield. This trial will be repeated in 2022.

## **Nitrogen Fertility Trial**

### **Objective:**

To evaluate canola yield response from various rates of urea alone and a 50/50 blend of urea + ESN applied PPI and a split nitrogen strategy of PPI urea followed by a post emergence (3-5 leaf canola) application of Agrotain coated urea and liquid nitrogen.

### **Background:**

Canola requires high levels of nitrogen and often times shows yield increases with high levels of soil available nitrogen. However, spring applied nitrogen is at risk for environmental losses. One strategy to reduce nitrogen losses into the environment is to delay nitrogen applications until just before peak uptake demand by the canola plant. This delay in nitrogen availability can be accomplished by an early post emergence



(three to five leaf) application of nitrogen (dry or liquid). This trial was initiated to evaluate the canola yield response to various rates, timings and combinations of urea, ESN and 28% nitrogen.

### **Methods:**

The canola variety L234PC was seeded at 12 PLS/ft.<sup>2</sup> on 5/12. Harvested plot size was 5 x 20'. The experimental design was a RCB with four replicates. The entire plot area had a background nitrogen level (0-24 inch) of 21#/ac. All plots received an application of 9-40-40-20s. Nitrogen treatments included PPI only compared to PPI + dry urea, PPI urea + ESN 50/50 blend and PPI urea + Agrotain coated urea or 28% nitrogen applied postemergence. This trial had 13 treatments.

- Untreated (background nitrogen)
- PPI only 60
- PPI only 90
- PPI only 120
- PPI only 160
- PPI + ESN 60 (50/50 blend)
- PPI + ESN 90 50/50 blend)
- PPI + ESN 120 (50/50 blend)
- PPI + ESN 160(50/50 blend)
- PPI 40 + 40 as Agrotain Ultra applied postemergence
- PPI 40 + 80 as Agrotain Ultra applied postemergence
- PPI 40 + 40 as 28% post applied with streamer nozzles
- PPI 40 + 80 as 28% post applied with streamer nozzles

Agrotain Ultra and 28% liquid nitrogen were applied to canola at the three to five leaf stage on 6/11. All plots were direct harvested on 8/26. Harvested canola plots were individually cleaned, weighted and a sub-sample taken for moisture, oil and an oil quality assessment. Additional data collected included early season vigor and percent ground cover, beginning and end of bloom, plant height, and lodging.

### **Results:**

Canola yields ranged from 861 to 1136 #/ac (Table 4). All nitrogen treatments gave higher seed yields compared to the untreated. However, no treatment differences were detected at the 0.05 level of confidence. The hot and dry weather conditions resulted in average canola yields of 1052 #/ac. This canola yield is at least 50% below the long-term average at the CPC. Results from this trial are well below what would be considered normal, as a result, data from this trial are not reliable for making nitrogen recommendations in canola. This trial will be repeated in 2022 as the extended hot and dry weather conditions had a negative impact on canola yields.

## **Top dress fertilizer in wide row canola**

### **Objectives:**

To compare various methods of fertilizer applications in canola seeded in wide rows (18 inch).

### **Background:**

The recent advancements in planter technology presents the opportunity for canola fertility to be applied in a band and/or top dressed. Further, the advancement of the pod shatter trait has created an opportunity for more canola acres to be direct harvested. This project will establish a small plot trial to be conducted at the site of the MN CPC in 2021.

### **Methods:**

Canola variety L234PC was seeded at 3.5#/ac in rows spaced 18 inches on 5/12. This small plot trial was a RCB design with four replications. Canola will be managed for a yield goal of 3,000#/ac. The entire plot area had a background nitrogen level (0-24 inch) of 21#/ac. All plots received an application of 9-40-40-20s. Individual plots were 4 rows x 27' and end trimmed to a harvest area of 2 rows x 20'. All treatments had a total nitrogen rate of 140#/ac. Urea (46-0-0) was applied PPI. Post emergence fertility was applied on 6/10. The four treatments in this trial were:

- PPI 140#/ac
- PPI 70#/ac + Agrotain coated urea (70#/ac) applied over the row at 3-5 leaf stage
- PPI 70#/ac + 28% liquid nitrogen (70#/ac) applied between rows (3-5) leaf stage
- PPI 105#/ac +28% liquid nitrogen (35#/ac) applied between rows (3-5) leaf stage

Data to be collected/assessed will include: crop emergence, vigor ratings, days to row closure, days to first flower, end of flower date, maturity date, plant height, lodging, canola yield, and canola quality parameters.

### **Results:**

Although the results of this trial were reported in 2021, due to extreme drought conditions the data is unreliable and should not be used for management decisions. Seed yields were less than 1,000 #/ac from any treatment. This small plot trial will be repeated in 2022.

## **Soil Applied Herbicides in Herbicide Tolerant Canola**

### **Objective:**

To demonstrate the effectiveness of soil applied herbicides followed by a post emergence herbicide as a weed control strategy to reduce the potential development of herbicide resistant weeds in the cropping rotation of northern MN.

### **Background:**

The majority of canola acres rely on two herbicides applied postemergence for weed control, either Roundup or Liberty. Relying solely on these two herbicides, especially in tight rotations, increases the chance for developing herbicide resistance. Weed resistance to Roundup is well documented. As an example, the 2020 North Dakota Weed Control Guide list several weeds resistant to Roundup herbicide including: common lambsquarters, kochia, common ragweed and marestalk. Recent additions to this list include Palmer amaranth and waterhemp. Due to the widespread use of Roundup and the technology that allow Roundup to be applied to several crops including: canola, corn, and soybeans the identification of herbicide resistant weeds has increased in the last few years. The rapid spread of these herbicide resistant weeds will require additional planning of crop rotations, herbicide choices and a strategy that will include herbicide programs that include multiple modes of action to control these difficult to control Roundup resistant weeds. One of these strategies is to couple a soil applied herbicide and planting and the standard post emergence herbicide for control of these herbicide resistant weeds in canola. With the development of herbicide tolerant weeds occurring more frequently in highly managed agricultural systems, having additional herbicide options with different modes of action will be of critical importance for weed control options for canola growers.

### **Methods**

Experimental design was a RCB with four replications. The canola variety in this trial was L234PC and was seeded at 12 PLS/ft.<sup>2</sup> on 5/12. Individual plot size was 6 x 27', end-trimmed to a harvest area of 5' x 20'. Fertilizer applied was 140-40-40-20s and incorporated prior to planting. Individual herbicide plots were staked out and the preplant herbicides (PPI) Sonalan (2 pints/ac) or Trust (1.5 pt/ac) were applied with a backpack sprayer. Stakes were removed and the PPI herbicides were incorporated with a spike tooth harrow. Pots re-staked and seeded according to treatment plan. After planting Spartan (2 oz/ac) was applied pre-emergence as one of the treatments. The entire area was rolled. Section 3 at 4 oz/ac + Grizzly Too at 1.5 oz/ac was applied for general grass and flea beetle control on 5/28. The entire area received an application of Liberty at 22 oz/ac on 6/10. Plots were kept weed free by hand weeding after Liberty application until harvest. Proline at 5.7 oz was applied to all plots at first petal fall (approximately 30% bloom) for white mild control. Canola was direct harvested on 9/1. Harvested canola was cleaned, weighted and a sub-sample taken from each plot for

moisture, percent oil content and other quality factors. Canola yields were adjusted to 8.5% moisture. Additional data collected included: early season vigor and percent ground cover, beginning and end of bloom, plant height, and lodging.

### **Results:**

Although the results of this trial were reported in 2021, due to extreme drought conditions the data is unreliable and should not be used for management decisions. Seed yields were less than 1,000 #/ac from any treatment. This small plot trial will be repeated in 2022.

## **Canola Micronutrient Trial**

### **Objective:**

The objective of this trial was to evaluate several micronutrients applied to flowering canola.

### **Background:**

High canola yield goals and intensive crop production management increase the probability that micronutrients will limit crop yields compared to crop production systems using average management strategies. The canola yield goal in this trial was 3,000#/ac which is a high, but attainable, canola yield goal for northwest Minnesota. A complete soil analysis in the spring of 2020 indicated that boron, copper, and zinc were testing in the low category based on a 3,000#/ac yield goal.

### **Methods:**

The canola variety L234PC was seeded at 12 PLS/ft.<sup>2</sup> on 5/12. Soil type at this location was a clay loam with an organic matter of 4.4% and a pH of 8.1. Fertility applied was a 140-40-40-20s. Plot size was 6 x 27', end trimmed to a harvest plot size of 5 x 20'. The experimental design was a RCB with four replicates. Section 3 at 4 oz/ac + Grizzly Too at 1.5 oz/ac was applied for general grass and flea beetle control on 5/28. Liberty was applied at 22 oz/ac on 6/10. The micronutrients were applied on 7/2 to canola that was approximately 70% bloom. The seven treatments included: Nachurs 9% Zn (2 pints/ac), Gowan Badge SC copper (1 pt/ac), Ele-max Sulfur (2 pints/ac), Iron 5% CFA (3 pints/ac), Nachurs Boron 10% (2 pints/ac) a combination of all micronutrients and an untreated. Tissue samples were collected 10 days after micronutrient application and sent to AGVISE Labs for analysis. All plots were direct harvested on 9/1. Harvested canola plots were individually cleaned, weighted, and sampled for moisture and oil content. Additional data collected included: early season vigor and percent ground cover, beginning and end of bloom, plant height, and lodging.

### **Results:**

Seed yields were less than 1,000 #/ac from any treatment. With the low canola yields in 2021 the probability that micronutrients were limiting canola yields is unlikely. This data would suggest micronutrients were not a limiting factor in canola yield in 2021. A micronutrient trial conducted in 2019 suggested a trend for canola yield improvement from micronutrients. With the low canola yields in 2021 would, most likely, reduce the probability of a canola response to micronutrients. This research effort with micronutrients in high yield canola will be continued in 2022.

## **Winter Canola Trial**

### **Objective:**

To evaluate three winter canola varieties in the environmental conditions of NW Minnesota.

### **Background:**

Winter canola has been evaluated several times in the growing conditions of NW Minnesota with limited success. However, new genetics, with improved winter hardiness has renewed the interest in growing winter canola. Several factors contribute to the renewed interest: 1) increased yield potential vs spring canola, 2) markets point to a strong canola price in 2022, 3) winter canola is seeded in late summer and would reduce the demands of spring fieldwork and, 4) winter canola would reduce wind and water erosion as soil would have a living cover in the fall, over winter and early spring. Currently, winter canola is raised in the winter wheat growing areas (Oklahoma, Kansas) the Pacific Northwest and in Idaho and Montana. For this trial, winter canola with high winter hardiness scores will be seeded at the U of MN - Magnusson Research Farm. This project will seek cooperation and recommendations from the following canola researchers: Mike Stamm, Kansas State University, Jim Davis University of Idaho, Perry Miller, Montana State University and Brian Caldbeck, Caldbeck Consulting in Kentucky.

### **Methods:**

Three winter canola varieties, Mercedes, Surefire and KS4719 were seeded at 12 PLS/ft.<sup>2</sup> at the University of Minnesota – Magnusson Research Farm located six miles NW of Roseau, MN. Canola was seeded into a clean tilled area at two dates: 8/11 and 9/1/2021. Winter canola was seeded with spring wheat at 0.25 bu/ac. Experiment design was a randomized complete with four replications. Individual plots were 6' wide and 27 feet long. Section 3 at 4 oz/ac was applied for volunteer wheat control in a 10-foot-wide area in each plot. Stand counts were taken on 9/28 from all plots. Data collected in the spring of 2022 include: winter survival score, date of spring green up, beginning and end of bloom, plant height, lodging, seed yield and seed quality analysis.

### **Results:**

The majority of the data from this trial will be collected in 2022 and will be presented in the 2022 canola annual report.

# **2021 Canola Production Center Research Data Summaries for Northwest Minnesota**

This summary and previous annual research summaries are on the Web at:  
<http://www.mncanola.org/CPC.php>

***Table 1. Variety/Systems Trial***

***Table 2. Variety Trial w/ Oil Components***

***Table 3. Shatter Trial***

***Table 4. Seed Treatment Trial***

***Table 5. Micro Nutrient Trial***

***Table 6. Nitrogen Use Efficiency***

***Table 7. Wide Row Nitrogen Applications***

***Table 8. Preemergent Herbicides Applications***

Table 1.

**2021 Canola Variety Trial**  
**Northern Resources -West Plant-Roseau,Mn**

Company	Entry	Herbicide Tolerance*	Maturity	#/acre <sup>1</sup>	Protein <sup>2</sup>	Oil <sup>2</sup>	Test wt./bu.	%		Begin Bloom Date	End Bloom Date	Days of bloom	Harvest Height (in)	2020 TKW <sup>4</sup>	2021 TKW <sup>4</sup>	% Seed Weight Reduction in 2021 <sup>4</sup>	% Reduction in wt. of source <sup>5</sup>	#/acre of seed lost due to size <sup>6</sup>
								Ground Cover- 21DAP	ESV- 21DAP <sup>3</sup>									
1 Winfield United	CP9978TF	TF	L	<b>2329</b>	22.3	44.6	52.6	63	6.0	23-Jun	11-Jul	18	49					
2 Star Specialty Seed	StarFlex	RR	M	<b>1978</b>	22.1	45.5	52.6	60	5.5	23-Jun	12-Jul	19	48	3.6	2.9	<b>19.4</b>	4.1	<b>384</b>
3 Pioneer	45CM39	RR	M/L	<b>1667</b>	21.8	46.1	51.3	48	4.5	23-Jun	12-Jul	19	48					
4 Nuseed	NC155 TF	TF	E	<b>2139</b>	22.8	43.5	53.0	78	7.5	21-Jun	11-Jul	20	48					
5 Nuseed	NC471 TF	TF	L	<b>1806</b>	22.2	44.7	52.9	70	7.0	23-Jun	10-Jul	17	52					
6 Nuseed	NC527CR	TF	L	<b>1911</b>	22.2	44.0	51.3	55	5.5	24-Jun	12-Jul	18	48					
7 BrettYoung	BY 6211TF	TF	M	<b>2137</b>	22.6	44.5	52.7	63	5.5	23-Jun	11-Jul	18	50					
8 Meridian Seeds	CS3000 TF	TF	M	<b>1909</b>	21.4	45.8	52.7	50	5.5	21-Jun	9-Jul	18	45					
9 Wilbur Ellis	Integra 7361RC	RR	M	<b>2115</b>	22.4	44.5	52.2	45	4.5	24-Jun	11-Jul	17	45					
10 Meridian Seeds	CS4000 LL	LL	M	<b>1518</b>	22.4	43.5	53.1	61	6.0	24-Jun	12-Jul	18	48					
11 BASF	InVigor L233P	LL	E	<b>1819</b>	21.7	42.9	52.7	73	6.5	26-Jun	11-Jul	15	47	3.2	2.5	<b>21.9</b>	-4.7	<b>398</b>
12 BASF	InVigor L255PC	LL	L	<b>1619</b>	20.7	45.6	52.8	63	6.0	26-Jun	13-Jul	17	52					
13 BASF	InVigor L345PC	LL	L	<b>1947</b>	20.8	43.3	52.9	73	7.0	26-Jun	13-Jul	17	55	3.3	2.7	<b>18.2</b>	5.7	<b>354</b>
14 BASF	InVigor L340PC	LL	E	<b>1613</b>	21.8	42.6	52.2	70	7.0	25-Jun	11-Jul	16	49					
15 Winfield United	CP7130LL	LL	L	<b>1781</b>	21.5	43.6	52.0	78	7.5	24-Jun	10-Jul	16	52					
16 Winfield United	CP7144LL	LL	L	<b>1783</b>	23.3	44.4	52.0	60	6.0	24-Jun	10-Jul	16	49					
17 Dekalb	DKTFL21SC	LL/TF	M	<b>1866</b>	21.4	46.6	52.3	65	6.0	22-Jun	8-Jul	16	44	3.6	2.7	<b>25</b>	13.3	<b>467</b>
18 Dekalb	H19W94354	LL	M	<b>1576</b>	21.8	45.6	52.1	50	5.5	23-Jun	9-Jul	16	42					
19 Dekalb	DKL82SC	LL	E/M	<b>1640</b>	22.4	45.4	52.5	55	6.0	24-Jun	11-Jul	17	44					
20 Pioneer	P506ML	LL	M/L	<b>1446</b>	21.9	43.9	51.7	53	5.0	24-Jun	12-Jul	18	53					
21 Pioneer	P505MSL	LL	M/L	<b>1735</b>	21.8	42.9	51.7	58	6.5	24-Jun	11-Jul	17	55					
LSD @ 5% level				<b>251</b>	0.7	0.7	0.3	20	2.0	1	1	2	4					
LSD @ 10% level				<b>209</b>	0.6	0.6	0.2	16	1.7	1	1	2	3					
CV(%)				<b>9.7</b>	2	1	0.3	23	23	3	9	4	6					

Experimental Design: RCB w/4reps

Seeding rate=12PLS/Ft.<sup>2</sup> Planting Date- 5/12/2021

\*Herbicide Tolerance--LL=Liberty Link, RR=Roundup Ready,  
and TF=TruFlex=Next level Roundup Ready

Trial was blocked by herbicide tolerance - 1-9 Roundup and 10-21 Liberty Link in each rep.

<sup>1</sup>Clean Seed Yields corrected to 8.5% moisture.

Trial Mean yield =1825#/acre

Yield comparisons should be made within the LL and RR, but not between LL and RR as soil moisture was a confounding factor in this trial.

<sup>2</sup> Protein and oil reported on dry matter basis.

Lodging - None noted in 2021

<sup>3</sup> ESV(early season vigor) 21 days after planting 9= best;1=least

<sup>4</sup> TKW(thousand kernal weight) in grams. % reduction in seed weight in 2021 over 2020 possibly due to the drought.

<sup>5</sup> % Seed weight reduction of planted seed in 2021 over 2020 seed(using PLS provided by company).

<sup>6</sup> #/acre of seed lost in 2021 vs. 2020 based only on seed weight per 1000 seeds.

Fertilizer application- 140-30-30-20s applied PPI 5/7/21

Table 2.

**2021 Canola Variety Trial-(Oil Components Added)**  
**Northern Resources -West Plant-Roseau,Mn**

Company	Entry	#/acre <sup>1</sup>	Protein <sup>2</sup>	Oil <sup>2</sup>	Palmitic acid Dry basis	Stearic acid Dry basis	Oleic acid Dry basis	Linoleic acid Dry basis	Linolenic acid Dry basis	Erucic acid Dry basis	Glucosinolates Dry basis	Eicosenoic acid As is
1 Winfield United	CP9978TF	<b>2329</b>	22.3	44.6	4.4	1.65	70	20.3	6.9	1.2	18.6	1.9
2 Star Specialty Seed	StarFlex	<b>1978</b>	22.1	45.5	4.1	1.62	71	19.7	7.0	1.3	16.9	2.1
3 Pioneer	45CM39	<b>1667</b>	21.8	46.1	4.1	1.98	71	16.4	6.6	2.2	4.9	1.6
4 Nuseed	NC155 TF	<b>2139</b>	22.8	43.5	4.5	1.81	67	18.7	5.7	1.1	5.5	2.2
5 Nuseed	NC471 TF	<b>1806</b>	22.2	44.7	4.2	1.75	70	18.7	6.5	1.3	7.8	2.3
6 Nuseed	NC527CR	<b>1911</b>	22.2	44.0	4.2	2.04	68	16.7	7.2	2.1	2.8	1.6
7 BrettYoung	BY 6211TF	<b>2137</b>	22.6	44.5	4.4	1.65	70	20.4	7.0	1.0	17.4	1.9
8 Meridian Seeds	CS3000 TF	<b>1909</b>	21.4	45.8	4.1	1.67	72	19.6	6.5	0.6	11.3	2.2
9 Wilbur Ellis	Integra 7361RC	<b>2115</b>	22.4	44.5	4.4	1.72	70	19.7	6.7	1.0	8.3	1.7
10 Meridian Seeds	CS4000 LL	<b>1518</b>	22.4	43.5	4.5	1.73	70	19.6	6.1	0.6	8.5	2.2
11 BASF	InVigor L233P	<b>1819</b>	21.7	42.9	4.4	2.08	68	17.6	6.7	2.0	0.1	1.6
12 BASF	InVigor L255PC	<b>1619</b>	20.7	45.6	4.2	1.79	68	17.8	7.7	1.1	8.0	2.5
13 BASF	InVigor L345PC	<b>1947</b>	20.8	43.3	4.4	1.99	68	17.8	7.6	2.3	0.1	0.9
14 BASF	InVigor L340PC	<b>1613</b>	21.8	42.6	4.5	2.21	69	16.9	6.7	2.6	2.3	1.0
15 Winfield United	CP7130LL	<b>1781</b>	21.5	43.6	4.5	2.12	70	17.3	5.9	2.1	0.9	1.2
16 Winfield United	CP7144LL	<b>1783</b>	23.3	44.4	4.3	1.96	66	17.5	5.8	1.7	4.5	2.3
17 Dekalb	DKTFLL21SC	<b>1866</b>	21.4	46.6	4.2	1.72	71	19.2	6.1	0.8	18.0	2.6
18 Dekalb	H19W94354	<b>1576</b>	21.8	45.6	4.3	1.80	71	18.4	6.5	1.3	16.2	2.3
19 Dekalb	DKLL82SC	<b>1640</b>	22.4	45.4	4.1	1.65	70	19.2	6.5	0.8	20.8	2.6
20 Pioneer	P506ML	<b>1446</b>	21.9	43.9	4.6	2.11	71	18.0	6.5	1.6	6.4	1.2
21 Pioneer	P505MSL	<b>1735</b>	21.8	42.9	4.7	2.21	71	17.5	6.4	2.2	5.2	0.8
	LSD @ 5% level	<b>251</b>	0.7	0.7	0.1	0.06	2	0.5	0.4	0.3	2.9	0.3
	LSD @ 10% level	<b>209</b>	0.6	0.6	0.1	0.0	2.0	0.4	0.3	0.3	2.5	0.2
	CV(%)	<b>9.7</b>	2	1	1	2	2	2	5	13	24	11

Seeding rate=12PLS/Ft.<sup>2</sup>

Experimental Design: RCB w/4reps

\*Herbicide Tolerance--LL=Liberty Link, RR=Roundup Ready,  
and TF=TruFlex=Next level Roundup Ready

Trial was blocked by herbicide tolerance - 1-9 Roundup and 10-21 Liberty Link in each rep.

<sup>1</sup>Clean Seed Yields corrected to 8.5% moisture.

Trial Mean yield =1825#/acre

<sup>2</sup> Protein and oil reported on dry matter basis.



Table 3.

## 2021 Canola Shattering Variety Trial

### Northern Resources -West Plant-Roseau,Mn

Variety	Company	Herbicide tolerance	Yield <sup>1</sup> lb/acre	% Seed Lost <sup>2</sup>	All Source Seed Loss			Total seed lost by date(#/acre)				Source of seed loss by date(#/acre)							
					Total <sup>4</sup>	seed <sup>5</sup>	pod <sup>6</sup>	8/12	8/18	8/23	8/30	8/12 seed <sup>5</sup>	8/12 pod <sup>6</sup>	8/18 seed <sup>5</sup>	8/18 pod <sup>6</sup>	8/23 seed <sup>5</sup>	8/23 pod <sup>6</sup>	8/30 seed <sup>5</sup>	8/30 pod <sup>6</sup>
InVigor L233P	BASF	LL	1819	13.7	<b>249</b>	70	179	99	84	61	6	21	78	23	61	22	39	4	2
InVigor L255PC	BASF	LL	1619	23.7	<b>383</b>	175	208	137	99	130	17	59	78	35	64	69	62	12	4
InVigor L345PC	BASF	LL	1947	12.3	<b>240</b>	125	114	96	55	81	8	33	64	34	21	53	28	6	2
InVigor L340PC	BASF	LL	1613	8.2	<b>133</b>	89	44	50	39	33	12	34	15	24	14	19	14	12	0
CP7130LL	Winfield United	LL	1781	60.4	<b>1076</b>	700	376	421	230	387	39	245	175	133	97	289	98	33	6
CP7144LL	Winfield United	LL	1783	29.5	<b>526</b>	284	241	257	102	144	21	123	134	57	45	93	51	11	10
H19W94354	Dekalb	LL	1576	17.9	<b>282</b>	103	179	118	96	62	6	46	71	19	77	33	29	4	2
DKLL82SC	Dekalb	LL	1640	18.8	<b>309</b>	92	217	154	59	83	14	39	114	17	42	31	51	4	9
DKTFLL21SC	Dekalb	LL/TF	1866	18.1	<b>338</b>	109	229	157	75	97	8	43	114	22	53	40	58	4	4
Integra 7361RC	Wilbur Ellis	RR	2115	21.5	<b>455</b>	266	190	166	85	180	25	83	83	38	47	133	47	13	12
StarFlex	Star Specialty Seed	RR	1978	17.2	<b>340</b>	141	199	155	73	103	9	48	107	20	54	66	37	7	2
CP9978TF	Winfield United	TF	2329	10.2	<b>238</b>	50	188	96	68	68	5	13	83	9	59	25	43	3	2
BY 6211TF	BrettYoung	TF	2137	14.6	<b>313</b>	53	260	162	51	93	7	17	145	7	43	26	68	3	4
LSD @ 5% level			251		161	70	119	97	47	67	15	40	71	19	49	36	41	11	9
LSD @10% level			209		133	58	99	80	39	56	12	33	59	16	41	30	35	9	7
CV(%)			10		30	28	41	42	38	40	77	45	51	40	66	36	60	87	131

Experimental Design-RCB with 4 reps

Shattered seed collected in 2 - 7" x 13" trays/plot

Seeding rate(12" row)=9PLS/Ft.<sup>2</sup>

2 Shatter pans placed in each plot 8/4/2021.

<sup>1</sup> Yields taken from the variety trial.

<sup>2</sup> % of total seed lost/total seed harvest in variety trial

<sup>4</sup> Total #/acre of lost seed. Cumulative pod seed + shattered seed lost

<sup>5</sup> Seed shattered directly from the plant to the ground collection pans

<sup>6</sup> Seed contained in pods and branches dropped from the plant to the ground collection pans

Table 4.

**2021 Canola Seed Treatment Trial**  
**Magnusson Research Farm and Northern Resources-West Plant**

Seed Treatment	Yield(#/acre) <sup>1</sup>		10% bloom		End bloom		Visual Plant Vigor Rating <sup>2</sup>					Ht.(in.)		% stand		Protein <sup>3</sup>		Oil <sup>3</sup>	
							8-Jun		10-Jun	16-Jun		at Harvest		28-May		at Harvest		at Harvest	
	Mag	NR	Mag	NR	Mag	NR	Mag	NR	NR	Mag	NR	Mag	NR	Mag	NR	Mag	NR	Mag	NR
1 DTKFLL21SC - Untreated	<b>2087</b>	<b>1118</b>	21-Jun	24-Jun	13-Jul	12-Jul	4	4	5	5	5	44	40	68	75	23	24	43	45
2 EverGol Prime	<b>2076</b>	<b>1256</b>	21-Jun	24-Jun	13-Jul	12-Jul	4	5	5	5	6	44	41	58	83	24	24	43	45
3 Prosper EverGol	<b>2345</b>	<b>951</b>	21-Jun	24-Jun	12-Jul	12-Jul	4	3	4	7	5	43	42	70	70	23	24	44	45
4 Prosper EverGol+Buteo Start	<b>2310</b>	<b>1314</b>	21-Jun	23-Jun	11-Jul	10-Jul	7	6	6	9	8	45	41	75	78	23	24	43	45
5 Prosper EverGol+Fortenza	<b>2171</b>	<b>1142</b>	21-Jun	24-Jun	13-Jul	11-Jul	5	5	5	7	7	42	42	68	80	23	23	44	45
6 Prosper EverGol+Fortenza+Buteo Start	<b>2487</b>	<b>1322</b>	20-Jun	23-Jun	13-Jul	10-Jul	6	7	7	8	8	46	39	65	83	23	23	43	45
7 Helix Vibrance	<b>2348</b>	<b>1129</b>	20-Jun	24-Jun	12-Jul	12-Jul	6	4	5	8	6	45	43	73	70	23	23	44	46
8 Helix Vibrance+Fortenza	<b>2193</b>	<b>1156</b>	20-Jun	24-Jun	13-Jul	10-Jul	5	6	6	7	7	44	42	68	75	23	22	43	47
9 Star 402 RR - Untreated	<b>1930</b>	<b>NH</b>	22-Jun	24-Jun	13-Jul	11-Jul	4	5	4	5	6	42	41	55	75	21	20	46	48
10 Helix Vibrance	<b>2156</b>	<b>NH</b>	23-Jun	24-Jun	14-Jul	10-Jul	3	5	5	5	6	45	39	55	73	21	22	46	47
11 Helix Vibrance+BioForage	<b>1996</b>	<b>NH</b>	22-Jun	24-Jun	12-Jul	11-Jul	4	5	4	5	6	43	40	60	75	21	23	46	46
LSD @ 5% level	<b>315</b>	<b>282</b>	1	1	1	1	2	2	1	2	2	3	3	12	NS	1	1	1	2
CV(%)	<b>10</b>	<b>14</b>	4	2	6	8	32	24	19	20	19	5	5	13	12	3	4	2	2

Experimental Design: RCB w/4reps

**Plot location-**

1-Magnusson Research Farm(Mag)- 5.5 miles NW of Roseau,Mn

Planting Date=5/7/2021

1.5 oz. Grizzly Too applied to Mag location only on 6/7/2021

Swathing date=8/3 ; Combining date=8/25

2-Northern Resources West Plant(NR)- Roseau,Mn

Planting Date=5/12/2021

Swathing date=8/4 ; Combining date=9/1

**Varieties-**

DTKFLL21SC- RR treatments 1-8

Star 402- RR treatments 9-11

<sup>1</sup>Clean Seed Yields corrected to 8.5% moisture.

At the Northern Resources location only 3 reps were harvested and treatments 9-11 were not harvested at all because of bird predation

<sup>2</sup>Plant vigor ratings- 9=best ;1=least

<sup>3</sup>Protein and Oil on dry matter basis

Table 5.

**2021 Canola Micronutrient Post-emergent Application  
Northern Resources-West Plant-Roseau,Mn**

TRT#	Treatment	Application Rate/Acre	Yield (#/Ac.)	Test Wt./Bu	Harvest Ht.(in)	Seed components on dry matter basis							plant sampled 7-14-2021 -GS= early pod set											
						Protein	oil	linoleic	linolenic	Oleic	Palmitic	Stearic	Erucic	%N	%P	%K	%S	%Ca	%Mg	Zn-ppm	Fe-ppm	Mn-ppm	Cu-ppm	B-ppm
1	Boron 10%	2 Pts.	814	51.8	47	22.9	42.8	17.6	6.9	67.6	4.37	2.08	1.95	2.9	0.11	1.76	1.1	3.1	1.3	14.2	92	73	3.8	18.5
2	5% Iron CFA	3 Pts	974	51.7	47	23.0	42.6	17.5	7.2	68.8	4.33	2.10	1.98	3.0	0.12	1.64	1.1	3.0	1.3	14.0	86	70	4.8	17.2
3	Ele-max Sulfur LC	2 Pts.	872	51.7	46	23.0	42.7	17.7	7.0	68.5	4.35	2.07	2.07	3.2	0.10	1.54	1.3	2.9	1.4	13.0	86	70	4.0	16.0
4	Badge SC	1 Pt	853	51.5	46	23.0	42.5	17.7	7.0	67.7	4.38	2.10	2.05	3.1	0.12	1.68	1.1	3.1	1.3	13.2	88	72	3.0	17.3
5	Zinc 4-0-0-9 Zn	2 Pts.	941	51.6	46	23.1	42.7	17.5	7.1	68.8	4.36	2.09	1.96	2.9	0.11	1.68	1.2	3.3	1.4	13.8	86	76	2.5	17.5
6	Combine trts 1-5	All added	925	51.5	47	22.9	42.3	17.6	6.9	69.0	4.35	2.08	1.94	3.0	0.11	1.50	1.1	3.0	1.3	12.3	83	66	2.5	16.2
7	No treatment		988	51.4	47	23.2	42.5	17.6	7.2	68.5	4.31	2.06	1.98	3.1	0.11	1.56	1.1	3.1	1.3	13.5	84	70	7.8	17.7
	LSD @5% level		NS	0.3	NS	NS	NS	NS	0.2	NS	0.04	NS	NS	0.2	NS	0.2	NS	0.3	NS	1.9	NS	NS	3	NS
	CV(%)		13	1	3	2	1	2	2	2	1	2	7	4	7	8	20	7	7	9	8	10	59	12

Experimental Design: RCB w/4reps

Variety = InVigor L234PC

TRT#

1	Nachurs	Boron 10%		2 pts
2	Wily farm	5% Iron CFA		3 pt
3	Ele-max Sulfur LC	10-5-0-10s-.4b		2 pt
4	Badge	Copper hydroxide+copper oxychloride		1pt
5	Nachurs	Nutri-sync Zinc	4-0-0-9z	2 pt
6		6 combine trts 1-5		
7		7 No treatment		

**Applications made 6-30-2021 full bloom--very dry**

2pm full sun 78F wind sse 5 mph

Application made with 6' backpack sprayer @ 18GPA

Harvested 8-26-2021

Table 6.

**2021 Canola Nitrogen Use Efficiency Trial**  
**Northern Resources -West Plant-Roseau,Mn**

	<b>Total Nitrogen added</b>	PPI-urea <sup>1</sup>	PPI-ESN	# N Post emerge <sup>4</sup>	<b>#/acre<sup>1</sup></b>	Protein <sup>2</sup>	Oil <sup>2</sup>	Palmitic acid Dry basis	Stearic acid Dry basis	Oleic acid Dry basis	Linoleic acid Dry basis	Linolenic acid Dry basis	Erucic acid Dry basis	Test wt./bu.	% Ground Cover- 21DAP	ESV- 21DAP <sup>3</sup>	Begin Bloom Date	End Bloom Date	Harvest Height (in)
1	<b>0</b>				<b>861</b>	20.9	44.6	4.34	2.07	70	17.5	7.2	1.9	51.6	70	7.0	23-Jun	7-Jul	43
2	<b>60</b>	60	0		<b>1052</b>	22.6	43.2	4.38	2.10	68	17.4	6.9	2.0	51.9	75	7.0	24-Jun	8-Jul	49
3	<b>90</b>	90	0		<b>1079</b>	23.1	42.8	4.43	2.07	68	17.5	6.7	2.0	51.7	78	7.5	23-Jun	7-Jul	47
4	<b>120</b>	120	0		<b>1109</b>	23.0	42.8	4.45	2.06	68	17.7	6.8	1.9	51.8	68	7.0	24-Jun	8-Jul	48
5	<b>160</b>	160	0		<b>1136</b>	22.8	43.1	4.40	2.08	68	17.5	6.9	1.9	51.7	75	7.5	23-Jun	8-Jul	47
6	<b>60</b>	30	30		<b>1102</b>	22.9	42.9	4.41	2.04	69	17.6	6.8	2.0	51.7	75	7.5	23-Jun	8-Jul	45
7	<b>90</b>	45	45		<b>1028</b>	22.6	43.1	4.43	2.06	67	17.7	7.0	2.0	51.7	73	6.5	24-Jun	8-Jul	45
8	<b>120</b>	60	60		<b>1012</b>	23.2	42.6	4.42	2.03	66	18.0	6.7	1.9	51.9	73	6.5	23-Jun	8-Jul	44
9	<b>160</b>	80	80		<b>1039</b>	23.1	42.8	4.38	2.00	65	17.9	6.9	2.0	51.7	70	7.0	23-Jun	9-Jul	46
10	<b>90</b>	40	0	50#N+Agrotain Ultra	<b>1064</b>	23.0	42.8	4.39	2.03	67	18.0	6.8	1.9	51.9	78	7.0	23-Jun	8-Jul	45
11	<b>120</b>	40	0	80#N+Agrotain Ultra	<b>1103</b>	23.0	42.9	4.42	2.07	67	17.8	7.0	2.0	52.2	63	6.0	23-Jun	8-Jul	46
12	<b>90</b>	40	0	50#N- 28% UAN	<b>1026</b>	22.6	42.9	4.43	2.08	68	17.7	7.0	1.9	52.1	55	5.5	24-Jun	9-Jul	46
13	<b>120</b>	40	0	80#N- 28% UAN	<b>1060</b>	23.4	42.4	4.44	2.10	67	17.8	7.2	1.9	52.1	70	7.0	23-Jun	8-Jul	47
				LSD @5% level	<b>169</b>	0.7	0.7	0.06	0.07	2	0.5	0.3	NS	0.3	20	1.7	NS	1	3
				CV(%)	<b>11</b>	2	1	1	2	2	2	3	8	1	20	18	3	11	5

Experimental Design: RCB with 4 reps

9-40-40-20s added to all plots

Variety= InVigor L234PC planted May 12, 2021

<sup>1</sup>PPI- urea application rates 5/11 prior to final seedbed prep

<sup>2</sup>Yield- clean seed #/acre corrected to 8.5% moisture

<sup>3</sup>ESV-Early season vigor visual rating 1=poor; 9=best

<sup>4</sup>Treatments 10-13 made 6/10/2021 at 4 leaf stage

Treatments 10&11 = urea + Agrotain Ultra

Treatments 12&13= 28% UAN Liquid fertilizer applied with

3 nozzle streamer @ 22gpa

Table 7.

**2021 Canola Wide Row Fertility Trial  
Northern Resources -West Plant-Roseau,Mn**

Trt#	PPI-Urea <sup>1</sup>	Yield (#/Ac.)	Test Wt./Bu	Harvest Ht.(in)	Bloom	
					10%	End
1	140	460	51.3	40	25-Jun	9-Jul
2	70 70#N-urea+Agrotain	571	51.0	41	24-Jun	9-Jul
3	70 70#N-28%UAN	560	50.9	41	24-Jun	9-Jul
4	105 35#N-28%UAN	590	50.8	41	24-Jun	9-Jul
LSD @5% level		NS	0.3	NS	NS	NS
CV(%)		21	1	4	4	6

Experimental Design: RCB with 4 reps

18" Rows--planted 5/12/2021 @ 9PLS/ft.2

Total Fertility Rate to all plots= 140-40-40-20S

Variety= InVigor L234PC planted May 12, 2021

<sup>1</sup>Nitrogen -Urea source-Applied 5/8/2021 prior to final seedbed prep before planting

TRT#--Post emergent applications 6-10-21

#2- 70#N/acre(Agrotain coated urea) applied in 12"band over rows

#3- 70#N/acre-28%N applied with streamer jet nozzels

#4- 35#N/acre- 28%N applied with streamer jet nozzels

Post applications made 6/10/2021 4-leaf stage canola

Table 8.

**2021 Canola PPI or Pre-Emergent Herbicide Applications  
Northern Resources -West Plant-Roseau,Mn**

TRT#	PPI or Pre Application	Application	Yield	ESV <sup>2</sup>	Harvest	Bloom	
		Rate	(#/Ac.)		Ht.(in)	10%	End
1	None	None	647	7	42	25-Jun	11-Jul
2	Spartan	2 oz. PRE	731	5	43	26-Jun	9-Jul
3	Sonolan HFP	2PT PPI	770	7	43	24-Jun	9-Jul
4	Trust	1.5PT PPI	804	7	42	25-Jun	9-Jul
LSD @5% level			NS	NS	NS	NS	NS
CV(%)			30	15	8	6	25

Experimental Design: RCB with 4 reps  
Variety= InVigor L234PC planted May 12, 2021

Soil Test Results Prior to Planting

Organic Matter: 3.9%  
Soil PH 8.2  
Phosphorous - 6 ppm  
Potassium - 148 ppm

PPI or Pre Application common

TRT# & trade name	name	#Ai/Gal	timing
1 None			
2 Spartan 4F	sulfentrazone	4	Pre-emerge
3 Sonolan HFP	ethofluralin	3	PPI
4 Trust(Treflan)	trifluralin	4	PPI

5/10-2021 PPI applications made just prior to final seedbed prep  
Post Spartan applied 5/12-21 just after seeding  
All plots received 28 oz. Liberty + 1.5#AMS on 6/10/2021