2018 Minnesota Canola Production Center (CPC)

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

2018 Research Summary Report

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SITE INFORMATION - 2018 MN Canola Production Center (CPC)

Location: 0.5 miles north of the U of MN Magnusson Research Farm

Cooperators: Brian and Sheldon Rice

Previous Crop: Perennial Ryegrass

Soil Test Results:

Nitrogen - 0-6'	5 ppm
Nitrogen – 6-24"	8 ppm
Phosphorous -	6 ppm
Potassium -	96 ppm
Target Yield Goal	2,500#/ac
Fertilizer Applied (#/ac):	N - 140; P - 40; K - 40; S - 20s
%Organic Matter:	4.5
Soil pH:	8.3

Tillage Operations: Tillage operations in the fall of 2017 included two chisel plow passes. In the spring of 2018, an S-tine superweeder tillage pass was conducted over the entire area after blanket fertilizer applications. A rau combi (s-time with rolling baskets) was used for seedbed preparation after the applications of small plot fertility treatments.

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

Seeding Method: Small plot trials were seeded a 5' Hege plot seeder. Precision planted plots were planted with a custom made planter manufactured by RDK Enterprises in Hillsboro, ND.

Herbicides Applied: Section 2 at 5 oz/ac + 1% crop oil + Warrior 1.5 oz/ac was applied to the entire area for general grass and flea beetle control on 6/7/2018. The various herbicides listed below were applied to the appropriate canola varieties.

A) Liberty Link (LL) hybrids - Liberty 280SL @ 22 fl. oz/ac + AMS @ 2.5% on 6-13-2018

B) Roundup Ready (RR) hybrids - Roundup PowerMax @ 16 fl. oz/ac + AMS @ 2.5% on 6-13-2018

C) Sulfonylurea (SU) hybrids - Draft 0.3oz/ac+ 5%NIS on 6-12-2018

Comments: April of 2018 was the coldest on record for northern MN (NOAA). This was followed by the month of May which was the second warmest on record. Early spring soil moisture conditions were below normal, but timely precipitation in May and early June was a factor in good early season canola growth and development (NDAWN). Accumulated rainfall for the remainder of the growing season was well below normal (less than 50% of normal for June, July and August). Daily high temperatures during June and July and during canola flowering period averaged +5F, or higher above the long term average (Source: NDAWN). The warm, dry conditions during the canola flowering and seed fill period resulted in pod and flower abortion on the upper portion of the canola plant. Information regarding pod fill on Table 1.

Canola stands were generally good with adequate soil moisture level and timely rainfalls after planting. Once fields dried out in the spring, planting proceeded at a rapid pace with no prolonged periods of rainfall. 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.

Due to the warm and dry summer, the infestations of white mold and other leaf diseases were low at the CPC in 2018. Other diseases and insect problems were generally at low levels, with the exception of early season flea beetles which were controlled with an application of Warrior. The Minnesota CPC had two field locations in 2018. The small plot replicated canola research trials were conducted at a field site approximately 0.5 miles north of the U of MN Magnusson Research Farm in cooperation with Rice Farms. The large plot direct harvest trial to compare canola seeded in 7.5 vs 22 inch rows was located on land farmed by McGlynn Farms of Stephen, MN.

The public canola trials conducted at the 2018 CPC included:

- Small plot canola variety trials
- Small plot canola shatter trial
- Small plot fertility nitrogen source, rate and timing trial
- Small plot bang for the buck trial
- Canola seed size trial
- Canola tolerance to sulfentrazone
- Small plot conventional vs singulation precision planting row spacing seeding rates
- Precision planting phosphorus trial
- Large plot straight harvest canola seeded in 7.5 and 22 inch rows

Variety and Systems Trial

Objective:
To evaluate agronomic characteristics of canola varieties with different herbicide production systems (Liberty Link (LL), Roundup Ready (RR), and Sulfonylurea (SU) grown under the climatic conditions of northern Minnesota.

Background:
Canola varieties with new and emerging technologies traits have given canola growers many choices in weed control by the selection of a crop variety. SU tolerant canola are considered a non-genetically modified (GMO) crop and may provide producers with a marketing advantage. 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.2 on May 23, 2018. The experimental design was a randomized complete block (RCB) with four replications. Fertility applied was 140-40-40-20s Individual plot size was 6 x 27 ft. and end-trimmed to a harvest area of 5 x 20 ft. The LL, RR and SU canola varieties were seeded in separate blocks with buffers to eliminate the potential herbicide drift. A post emergence grass herbicide (Section 2) was applied for grass control to all plots on 6/7/2018. Liberty and Roundup were applied 6/13/2018 and Draft was applied 6/12/2018 to the appropriate varieties prior to bolting. Proline at 5.7 oz/ac was applied to all plots at 20% bloom for white mold control. The SU canola was swathed on 8/22/18 and harvested on 9/7/18. All other canola varieties were swathed on 8/16/18 and harvested on 9/2/18. 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.

Results:
A total of 23 canola lines were entered in the 2018 CPC (Table 1). A breakdown of the canola varieties: 16 RR, 4 LL and 3 SU canola varieties were evaluated in this small plot replicated trial. Canola yields ranged from 1,986 to 2,742 #/ac. The trial average yield was 2,468 #/ac. The 2018 canola trial mean was 671 #/ac lower that the trial average in 2017. Hot and dry conditions during flowering caused some flower and pod abortion, especially on the upper portion of the canola plant.

Seven canola varieties produced seed yield of 105 to 111% of the mean. Using the trial average of 2,468 lb/ac, and canola price of $0.16/lb, the gross dollar return in 2018 would be of $394.88/ac. All varieties exhibited good early season vigor. First flower date ranged from June 30th to July 5th with the end of flowering ranging from July 15th to July 25th. Plant height ranged from 43 to 61 inches. Oil content ranged from 46.1% to 53%. The breakdown of oil components and other agronomic information is summarized in Table1.

Canola Variety Trial Shattering Evaluation

Objective

The ability of canola plant to hold pods and not dehisce (shatter) seed, is a desirable trait in current canola varieties, especially when considering direct harvest. The ability to direct harvest will allow the expansion of canola acres in production areas where swathers are not available and to reduce harvesting time and cost.

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 entering lines in the variety trial were invited to enter lines in the shattering trial.

Materials and Methods:

In 2018, 11 canola lines were submitted for testing using the canola shatter trial protocol used since 2016. Canola varieties were seeded in 12 inch rows at 9PLS/ft2 on May 23rd. Plots were maintained using best management practices in the same manner as the variety and systems trial. On August 16th, 2 plastic 7" x 13" collection trays were placed between rows in the front and back of each plot for a total of eight trays/variety. Seed trays were inspected weekly with the seeds and pods collected from the trays for four weeks. Canola seed loss/ac was calculated for both the seed that shattered directly to the ground (seed) and seed contained in the pods which dropped from the plants to the ground (pod). Data from this trial is presented in Table 2.

Results:

Collection trays were placed between the canola rows on August 16 which would be the approximate date of swathing. In the first two weeks no canola seeds or pods were observed in the collection pans (Table 2). Three weeks (Sept 6) after trays were placed between canola rows was the first date canola seeds and pods were observed in the collection trays. Collected seeds from the 11 canola varieties ranged from 0.16 to 1.41 grams. Seed collected from pod drop from the 11 varieties ranged from 0.03 to 0.15 grams. Total canola seed collection (seeds and pods) on 9/13 (four weeks from swathing) ranged from 0.59 to 5.12 grams. Total canola seed loss, four weeks after swathing, ranged from 45 to 389 pounds/ac.

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 wind speeds of over 30 mph on six days and one day had wind gusts of 41.7 (8/26). Measurable rainfall was recorded on 8/26, 9/9, 9/10, 9/11 and 9/13. Results from this canola shatter trial suggest that canola varieties adapted for direct harvest can withstand wind and rain and still keep the majority of the seeds and pods on the plant. The incorporation of pod shatter reduction technology will allow more canola growers to consider a direct harvest strategy for their farms.

Nitrogen Fertility Trial

Objective:
To evaluate canola yield response from various rates of urea applied PPI, and post emergence (3-5 leaf canola) dry and liquid nitrogen.

Background:
Canola requires high levels of nitrogen and often times shows yield increases with higher levels of soil available nitrogen. However, high spring application rates of nitrogen can be subject to environmental losses. One strategy to reduce nitrogen losses into the environment, is to delay nitrogen availability 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 urea (dry or liquid). This trial was initiated to evaluate the canola yield response to various rates, timings and combinations of urea (46-0-0 and 28%) and dry and liquid sulfur.

Methods:
The canola variety L140P was seeded at 12 PLS/ft.2 on 5/23/2018. Harvested plot size was 5 x 20 ft. The experimental design was a RCB with four replicates. The entire plot area had a background nitrogen level (0-24 inch) of 14 #/ac. All plots received an application of 9-40-40. Nitrogen treatments included PPI urea (46-0-0) applied at 0, 80, 120 and 160 #/ac plus 20 #/ac of ammonium sulfate (AMS). Urea applied PPI at 80, 160 and 180#/ac plus post emergence dry urea treated with a nitrogen stabilizer applied at 40 and 80 #/ac. Liquid nitrogen (28%UAN) at 31 and 71 #/ac and ammonium thiosulfate at 7 gal/ac were applied post emergence to treatments 7-8 in the three to five leaf stage. All plots were swathed on 8-17-2018 and harvested on 9-1-2018. Harvested canola plots were individually cleaned, weighted and sampled for moisture and oil content.

Results:
Canola leaf burn of 14 to 18% was observed from liquid 28% and ammonium thiosulfate (Table 3). The canola plants recovered as no differences in canola flowering date was observed from any of the treatments. In 2018, the average canola fertility trial yield from supplemental nitrogen was 2,699 lb/ac. Generally canola yields tended to increase as the nitrogen rate increased to a rate of 180lb/ac, regardless of nitrogen formulation, or time of application. However, optimum canola yields (111% of mean) were achieved with the 80lb/ac nitrogen applied PPI followed by 40lb/ac applied early post emergence. Net return for the various nitrogen fertilizer costs for rates applied over the base rate of 9-40-40 is presented in Table 3a. With cost basis used in this table, 80 lb/ac urea PPI followed by 40# urea applied early post emergence returned $221.50 to the grower. This was $33/ac more than the next highest return treatment of 160lb/ac ($188.5) when nitrogen was applied PPI only. Liquid fertilizer as 28% and ammonium thiosulfate gave net returns in the $18-128/ac range Results from this fertility trial suggest that a split application of 80lb/ac Nitrogen applied followed by 40lb/ac post emergence can increase the nitrogen use efficiency and increase the net return/ac compared to nitrogen applied PPI only. These results are similar to previous nitrogen fertilizer results from the CPC. In prior years, split N (pre-emergent +post

emergent) applications and a portion of the pre-emergent N applied as ESN has had the highest nitrogen use efficiency (NUE). Rainfall patterns and amounts along with application timing have a large impact on when nitrogen is available and for plant growth and development. Applications of nitrogen all at once prior to planting is an easy option preferred by many growers. However, split applications of nitrogen will offer increased nitrogen use efficiencies and may lead to higher profits compared to a PPI only option for nitrogen applications in canola.

Canola Return on Investment (Bang for the Buck) Trial

Objective:

The objective of this trial is to compare 3 high and 3 lower cost management options that a canola grower may choose in the production of canola crop and to determine where these canola input costs have the most impact for the return on investment (ROI).

Background:

The three canola management variables evaluated in this trial are seeding rate, nitrogen rate and choice of fungicide treatment. Each variable will have a high and low option as listed below with high management option listed first:

- Seeding rate-12 PLS in 6” rows vs. 6 PLS in 12” rows(conventional seeding)
- Nitrogen rate-160#/ac vs 120#/ac
- Fungicide application- Proline @10%bloom + Priaxor late vs. Topsin M @10%bloom

Methods:

Experimental design was a RCB with four replications. This trial was repeated at two locations in 2018. The canola variety in this trial was L140P seeded on 5/23/2018. Individual plot size was 6’ wide by 27’ long, end trimmed to 5’ x 20’ harvest area. An application of 9-40-40 was applied to the entire area and incorporated into the soil. Individual plots were staked out and supplemental urea was hand spread as per plan to each individual plot. Stakes were then pulled and fertilizer incorporated with a Rau Combi (s-tine with rolling basket). Plots were re-staked and plots seeded according to row space and seeding rates trial plan. Post emergence fungicides were applied with hand boom sprayer with flat fan nozzles delivering 17 gpa @ 28psi. The treatments were applied as listed in Table 4.

Results:

Yield results and other agronomic data for individual treatment groupings are presented in Table 4. The two location mean canola yield was 2,894#/ac. The combined location

data indicated two treatments produced less canola yield (LLL and LLH) than the rest of the treatments. All other treatments were similar based on an LSD (0.05) of 269#/ac. In the comparisons of treatment means, canola yields ranged from 2,823 to 2,925#/ac. This narrow range indicates that in 2018 no differences in treatment means could be detected from the various management options tested.
The yields and economic return of individual main plot treatment means is listed on Table 4b. Also listed are seed, fertilizer and fungicide costs used to achieve the net return and the return to management. In this trial in 2017, the higher seeding rate in narrow rows gave the best bang for the buck. Across all treatments, the 12 PLS (5.1#/ac) seeding rate in 6" rows yielded 397#/acre more than the 9 PLS (3.8#/ac) seeding rate in 12" rows. This increase return by $71.46 with an added cost of $17.29 for a net increase of **$54.17/ac**. In 2018, only two treatments gave a positive dollar return to the grower (L/H/L **$40.41**/ac and H/L/L **$3.20/ac**). All other higher management treatments the grower would have lost money based on the growing conditions in 2018.

Narrow vs. wide rows each have advantages. Narrow rows canopy the ground more rapidly and have higher photosynthetic potential early in the season. They also provide better weed competition. Wider rows are better able to be productive with lower seeding rates, leave sufficient space to allow field equipment to operate between rows and maybe less susceptible to white mold by allowing better air flow. Also, wider rows may allow crop to better 'table' or tie together in the upper canopy better for direct harvest.

White mold and other disease pressure was generally low in 2018. It would be expected that in years with moderate to heavy disease pressure canola would respond to fungicide multiple treatments.

It should also be noted that prices quoted are retail cost estimates. It is certainly possible better pricing may be obtained making some of the treatments more economical.

Canola Seed Size Trial

Objective:
The objectives of this trial were to determine-
1-If larger planted seed has better stand/seedling vigor
2-If larger seed has better yield potential at various seeding rates.
3-Optimal seeding rate of small and large seeded varieties.
4-Heritability of the large seed trait.

Background:
Canola seed lots have a wide range of seed counts which is listed on the canola bag/tag. The range of canola seed/pound ranged from 83,000 - 130,000 for hybrid

canola (Canola Council of Canada). Further, the seed count for open pollinated canola varieties have a wider range than hybrid canola.

Methods:
RR canola varieties with similar genetic background was selected for this trial. The large canola seed size (85,000/#) variety was DKL 70-10. The small seed size (120,000/#) was DKL75-42CR. Seeding rate for each variety compared the standard 5#/ac seeding rate with 6, 9 and 12 plants/ft. Trial was planted on 5/23/18. Treatments were arranged in a RCB design with four replications. Canola was swathed and harvested with a small plot combine. Canola samples were cleaned, weighed and a sub-sample taken from each plot for moisture, percent oil content and other quality factors. Canola yields are adjusted to 8.5% seed moisture.

Results:
In general, the large seeded canola tended to produce higher yields than small seeded canola (Table 5). The standard 5lb/ac seeding rate gave the highest canola yield (2,837#/ac) with large seed (8pls/ft.) and compared to (2,690#/ac) from the small seeded canola (14pls/ft.). All other seed sizes and plant populations produced canola seed yields that ranged from 98 to 101% of the trial mean. Large seeded canola at planting produced canola seed with a higher test weight than the small seeded canola at planting. Canola seed yield averaged over the plant population by seed size was similar for large and small seed size at 2,763 vs 2,700#/ac, respectively. The progeny (harvested seeds) of the large and small planted varieties were essentially the same size at harvest.

Canola Tolerance to Sulfentrazone

Objective:
The objective of this trial was to evaluate the tolerance of canola to herbicide sulfentrazone at different rates and growth stages.

Background:
This trial was conducted in cooperation with the North Dakota researchers in Minot and Langdon. In the last few years resistant weeds to Roundup have been identified in canola growing areas of western North Dakota. Small seeded broadleaf weeds appear to be species that have developed resistance to Roundup. Sulfentrazone applied as an early post emergence treatment would provide an option to this developing weed problem.

Methods:
The canola variety L140P was seeded at 12 PLS/ft.2 on 5/23/2018. Soil type at this location was a clay loam with an organic matter of 4.5% and a pH of 8.3. Fertility applied was 140-40-40-20s. Plot size was 6x27 feet and end trimmed to a harvest plot

size of 5 x 20 ft. The experimental design was a RCB with four replicates. Sulfentrazone at 2 and 4 ounces/ac was applied to canola at three timings. May 30th to cotyledon stage canola, June 5th to 2 leaf canola and June12th to 2 - 3 leaf canola. All plots were swathed on 8-17-2018 and harvested on 9-1-2018. Harvested canola plots were individually cleaned, weighted and sampled for moisture and oil content.

Results:
Sulfentrazone at both rates applied to cotyledon canola caused a reduction in early season vigor (Table 6). Canola symptomology from sulfentrazone was a general stunting and a white cast to the canola plant. The reduction early season vigor was not detected when sulfentrazone was applied to 2 and 2-3 leaf canola. Sulfentrazone applied at 4 ounces/ac to cotyledon and 2 -3 leaf canola caused a yield depression of 379#/ac and 236#/ac, respectively compared to a LL check. All other sulfentrazone rates and timings produced canola yields similar to the LL check. This is the first year for this trial and the results suggest that sulfentrazone may have potential for weed control in canola, especially at the 2 ounce/ac rate.

Convention vs. Precision Planted Row Spacing and Seeding Rates

Objective:
The objective of this trial was to compare canola seed yield from various row widths and seeding rates.

Background:

Until recently, most canola has been planted with conventional type seeding equipment ie. press drill, air seeder, etc. With the high cost of seed and interest in direct harvest, additional information on yield and other effects regarding planting method, seeding rates and row spacing is needed. In 2015 and 2016, conventional plantings only were done with inconclusive results. In 2017, the trial was expanded to include precision planting technology with conventional plantings methods in canola.

Materials and Methods
The canola variety used in this trial was L140P and was seeded at various row widths and seeds/ft. on 5/23/2018. The experimental design was a RCB with four replicates. Individual plot size was 6 x 27 and end trimmed to 5 x 20 for harvest. The entire plot area had a background nitrogen level (0-24 inch) of 14 #/ac. A broadcast application of 140-40-40-20s was applied to the entire plot area. All plots were swathed on 8-17-2018 and harvested on 9-6-2018. Harvested canola plots were individually cleaned, weighted and sampled for moisture and oil content.

The conventional seeding methods was accomplished with a Hege small plot seeder in either 6, 12, or 24” rows. Seeding rates in this trial will be 3, 6, 9, and 12 PLS/ft. The

precision planting component for this trial was done in cooperation with RDK Enterprises in Hillsboro, ND. The seeder used was 11' wide with precision depth control with 22" row spacing. The seeder also precisely removes individual seeds from planting plates making possible precise, singulation planting. The treatments include 11 or 22"rows with either 3 or, 6PLS/ft.2.

Results:

The results from 2018 canola row space seeding rate trial can be found in Table 7. The precision planting row spacing was not included as due to planter configuration the tractor and planter had to split the 22' row which in 2018 resulted in wheel tracks and crusting problems with canola emergence. No differences was observed in canola emergence from the precision or conventional planted canola. Early season vigor and ground cover generally was better with narrow rows and with higher seed populations. Trial average canola yield was 2,787#/ac. In 2017, precision planted plots generally were higher than conventional plantings at equivalent seeding rates, however in 2018 the conventional seeded canola generally had higher yields than the precision planted canola. The precision planted canola in 22" rows were lowest yielding at both seeding rates. In 2017, the highest canola yields in conventional plantings were from in 6" or 12" and high seeding rates of 9PLS-12PLS/ft.2. In 2018, conventional planted canola yields were 112, 105 and 109% of mean from 6 '' rows at 6PLS, 12" rows at 9PLS and 24" rows at 9PLS, respectively.

The four year average yields from the conventional seeded row space seeding rate canola trials are presented in Table 7a. The data suggests that canola is a crop that will respond to a wide range of row widths and seeding rates. The four average canola yield suggests that 3PLS/ft. may not provide consistent yields from a plant population in 6 and 12'rows. The four year data also suggests that the canola seeded in 24'rows may give up some yield potential to the other two row widths.

Precision Planted, Liquid Phosphorus and Direct Harvest Canola

Objective:

The objective of this trial was to evaluate phosphorus applied in-furrow at planting and to compare swathing and direct harvest in precision planted 22' canola.

Background:

The precision planter from RDK Enterprises has the capability of applying liquid fertilizer over the row at planting. Previous research has suggested that phosphorus applied with canola will improve early season emergence and growth, especially in the cold, high pH soils of northern MN. Further data is limited on the response of canola in 22' rows to swathing and harvest compared to direct harvest canola.

Methods:

This trial was conducted at the U of MN Magnusson Research Farm, six miles northwest of Roseau, MN. This trial was seeded with a precision planter from RDK Enterprises that had 6- 22" rows. Plot size was 11 x 100 feet and treatments were

arranged in a RCB design with four replications. Canola L140P at 261,000 seeds/ac was seeded on 6/1/2018. Three phosphorus treatments were included in this trial:

- Dry 0-46-0 at 87lb/ac surfaced applied and incorporated prior to seeding
- Liquid 10-34-0 at 2 gallons/ac applied in-furrow
- Liquid 7-21-3 at 2.5 gallons/ac applied in-furrow

A broadcast application of 140-0-40-20s was applied to the entire plot area. Plots were swathed on 8-21-2018 and harvested on 9-6-2018. Harvested canola plots were individually cleaned, weighted and sampled for moisture and oil content.

Results:
No differences in early season vigor or canola yield was detected from phosphorus source applied broadcast or in-furrow. (Table 8). Canola yield ranged from 2,540 to 2,599#/ac from the three phosphorus treatments and the untreated. In the combined analysis, no difference was detected in canola yield between the swath and combine (2,521#/ac) compared to direct harvest (2,557#/ac) of canola in 22 inch rows.

Large Plot Direct Harvest Trial - McGlynn Farms

Objective:
To compare direct harvest canola seeded in 7.5 and 22 inch rows.

Background:
In the last two years, precision planting of canola in 22 inch rows has gained interest, especially with farmers that raise sugarbeets. In this trial both treatments and general field management operations were done with commercial sized field equipment using best management practices(BPM). University personal assisted with the plot harvest, stand counting and the recording of treatment information.

Methods:
This trial was located west of Stephen, MN with the cooperation of McGlynn Farms. Canola was seeded on May 4, 2018. The canola variety was L-140P. Seeding rate was 4.5#/ac with a hoe drill in 7.5 inch rows and 2.5#/ac with a precision planter in 22 inch rows. Canola at this site was managed for a 2,500#/ac canola crop. Experimental design was a RCB with three replications. Plot size was 1.78 ac/plot. Canola was harvested on 8/20/18.

Results:
Results from this direct harvest canola trial can be found in Table 9. Canola yields averaged 2,869 and 2,839#/ac for 22 and 7.5 inch rows, respectively. Canola yield were similar from both seeding methods. Results of this trial indicate that precision planting in 22 inch rows can give similar canola yields as the standard 7.5 inch rows.

Swath vs Direct Harvest Canola – Rice Farms

Objective:
To compare swathing and harvest with direct harvest canola seeded in 22 inch rows.

Background:
In the last two years, precision planting of canola in 22 inch rows has gained interest, especially with farmers that raise sugarbeets. In this trial both treatments and general field management operations were done with commercial sized field equipment. University personal assisted with the plot harvest and the recording of treatment information.

Methods:
The canola variety L-140P was seeded June 1, 2018. The two seeding rates were 6PLS/ft. (261,360seeds/ac) and 9 PLS/ft. (392,040 seeds/ac). The experimental design was a randomized complete block (RCB) with four replications. Fertility applied was 140-40-40-20s. Individual plot size was 6 x 27 ft. and end-trimmed to a harvest area of 5 x 20 ft. Liberty at 22 oz/ac + 2.5% AMS was applied for weed control and Proline at 5.7 oz/ac was applied to all plots at 20% bloom for white mold control. Canola was swathed on 8/23/18 and harvested on 9/6/18. 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.

The precision planting equipment used in this trial in cooperation with RDK Enterprises in Hillsboro, ND. The seeder used was 11' wide with precision depth control with 22" row spacing. The seeder also precisely removes individual seeds from planting plates making possible precise, singulation planting.

Results:
The results from this trial is listed in Table 10. Canola yields were similar for both seeding rates and harvest method and not statistically different. Canola yields for 6PLS was 2,758#/ac for direct harvest and 2,553#/ac for swath and harvest. In canola plant populations of 9PLS the reverse was found as the swath and combine was 2,485#/ac and the direct harvest was 2,264#/ac. Averaged over both planting rates canola yields were 2,519#/ac from swath and harvest compared to 2,511#/ac from direct harvest. Results from this trial suggest direct harvest is a viable option for canola growers that don't have access to a swather. Direct harvest canola appears to be a management practice that can be considered by canola growers using precision planting equipment.

Table 1.

2018 Spring Canola Variety Trial

Location- Rice Farms NW of Roseau,Mn.

University of Minnesota

Company	Herbicide Tolerance*	Variety	Seeding ** Rate (#/ac)	Yield[1] lb/acre	Yield[1] % of mean	Protein and Oil components(%)[2] % oil	% protein	Palmitic	Stearic	Oleic	Linoleic	Linolenic	Lodging[3]	ESV[4]	% ground cover[5]	Ht(in.)	Flowering begin day	Flowering end day	Flowering # of days
Cibus	SU	C5507	4.4	**2013**	**82**	**46.1**	19.9	3.9	1.9	74	18	8.0	7.0	7.0	71	45	7/5	7/23	18
Cibus	SU	exp201803	4.7	**1986**	**80**	**49.6**	17.7	3.9	1.7	78	19	8.5	1.5	6.0	65	48	7/3	7/19	16
Cibus	SU	exp201801	3.9	**2580**	**105**	**48.7**	18.1	4.0	1.7	75	19	8.0	2.5	5.0	48	52	7/5	7/25	21
Dekalb-Monsanto	RR	DKL70-10	7.3	**2348**	**95**	**50.2**	16.2	4.2	1.8	78	19	8.3	4.0	8.5	88	45	6/30	7/15	15
Dekalb-Monsanto	RR	DKL 75-42CR	4.4	**2475**	**100**	**50.0**	16.0	4.0	1.9	82	18	7.2	2.0	7.5	79	48	7/2	7/20	18
Dekalb-Monsanto	RR	DKL35-23	5.8	**2315**	**94**	**51.1**	16.3	4.1	1.7	77	20	8.6	3.5	8.0	85	47	6/29	7/15	16
Dekalb-Monsanto	RR	DKL71-14BL	6.5	**2714**	**110**	**51.0**	15.8	4.0	1.8	69	20	8.0	1.5	8.0	84	46	6/30	7/19	19
DuPont Pioneer	RR	45M35	5.0	**2669**	**108**	**52.5**	14.0	4.0	2.0	64	19	8.0	1.5	7.5	84	50	7/1	7/18	16
DuPont Pioneer	RR	45H33	5.0	**2514**	**102**	**50.4**	15.6	4.0	1.9	81	17	7.5	1.0	7.5	76	51	7/1	7/20	19
BrettYoung	RR	6074 RR	5.2	**2708**	**110**	**49.6**	14.5	4.2	1.8	78	18	8.2	1.0	8.0	85	47	6/30	7/22	22
BrettYoung	RR	6090 RR	5.6	**2512**	**102**	**49.9**	15.4	4.1	1.8	77	18	8.6	1.0	7.5	80	61	7/4	7/25	21
BrettYoung	RR	4187 RR	5.6	**2665**	**108**	**50.1**	15.4	4.0	2.0	82	17	5.5	1.0	7.5	80	53	7/4	7/23	19
Integra Seed/Wilbur Ellis	RR	7257R	4.4	**2278**	**92**	**50.6**	16.3	4.3	1.6	76	21	9.3	4.0	7.5	78	45	6/30	7/15	15
Star Specialty Seed	RR	Star 402	4.6	**2562**	**104**	**53.0**	14.1	4.0	1.8	73	19	8.4	2.0	7.0	75	48	7/2	7/17	15
Proseed	RR	300 Magnum	5.6	**2455**	**99**	**51.8**	15.1	4.1	2.0	71	19	6.9	5.0	7.5	76	45	6/30	7/18	18
Proseed	RR	PS 5000	5.3	**2426**	**98**	**49.3**	15.7	4.0	1.8	78	18	8.3	1.5	8.5	89	53	7/3	7/23	20
Winfield United	RR	HyClass 955	4.7	**2289**	**93**	**51.4**	15.5	4.2	1.7	76	20	8.0	6.5	8.5	86	45	6/30	7/16	16
Winfield United	RR	HyClass 730	4.9	**2280**	**92**	**52.1**	15.2	4.1	1.8	71	20	8.1	5.0	8.5	83	43	6/30	7/15	16
Winfield United	RR	HyClass 930	4.9	**2546**	**103**	**52.1**	14.9	4.1	1.9	67	20	7.9	2.0	7.5	76	46	6/30	7/15	16
Bayer CropScience	LL	InVigor L140P	5.4	**2442**	**99**	**48.0**	16.4	3.9	1.8	77	18	8.6	1.5	9.0	81	52	7/1	7/16	15
Bayer CropScience	LL	InVigor L233P	5.7	**2675**	**108**	**48.4**	16.0	4.1	1.9	77	18	8.0	1.5	9.0	91	47	7/1	7/15	15
Bayer CropScience	LL	InVigor L255P	6.0	**2563**	**104**	**51.0**	13.7	3.4	1.9	87	21	9.0	1.0	9.0	91	48	7/2	7/19	17
Bayer CropScience	LL	InVigor L252	5.4	**2742**	**111**	**51.5**	14.2	4.2	1.7	74	20	8.6	1.0	7.0	81	51	7/3	7/21	18
		LSD @ 5% Level		**222**	**9**	**0.9**	0.9	0.3	0.1	8.0	0.6	0.4	1.7	1.1	9.6	4.0	1.5	1.3	1.9
		CV(%)		**6**	**6**	**1**	4	6	5	7	2	4	47	10	8	6	3	5	7

Experimental Design: RCB w/4reps

*Herbicide Tolerance--LL=Liberty Link, RR=Roundup Ready and SU=Sulfonated Urea

**Seeding rate=12PLS/Ft.^{2}(using company provided PLS/lb)

[1]Clean Seed Yields corrected to 8.5% moisture

Trial Mean yield =2468#/acre

[2] Seed components on dry matter basis

[3]Lodging at harvest-1=Upright ; 9=flat

[4] ESV(early season vigor)-June 13 -- 9= best;1=least

[5]% ground cover June 14

Pod fill information or random pods picked at maturity--

	Average Pod Length	Seed wt per pod(GM)
Top portion	5cm	0.03
Middle portion	6.5cm	0.07
Lower portion	6.8cm	0.09

Top pods only had only 43% seed quantity of middle pods and 33% of bottom pods

Herbicide Treatments:	Where applied	Date of Application
Draft- .3oz. + .5% NIS	SU lines	6/12
Liberty-- 22oz.+ 2.5%AMS	LL lines	6/13
Roundup PowerMax--16oz.+2.5%AMS	RR lines	6/13
Section 2 --5oz. + 1%COC+1.5oz. Warrior	all plots	6/7

Soil Test=	PH	%OM	Olsen P	K	NO3-ppm
0-6"	8.2	5	3	107	5.8
6-24"					2.8

Table 2.

2018 Canola Variety Shattering Trial

Rice Farms-Roseau,Mn

	Company	Herbicide tolerance	Variety*	Yield[1] lb/acre	Lodging2	Seed shatter loss 8/23 seed[3]	8/23 pod[4]	8/30 seed[3]	8/30 pod[4]	9/6 seed[3]	9/6 pod[4]	9/13 seed[3]	9/13 pod[4]	**Total Seed Lost[5]** Pod only	Grams	**#/acre**
1	Bayer CropScience	LL	InVigor L233P	2675	1.5	0	0	0	0	0.47	0.15	1.09	0.41	0.56	1.56	**118**
2	Bayer CropScience	LL	InVigor L140P	2442	1.0	0	0	0	0	0.26	0.10	0.74	0.22	0.33	1.00	**76**
3	Bayer CropScience	LL	InVigor L255P	2563	1.0	0	0	0	0	0.42	0.10	1.00	0.20	0.30	1.42	**108**
4	Winfield United	RR	HyClass 930	2546	2.5	0	0	0	0	0.53	0.09	1.98	0.51	0.60	2.50	**190**
5	Winfield United	RR	HyClass 955	2289	7.5	0	0	0	0	0.55	0.04	1.15	0.09	0.12	1.70	**129**
6	Winfield United	RR	HyClass 730	2280	5.5	0	0	0	0	0.38	0.07	1.26	0.31	0.38	1.64	**125**
7	Dekalb-Monsanto	RR	DKL70-10	2348	6.0	0	0	0	0	0.55	0.05	1.00	0.16	0.21	1.55	**118**
8	Dekalb-Monsanto	RR	DKL35-23	2315	7.5	0	0	0	0	0.16	0.03	0.44	0.05	0.09	0.59	**45**
9	Integra Seed/Wilbur Ellis	RR	7257	2278	7.5	0	0	0	0	0.65	0.04	1.00	0.10	0.14	1.65	**125**
10	Star Specialty Seed	RR	Star 402	2562	2.0	0	0	0	0	0.81	0.20	3.25	0.93	1.13	4.07	**309**
11	Brett Young	RR	6099	2512	1.0	0	0	0	0	1.41	0.24	3.72	0.50	0.54	5.12	**389**
	LSD @5% level			222	3	0	0	0	0	0.29	0.12	1.00	0.50	0.54	1.15	**87**
	CV(%)			6	44	0	0	0	0	36	82	46	93	78	38	38

Experimental Design-RCB with 4 reps

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

*Seeding rate(12" row)=9PLS/Ft.[2]

[1] Seed yields taken from variety trial

[2]Lodging at harvest-1=Upright ; 9=flat

[3]Seed shattered directly from the plant to the ground collection pans

[4]Seed contained in pods shattered from the plant to the ground collection pans

[5]Total #/acre of all seed lost through 9/13/2018

Table 3.

2018 Canola Fertility Trial

Rice Farms-Roseau,Mn

	Total	PPI[1]		Post fertilizer[1a]			Yield*		Leaf		% Ground	Bloom			Stalk		Test wt.		
TRT#	Added N	N-Urea	PPI S	Sulfur**	urea	28%N	lb/acre	%mean	Burn[2]	ESV[3]	Cover[4]	Begin	End	Lodging5	dia.[6]	Ht(in.)	#/bu.	Protein	Oil
0	0	0	0				**1798**	**67**	NA	7.0	83	1-Jul	16-Jul	1.5	1.0	40	50.7	16.6	48.1
1	0	0	20#AMS				**1598**	**59**	NA	7.5	77	30-Jun	16-Jul	1.0	1.0	42	50.5	16.5	48.1
2	80	80	20#AMS				**2646**	**98**	NA	8.5	85	1-Jul	17-Jul	2.5	4.0	51	51.0	18.0	46.9
3	120	120	20#AMS				**2563**	**95**	NA	8.0	86	30-Jun	16-Jul	3.0	3.5	50	51.0	18.4	46.4
4	160	160	20#AMS				**2884**	**107**	NA	8.5	84	1-Jul	18-Jul	7.5	4.0	51	51.3	20.0	44.9
5	120	80	20#AMS		40#		**2990**	**111**	NA	8.0	85	30-Jun	17-Jul	6.5	4.0	51	51.1	19.4	45.6
6	160	80	20#AMS		80#		**2871**	**106**	NA	8.5	86	1-Jul	17-Jul	5.5	3.5	49	51.3	20.3	45.0
7	120	80		20#am.t		31#	**2497**	**93**	14	7.5	79	1-Jul	18-Jul	2.5	2.5	50	51.0	18.1	46.7
8	160	80		20#am.t		71#	**2641**	**98**	18	7.5	80	1-Jul	19-Jul	4.5	3.0	50	50.8	18.3	46.6
9	120	120	0				**2497**	**93**	NA	8.5	86	1-Jul	18-Jul	2.0	3.0	50	51.0	18.2	46.4
10	160	160	0				**2702**	**100**	NA	7.5	85	1-Jul	17-Jul	4.5	3.0	48	50.9	19.2	45.8
				LSD @5%level			**319**	**12**	NS	1.4	7	NS	2	2.8	1.2	4	0.3	1.5	1.4
				CV(%)			8.7	8.7	2	12	6	2	8	52	27	6.2	0.4	6	2
			#/acre mean (trt2-10 only)				2699												

Experimental design= RCB with 4 reps

Variety=InVigor L-140P

Seeded and rolled 5/23/2018

*Yield- clean seed #/acre corrected to 8.5% moisture- yield mean does not include 0 N rate

**Sulfur -Post emergent ammonium thiosulfate(12-0-0-26s) source @ 7gallons per acre

[1]PPI- urea and sulfur application rates 5/22/2018 prior to final seedbed prep

[1a]Post fertilizer applied per acre 6/12--urea =dry application OR stream=streamer jet nozzel applications with 28%UAN + amm.thiosulfate

[2]Leaf burn- Visual rating of leaf desiccation 6/16/2018 from streamer thiosulfate applications

[3]ESV-Early season vigor visual rating 6-13-18

[4]%Ground cover-visual rating 6-14-18

[5]Lodging at harvest- 1=Upright; 9=flat

[6]Stalk diameter at harvest- 1=1/8" , 3=1/8"-1/4" , 5=1/4"-1/2"(larger number=thicker stem)

Backround soil test-5/12/2018

Soil Depth	Olsen P mg/kg)	NH_4OAc-K (mg/kg)	LOI OM (%)	Water pH	EC (mmhos/cm)	SO_4-S #/acre	NO_3-N #/ac
0-6"	6	96	4.5	8.3	0.3	9	5.91
6-24"							7.62

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Table 3a.

	Total	PPI		Post fertilizer			Yield	Fertilizer[1]	**Net $$[2]**
TRT#	Added N	N-Urea	PPI S	Sulfur*	urea	28%N	#/acre	cost	**Return**
0	0	0	0				1798	$0.00	**$88.00**
1	0	0	20#AMS	77#			1598	$13.00	**$43.00**
2	80	80	20#AMS				2646	$40.50	**$182.50**
3	120	120	20#AMS				2563	$56.50	**$153.50**
4	160	160	20#AMS				2884	$72.50	**$188.50**
5	120	80	20#AMS		40#		2990	$56.50	**$221.50**
6	160	80	20#AMS		80#		2871	$72.50	**$186.50**
7	120	80		20#am.thi		31#	2497	$71.08	**$128.92**
8	160	80		20#am.thi		71#	2641	$104.43	**$118.57**
9	120	120	0				2497	$47.00	**$153.00**
10	160	160	0				2702	$63.00	**$169.00**

[1]Cost of added urea, AMS, liquid 28%N, and ammonium thiosulfate

[2]Net return = Plot yield x $.16/LB minus $200/acre + the cost of fertilizer

<u>Fertilizer-Cost basis used</u>

Urea	$360/Ton
28% Liquid N	$275/Ton
Ammonium Sulfate	$340/Ton
Ammonium thiosulfate $2.19/gallon	

Table 4.

2018 Canola Return on Investment- Bang for the Buck

2 Locations- Rice Farms and Magnusson Research Farm

					Yield lb/acre[1]		Yield	ESV[2]		% Ground cover[3]		# Days[4]	Ht.(in.)	Lodging[5]		%Protein		% Oil		Test Wt./Bu	
Trt#	Management	Seed Rate	Fertilizer	Fungicide	Rice	Magnusson	Mean	% mean	Rice	Mag.	Rice	Mag.	in Bloom	Rice	Rice	Mag.	Rice	Mag.	Rice	Mag.	Rice	Mag.
1	L/L/L	6PLS/ft.2- 12"rows	120-40-40-20s	Topsin M WSB	2275	2970	**2622**	**91**	8.0	7.5	60	59	18	51	2.5	9.0	17.7	21.1	47.8	43.8	50.6	50.7
2	L/L/H	6PLS/ft.2- 12"rows	120-40-40-20s	Proline/Priaxor	2651	2908	**2779**	**96**	6.5	8.0	50	58	19	54	3.5	9.0	18.9	20.8	46.9	44.1	50.3	50.5
3	L/H/L	6PLS/ft.2- 12"rows	160-40-40-20s	Topsin M WSB	2772	3353	**3063**	**106**	7.0	6.5	61	53	18	52	6.5	9.0	19.7	21.4	46.1	43.4	50.0	50.7
4	L/H/H	6PLS/ft.2- 12"rows	160-40-40-20s	Proline/Priaxor	2491	3162	**2826**	**98**	8.0	7.0	63	60	18	51	4.0	9.0	19.2	21.8	46.3	43.0	50.6	50.8
5	H/L/L	12PLS/ft.2-6" rows	120-40-40-20s	Topsin M WSB	2775	2934	**2854**	**99**	7.5	7.5	75	79	18	51	3.5	9.0	18.3	20.7	47.3	43.8	50.6	50.8
6	H/L/H	12PLS/ft.2-6" rows	120-40-40-20s	Proline/Priaxor	2798	3282	**3040**	**105**	7.0	7.0	80	81	18	50	2.0	9.0	18.4	20.8	47.1	43.8	50.5	50.5
7	H/H/L	12PLS/ft.2-6" rows	160-40-40-20s	Topsin M WSB	2841	2886	**2863**	**99**	7.5	8.0	79	84	18	51	6.0	9.0	19.6	21.9	46.0	42.8	50.9	51.0
8	H/H/H	12PLS/ft.2-6" rows	160-40-40-20s	Proline/Priaxor	2777	3108	**2942**	**102**	7.5	8.0	80	84	17	48	4.5	9.0	18.5	21.2	47.2	43.6	50.3	50.8
9	H/H/H+I	12PLS/ft.2-6" rows	160-40-40-20s	Warrior/Proline/Priaxor	2986	3085	**3035**	**105**	8.0	8.0	89	76	17	50	6.5	9.0	19.1	22.0	46.4	42.8	50.3	51.0
10	H/H/H+F	12PLS/ft.2-6" rows	160-40-40-20s	Quadris/Proline/Priaxor	2818	3010	**2914**	**101**	8.0	7.5	85	81	17	51	5.5	9.0	19.3	21.3	46.2	43.3	50.5	50.8
				LSD @5% level	393	384	**269**	**9**	NS	NS	14	12	NS	3	2.7	NS	1.1	0.8	1.1	0.8	NS	NS
				CV(%)	10	9	**6**	6	14	17	14	11	1	4	41	0	4	3	2	1	1	1
				Overall Mean Yields--#/acre	2718	3070	**2894**															

		Yield #/acre		
2018 means	TRT Mean	Rice	Magnusson	Mean
Row space/Seed rate	6"row 12PLS	2798	3053	**2925**
	12"row 6PLS	2547	3098	**2823**
Fungicide	Topsin	2666	3036	**2851**
	Proline+Priaxor	2679	3115	**2897**
Fertility	120-30-30-20s	2625	3023	**2824**
	160-40-40-20s	2720	3127	**2924**

Soil test 5-15-2018 (Olsen)

Magnusson	PH	%OM	P	K	NO3-ppm
0-6"	8.1	2.8	9	91	19
6-24"					7

Rice					
0-6"	8.2	4.6	5	103	8.9
6-24"					2.5

Experimental Design=RCB with 4 reps

TRT#9&10 (Warrior or Quadris) 6/6/2018 7:00pm sse 5-7 2 leaf growth stage 7:00pm sse 5-7mph

Topsin(low management) or Proline(high management) applied to all plots 7/9/2018 -- 50% bloom 5:00pm nw 4-6mph

TRT#2,4,6,8,9,10- Priaxor in addition to Proline in high management plots applied 7/13/2018 late bloom 9:00am 70F wsw 2-6mph

[1]Yield- clean seed #/acre corrected to 8.5% moisture

[2]ESV-Early season vigor visual rating 6-13-18

[3]%Ground cover-visual rating 6-14-18

[4]# Days in Bloom -Rice farm only

[5]Lodging at harvest- 1=Upright; 9=flat

Pesticide	Application rate
Topsin M WSB	20oz.
Proline	5.7oz.
Priaxor	6oz.
Warrior	1.5oz.
Quadris	6oz.

Table 4a.

2018 Canola Return on Investment Budgets*

2 Locations- Rice Farms and Magnusson Research Farm

					Yield lb/acre				Net	**Management[2]**
Trt#	Management	Seed Rate	Fertilizer	Fungicide	Rice	Magnusson	Mean	Gross[1]	return/ac	**return**
1	L/L/L	6PLS/ft.2- 12"rows	120-30-30-	Topsin M WSB	2275	2970	2622	419.52	199.52	**$0.00**
2	L/L/H	6PLS/ft.2- 12"rows	120-30-30-	Proline/Priaxor	2651	2908	2779	444.64	188.96	**-$10.56**
3	L/H/L	6PLS/ft.2- 12"rows	160-40-40-	Topsin M WSB	2772	3353	3063	490.08	239.93	**$40.41**
4	L/H/H	6PLS/ft.2- 12"rows	160-40-40-	Proline/Priaxor	2491	3162	2826	452.16	166.3	**-$33.22**
5	H/L/L	12PLS/ft.2-6" rows	120-30-30-	Topsin M WSB	2775	2934	2854	456.64	202.72	**$3.20**
6	H/L/H	12PLS/ft.2-6" rows	120-30-30-	Proline/Priaxor	2798	3282	3040	486.4	196.8	**-$2.72**
7	H/H/L	12PLS/ft.2-6" rows	160-40-40-	Topsin M WSB	2841	2886	2863	458.08	174.01	**-$25.51**
8	H/H/H	12PLS/ft.2-6" rows	160-40-40-	Proline/Priaxor	2777	3108	2942	470.72	150.97	**-$48.55**
9	H/H/H+I	12PLS/ft.2-6" rows	160-40-40-	Proline/Priaxor+Warrior	2986	3085	3035	485.6	160.85	**-$38.67**
10	H/H/H+F	12PLS/ft.2-6" rows	160-40-40-	Proline/Priaxor+Priaxor	2818	3010	2914	466.24	138.49	**-$61.03**

Production cost basis for low management regime=$220/acre

*Means of both locations used to calculate profit margins

[1]Gross revenue per acre= yield x $.16/LB

[2]Management return= profit or loss realized by adding the higher input variables

Variable	Added cost of higher management	lb/ac extra seed needed to break even
seed	$33.92	212
fertilizer	$30.15	188
fungicide	$35.68	223

Fungicide	Rate	cost per acre
Topsin M WSB	20oz.	$11.25
Proline	5.7oz.	$23.65
Priaxor	6oz.	$23.28
Warrior	1.5oz.	$6.50
Quadris	6oz.	$8.00

Product	Cost basis
Urea Fertilizer	$380/Ton
InVigor L140P Seed	$13.30/LB

Table 5.

2018 Canola Seed Size Trial

Rice Farm-Roseau,Mn

Variety	Seeding rate	lb/acre	(Dekalb) PLS/acre	Yield[1] lb/acre	Yield[1] %Mean	1000 seed wt	plants/ft2 Harvest	plants/ft2 6/26	ESV[2]	% Ground cover[3]	Bloom date Begin	Bloom date End	Harvest Lodging4	Harvest Ht(in)	Protein	Oil	Test wt. (#/bu.)
Large seed-V1	5#/ac(8PLS)	5.0	358000	**2837**	**104**	1.86	7.0	5.3	6.5	75	30-Jun	17-Jul	4.0	45.5	16.3	50.1	51.0
Large seed-V1	6pls/ft	3.6	261000	**2756**	**101**	1.88	5.0	3.8	6.5	71	1-Jul	17-Jul	2.5	44.8	16.5	49.8	51.0
Large seed-V1	9pls/ft	5.4	392000	**2759**	**101**	1.91	5.5	6.5	8.0	84	1-Jul	16-Jul	5.0	45.5	16.5	49.9	51.0
Large seed-V1	12pls/ft	7.3	522000	**2697**	**99**	1.86	8.3	7.2	9.0	91	30-Jun	16-Jul	5.5	44.5	16.7	49.9	51.0
Small seed-V2	5#/ac(14PLS)	5.0	600000	**2655**	**97**	1.93	8.5	7.0	8.5	86	1-Jul	19-Jul	2.5	45.3	16.4	49.9	50.8
Small seed-V2	6pls/ft	2.1	261000	**2768**	**101**	1.89	3.9	3.5	5.0	57	2-Jul	20-Jul	1.5	48.8	16.5	50.0	50.9
Small seed-V2	9pls/ft	3.3	392000	**2687**	**98**	1.97	6.0	5.3	7.0	71	1-Jul	20-Jul	1.5	47.8	16.2	50.0	50.8
Small seed-V2	12pls/ft	4.3	522000	**2690**	**98**	1.99	7.3	6.7	7.5	80	1-Jul	19-Jul	4.0	46.3	16.5	49.8	50.8
		LSD @5% level		**143**	**5**	0.1	1.9	1.25	1.1	7	0.6	1.1	1.9	2.7	NS	NS	0.1
		CV(%)		3.5	3.5	3.4	20	15	10	6	1	4	39	4	1.8	0.4	0.1

Experimental design= RCB with 4 reps

[1]Yield- clean seed #/acre corrected to 8.5% moisture

[2]ESV-Early season vigor visual rating 6-13-18

[3]%Ground cover-visual rating 6-14-18

[4]Lodging at harvest- 1=Upright; 9=flat

	Yield	Seeds/LB	
	lb/acre	Harvested	Planted
Mean Large seed treatments(V1)	**2763**	121000	85000
Mean small seed treatments(V2)	**2700**	117000	120000

	seed size	company	variety	PLS used for planting	actual-counted Seeds/#(treated)
V1	LARGE	Dekalb	DKL70-10	71,747	85,000
V2	small	Dekalb	DKL 75-42CR	120,144	120,000

Table 6.

2018 Spartan(sulfentrazone) Applications to Canola

Rice Farms-Roseau,Mn

		Spartan	Yield[1]		Test wt.				18-Jun	23-Jun		Bloom		Harvest	
TRT#	Rate	Timing	lb/acre	% of mean	#/bu.	Protein	Oil	ESV[2]	% Ground cover[3]		Vigor[4]	10%	End	Lodging[5]	Ht(in.)
1	Liberty only	none	2846	104	50.4	16.6	48.1	8.0	84	99	8.5	1-Jul	17-Jul	4	50
2	Liberty only	none	2804	103	50.4	16.6	48.0	8.5	88	98	8.5	1-Jul	16-Jul	4	50
3	2oz.	5/30	2712	100	50.3	17.6	47.3	5.0	55	83	5.5	3-Jul	20-Jul	3	51
4	4oz.	5/30	2467	90	50.6	17.7	47.1	3.0	43	73	4.8	4-Jul	21-Jul	3	51
5	2oz.	6/5	2806	103	50.4	16.7	48.1	8.0	86	95	8.0	1-Jul	17-Jul	4	48
6	4oz.	6/5	2780	102	50.5	16.9	47.9	7.5	79	94	7.3	1-Jul	17-Jul	4	48
7	2oz.	6/12	2753	101	50.5	16.8	48.2	8.0	84	99	8.5	1-Jul	16-Jul	5	48
8	4oz.	6/12	2610	96	50.5	16.9	48.2	7.5	81	95	7.8	1-Jul	17-Jul	4	46
	LSD @5% level		223	8	0.24	0.4	0.5	1.3	10	10	0.9	1	1	NS	2
	CV(%)		5.6	5.6	0.3	1.9	0.8	13	9	7	8	3	4	45	3.2

Trial Mean = 2722#/acre

Experimental design= RCB with 4 reps

Variety- InVigor L140-P

[1]Yield- clean seed #/acre corrected to 8.5% moisture

[2]ESV-Early season vigor visual rating 6-13-18

[3]%Ground cover-visual rating 6-14-18

[4]Plant Vigor 6-23-18-visual rating-1=least;9=best

[5]Lodging at harvest- 1=Upright; 9=flat

Application

Date	Growth stage	Applications made with CO2 backpack sprayer @ 16GPA
30-May	cotelydon	7pm with windSSW 3-5mph 74F
5-Jun	2 leaf stage	6pm with wind SSE 5-8mph 72F
12-Jun	2-3 leaf stage	6pm wind w 4-7mph 65F

clay loam soil type

Soil test=	Olsen P	%OM	EC	PH
0-6"	6	4.5	0.296	8.3

Table 7.

2018 Canola Conventional vs. Singulation/Precision Planting x Row SpacingxSeeding Rate

Rice Farms-Roseau,Mn

TRT#	Row Spacing1	Seeding Rate(PLS)	Yield lb/acre	Yield % of mean	Protein	Oil	Test Wt./Bu	ESV[1]	%ground cover[2]	Begin Bloom	End Bloom	Ht(in.)	Lodging[3]	Stand at Harvest Plant/ft. row	Stand at Harvest Plants/ft.2
2	22"	3	**2553**	**92**	16.9	48.7	50.5	6.5	55	8-Jul	26-Jul	57	1.0	5.1	2.8
4	22"	6	**2484**	**89**	16.2	48.9	50.5	7.5	65	8-Jul	25-Jul	52	1.0	8.5	4.6
5	6"	3	**2815**	**101**	16.3	47.6	50.5	6.0	30	8-Jul	26-Jul	56	1.0	2.5	5.0
6	6"	6	**3113**	**112**	16.6	47.6	50.4	7.0	64	8-Jul	25-Jul	54	1.0	5.6	11.2
7	6"	9	**2793**	**100**	16.3	48.1	50.4	8.0	73	8-Jul	25-Jul	51	1.0	6.0	12.0
8	6"	12	**2774**	**100**	16.3	47.9	50.3	8.5	80	8-Jul	25-Jul	49	1.0	8.3	16.6
9	12"	3	**2733**	**98**	16.6	47.7	50.6	6.0	45	8-Jul	26-Jul	54	1.0	3.5	3.5
10	12"	6	**2889**	**104**	16.6	47.8	50.4	7.5	63	8-Jul	25-Jul	53	1.0	6.3	6.3
11	12"	9	**2920**	**105**	16.6	47.8	50.4	8.5	75	8-Jul	26-Jul	50	1.0	9.1	9.1
12	12"	12	**2563**	**92**	16.3	47.8	50.3	8.5	65	8-Jul	25-Jul	50	2.5	12.5	12.5
13	24"	3	**2904**	**104**	16.8	47.2	50.5	5.5	25	8-Jul	26-Jul	56	1.0	5.5	2.8
14	24"	6	**2727**	**98**	16.8	47.4	50.4	6.5	35	8-Jul	26-Jul	53	1.0	10.3	5.2
15	24"	9	**3024**	**109**	16.8	47.4	50.4	7.5	33	8-Jul	26-Jul	51	1.0	12.3	6.2
16	24"	12	**2726**	**98**	17	47.1	50.5	7.5	45	8-Jul	25-Jul	51	5.0	14.6	7.3
LSD @5% level			**279**	**10**	0.4	0.4	0.1	1.8	12	NS	1	3	0.7	2	4
CV(%)			7	7	2	0.5	0.2	17	16	3	2	5	35	18	18

Trial Mean=2787

Experimental Design=RCB with 4 reps

[1]Row spacing- 22" rows were precision,singulation seeded with RDK planter

All other planting was done with a Hege plot seeder

[2]%Ground cover-visual rating 6/14/2018

[3]Lodging at harvest- 1=Upright; 9=flat

Soil Depth	Olsen P (mg/kg)	NH_4OAc-K (mg/kg)	LOI OM (%)	Water pH	EC (mmhos/cm)	SO_4-S #/acre	NO_3-N #/ac
0-6"	6	116	3.8	8.2	0.296	9	8
6-24"							12

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Table 7a.

2015-18 Canola Conventional Planting Row Space x Seeding Rate Trial

Roseau,Mn.

Row Spacing	Seeding Rate PLS/Ft.2	Seed Yield(lb/ac.)[1] 2015	2016	2017	2018	4Yr. Ave.
6"	3	2518	2706	2886	2815	**2731**
6"	6	2636	2787	3524	3113	**3015**
6"	9	2850	2533	3312	2793	**2872**
6"	12	3194	2590	3454	2774	**3003**
12"	3	2692	2498	2971	2733	**2724**
12"	6	2972	2310	3071	2889	**2811**
12"	9	2901	2695	3688	2920	**3051**
12"	12	3337	2500	3591	2563	**2998**
24"	3	2898	2568	2502	2904	**2718**
24"	6	2561	2391	2778	2727	**2614**
24"	9	2822	2376	2916	3024	**2785**
24"	12	3018	2475	3043	2726	**2816**
LSD @5% level		518	318	366	279	**275**
CV(%)		12	8	8	7	6

Experimental design= RCB with 4 reps

2015 Canola variety- InVigor L 252 ; 2016-18 InVigor L 140P

[1]Yield=Cleaned seed yield corrected to 8.5% moisture

Table 8.

2018 Precision Planted Phosphorous Fertility/Harvest Method Trial

Magnusson Research farm -Canola Variety-InVigor L140P

RDK precision planting---6-22" rows Seeding Rate= 261000

Plot size 11' x 100'

Planted 6/1/2018

all plots(combined swath and direct harvest)								% Ground	Plant		Bloom Date	
TRT#	Treat*	rate/acre	Yield[1]	TW	Protein	oil	ESV[2]	cover[3]	Ht(in.)	Lodging[4]	Start	End
1	none		2563	50.8	18.1	45.9	6.0	50	54	2.5	8-Jul	26-Jul
2	dry 0-40-0	87#	2540	50.8	17.9	46.0	7.0	58	53	1.0	8-Jul	26-Jul
3	10-34-0	2gal	2599	50.9	18.0	46.2	6.5	45	53	1.5	8-Jul	27-Jul
4	7-21-3	2.5gal	2524	50.8	17.7	46.3	7.5	58	53	2.5	8-Jul	26-Jul
	LSD @5% level		NS	NS	0.3	NS	NS	5	NS	1.9	NS	0.7
	CV(%)		9.4	0.3	2.2	1	15	6	3.7	53	0	1.6

Experimental design= RCB with 4 reps

*Trt 2 applied dry before final seedbed prep; Trt. 3&4 applied as liquid at planting on top of the row

[1]Clean Seed Yields corrected to 8.5% moisture

[2] ESV(early season vigor)-June 13 -- 9= best;1=least

[3]% ground cover June 14

[4]Lodging at harvest-1=Upright ; 9=flat

Table 8a.

TRT#	treatment	rate/acre	Harvest method	Yield	TW	Protein	oil
1	none		Swath	2502	51.1	17.8	46.3
2	dry 0-40-0	87#	Swath	2421	51.0	18.2	46.1
3	10-34-0	2gal	Swath	2720	51.2	17.8	46.6
4	7-21-3	2.5gal	Swath	2440	50.9	17.6	46.6
1D	none		Direct	2685	50.9	19.1	45.1
2D	dry 0-40-0	87#	Direct	2247	51.3	18.9	45.2
3D	10-34-0	2gal	Direct	2845	50.9	18.8	45.7
4D	7-21-3	2.5gal	Direct	2449	50.9	18.2	45.8
		LSD @5% level		443	NS	NS	NS
		CV(%)		7.4	0.4	3.4	1.6

Table 8b.

Harvest Method	Yield	TW	Protein	oil
Swath+combine	2521	51.1	17.9	46.4
Direct combine	2557	51.0	18.8	45.5
LSD @5% level	NS	NS	0.6	0.5

Phosphorous sources

Rate/ac	formulation		N-P-K per acre	Trade name	Application method
87#	Dry	0-46-0	0-40-0	Super phosphate	Surface application-incorporate with final tillage
2gallons	Liquid	10-34-0	2-8-0	ammonium polyphosphate	In furrow
2.5gallons	Liquid	7-21-3	2-6-0	MPK starter	In furrow

Table 9.

2018 Canola Seeding Trial-Precision planting-- McGlynn Farms

Large plot-On Farm--West of Stephen Minnesota

	Yield lb/ac	plants/ft	Plants/acre
Flex Hoe drill	2839	4.7	204000
Precision planting	2869	3.0	131000
LSD @5%level	NS	NS	NS
CV(%)	2.4	23	23

Experimental Design-RCB with 4 reps

22" precision plant rows at 2.5#/ac. With converted sugar beet planter

7.5" Flex Hoe drill air seeder at 4.5#/acre with hoe drill

Variety- InVigor L-140P

All plot direct combined

Harvest area= 1.78acres per plot

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Table 10.

2018 Harvest Methods on Precision planted Canola

Rice Farms-Roseau,Mn

			lb/acre	
Trt#	Row spacing	Seeding Rate (PLS)	**Direct Harvest**	**Swath and combine**
1	22"	6	**2758**	**2553**
2	22"	9	**2264**	**2485**
LSD @5% level			**NS**	**NS**
CV(%)			11	8

Seeding Date- 6/1/2018

Variety- InVigor L140-P

Planter-RDK Enterprises- Precision planting in 22" rows

Seeding Rates= 6PLS(261360/ac)

9PLS(392040/ac)