2016 Minnesota Canola Production Center (CPC)

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

2016 Research Summary Report

Donn Vellekson and Dave Grafstrom
CPC Site Agronomists

Table of Contents

Minnesota Production Center Results

Acknowledgements

Minnesota Canola Production Center

The Minnesota Canola Production Center (CPC) is a public-private partnership between the Minnesota Canola Council and the University of Minnesota.
The efforts of many individuals, companies, organizations and agencies make it possible to conduct this field research in support of the canola industry. The financial, products & services and information 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 Rice Farms Inc., for land and field preparation for the small plot canola trials and Peter Grafstrom for land, field preparation and harvest assistance with the large on-farm three year canola rotation trial.

SITE INFORMATION - 2016 MN Canola Production Center (CPC)

Location: Approximately, 5 miles NW of Roseau, MN

Cooperator: Rice Farms Incorporated

Previous Crop: Perennial Ryegrass

Soil Test Results:

Nitrogen - 0-24 inch	33 #/acre
Phosphorous -	16 ppm
Potassium -	164 ppm

Target Yield:	2500 #/acre
Fertilizer Applied (#/acre):	N - 130; P - 40; K - 40; S - 20s
%Organic Matter:	3.9
Soil pH:	7.9

Tillage Operations: In the fall of 2015, a super-coulter operation was performed on the entire area. The first spring tillage operation was an s-tine harrow. Broadcast fertilizer applied and incorporated with a spike tooth harrow.

Fertilizer Applied: All small plot trials received 130-40-40-20s, except the fertility trial which received a base fertility program of 26-40-40-20s. The canola fertility trial area received various nitrogen sources, rates and timings as listed on the trial protocol.

Seeding Method: All small plot trials were seeded a Hege plot seeder and the on-farm location established with a press drill.

Herbicides Applied: Select at 5 oz/ac + 1% crop oil was applied to the entire area for general grass control on 6/8/2016. The various herbicides were applied to the appropriate canola variety on 6/22/2016.

A) Clearfield hybrids - Beyond @ 4 fl. oz/ac + NIS 0.25% v/v + AMS @ 15 lbs. /100 gal

B) Liberty Link hybrids - Liberty 280SL @ 22 fl. oz/ac + AMS @ 3.0 lbs. /ac

C) Roundup Ready hybrids - Roundup PowerMax @ 16 fl. oz/ac + AMS @ 17 lbs. /100 gal

D) Sulfonylurea hybrids - Draft 0.3 oz/ac+0.5%AMS+.5%NIS

Comments: Total precipitation in the fall of 2015, winter and early spring of 2016 were below normal. However, rainfall was above normal in May and June. Daily maximum and minimum temperatures were below normal in May-July during the 2016 growing season (Source: NDAWN). Further, accumulated rainfall during the growing season (May-July) was 2.68 inches above normal at Roseau, MN. Further, 3.31 inches fell in a 10 day period from May 26th to June 4th and 4.4 inches fell in another 10 day period from June 12th to June 22nd. The cool weather coupled with surplus soil moisture was an ideal environmental condition for the nitrogen losses and potential development of white mold in canola.

Canola stands were generally good with adequate soil moisture level and timely rainfalls after planting. Crops (canola, barley, soybeans and wheat) in the area were seeded in April into May. Canola planted on course textured, lighter soils tended to have better stands than canola seeded into fine textured, heavy soils.

The crop planting window this year was late April through late May. Crop planting proceeded at a rapid pace, in the fields that dried out enough for field operations. Once planted, canola stands, were generally good. Cool, early season temperatures inhibited early season growth of canola seedlings. In early plantings, seed coating treatments for flea beetle control did not persist and the crop was unable to grow rapidly enough to stay ahead of flea beetle predation. Consequently, many canola fields developed populations above threshold levels and required a post emergence insecticide treatment. After emergence, many fields experienced excess soil moisture conditions with plant stunting and drowned out areas. Later season conditions were more favorable to canola growth and development.

In 2015, white mold infestations were moderate to severe at the CPC. However, in 2016, white mold occurrence in the region was variable dependent upon past cropping, soil moisture levels and rainfall during the period of canola bloom. Other diseases that impact canola growth and development were at low levels in the 2016 season with the exception of late season alternaria observed at the MN CPC. Insect pressure, other than early season flea beetles, were also at a low levels in the 2016 growing season.

The Minnesota CP had two field locations in 2016. The small plot replicated canola research trials were conducted near Roseau with cooperation of Rice Farms Inc. The three year canola rotation trial was initiated in Roseau County (Spruce Township, Section 13) with cooperation of Peter Grafstrom. The three year rotation on-farm trials were performed with commercial farming equipment with the cooperation of Mr. Grafstrom.

The public canola trials conducted at the 2016 CPC included:

- Small plot canola variety trials
- Small plot fertility nitrogen source, rate and timing trial
- Small plot canola fungicide trial
- Canola rotation trial
- Small plot seeding rate x row spacing trial
- Small plot canola shatter trial

Small Plot Variety and Systems Trial

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

Background:
New and emerging technologies in canola varieties have given canola growers choices in variety selection. Yield, lodging resistance, maturity, and crop quality are important variety 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 to compare against similar varieties in a small plot replicated research trial.

Methods:
All varieties were seeded at 12 PLS/ft.2 on May 18, 2016. The experimental design was a randomized complete block (RCB) with four replications. Individual plot size was 6 x 27 ft. and end-trimmed to a harvest area of 5 x 20 ft. The Clearfield, Liberty Link, Roundup Ready and Sulfonylurea canola varieties were planted in separate blocks with buffers to minimize the influence of potential herbicide drift. All herbicides were applied on 6/22/16. Proline at 5.7 oz/ac was applied to all plots at 20% flowering for white mold control. The early canola varieties were swathed on 8/15/16 and harvested on 9/1/16. Late canola varieties were swathed on 8/17/16 and harvested on 9/2/16. 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 37 canola varieties were entered in the 2016 CPC (Table 1). A breakdown of the canola varieties: 26 Roundup Ready, 5 Sulfonylurea, 4 Liberty Link and 2 Clearfield canola entries. Canola yields ranged from 1,709 to 2,623 #/ac. The trial average yield was 2,147 #/ac.

The top-yielding canola varieties were: Star 402, 45H33, G35153, HyClass 930, 300 Magnum, HyClass 955, HyClass 972 and 6080 RR. Statistical analysis at the 5% level of confidence (295#/ac) suggests these 8 canola varieties did not differ from each other in yield. Average canola yield for these 8 varieties were 2,450 #/acre, and at $15/cwt would be a gross dollar return of $367.50/ac.

All varieties exhibited good early season vigor. First flower date ranged from June 28th to July 3rd with the end of flowering ranging from July 19th to July 27th. Plant height ranged from 34 to 47 inches. Percent oil ranged from 53.9 to 47.7%. Breakdown of oil components and other agronomic information is summarized in Table1.

Nitrogen Fertility Trial

Objective:
To evaluate canola yield response from various rates of urea applied PPI, and post emergence (3-5 leaf canola). In 2016, 28% UAN was an additional post emergence treatment applied with streamer nozzles to 3-5 leaf canola. Post emergence urea with the nitrogen stabilizer Agrotain® Ultra was applied on 6/14/16 and 28% applied on 6/16/16. Urea nitrogen was also applied PPI in combinations with a coated urea product ESN (evironmentaly smart nitrogen). To validate results under different conditions and over time, this trial was conducted in 2013, 2014 and 2015.

Background:
Canola requires high levels of nitrogen and usually shows increased yields with increasing levels of nitrogen fertilizer. 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; 1) early season application of a coated urea product like ESN, which is a polymer-coated urea, that releases nitrogen based on temperature and moisture, or 2) an early post emergence application of urea (dry or liquid). This trial was initiated to evaluate the canola yield response to various rates, timings and combinations of urea with ESN and dry urea applied with the nitrogen stabilizer, Agrotain® Ultra and liquid nitrogen (28%).

Methods:
In 2016, the canola variety, Star 402 was seeded at 12 PLS/ft.2 on 5/18/16. 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 33 #/acre. A broadcast application of 26-40-40-20s was applied to the entire plot area. Nitrogen treatments included PPI urea (46-0-0) applied at 0, 90, 135 and 180 #/acre. A 50/50 blend of urea and ESN (44-0-0) applied at 0, 90, 135 and 180 #/acre. Urea applied PPI at 45#/ac plus post emergence urea with Agrotain® Ultra and liquid nitrogen (28%) applied at 45, 90 and 135 #/acre. All plots were swathed on 8-16-16 and harvested on 8-31-16. Harvested canola plots were individually cleaned, weighted and sampled for moisture and oil content.

Results:

This trial was seeded approximately 1 inch deep into dry soil with good sub-soil moisture. As nitrogen rate increased from the baseline nitrogen of 59 #/ac (33 + 26) to 180#/ac plant height and lodging score increased (Table 2). For example canola height was 34 inches with a nitrogen rate of 59 #/ac and 44 for 180 #/ac. Lodging score was 3.3 from 59 #/ac compared to 5.8 from 180 #/ac. Protein tended to increase and % oil tended to decrease as nitrogen rate increased from 59 to 180 #/ac.

The canola fertility trial average yield in 2016 was 2,658 #/ac (Table 2). The untreated canola plots (33#N soil residual+ 26#N applied incidentally with P, K & S) produced a canola yield of 1,778#/ac. All supplemental nitrogen treatments produced a higher yield of canola than the untreated with an LSD (0.05) of 269#/ac. Generally, canola yields tended to increase as the nitrogen rate increased to 180#/ac, regardless of nitrogen formulation, or time of application. Top yields and highest net return over years, indicate several possible options to improve nitrogen use efficiency (Table 2). If only one pre-plant application is desired, a higher N rate with half ESN, tended to be best. Better nitrogen use efficiency (NUE) was obtained by not applying high straight urea N rates prior to planting. If a pre-emergent + a post emergent application is possible, a lower overall rate of N fertilizer can be used. Post emergent urea applications made with the addition of Agrotain® Ultra were also shown to increase yields over time with highest benefits achieved with applications made during dry conditions.

A chlorophyll meter, FIELDSCOUT, CM 1000, from Spectrum Technologies, Inc., was used in this trial to determine if a light meter could be used to detect nitrogen levels in canola. A light meter reading was taken under full sun conditions at 12:00 pm on 7/15/16. Results suggest that the chlorophyll meter readings generally were higher from the nitrogen treatments compared to the untreated. However, treatment differences were not detected at the single observation date. Additional research is needed to determine the utility of light meter technology in canola. The goal would be to correlate light meter readings with nitrogen status in the plant. This information could be used to predict nitrogen deficiencies in canola and develop a predictive model of how much nitrogen should be applied at a given canola growth stage to maximize canola yield and minimize environmental concerns.

The four year fertility trial average canola yield was 103, 105 and 107% of the mean for urea nitrogen applied as 100% PPI, urea 50% PPI + 50% ESN and urea 45#/ac PPI + post emergence urea applied at 3-5 leaf canola, respectively (Table 2). This data would indicate that nitrogen efficiency can be improved by using a coated nitrogen product or a base rate of nitrogen PPI followed by post emergence urea at 3-5 leaf canola.

Canola Fungicide Management Small Plot Trial

The primary objective of this trial is to evaluate fungicides applied at two timings to determine the influence of disease control on canola growth, development and yield. A secondary objective is to evaluate disease development in canola seeded in 6 and 12 inch row.

Background:
White mold, caused by the fungal pathogen, *Sclerotinia sclerotiorum*, is the most serious disease in canola. White mold infects the canola plant during flowering and fungicides are an effective management tool for disease management

Methods:
Experimental design was a RCB with four replications. The canola variety in this trial was Star 402 seeded on 5/18/16 at 12.5 PLS in 6 inch rows and 9 PLS in 12 inch rows. Individual plot size was 6' wide by 27' long, end trimmed to 5' x 20'. The treatments were applied as listed in Table 3. Post emergence fungicides were applied with hand boom sprayer with flat fan nozzles delivering 17 gpa @ 30 psi. Plots were swathed on 8/16/16 and harvested on 8/31/16. Harvested canola was cleaned, weighted and a sub-sample taken from each plot for moisture, percent oil content and other quality factors.

Canola bloom began on June 27th with total bloom period of 21 to 23 days. The month of June at the 2016 CPC accumulated 5.71 inches of rain. However, the month of July was average, but 0.96 inches fell after canola petal fall. Further, average daily high temperatures for July were 5 to 15 degrees below normal (NDAWN).

Results:
Yield results and other agronomic data are presented in Table 3. The untreated canola averaged 2,383 and 2,310 #/ac in 6 and 12 inch rows, respectively. In 2016, canola seeded in 12 inch rows gave similar yields as canola seeded in 6 inch rows. No differences were observed in the expression of white mold from canola seeded at the two row spacing's. At the 95% confidence level, all fungicide treatments gave similar canola yields, except the sequential treatment of Quash followed by Topsin gave higher canola yields than untreated canola seeded in 12 inch rows. Although statistically non-significant, fungicide treated canola tended to produce more canola yield that the untreated. The highest canola yield of 2,723#/ac was from a sequential fungicide treatment of Quash + Topsin.

To determine a return on investment an economic analysis was performed on the data for the various white mold treatments. Canola price after the 2016 harvest was $0.15#. The cost for the various fungicide treatments were calculated based on average retail costs in the spring of 2016. Prices used for the various fungicide treatments were:

- Proline 4.3 oz/ac = $17.74
- Proline 5.7 oz/ac = $23.51
- Priaxor 6 oz/ac = $21.10
- Topsin 20 oz/ac = $6.88
- Quash 2 oz/ac = $13.75

Canola gross return from the untreated seeded in 6 inch rows was $357.45 and in 12 inch rows was $346.50. However, with the decreased seed cost when canola is seeded in 12 inch rows ($12/ac) the net return was $28.49 in 12 and $27.44 in 6 inch rows.

Canola return for the standard white mold treatment, Proline at 5.7 oz/ac applied at first petal fall was 2,624#/ac x $0.15# = $393.60. Canola return was the highest from a sequential treatment of Quash + Topsin 2,721#/ac x 0.15# = $408.15. Looking at the net profit return untreated canola in 6 inch rows and the standard white mold treatment (Proline 5.7 oz/ac) was $27.44 and $40.08, respectively.. The highest net return/ac was $57.51 from a sequential treatment of Quash applied at 20% bloom followed by Topsin applied at late bloom. This data indicates that in a year with moderate white mold pressure, the choice of fungicide for white mold control choice gave a range of canola net return/ac of $18.60 to $57.51.

Impact of Previous Crop on Soybean and Canola Yields

Principal Investigator: Dr. Brian Jenks, NDSU

Co-Principal Investigators:
Dr. Nancy Ehlke, Univ. of MN
Dr. Mike Ostlie, NDSU-Carrington
Dr. Jasper Teboh, NDSU-Carrington
Dr. Pravin Gautam, NDSU-Langdon
Bryan Hanson, NDSU-Langdon
Eric Eriksmoen, NDSU-Minot

Objectives

1: Determine if soybean yield is greater following canola than wheat
2: Determine if canola yield is greater following soybean than wheat

Materials and Methods

This trial will be conducted at three NDSU Research Extension Centers (Minot, Carrington, and Langdon) and at the MN Canola Production Center.

The experiment design was a randomized complete block with four replications. Individual research plots were 30 by 120 ft. Crops will be planted in research plots as shown in Tables 1 and 2 with one crop sequence from 2013-2015 and repeated in 2014-2016. Soil will be tested each year for N-P-K-S and plots fertilized for optimum crop growth. Tillage system and production practices will follow local grower practices to achieve optimal yields. Liberty Link canola will be used to more easily control volunteers in the following RR soybean crop. Short residual herbicides will be used in the wheat crop to avoid carryover concerns to following crops. Fungicides will be applied to reduce disease in each crop, in particular Sclerotinia in canola and soybean.

Data to be collected includes: yield, test weight, oil, protein, crop density, crop height, flowering date, physiological maturity, and disease evaluations for Sclerotinia in canola and soybean. Data will be evaluated using proper statistical procedures.

Table 1. Planned crop sequence to evaluate effect of previous crop on soybean and canola yield.

Treatment	2013	2014	2015
1	Wheat	Wheat	Soybean
2	Wheat	Canola	Soybean
3	Wheat	Wheat	Canola
4	Wheat	Soybean	Canola

Table 2. Repeat of planned crop sequence in Table 1.

Treatment	2014	2015	2016
1	Wheat	Wheat	Soybean
2	Wheat	Canola	Soybean
3	Wheat	Wheat	Canola
4	Wheat	Soybean	Canola

Results:

This three year trial was initiated in April 2014. Date collected in 2015 and 2016 is presented in Table 5. This trial was located 5 miles east of Roseau with cooperation of Peter Grafstrom. The experimental design was a RCDB with 4 reps. Fertilizer applied for soybeans was an 18-40-40-10s and for canola and wheat a 140-40-40-20S. All plots were seeded on April 30 in 2015 and May 7, 2016. Canola variety was In Vigor L252 and the Soybean variety was CZ0525LL. Liberty was applied at for weed control in canola and soybeans and Curtail and Tacoma was applied for weed control in wheat. Proline at 5.7 oz/ac was applied for disease control in canola and soybeans.

Canola yields and agronomic data is presented in Table 5. Soil residual nitrogen was higher from a wheat-soybean-canola than a wheat-wheat-canola rotation by 32 # in 2015 and 18 #/ac in 2016. Crop rotation did not influence canola height or plant stand. In 2015, significant canola shatter occurred from hail and wind prior to canola harvest. Actual canola yields were 1430#/A from the canola following wheat compared to 1,817#/A from canola following soybeans. This difference of 387#/A is significant at the 95% statistical confidence level. However, in 2016, crop rotation were not influenced crop rotation at the 95% confidence level. However, canola yield tended by be higher (237#/ac) from canola following soybeans compared to wheat.

Soybean plant height and plant stand were not influenced by crop rotation in 2015 or 2016 (Table 4). In 2015 soybeans were not harvested and individual plot treatment

data is not available. However, soybean growth and development at this site were tardy all season due to the cold soils at planting and above normal precipitation, especially in July and August. The seeding date of April, 30th may have been too early this year for soybeans as the soil temperature was cool during the month of May. Soybeans were harvested in 2016 and the data indicated that soybeans after canola yielded 4.8 bu/ac more than canola after wheat. Proline at 5.7oz/ac was applied for white mold control at this site.

Impact of Row Spacing and Seeding Rate on Canola Yields

Rationale and Significance: Canola is an important crop in the northern tier counties along the Canadian border of MN and ND, excluding the Red River Valley. The canola industry is always looking for ways to expand acres across the region by including it in rotations with other crops. Recently the Northern Canola Growers, Minnesota Canola Council and Bayer Crop Science have been working with American Crystal Sugar to address some of the concerns of growing canola in a rotation with sugarbeets. There is interest in knowing if the row spacing used in crops such as sugarbeets, soybeans, or corn could be used in canola production. Past canola research has shown there is no difference in yield between 6 and 12 inch row spacing, but limited data is available for canola seeded with wider row (15 to 24 inches) spacing. Current canola seeding rate recommendations are 9 to 12 pure live seed/square foot. Research is limited on reduced seeding rate with wider row spacing. This trial will be designed to answer the question of the proper canola seeding rate to use in wide row.

Approach The objective of the study would be to compare canola planted at three row widths: 6, 12 and 24 inches in combination with four seeding rates of 3, 6, 9, and 12 pure live seeds/square foot. There will be 12 total treatments. The experimental design will be a randomized complete block (RCB) with four replicates. Individual plots will be approximately 5 feet wide by 20 feet long. Best management practices will be followed for this canola trial and plots will be harvested with small-plot equipment. To protect against while mold development, a fungicide will be applied when canola in the 20 to 40% bloom stage. The canola hybrid used in this trial will be Bayer Crop Science InVigor L-140P. Field research sites for this trial will be at the MN CPC, the Langdon REC and Prosper (Fargo-main station), ND.

Data collection during the season includes percent ground cover, early season vigor, days to flower, days to maturity, lodging, plant height, and Sclerotinia infection ratings. Seed yield, oil content, contribution margins, and weather data will also be collected.

Results:
Agronomic data is listed in Table 5. Canola early season vigor had scores generally increased as seeding rate increased from 3 to 12 PLS/ft2 at all three row widths. Percent ground cover also increased as seeding rate increased from 3 to 12 PLS/ft2 at all three row widths. Plant lodging was more pronounced at all seeding rates from canola seeded in 24 inch rows than 6 or 12 inch rows. Canola bloom generally was earlier with high seeding rates at all row widths compared to low seeding rates

Canola yields in 2016 ranged from 2,310 to 2,787#/ac from the various canola row spacing and seeding rates (Table 5). In general, canola yields tended to be higher as the canola seeding rate increased from 3 to 12 PLS/square foot, especially at the 6 inch row spacing. With an LSD (0.05) of 318#/ac the only treatments that were statistically different from each other was canola at the high seeding rate vs. the low seeding rate spaced in 6 or 12 inch rows. Canola yields were NS for all seeding rates in the 24 inch

Net profit/ac was calculated based on canola yield and seed cost for the various seeding rates and row widths. Seed costs for LL-140-P was $12.30/#. The highest net profit/ac in 2016 was $91.90/ac from canola seeded at 3 PLS/ft2 in 6 inch rows. The lowest net return/ac was $10.52/ac canola seeded at 12 PLS/ft2 in 24 inch rows. In 2016 as seeding rate increased from 3 to 12 PLS/ft2 net return/ac decreased for all row widths. However, in 2015 the opposite observation was made as the higher seeding rate generally produced a higher net return/ac at all row widths. These data indicate that environmental conditions influence canola growth, development and yield and further research will be required to determine optimum row spacing and seeding rate for canola grown in northern MN environments.

Canola Shatter Trial

Objective:
To evaluate agronomic characteristics and variability to shatter (seed and pod) of canola varieties with different herbicide production systems (Liberty Link, Roundup Ready, and Sulfonylurea) grown under the climatic conditions of northern Minnesota.

Background:
A recent development in canola genetics are the release in varieties that are less prone to seed losses due to shatter. This development has given canola growers more confidence in a direct harvest strategy as opposed to the conventional swath and harvest method. New and emerging technologies, in canola varieties, give canola growers more options in variety selection for direct harvest of canola. Yield, lodging resistance, maturity, and crop quality are important variety traits for growers to consider when making variety selections. In addition, growers that plan to direct harvest canola would like information on the ability of the canola plant to hold seed and pods. This tendency to reduce shatter would improve harvest efficiency and reduce potential seed loss prior to harvest. Canola seed companies were invited to submit current and pending varieties for entry in the trial to compare against the same varieties in a small plot replicated variety research trial.

Methods:
All canola varieties were seeded in 12 inch rows at 9 PLS/ft.2 on May 18, 2016. The experimental design was a randomized complete block (RCB) with four replications. Individual plot size was 6 x 27 ft. Canola varieties evaluated included: Liberty Link, Roundup Ready and Sulfonylurea canola varieties.

All herbicides were applied on 6/22/16. Proline at 5.7 oz/ac was applied to all plots at 20% flowering for white mold control. To determine the level of shatter, two plastic collection pans were placed between canola rows in the front and back of each plot. The dimensions of these collection pans were 7 x 13 inches (0.63 ft2). Collection pans were placed in each plot (8/15/16) prior to traditional swathing time. Canola seed shatter and pod drop was identified at each sampling timing. Number of seeds that shattered in the pan were counted separately from the seeds that were contained within a pod when dropped in the collection pans. Seeds and pod shatter data was collected at weekly intervals for a total of four weeks.

Results:
A total of 19 canola varieties were entered in the 2016 CPC shatter trial (Table 6). A breakdown of the canola varieties: 15 Roundup Ready, 3 Sulfonylurea, 1 Liberty Link canola entries. Canola yields ranged from 1,769 to 2,623 #/ac.

The first seed collection date was 8/23/16 which was a week after canola would have been swathed. Canola seed shatter was observed from 7 of the 19 varieties (Table 6). The level of seed shatter was low (1 #/ac) and no pod drop was observed one week after swathing.

The second seed collection date was 8/30/16 and was close to the time swathed canola would have been harvested. Canola seed shatter was observed from 13 of the 19 varieties (Table 6). The level of seed shatter ranged from 1 to 3 #/ac. No canola pod drop was observed two weeks after normal swathing time.

The third seed collection date was 9/6/16 and was three weeks after swathing and one week after the harvest of swathed canola. Canola seed shatter was observed from all 19 varieties and pod drop observed from 7 of the 19 varieties (Table 6). The level of seed shatter ranged from 5 to 39 #/ac and seed from pod drop ranged from 0 to 14 #/ac.

The fourth seed collection date was 9/12/16 and was approximately four weeks after swathing and two weeks after the harvest of swathed canola. Canola seed shatter was observed from all 19 varieties and pod drop observed from 16 of the 19 varieties (Table 6). The level of seed shatter ranged from 11 to 56 #/ac and seed from pod drop ranged from 0 to 29 #/ac.
Canola varieties at this fourth seed collection date were “dead ripe” and were well past the time for direct harvest. The data in presented in the total column give an estimate of total canola seed loss from both seed shatter and seed from pod drop (Table 6).

Canola seed losses ranged from 29 to 128 #/ac. Genetic differences in level of seed shatter and pod drop were observed in this data set. However, in 2016 even though canola plants were “dead ripe” seed losses were not as high as would be anticipated by just looking at the mature canola plants.

Canola plants that are mature would be at an increased risk for adverse environmental conditions (wind, hail). The data from 9/22/16 (Table 6) was collected after several days of high winds (35+ mph). Total canola seed losses after several days of high wind events ranged from 201 to 2169 #/ac.

The results from this shatter trial indicate that genetic differences exist in canola seed and pod shatter. Canola seed losses from shatter, in the first two weeks, ranged from 0 to 3#/ac. This would be the most likely harvest widow for direct harvest canola. The data also indicates that the longer the mature canola plants remain in the field the higher chance for seed shatter and pod losses.

Table 1.

2016 Spring Canola Variety Trial

Rice Farms- 2 mi. north and 3.5mi. West of Roseau,Mn

University of Minnesota

Variety#	Company	Herbicide tolerance	Variety	Seeding [4] Rate (#/ac)	Yield #/acre	Yield % of mean[1]	Oil components[2] % oil[2]	% protein	Palmitic	Stearic	Oleic	Linoleic	Linolenic	% ground cover[3]	ESV[4]	Test Wt. #/bu.	Lodging[5]	Ht.(in.)	Flowering date begin	end	total
1	Bayer CropScience	LL	InVigor L130	5.2	**2113**	**98**	48.9	21.0	4.6	2.5	67	18	8.5	74	6.5	52	2	43	2-Jul	20-Jul	22
2	Bayer CropScience	LL	InVigor L140P	4.9	**2242**	**104**	48.7	20.0	4.4	2.5	68	18	8.1	64	5.5	51	2	44	30-Jun	19-Jul	20
3	Bayer CropScience	LL	InVigor L252	5.5	**2289**	**107**	51.7	19.0	4.2	2.1	66	20	8.8	64	5	53	2	47	2-Jul	20-Jul	18
4	Bayer CropScience	LL	InVigor 5440	5.8	**2310**	**108**	50.0	19.0	4.5	2.4	67	19	8.7	63	5.5	52	2	45	2-Jul	21-Jul	19
5	Mycogen	CL	2020CL	6.3	**2071**	**96**	51.6	20.0	4.0	2.7	75	16	1.5	63	3.5	52	3	45	2-Jul	22-Jul	20
6	Mycogen	CL	2022CL	8.3	**2006**	**93**	50.1	22.0	4.0	2.7	72	15	2.7	48	5.5	52	2	43	3-Jul	21-Jul	18
7	Cibus	SU	C1511	6.3	**2079**	**97**	47.9	22.0	5.0	2.4	66	19	9.5	63	5.5	52	2	45	30-Jun	25-Jul	26
8	Cibus	SU	C1516	5.9	**2060**	**96**	47.8	23.0	4.8	2.1	62	20	9.3	68	6.5	53	2	45	1-Jul	24-Jul	23
9	Cibus	SU	C5507	4.5	**2014**	**94**	48.8	21.0	4.5	2.5	65	18	8.6	63	5.5	51	3	44	30-Jun	22-Jul	23
10	Cibus	SU	C5522	5.4	**2114**	**98**	48.7	21.0	4.4	2.5	63	17	9.1	78	6	51	2	42	1-Jul	23-Jul	22
11	Cibus	SU	C5513	4.7	**1769**	**82**	47.1	22.0	4.7	2.4	63	19	9.0	70	5.5	53	2	45	1-Jul	27-Jul	26
12	Monsanto	RR	G49733	4.9	**2182**	**102**	52.9	18.0	4.4	2.1	69	20	8.3	45	3	52	5	34	29-Jun	19-Jul	21
13	Monsanto	RR	DKL70-10	5.2	**2191**	**102**	51.1	19.0	4.4	2.5	71	18	8.0	45	3.5	52	4	37	30-Jun	20-Jul	21
14	Monsanto	RR	DKL70-07	5.8	**1869**	**87**	53.1	18.0	4.5	2.3	71	19	7.6	66	5	52	3	35	28-Jun	19-Jul	22
15	Monsanto	RR	DKL71-14BL	4.7	**2178**	**101**	53.5	17.0	4.3	2.1	72	20	8.0	63	4.5	52	4	36	29-Jun	19-Jul	21
16	Monsanto	RR	DKL70-50CR	7.8	**2071**	**96**	52.3	18.0	4.5	2.5	71	19	7.1	60	5.5	52	4	38	28-Jun	20-Jul	23
17	DuPont Pioneer	RR	46M34	5.5	**1925**	**90**	52.4	19.0	4.3	2.2	71	19	8.1	48	4	52	4	39	29-Jun	20-Jul	22
18	Integra Seed/Wilbur Ellis	RR	7150	4.1	**2035**	**95**	53.2	18.0	4.5	2.2	71	19	8.2	45	4	51	5	37	29-Jun	20-Jul	22
19	Mycogen	RR	1020RR	5.1	**1982**	**92**	50.4	19.0	4.5	3.2	79	15	2.7	60	5	50	3	40	2-Jul	22-Jul	20
20	Mycogen	RR	1022RR	5.6	**1800**	**84**	51.0	19.0	4.3	3.2	78	14	2.6	53	4	51	1	41	2-Jul	24-Jul	22
21	BrettYoung	RR	6074 RR	4.8	**2109**	**98**	50.4	18.0	4.6	2.5	70	19	8.6	48	3.5	52	2	42	30-Jun	24-Jul	25
22	BrettYoung	RR	BY15-754	4.9	**1709**	**80**	50.4	20.0	4.4	2.6	69	17	8.1	48	3.5	50	3	38	1-Jul	20-Jul	19
23	CROPLAN	RR	HyClass 930	5.7	**2453**	**114**	53.9	18.0	4.4	2.2	70	19	8.1	60	4.5	52	4	36	28-Jun	19-Jul	22
24	CROPLAN	RR	HyClass 955	5.2	**2391**	**111**	53.5	18.0	4.3	2.1	69	20	8.1	68	5.5	52	4	38	28-Jun	20-Jul	23
25	CROPLAN	RR	HyClass 970	6.0	**2291**	**107**	52.8	19.0	4.4	2.3	70	19	7.1	53	4.5	52	2	37	29-Jun	21-Jul	23
26	CROPLAN	RR	HyClass 972	5.1	**2390**	**111**	52.0	19.0	4.5	2.4	70	18	8.5	58	5	52	1	40	29-Jun	20-Jul	22
27	Monsanto	RR	G35153	7.4	**2479**	**115**	52.1	20.0	4.5	2.1	67	20	8.5	58	4.5	52	4	37	28-Jun	20-Jul	23
28	Monsanto	RR	G49720	6.0	**2295**	**107**	51.2	20.0	4.5	2.3	67	20	8.4	58	4.5	52	5	37	28-Jun	19-Jul	22
29	Monsanto	RR	DKL38-48	5.4	**2220**	**103**	51.4	19.0	4.2	2.3	69	19	7.5	66	6.5	53	4	38	28-Jun	19-Jul	22
30	DuPont Pioneer	RR	45H33	5.7	**2488**	**116**	51.1	19.0	4.5	2.7	73	17	7.5	74	6.5	50	3	45	29-Jun	21-Jul	23
31	Integra Seed/Wilbur Ellis	RR	7257R	4.6	**2316**	**108**	51.2	20.0	4.7	2.1	66	21	8.3	50	4	52	5	39	29-Jun	19-Jul	21
32	Star Specialty Seed	RR	Star 402	5.1	**2623**	**122**	54.3	18.0	4.4	2	70	20	8.1	63	5	52	4	42	29-Jun	20-Jul	22
33	Proseed	RR	300 Magnum	4.9	**2422**	**113**	52.6	19.0	4.6	2.2	70	19	6.7	65	5	52	4	39	29-Jun	21-Jul	23
34	Nuseed	RR	GT50	7.3	**1807**	**84**	47.8	21.0	4.8	2.4	66	20	8.8	79	6	52	4	36	28-Jun	20-Jul	23
35	Nuseed	RR	NCH13G046	7.2	**1781**	**83**	47.7	20.0	4.5	2.4	65	19	9.0	64	5.5	53	5	37	28-Jun	20-Jul	23
36	BrettYoung	RR	6080 RR	5.1	**2356**	**110**	50.6	20.0	4.6	2.5	69	18	8.5	65	4	52	2	39	29-Jun	21-Jul	23
37	BrettYoung	RR	BY16-768	4.9	**2020**	**94**	49.9	20.0	4.7	2.6	69	18	8.3	65	4	51	3	36	30-Jun	20-Jul	21
			LSD @ 5% Level		**295**	**13**	1.0	**1.0**	0.4	0.1	1.9	0.6	0.4	14	1.5	1	1	3	2.3	1.5	
			CV(%)		9.8	9.8	1.4	3.5	4	3.2	2	2.4	4	17	22	0.5	33	5.6	5.5	5.1	

*Seeding rate= All plots seeded at 12PLS/Ft.[2]

[1] Mean trial yield=2147#/ac.

[2]All quality on dry matter basis

[3]% ground cover June 15

[4] ESV(early season vigor)-June 15-- 9= best;1=least

[5]Lodging-1=Upright; 9=Flat

Table 2.

2016 Canola Fertility Trial- University of Minnesota

Location- Rice Farms northwest of Roseau,Mn[1]

	N' Rate	Yield	Net[1]	Added	Yield as % of Mean						%Ground	Begin	End					
	PPI	#/ac	treatment	fertility cost					4 Yr.[2]	ESV[3]	cover	Bloom	Bloom	Harvest				
Trt#	Urea	2016	2016	2016	2016	2015	2014	2013	Ave		6/17	Date	Date	Ht.(in.)	Lodging	RCI[4]	%Protein	% Oil
1	0	1778	**$-38.16**	0	67	72	76	73	**72**	4.5	61	6/27	7/19	34	3.3	292	18.0	54.0
2	90	2602	**$55.74**	$29.70	98	95	99	96	**97**	4.5	58	6/28	7/19	41	4.0	312	18.4	53.7
3	135	2883	**$83.04**	$44.55	108	98	110	106	**106**	4.5	55	6/29	7/19	44	5.8	335	20.0	51.9
4	180	2793	**$54.69**	$59.40	105	105	106	111	**107**	4.0	53	6/29	7/20	44	5.8	292	20.8	51.0
							(All PPI) urea only =		**103**									
All PPI- 50%Urea+50%ESN																		
5	90	2640	**$54.24**	$36.90	99	87	95	98	**95**	5.0	64	6/28	7/19	41	4.0	314	18.3	54.0
6	135	2719	**$47.64**	$55.35	102	106	110	109	**107**	4.5	60	6/29	7/20	42	6.8	298	19.7	52.2
7	180	3036	**$76.74**	$73.80	114	117	104	120	**114**	4.5	60	6/29	7/19	42	6.5	312	21.1	50.9
							(All PPI) 50% urea+50% ESN=		**105**									
PPI urea/+Post liquid streamer(UAN 28%N= 3#N/gal)[5]																		
8	45/+45	2604	**$70.89**	$34.88	98	n/a	n/a	n/a	**N/A**	5.0	70	6/28	7/19	41	5.0	280	18.0	54.1
9	45/+90	2554	**$63.39**	$54.91	96	n/a	n/a	n/a	**N/A**	3.5	59	6/29	7/20	41	5.3	260	19.6	51.9
10	45/+135	2856	**$108.69**	$74.93	107	n/a	n/a	n/a	**N/A**	4.0	66	6/30	7/20	40	5.5	344	19.7	52.1
PPI Urea/+ Post Urea+Agrotain Ultra																		
11	45/+45	2416	**$42.69**	$32.63	91	103	104	96	**98**	3.5	50	6/29	7/20	38	5.3	271	18.6	53.2
12	45/+90	2808	**$101.49**	$50.40	106	107	107	112	**108**	4.0	61	6/29	7/20	39	5.8	279	19.7	52.3
13	45/+135	2871	**$110.94**	$68.19	108	115	118	115	**114**	4.0	60	6/30	7/21	38	6.8	299	20.4	51.4
							PPI 50%urea/+Post 50% urea+Agrotain =		**107**									
LSD @5% Level		269			10	17	9	15		NS	14	1	1	4	2	60	1.2	1.4
CV(%)		7			7	12	7	10		26	16	2	4	7	27	14	5	2
					2658	2854	3007	2344	2715									

Variety= Star 402RR

[1]Net treatment=Profit per acre for each fertility treatment or Gross treatment return- costs

[2]4 year average yield per treatment; Each 1% difference =27#/acre

[3]ESV(Early Season Vigor) 6/17/16-visual rating 1=least ;9=best

[4]RCI (Relative Chlorophyll Index) 7/15/16- higher number =more chlorophyll

[5]Only 1 year data on post emerge liquid applications- 4 year summaries not applicable(NA)

45#PPI urea-N /+ Post Liquid 28%UAN- 6/16/16

Fertilizer applications-

26-40-40-20s to all plots 5/5/2016

Post emerge dry fertilizer 6-14-16--4 leaf Growth stage

swathed 8-16-16

combined 8-31-16

Prices used=	Unit price-(per#/N)
Urea--$305/ton	0.330
ESN--$435/ton	0.494
28%N--$250/ton 3#/gal	0.445
Agrotain Ultra(Factor)--	0.065

Agrotain Ultra(Factor)--$160/ton(3pts./ton)

920#N($.065/pound N)

Fertilizer applied(other than N) $32

cost of all inputs/acre except N treatments= $306.86

Table 3.

2016 Fungicide Applications to Canola

Roseau,Mn.

Trt.#	Fungicide treatment	Application Rate/acre	Treatment Cost	Treatment Timing	Yield #/acre	Gross return[1] per acre	Net profit per acre	Treatment cost	Treatment Return[6]	ESV[2] 6/23	Bloom First	Bloom End	Harvest Ht.(in.)	Harvest Lodging[3]	Scleritinia incidence[4]	Scleritinia severity[5]	% oil	% protein
1	**No treatment---6" rows**				**2383**	$357.45	$27.44	$0.00	$0.00	5.0	6/27	7/19	41	4.5	2.8	4.3	54.0	18.4
2	**No treatment---12" rows**				**2310**	$346.50	$28.49	-$12.00	$1.05*	4.5	6/27	7/20	40	4.3	2.3	4	53.0	18.5
3	Proline	4.3oz.	$17.74	7/6	**2566**	$384.90	$37.15	$17.74	$27.45	5.0	6/27	7/19	38	4.0	1.8	2.3	53.0	18.7
4	Proline	5.7oz.	$23.51	7/6	**2624**	$393.60	$40.08	$23.51	$36.15	4.5	6/27	7/20	41	4.5	1.5	2	54.0	18.2
5	Priaxor	6oz.	$21.10	7/18	**2609**	$391.35	$40.24	$21.10	$33.90	4.5	6/27	7/20	41	4.5	2.3	3.5	54.0	18.3
6	Proline/Priaxor	5.7oz+6oz		7-6 & 7-18	**2583**	$387.45	$18.60	$38.84	$30.00	6.0	6/27	7/18	43	4.8	1.3	1	54.0	18.2
7	Topsin	20oz.	$6.88	7/6	**2502**	$375.30	$38.41	$6.88	$17.85	4.5	6/27	7/19	41	4.8	2	3	53.0	18.9
8	Quash/Topsin	2oz.+20oz.	13.75+ 6.88	7-6 & 7-18	**2721**	$408.15	$57.51	$20.63	$50.70	6.0	6/27	7/18	45	4.5	1.8	2.5	54.0	17.8
			LSD @5% level		407					NS	NS	1	6	0.7	0.7	1	NS	1
			CV(%)		11					30	0	4	10	11	23	25	1	4

Variety= Star 402RR Seeding rate=12.5PLS(except treatment #2 is 9PLS)

*Seed cost reduced by $12/acre with this treatment planted in 12" rows

[1]Canola price used for gross return=$.15/#

Cost of production using ND Farm Management budget for 2016

[2] ESV(early season vigor)-June 15-- 9= best;1=least

[3]=Lodging ;1=none, 9=flat

[4]=incidence; 1=none,10=100% plants infected

[5]=severity; 1=few lesions,2=large branch dead,3=several branches dead,4=stem girdling with dead branch,5=stem girdling with white plant

[6]=Net return on fungicide application and saving on seeding rate reduction in treatment 2.

First fungicide application 7/6/2016 GS= 20% flowering

Late fungicide application 7/18/2016 =GS late bloom

Fungicide applications made with CO2 backpack @ 17gpa--30psi

All fungicide treatments add 1pt./100 gallon Preference (.05%NIS)

Fungicide formulations:

Trade name	common name	Ai/#gal
Proline 480SC	prothioconazole	4
Priaxor	fluxapyroxad+pyraclostrobin	1.39+2.78
Warrior II	Lambda-cyhalothrin	2.08
Quadris Flowable	azoxystrobin	2.08
Topsin	thiophanate-methyl	4.5

Table 4.

2015-16 Canola/Soybean Rotation Trial

Roseau,Mn. [1]

Canola

Rotation				2015 Actual Harvested Yield	Soil [2] Residual NO3-N	Visual shatter[3] (#/ac)	Visual shatter[4] (#/ac.)	Ht(in.) 6/24/15	Ht(in.) harvest	Stand[6] 6/24/15	Oil	2016 Yield(#/acre) 2016	2015-16 Mean	Soil [2] Residual NO3-N	Stand[6]	oil[7]	HT	sclerotinia incidence	sclerotinia severity
		2015/16	TRT#	**Yield**	NO3-N	(#/ac)	(#/ac.)	6/24/15	harvest	6/24/15	Oil		Mean	NO3-N				incidence	severity
wheat	wheat	**canola**	3	**1430**	25	257	649	19	41	407000	52	2309	1998	23	500000	48.1	43	1	1.7
wheat	soybean	**canola**	4	**1817**	57	282	548	21	41	367000	49	2546	2323	41	516000	48.2	46	1.7	3
		LSD @5% level		**108**		NS	NS	NS	NS	NS	2	NS(360)	280		NS(127000)	NS(4)	NS(7)	NS(.8)	0.8
		CV(%)		3		21	14	7	5	17	2	7	5		11	3	7	25	15

Soybean

Rotation				2015 Ht(in.) 6/24/15	Ht(in.) harvest	Stand[6] 6/24/15	2016 Grower	M2	harvest ht	stand 06/14/16	stand harvest
		2015/16	TRT#				**Bu/ac.**				
wheat	wheat	**soybean[5]**	1	6	29	192000	**50.6**	52	21	183300	178250
wheat	canola	**soybean[5]**	2	6	28	192000	**55.4**	51.1	21	150800	153625
		LSD @5% level		NS	NS		**1.4**	NS(6.5)	NS(3)	NS(95000)	NS(55000)
		CV(%)		10	2		1	5	5	28	14

Experimental Design- RCB w/4reps

Plot size=30' x 120'

Canola variety- InVigor L-252 Soybean variety-CZ 0525 LL

[1]-Location is Peter Grafstrom Farm- 4 miles east of Roseau.

[2]-2 composite soil samples taken per treatment 4/16/2015&5/5/2016-- residual #N/ac. 0-24"

[3]-2015 Shattered seed loss on the ground counted prior to harvest- 2- 0.25m2 area/plot.

[4]-2015 Visual estimate of shattered seed and bird predation prior to harvest.

[5]-2015 Soybeans were mistakenly not harvested.

[6]Stand=Counted plants per acre

[7]Oil=% oil and seed yield on 8.5% dry matter basis

Plot Management-

Fertilizer applications made 4/14/2015 & 5/5/2016 w/12' Gandy spreader

Soybeans=18-40-40-10s

Canola and Wheat= 140-40-40-20s

All plots seeded by cooperator 4/30/2015 and 5/7/2016

22oz. Liberty +1gal AMS applied 6/12/2015 to canola and soybeans and 6/9/2016 to canola.

16oz. Roundup PowerMax+1pt. AMS 6/9/2016 to soybeans.

canola fungicide application-

Prosaro 6.5 oz.+1.28oz. Grizzly+ 4oz. Trophy Gold Advance/ acre applied 7/2/2015

Proline 5.7oz.+ 4oz. NIS 7/8/2016

Table 5.

2015-16 Canola Row Spacing-Seeding Rate Study

Roseau,Mn.

		Seeding Rate																							
	Row		2015	2016		**Seed Yield(#/ac.)**			**$$Net Profit/acre**			2016	Stand[2]			ESV[4]		%Ground cover		Lodging[5]		Harvest ht.(in.)		first bloom		end bloom	
Trt.#	Spacing	PLS/Ft.2	#/acre	#/acre	pls/ac.	2015	2016	2Yr. Ave.	2016	2015	**2015-16**	%oil	6/18/15	6/8/16	harvest	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016
1	6"	3	1.6	1.3	131000	2518	**2706**	**2612**	$91.90	$62.09	**$77.00**	48.8	126000	138000	196000	6.0	5	53	38	2.0	3.3	52	47	7/11	7/2	7/28	7/21
2	6"	6	3.2	2.6	261000	2636	**2787**	**2712**	$89.29	$62.19	**$75.74**	48.9	175000	285000	261000	7.0	6	78	63	2.0	3.3	54	46	7/10	7/1	7/27	7/20
3	6"	9	4.8	3.8	392000	2850	**2533**	**2692**	$35.69	$76.69	**$56.19**	49.3	232000	415500	407000	8.3	8	90	83	2.0	2.8	54	45	7/9	7/1	7/27	7/19
4	6"	12	6.4	5.1	523000	3194	**2590**	**2892**	$27.76	$110.69	**$69.23**	49.2	318000	456000	537000	8.8	8	88	88	2.3	3	53	46	7/9	6/30	7/27	7/19
5	12"	3	1.6	1.3	131000	2692	**2498**	**2595**	$60.70	$88.19	**$74.45**	48	79000	142000	152000	6.5	5	53	45	2.0	3.8	53	50	7/11	7/2	7/28	7/22
6	12"	6	3.2	2.6	261000	2972	**2310**	**2641**	$17.74	$112.59	**$65.17**	49.4	153000	231000	202000	7.3	6.5	78	53	2.3	2.8	52	46	7/10	7/1	7/27	7/20
7	12"	9	4.8	3.8	392000	2901	**2695**	**2798**	$59.99	$84.34	**$72.17**	48.7	172000	303000	269000	8.3	8	83	70	2.3	4.5	51	49	7/9	6/30	7/26	7/19
8	12"	12	6.4	5.1	523000	3337	**2500**	**2919**	$14.26	$132.14	**$73.20**	49.5	235000	378000	362000	8.5	7.5	88	70	3.0	3.3	51	45	7/9	6/30	7/26	7/20
9	24"	3	1.6	1.3	131000	2898	**2568**	**2733**	$71.20	$119.09	**$95.15**	48	72000	104000	90000	7.0	4.5	43	25	2.3	6.3	52	47	7/10	7/3	7/28	7/22
10	24"	6	3.2	2.6	261000	2561	**2391**	**2476**	$29.89	$50.94	**$40.42**	47.6	134000	157000	204000	7.5	6.5	50	33	3.3	7.3	52	49	7/10	7/2	7/27	7/22
11	24"	9	4.8	3.8	392000	2822	**2376**	**2599**	$12.14	$72.49	**$42.32**	48.1	176000	212000	241000	8.3	7	58	38	4.8	6.8	52	48	7/10	7/2	7/27	7/20
12	24"	12	6.4	5.1	523000	3018	**2475**	**2747**	$10.51	$84.29	**$47.40**	48.1	238000	282000	294000	7.8	7.5	53	40	4.8	7.3	50	50	7/9	7/2	7/26	7/20
	LSD @5% level					518	**318**	**320**				1.1	79	63000	81000	1.0	1.7	13	12	1.1	2	3	4	1	2	1	1
	CV(%)					12	8	8				2	16	17	21	8	18	13	16	29	31	4	6	7	4	3	4

Planting date- May 23-2015 ;May 18-2016

2016 Canola variety- InVigor LL-140P (105000 PLS/#)

2015 Canola variety- InVigor L-252 (82100 PLS/#)

Seed cost of L-140P is $12.30/LB in 2016

Seed cost used for L-252 was $11.00 in 2015

[2]Stand=Counted plants per acre (2- 2ft.plant counts/row/per plot)

[3]%survival=stand/seededPLS

[4]ESV(Early Season Vigor)-visual rating 1=least ;9=best

[5]Lodging ;1=none, 9=flat

All production cost without seed cost=$298.01

Table 6.

2016 Canola Variety Shattering Trial

Rice Farms- 2 mi. north and 3.5mi. West of Roseau,Mn

University of Minnesota

	Company	Herbicide tolerance	Variety	Seeding * Rate #/ac.	Yield[1] #/acre	ESV[4]	% Ground cover[3]	Harvest Lodging[5]	26-Sep visual[2] shattering	#/acre---- Shattered or pod dropped[7] shatter 23-Aug	shatter 30-Aug	shatter 6-Sep	pod 6-Sep	All 6-Sep	shatter 12-Sep	pod 12-Sep	All 12-Sep	shatter 15-Sep	**Total Lost[6]**	shatter 22-Sep	pod 22-Sep	All 22-Sep	Total Lost	Relative maturity[8]
1	Monsanto	RR	G49733	3.7	2182	5.0	43	4.8	1.0	0	0	13	0	13	13	0	13	11	**37**	67	134	201	238	L
2	Monsanto	RR	DKL70-10	3.9	2191	4.5	38	3.5	1.0	0	0	21	0	21	19	10	29	13	**64**	82	168	250	314	L
3	Monsanto	RR	G35153	5.6	2479	5.0	53	5.3	1.0	0	0	15	0	15	19	0	19	15	**49**	71	183	254	303	E
4	Monsanto	RR	G49720	4.5	2295	5.5	55	5.0	1.0	0	1	19	0	19	41	12	53	15	**87**	79	117	196	283	M
5	BrettYoung	RR	6080 RR	3.8	2356	5.0	55	2.0	2.8	1	0	24	5	30	44	10	54	40	**123**	670	435	1105	1229	M
6	BrettYoung	RR	6074 RR	3.6	2109	4.5	38	1.0	3.5	1	3	45	0	45	37	5	42	9	**99**	858	613	1471	1570	ML
7	CROPLAN	RR	HyClass 930	4.3	2453	5.0	48	2.0	1.8	0	1	17	6	23	17	6	22	8	**54**	162	128	290	344	E
8	CROPLAN	RR	HyClass 955	3.9	2391	5.0	58	2.8	1.3	0	1	18	0	18	22	5	27	14	**61**	127	97	224	286	M
9	CROPLAN	RR	HyClass 970	4.5	2291	4.5	45	1.3	2.5	0	0	30	6	36	23	18	41	12	**89**	444	1725	2169	2258	M
10	CROPLAN	RR	HyClass 972	3.8	2390	5.0	48	5.3	2.5	1	1	30	0	30	11	5	16	9	**56**	388	763	1151	1208	M
11	Integra Seed/Wilbur Ellis	RR	7257R	3.5	2316	5.5	48	6.0	1.0	0	0	31	0	31	25	18	44	8	**83**	89	119	208	290	ME
12	Star Specialty Seed	RR	Star 402	3.8	2623	5.0	48	2.3	2.0	0	1	25	0	25	16	10	26	13	**67**	443	146	589	656	M
13	Nuseed	RR	GT50	5.5	1807	6.5	65	2.5	1.5	1	0	23	14	37	32	29	61	14	**112**	248	537	785	897	M
14	Nuseed	RR	NCH13G046	5.4	1781	5.0	50	6.5	1.0	0	2	32	7	39	56	14	70	17	**128**	111	198	309	438	M
15	DuPont Pioneer	RR	46M34	4.1	1925	5.0	43	2.8	1.3	1	3	30	0	30	14	11	25	20	**79**	111	363	474	553	L
16	Cibus	SU	C5507	3.4	2014	5.5	53	1.3	3.3	0	2	23	9	31	29	9	38	28	**100**	470	129	599	699	M
17	Cibus	SU	C5522	4.1	2114	6.0	65	1.0	2.8	1	2	21	0	21	22	5	27	22	**73**	586	234	820	893	M
18	Cibus	SU	C5513	3.5	1769	5.5	58	1.0	5.0	1	2	28	9	37	53	14	67	12	**119**	1222	83	1305	1424	M
19	Bayer CropScience	LL	InVigor L140P	3.7	2242	7.0	60	1.5	1.0	0	1	5	0	5	13	0	13	9	**29**	77	125	202	231	M
				LSD @5%level		1	10	1.7	0.5	ns	2	16	11	21	29	20	44	20	**54**	207	333	436	438	
				CV(%)		13	14	42	20	193	138	49	275	55	77	154	85	94	47	44	71	46	41	

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

Planted May 18,2016

[1] Seed yields taken from variety trial

Plot size= 6' x 27' --planted in 12" rows

[2]Visual shattering estimate- 1=no shattering; 5=most shattering

[3]% ground cover June 15

[4] ESV(early season vigor)-June 15-- 9= best;1=least

[5]Lodging-1=Upright; 9=Flat

[6]Total lost=Total measure dehisced seed + pod dropped seed(ie.total all lost seed) Through 9/15/2016

[7]Shatter=shattered seed; pod=seed contained in pods dropped ; all=total all lost seed, shattered+pod drop. Seed collected in 2- plastic 7" x 13" boxes/plot(.63ft.2)

[8]Relative maturity= Early,Medium Early,Medium,Medium Late,or Late

Conversions-

Seed weights used =counted seed x 1.24 of company provided seed weights of planted seed

Seed lost in dropped pods= about 36 seeds/pod

Table7.

Budget Margins for Various Management Regimes

2015-16 Canola Row Spacing-Seeding Rate Study
Roseau,Mn.

	Row	Seeding Rate*			Net return of treatments				Seed Yield(#/ac.)		
Trt.#	Spacing	PLS/Ft.2	2015#/ac	2016#/ac	2016	2015	2015-16	Net return[1]	2015	2016	2Yr. Ave.
1	6"	3	1.6	1.3	$91.90	$62.09	$77.00	**$7.77**	2518	2706	2612
2	6"	6	3.2	2.6	$89.29	$62.19	$75.74	**$6.51**	2636	2787	2712
3	6"	9	4.8	3.8	$35.69	$76.69	$56.19	**$-13.04**	2850	2533	2692
4	6"	12	6.4	5.1	$27.76	$110.69	$69.23	**$0**	3194	2590	2892
5	12"	3	1.6	1.3	$60.70	$88.19	$74.45	**$1.25**	2692	2498	2595
6	12"	6	3.2	2.6	$17.74	$112.59	$65.17	**$-8.03**	2972	2310	2641
7	12"	9	4.8	3.8	$59.99	$84.34	$72.17	**$-1.03**	2901	2695	2798
8	12"	12	6.4	5.1	$14.26	$132.14	$73.20	**$0**	3337	2500	2919
9	24"	3	1.6	1.3	$71.20	$119.09	$95.15	**$47.75**	2898	2568	2733
10	24"	6	3.2	2.6	$29.89	$50.94	$40.42	**$-6.98**	2561	2391	2476
11	24"	9	4.8	3.8	$12.14	$72.49	$42.32	**$-5.08**	2822	2376	2599
12	24"	12	6.4	5.1	$10.51	$84.29	$47.40	**$0**	3018	2475	2747

Base cost $ 298.86/ac.(Without seed)

[1]Net return= High seeding rate vs. lower seeding rate comparison in each row spacing treatment.

2016 Canola Fertility Trial- University of Minnesota
Roseau,Mn

	Trt#	N' Rate PPI	**Yield #/ac**	**Net return Per treatment**
		Urea	2016	2016
	1	0	1778	**$-38.16**
	2	90	2602	**$55.74**
	3	135	2883	**$83.04**
	4	180	2793	**$54.69**
	All PPI- 50%Urea+50%ESN			
	5	90	2640	**$54.24**
	6	135	2719	**$47.64**
	7	180	3036	**$76.74**
PPI/+Post liquid streamer(UAN 28%N= 3#N/gal)				
	8	45/+45	2604	**$70.89**
	9	45/+90	2554	**$63.39**
	10	45/+135	2856	**$108.69**
PPI Urea+ Post/Urea+Agrotain Ultra				
	11	45/+45	2416	**$42.69**
	12	45/+90	2808	**$101.49**
	13	45/+135	2871	**$110.94**

Base cost $ 306.86/ac.(without) nitrogen--

2016 Fungicide Applications to Canola
Roseau,Mn.

		Application	Treatment		**Yield**	**Treatment**
Trt.#	Fungicide treatment	Rate/acre	Cost	Timing	**#/acre**	**Return[1]**
1	**No treatment---6" rows**				**2383**	$0.00
2	**No treatment---12" rows**				**2310**	$1.05
3	Proline	4.3oz.	$17.74	7/6	**2566**	$27.45
4	Proline	5.7oz.	$23.51	7/6	**2624**	$36.15
5	Priaxor	6oz.	$21.10	7/18	**2609**	$33.90
6	Proline/Priaxor	5.7oz+6oz	$23.51+$21.10	7-6 & 7-18	**2583**	$30.00
7	Topsin	20oz.	$6.88	7/6	**2502**	$17.85
8	Quash/Topsin	2oz.+20oz.	13.75+ 6.88	7-6 & 7-18	**2721**	$50.70

Base cost $ 328.86/ac.(without) fungicide--

[1]Treatment return=Increase in profit over no fungicide application and seeding in 6" rows

Base production cost variables-

Seed= $48-$62.73/ac. ($9.60- $12.30/#)

Fertilizer- P+k+AMS= 24-40-40-20s =$32/ac 120-0-0 =$40/acre

Fungicide= $18/acre

Other production costs of production determined using ND Farm Management budget for 2016