2015 Minnesota Canola Production Center (CPC)

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

2015 Research Summary Report

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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 and organizations 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 Canola Production Center. This generous support has made the Minnesota Production Center a research project that benefits, not only canola growers in Minnesota, but canola growers in the entire region.

A special thank you goes to Magnusson Farms Incorporated for land and field preparation for the small plot canola trials, Hugh Hunt for large plot canola swathing compared to direct harvest and Peter Grafstrom for land, field preparation and harvest assistance with the large on-farm three year canola rotation trial.

SITE INFORMATION – 2015 MN Canola Production Center (CPC)

Location: Approximately, 5 miles NW of Roseau, MN

Cooperator: Magnusson Farms Incorporated

Previous Crop: Wheat

Soil Test Results:

Macronutrient Level:	
Nitrogen – 0-6 inch	25 #/acre
Nitrogen – 6-24 inch	17 #/acre
Phosphorous -	8 ppm
Potassium -	114 ppm

Target Yield:	2500 #/acre
Fertilizer Applied (#/acre):	N - 140; P - 40; K - 40; S - 20s
%Organic Matter:	3.7
Soil pH:	7.9

Tillage Operations: The entire experimental site was tilled with a field cultivator prior to a broadcast fertilizer application. A second pass with a field cultivator and harrow was completed prior to planting.

Fertilizer Applied: A base fertility program of 26-40-40-20s was applied to the entire area. The canola variety trial, fungicide trial and seeding rate area received 140 units of urea nitrogen (46-0-0). The fertility trial area received various nitrogen sources, rates and timings as per trial protocol.

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

Herbicides Applied: 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

Comments: Total precipitation in the fall of 2014, winter and early spring of 2015 were below normal. However, rainfall was above normal in May, June and July. Daily maximum and minimum temperatures were approximately 5 degrees below normal in May-July during the 2015 growing season (Source: NDAWN). Further, accumulated rainfall during the growing season (April-July) was 5.63 inches above normal at Roseau, MN. The cool weather coupled with surplus soil moisture was an ideal environmental condition for the 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. In general, lighter textured soil had more uniform canola stands than the heavy fine textured soils. 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. With flea beetles controlled, subsequent canola growth and development was good to excellent going into summer.

In 2015, white mold infestations were moderate to severe at the CPC. White mold occurrence in the region was variable largely depended upon 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 2015 season. Insect pressure, other than early season flea beetles, were also at a low levels in the 2015 growing season.

The Minnesota Canola Production Center (CPC) had three field locations in 2015. The small plot replicated canola research trials were conducted near Roseau with cooperation of Magnusson Farms Inc. The three year canola rotation trial was initiated in Roseau County (Spruce Township, Section 13) with cooperation of Peter Grafstrom. The large on-farm trial that compared canola yields from swathing and direct harvest was in Kittson County in cooperation with Hugh Hunt. The Grafstrom and Hunt large plot on-farm trials were performed with commercial farming equipment with the cooperation of Mr. Grafstrom and Mr. Hunt.

The public canola trials conducted at the 2015 CPC included:

- Small plot canola variety trials
- Small plot fertility nitrogen source, rate and timing trial
- Small plot seeding rate x row spacing trial
- Small plot canola fungicide trial
- Canola rotation trial
- Large plot swathed vs.direct harvest canola

Small Plot Variety and Systems Trial

Objective:
To evaluate agronomic characteristics of canola varieties with different herbicide production systems (Roundup Ready, Liberty Link and Clearfield) 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 variety selections. Canola seed companies were invited to submit current and pending varieties for entry in the trials to compare against similar varieties in a small plot replicated research trial.

Methods:
All varieties were seeded at 13 PLS/ft.2 (or 5 #/acre if PLS was not given) on May 23, 2015. The experimental design was a randomized complete block (RCB) with four replications. Individual plot size was 5 x 27 ft. and end-trimmed to a harvest area of 5 x 20 ft. Roundup Ready, Liberty Link, and Clearfield canola varieties were planted in separate blocks with buffers to minimize the influence of potential herbicide drift. Roundup and Liberty were applied on 6/18/15 and Beyond was applied on 6/13/15. Early canola varieties were swathed on 8/21/15 and harvested on 9/9/15. Late canola varieties were swathed on 8/25/15 and harvested on 9/16/15. Harvested canola was 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 27 canola varieties were entered in the 2015 CPC (Table 1). A breakdown of the canola varieties: 20 Roundup Ready, 4 Liberty Link and 3 Clearfield canola entries. Canola yields ranged from 2,085 to 3,212 #/acre. The trial average yield was 2,620 #/acre.

The top-yielding canola varieties were: InVigor L252, HyClass 970, Mycogen CL2562966H and Monsanto 74-44BL. Statistical analysis at the 5% level of confidence

(351#/acre) suggests these 4 canola varieties did not differ from each other in yield. Average canola yield for these 6 varieties were 3,037 #/acre and at $16/cwt would be a gross dollar return of $486/acre.
All varieties exhibited good early season vigor. First flower date ranged from July 1st to July 9th with the end of flowering ranging from July 29th to August 4th. Percent oil, protein, lodging plant height and other agronomic information is summarized in Table1.

Nitrogen Fertility Trial

Objective:
To evaluate canola yield response from various rates of urea applied at PPI and post emergence (3-5 leaf canola, applied 6/15/15), with and without the nitrogen stabilizer Agrotain®. Urea was also applied PPI in combinations with a coated urea product ESN (environmentally smart nitrogen). To validate results under different conditions and over time, this trial was conducted in 2013 and 2014 as well.

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 with and without the nitrogen stabilizer Agrotain®. This study was initiated to evaluate the canola yield response to various rates, timings and combinations of urea with ESN and urea applied with and without the nitrogen stabilizer, Agrotain® Ultra.

Methods:
In 2015, the canola variety, InVigor LL252 was seeded at 13 PLS/ft.2 on 5/23/15. 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 of 42 #/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, 45, 90, 135 and 180 #/acre. A 50/50 blend of urea and ESN (44-0-0) applied at 0, 45, 90, 135 and 180 #/acre. Post emergence urea alone and with Agrotain® Ultra applied at 45, 90 and 135 #/acre with and without a base urea treatment of 45 #N/acre applied PPI. All plots were swathed on 8-27-15 and harvested on 9-16-15. Harvested canola plots were individually cleaned, weighted and sampled for moisture and oil content.

Results:
This trial was seeded approximately 1 inch deep into soil that was slightly dry with good sub-soil moisture. The average canola trial yield in 2015 was 2,864 #/acre (Table 2). The untreated canola plots (42#N soil residual+ 26#N applied incidentally with P, K & S) produced a canola yield of 2,055#/A. All supplemental nitrogen treatments

produced a higher yield of canola than the untreated with an LSD (0.05) of 483#. Generally, canola yields tended to increase as the nitrogen rate increased to 180#/A, regardless of nitrogen formulation or time of application. Top yields and highest net return over years, indicate several possible options (Table 2a). 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 7/18/15. 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. Further, research will 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.

Canola Fungicide Management Small Plot Trial

Objective:
To evaluate fungicides applied at three timings to determine the influence of disease control, canola growth & development and yield.

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 used by canola growers. Blackleg, *Leptosphaeria maculans* is another fungal disease that can damage canola. Blackleg is most damaging to canola when infection occurs from the cotyledon to the six-leaf stage. Genetic resistance is the most effective method of control for Blackleg in canola. However, recent disease surveys suggests Blackleg is becoming more common in canola (Source: NDSU, Plant Disease Bulletin, PP-1367). If fungicides are to be effective in the control of these two canola diseases, two different timing windows will be required to optimize disease control. This multiply fungicide strategy has worked well in spring wheat. In fact, the U of MN has several years of field research which

wheat yields were higher from an intensive fungicide regime compared to the standard (Source: MN Varietal Trials, Jan 2014). This fungicide trial in canola was designed to evaluate canola yield and growth parameters from a standard fungicide program compared to a sequential fungicide program.

Methods:

This small plot trial was conducted on land operated by Magnusson Farms Inc. Experimental design was a RCB with four replications. The canola variety in this trial was DKL-3848RR, seeded at 13PLS/ft.2 on 5/23/15. Individual plot size was 5' 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 18 gpa. Plots were swathed on 8/20/15 and harvested on 9/4 & 8/15. Harvested canola was cleaned, weighted and a sub-sample taken from each plot for moisture, percent oil content and other quality factors.

Results:

Canola yields in this small plot fungicide trial ranged from 1,912 to 2,949 #/acre (Table 3). At this location, canola bloom began on June 30th. The month of July was very wet at this site. Long term average precipitation in July is 3.3 inches. This year 6.27 inches of rain was recorded near this site! On July 5th 2.59 inches was recorded and measurable rainfall was recorded every two-to-three days in the month of July. Further, average daily high temperatures for July were 5 degrees below normal. These conditions are ideal for the development of white mold.

Yield results and other agronomic data are presented in Table 3. The untreated canola averaged 1,912#/A compared to the standard Proline applied at first petal fall of 2,949 #/A. This is a difference in canola yield of 590#/A/. This difference in canola yield between the untreated and the standard was an indication that 2015 was a good year for white mold expression. A sequential fungicide program of Proline at first petal fall followed by Priaxor at 60-70% bloom gave 1,037#/A more canola yield than the untreated.

The canola disease Blackleg was not observed at this site. Fungicide treatments containing Quadris were applied to the canola in the two leaf stage mainly for blackleg control. These early Quadris applications generally did not show a yield advantage.

To determine a return on investment an economic analysis was performed on this data for the various white mold treatments. The Quadris treatment did not show a yield advantage and had a negative return on investment. Canola price was $0.16# after harvest in 2015. The cost for a single white mold treatment averaged $18.00 (Canola Crop Budgets for 2015, NDSU) and an average application of $6.00/A for a total of $24.00/acre. The sequential application would be $48.00/A. Canola return from the

untreated was 1,912# x $0.16/# = $305.92/A. Canola return for the standard white mold treatment applied at first petal fall was 2,502#/A x $0.16# = $400.32. The dollar difference from the untreated and the standard white mold treatment was $400.32/A - $305.92 = $94.4/A. The return on investment from the untreated, single (Proline) and sequential treatments (Proline + Priaxor) were 1,912#, 2.502, and 2949, respectively. Total return (canola yield – cost of treatment) was $305.92, $376.32 and $423.84, respectively. This data indicates that in a year that has wet soil conditions for the 20 days of canola bloom the application of two fungicides are needed to optimize return on investment.

Straight Harvest Trial

Objective:

To compare canola yields from the standard practice of swathing and harvesting compared to straight harvest.

Background:

Swathing is a common management practice in the production of canola. Swathing prior to harvest has the potential to reduce shattering loss, reduce moisture content, lower green count and may "even up" canola maturity. However, many growers and potentially new growers are interested in eliminating swathing in favor of direct harvest of canola. With the introduction of better adapted varieties to direct harvest, this is becoming a more viable option. This study was initiated to determine the effectiveness of straight harvest canola as compared to the standard practice of swathing prior to combining.

Methods:

The experimental design was a RCB with three replications. The canola variety selected was Star '402' and was seeded at a rate of 5.5 #/ac on 4/27/15. The two treatments included swathing prior to harvest and a direct harvest. Plots were swathed on July 29th and combined on August 19th. The entire experiment used field scale equipment with the cooperation of Mr. Hugh Hunt.

Results:

The canola stand at this location exhibited uniform emergence. Environmental conditions, at this site, were cooler than average temperatures and wetter than normal. Even with the wet conditions the canola stand was uniform, very few weeds and was 'tabled' at the time of swathing and direct harvest.

Results for this trial are listed in Table 4. Swathed canola yields were 2,149#/A Compared 2,333 #/A from the direct harvest. The results of this trial suggest that direct harvest of canola is a management strategy available to canola growers. To consider a direct harvest practice, it will be important to plant a canola variety with a high degree of shatter resistance, have a canola stand that is knit together (uniform stand) and 'tabled" If the canola stand at harvest is thin, uneven maturity, or moderate to heavy weed pressure, swathing may be a better management decision than direct harvest.

Impact of Previous Crop on Soybean and Canola Yields

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

The experiment will be conducted as a randomized complete block design with four replications. Individual research plots will be approximately 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 is presented in Table 5. This trial was located 5 miles east of Roseau with cooperation with Peter Grafstrom. The experimental design was a RCDB with 4 reps. Individual plot size was 30' wide x 120' long. Fertilizer applied for soybeans was an 18-40-40-20s and for canola and wheat a 140-40-40-20S. All plots were seeded on April 30th. Canola variety was InVigor L252 and the Soybean variety was CZ0525LL. Soil conditions were dry at planting, but this area received adequate moisture for seed germination. Liberty was applied at for weed control in canola and soybeans and Curtail and Tacoma was applied for weed control in wheat.

Canola yields and agronomic data is presented in Table 5. 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 0.05 level of statistical confidence. In addition to the canola yield difference from previous crop, residual soil fertility was 32#/A higher when the previous crop was soybeans compared to wheat.

The soybeans at this site were bulk 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.

This trial is setup for the 2016 season per the protocol above.

Impact of Row Spacing and Seeding Rate on Canola Yields

Rationale and Significance: Canola is an important crop in North Dakota with most of the acreage located in counties along the Canadian border 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 research in North Dakota has shown there is no difference in yield between 6 and 12 inch row spacing but no comparison have been made to wider row 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 140P – LL in North Dakota and InVigor LL252 at the MN CPC. 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:
Canola yields ranged from 2,510 to 3,337#/A from the various canola row spacing and seeding rates. Results from the trial, including yield, stand count, lodging and other data, can be found in table 6. 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 518#/A 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 row spacing.

Table 1.

2015 Spring Canola Variety Trial

Roseau,Mn.

	Company	Herbicide tolerance	Variety	Seeding * Rate (#/ac)	Yield[1] #/acre	% of mean	% oil	% protein	Oil components dry basis: Palmitic	Stearic	Oleic	Linoleic	Linolenic	% ground cover[2]	ESV[3]	Ht.(in.)	Flowering begin day	Flowering end day	days
1	Winfield Solutions	RR	HyClass 930	5.9	2748	**105**	**51.4**	22.0	4.8	2.0	63.0	18.0	11.0	86	8.8	47	7/1	7/20	20
2	Winfield Solutions	RR	HyClass 955	5.5	2583	**99**	**50.0**	22.0	4.9	2.1	62.0	17.0	12.0	80	8.3	44	7/3	7/20	17
3	Winfield Solutions	RR	HyClass 970	5.6	3068	**117**	**48.8**	22.0	5.2	2.2	61.0	17.0	11.0	86	8.3	48	7/3	7/22	19
4	Monsanto	RR	DLK38-48RR	4.7	2202	**84**	**49.3**	22.0	4.1	2.1	65.0	21.0	8.0	79	8	45	7/1	7/22	21
5	Monsanto	RR	DKL70-07RR	5.3	2474	**94**	**50.5**	23.0	3.8	1.9	65.0	20.0	8.0	75	7.8	47	7/3	7/22	19
6	Monsanto	RR	DLK70-10RR	5.9	2510	**96**	**47.4**	24.0	4.4	2.2	63.0	19.0	10.0	79	8.3	46	7/6	7/22	16
7	Monsanto	RR	DLK70-50CR	8.5	2407	**92**	**48.9**	22.0	4.1	2.4	67.0	21.0	7.0	80	8.3	47	7/3	7/22	19
8	Monsanto	RR	74-44BL	5	2870	**110**	**50.0**	21.0	4.5	2.1	64.0	21.0	10.0	78	7.8	46	7/3	7/23	20
9	Monsanto	RR	G28101	4.7	2608	**100**	**50.8**	21.0	3.9	2.1	68.0	23.0	8.0	79	7.8	46	7/7	7/22	15
10	Monsanto	RR	G32176	6.2	2142	**82**	**48.9**	23.0	4.2	2.1	66.0	21.0	8.0	76	7.3	47	7/4	7/23	19
11	Star Specialty Seed	RR	Star 402	5.6	2649	**101**	**52.5**	20.0	4.3	2.0	68.0	20.0	9.0	83	8	43	7/2	7/22	20
12	Proseed	RR	300 Magnum	4.9	2349	**90**	**49.3**	23.0	4.4	2.2	65.0	19.0	9.0	83	8.8	44	7/3	7/23	20
13	Proseed	RR	PS 5000	4.9	2311	**88**	**46.8**	22.0	4.9	2.4	60.0	19.0	10.0	84	8.5	47	7/8	7/27	19
14	BrettYoung	RR	6074 RR	4.8	2724	**104**	**48.3**	21.0	4.6	2.4	65.0	21.0	9.0	74	7.3	48	7/8	7/28	20
15	BrettYoung	RR	BY15-975	4.2	2680	**102**	**47.9**	21.0	5.0	2.6	62.0	18.0	11.0	74	7.3	47	7/5	7/24	19
16	BrettYoung	RR	6064RR	4.6	2706	**103**	**48.9**	22.0	4.7	2.5	61.0	16.0	10.0	75	7.8	49	7/7	7/26	21
17	Mycogen	RR	Nexera 1012 RR	5.5	2085	**80**	**46.5**	25.0	4.6	3.0	68.0	13.0	5.0	86	8.3	56	7/8	7/29	21
18	Mycogen	RR	Nexera 1020 RR	5.4	2455	**94**	**47.5**	24.0	4.2	2.9	71.0	14.0	4.0	85	8.8	48	7/6	7/28	22
19	Mycogen	RR	Nexera 1022 RR	5.2	2654	**101**	**48.5**	25.0	3.9	2.7	71.0	14.0	3.0	84	8.5	51	7/9	7/27	18
20	Winfield Solutions	RR	HyClass 972	5.5	2739	**105**	**48.7**	25.0	4.3	2.0	60.0	17.0	10.0	88	8.5	44	7/2	7/24	22
21	Mycogen	CL	Nexera 2020CL	7.4	2813	**107**	**46.8**	27.0	3.9	2.5	65.0	16.0	4.0	83	8.5	53	7/7	7/25	18
22	Mycogen	CL	CL2562968H	6.5	2562	**98**	**45.9**	28.0	3.9	2.6	65.0	16.0	4.0	80	8.3	54	7/6	7/26	20
23	Mycogen	CL	CL2562966H	6.2	2997	**114**	**47.2**	26.0	4.1	2.8	70.0	14.0	4.0	85	8.3	57	7/6	7/25	19
24	Bayer CropScience	**LL**	InVigor L130	5	2607	**100**	**45.6**	25.0	4.6	2.4	60.0	19.0	11.0	84	8.3	55	7/7	7/26	19
25	Bayer CropScience	**LL**	InVigor L140p	5	2742	**105**	**45.0**	24.0	4.7	2.4	60.0	19.0	10.0	83	8.3	55	7/6	7/25	19
26	Bayer CropScience	**LL**	InVigor L252	5	3212	**123**	**48.2**	23.0	4.5	2.0	58.0	20.0	11.0	85	8.8	53	7/9	7/26	17
27	Bayer CropScience	**LL**	InVigor 5440	5	2845	**109**	**45.7**	25.0	4.5	2.1	57.0	20.0	11.0	81	8.3	57	7/8	7/28	20
			LSD @ 5% Level		351	**13.3**	**1.4**	1.6	1.0	0.4	5.3	3.6	3.0	10	1.2	1.8	1.3	1.3	
			CV(%)		9.5	9.5	2	5	16	13	6	14	25	9	10	3	20	4	

Planting date- May 23-2015

*Seeding rate=13PLS/Ft.[2](or 5#/acre if not stated)

[1] Yields corrected to 8.5% moisture-Trial mean=2620#/acre

[2]% ground cover June 18

[3] ESV(early season vigor)-June 18-- 9= best;1=least

Table 2.

2015 Canola Fertility Trial- University of Minnesota

Location- Magnusson Farms northwest of Roseau,Mn

	N' Rate	Yield	Yield as % of Mean[3]				%Ground[4]					Begin	End			Oil components				
Trt#	PPI	#/ac				3 Yr.	Harvest		Cover	ESV[5]	RCI[6]	Bloom	Bloom							
	Urea[1]	2015	2015	2014	2013	Ave.	Lodging	Ht(in.)	6/23	6/23	7/18	Date	Date	% Oil	%Protein	Palmitic	Stearic	Oleic	Linoleic	Linolenic
2	45	2577	90.0	91.8	97.0	92.9	3.5	53	75	7.8	381	7/7	7/26	49.5	21	4	2	62	22	9
3	90	2721	95.0	99.1	96.1	96.7	4.5	55	85	8.5	393	7/7	7/26	47.7	21	5	2	59	21	12
4	135	2811	98.1	109.7	105.9	104.6	4.5	55	88	8.8	406	7/6	7/26	47.8	24	4	1	57	21	10
5	180	2998	104.7	106.1	110.6	107.1	6.5	57	90	9.0	405	7/6	7/26	47.0	24	4	2	57	21	11
				(All PPI) urea only =		100.3														
	Urea/ESN[1]																			
7	45	2572	89.8	93.5	96.4	93.2	3	52	80	8.0	391	7/7	7/25	50.0	21	3	1	66	24	7
8	90	2503	87.4	94.6	98.2	93.4	4	54	83	8.3	400	7/7	7/26	49.0	21	5	2	58	21	11
9	135	3039	106.1	110.2	109.4	108.6	5	56	90	9.0	385	7/7	7/26	47.8	24	4	2	61	22	9
10	180	3360	117.3	103.9	120.1	113.8	4.5	56	85	8.5	400	7/7	7/26	47.0	23	5	2	55	20	13
			(All PPI) 50% urea+50% ESN=			102.3														
	Urea[1]																			
12	0/45	2554	89.2	93.4	101.2	94.6	4	52	70	7.5	366	7/9	7/25	48.9	21	4	2	61	21	11
13	0/90	2860	99.9	102.1	89.8	97.3	4.5	53	78	7.8	359	7/9	7/26	49.5	22	3	2	67	23	7
14	0/135	2843	99.3	112.1	95.1	102.2	4	55	75	7.8	377	7/8	7/26	46.3	23	5	2	56	21	11
15	45/45	2983	104.2	100.5	111.4	105.4	4	54	80	8.0	385	7/8	7/26	47.8	22	4	2	60	22	10
16	45/90	3394	118.5	103.9	102.0	108.1	3.5	55	88	8.8	408	7/8	7/25	48.2	23	4	2	61	21	10
17	45/135	3361	117.4	116.0	106.6	113.3	5.5	56	80	8.0	373	7/9	7/26	47.1	24	4	2	63	23	8
			50%PPI+50%Post- urea only =			103.5														
Urea+Agrotain Ultra[2]																				
18	0/45	2467	86.1	94.0	94.2	91.4	4.5	53	70	7.3	392	7/8	7/26	48.5	22	4	2	59	22	10
19	0/90	2849	99.5	105.4	110.3	105.1	5	56	65	7.0	371	7/8	7/26	47.9	22	4	2	58	22	10
20	0/135	2890	100.9	106.4	112.9	106.7	6	55	78	7.8	402	7/8	7/26	46.2	24	4	2	58	22	10
21	45/45	2955	103.2	104.0	95.9	101.0	5	53	88	8.8	428	7/8	7/26	47.8	24	4	2	56	21	10
22	45/90	2849	106.7	106.6	112.4	108.6	4	56	85	8.5	405	7/8	7/26	48.2	24	3	1	60	23	8
23	45/135	3297	115.1	118.4	114.7	116.1	4.5	56	85	8.5	392	7/7	7/26	47.1	23	4	2	58	22	11
			50%PPI+50%Post urea+Agrotain =			104.8														
1	0/0	2055	71.8	76.1	73.2	73.7	4	51	59	6.5	352	7/7	7/24	48.9	20	5	2	62	22	10
LSD @5% Level		483	16.8	9.3	15.3		1.7	2	13	1	45	2	1	1.5	2	1	1	6	2	3
CV(%)		12	12	7	10		27	2	12	9	8	18	4	2	6	19	21	7	7	20
	Trial Mean=	2864		3007	2344															

26-40-40-20s Added to all plots as base application

[1]N rate-Urea source PPI treatments= all applied at planting time and incorporated with final seedbed prep.

PPI urea/ESN= 50%coated Urea(ESN)+ 50% Urea nitrogen source and shallow tilled into soil at final seedbed prep.

PPI/Post= #N urea source applied pre-plant incorporate/#N source urea applied June 16.

[2]Urea+Agrotain Ultra= PPI urea/Post urea+Agrotain

[3] Cleaned seed yields corrected to 8.5% moisture.

[4]%Ground cover-Visual rating of % of ground covered by plant material

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

[6]RCI (Relative Chlorophyll Index)- higher number =more chlorophyll

Variety= InVigor LL252 @13PLS

Plots seeded 5/23/2015

Table 2a.

2013-15 Canola Fertility Trial Summary[1]

Roseau,Mn

TRT#	Nitrogen Timing/Source[2]	Nitrogen Rate	2013-15 Yield 3yr.ave	Added Fertility Cost[3]	Net/acre Return[4]
3	preplant 100% urea	90	**2647**	**$0.00**	**$135.44**
8	preplant 50% urea+50%ESN	90	**2557**	**$6.55**	**$111.75**
15	50%preplant urea+50%urea at 4leaf	90	**2886**	**$6.00**	**$172.46**
21	50%preplant urea+50%urea+Agrotain at 4leaf	90	**2765**	**$9.04**	**$148.23**
13	100% post plant urea	90	**2664**	**$0.00**	**$138.50**
19	100%post plant urea+Agrotain	90	**2878**	**$6.08**	**$172.12**
4	preplant 100% urea	135	**2864**	**$22.80**	**$153.65**
9	preplant 50% urea+50%ESN	135	**2973**	**$32.86**	**$161.82**
16	33%preplant urea+67%urea at 4leaf	135	**2960**	**$28.80**	**$164.93**
22	33%preplant urea+67%urea+Agrotain at 4leaf	135	**2973**	**$35.11**	**$162.15**
14	100% post plant urea	135	**2798**	**$22.80**	**$141.77**
20	100%post plant urea+Agrotain	135	**2921**	**$31.88**	**$156.58**
5	preplant 100% urea	180	**2932**	**$45.83**	**$144.82**
10	preplant 50% urea+50%ESN	180	**3116**	**$54.53**	**$170.66**
17	25%preplant urea+75%urea at 4leaf	180	**3102**	**$51.83**	**$169.42**
23	25%preplant urea+75%urea+Agrotain at 4leaf	180	**3178**	**$60.91**	**$175.77**
	LSD @ 5% level		**264**		
	CV(%)		7		

[1] Yield data and cost analysis of small plot canola fertility trials done for 3 years northwest of Roseau,Mn.

[2]Fertilizer timing(preplant or 3-5leaf post plant) and source (urea,urea+ESN,or urea+Agrotain Ultra)

[3]Added fertility cost above base treatment of 90#N urea

[4]Net return- net profit from each treatment(@$.18/LB canola)

[A]-2015 canola budgets for NE North Dakota courtesy of NDSU Extension Service(see table 7)

Table 3.

2015 Fungicide Applications to Canola

Roseau,Mn.

Trt.#	Fungicide treatment	ai #/acre Rate	product rate/acre	Timing	Yield[1] #/acre	Gross return per acre	Net profit per acre[6]	Treatment cost[7]	ESV[2] 6/23	First bloom	End bloom	Harvest Ht.(in.)	Harvest Lodging[3]	Sclerotinia incidence[4]	Sclerotinia severity[5]	% oil	% protein	Oil components-dry basis Palmitic	Stearic	Oleic	Linoleic	Linolenic
1	No treatment				**1912**	**$305.92**	**-$37.97**	$0.00	8.0	7/1	7/22	43	5.5	4.3	5.0	47.5	24	4	2.0	58	20	9
2	Quadris		7 oz.	2 Leaf	**1948**	**$311.68**	**-$52.21**	$20.00	8.5	7/1	7/22	43	6.5	3.8	5.0	46.7	24	3	2.0	60	22	8
3	Proline		5.7oz. Fl	1stpetal fall	**2502**	**$400.32**	**$32.43**	$24.00	8.0	7/1	7/23	43	6.3	2.0	3.0	47.2	24	4	2.0	58	19	10
4	Priaxor		6oz.	50% Bloom	**2214**	**$354.24**	**-$13.65**	$24.00	8.3	7/1	7/22	43	7.0	2.3	4.0	47.8	24	4	2.0	62	22	8
5	*Proline-med+ Priaxor late		5.7oz+5.7oz		**2949**	**$471.84**	**$79.95**	$48.00	7.8	7/1	7/23	44	7.3	1.3	2.3	46.9	24	4	2.0	59	20	9
6	*Quadris early+Proline med		7oz.+5.7oz.		**2463**	**$394.08**	**$6.19**	$44.00	8.0	7/1	7/22	44	6.3	1.3	3.3	47.1	23	4	2.0	63	20	9
7	*Quadris early+Proline med+Priaxor late		7oz+5.7oz+5.7oz.		**2669**	**$427.04**	**$15.15**	$68.00	7.5	7/1	7/23	44	7.3	1.0	2.0	47.2	24	4	2.0	60	20	10
8	**Quadris early+Proline med+Priaxor late+Insecticide		7oz+5.7oz+5.7oz.		**2756**	**$440.94**	**$20.07**	$77.00	9.0	6/30	7/22	44	7.3	1.0	2.5	47.1	24	3	2.0	64	22	7
			LSD @5% level		**412**				1.0	NS	NS	NS	1.0	0.7	0.7	1.0	NS	NS	NS	NS	2	NS
			CV(%)		11				8	107	3	3	10	22	13	1	6	18	20	8	7	21

Variety=DLK-38-48RR planted 5/23/2015

1pt./100gal. Preference(NIS) added to all treatments

Treatment dates and growth stages-

*Quadris(early) treatment= 6/12/2015--GS=2 leaf stage

*Proline(standard) application= 7/10/2015--petal drop

*Priaxor(late) treatment = 7/22/2015--late bloom

**TRT#8 had 1.5oz. Warrior applied with each fungicide application

Applications made with CO2 backpack sprayer-Turbo T-Jet nozzels 18GPA @ 28psi

[1]=Yield corrected to 8.5% moisture

[2] ESV(early season vigor)-June 23-- 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 profit for each treatment with canola @$.16/pound

[7]=cost/acre of treatment including application=$24 for Priaxor and Proline- $20 for Quadris(+$3/acre for Warrior)

Other cost calculation see table 7

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

Table 4.

2015 Canola Direct Harvest

Hugh Hunt-Hallock,Mn[1]

	Yield(#/ac.)
Swath/combine(standard)	**2149**
Direct combine	**2333**

[1]-Plots set up,managed and harvested by Hugh Hunt

canola variety- Star 402RR

Planting date-4/27/2015 @5.5#/ac.

Swathing date- July 29 ; combined August 19

Straight and direct combining done with John Deere flex draper head

No desiccant was used

Plot size= .5acres

Plots managed by the grower using best management practices

Table 5.

2015 Canola Rotation Trial

Roseau,Mn. [1]

Rotation				Actual	Soil [2]		Visual											
				Harvested	Residual	shatter[3]	shatter[4]	Ht(in.)		Stand[6]	Oil seed parameters-dry basis							
2013	2014	**2015**	TRT#	**Yield**	**NO3-N**	(#/ac)	(#/ac.)	6/24/15	harvest	6/24/15	Linoleic	Linolenic	Oil	Oleic	Palmitic	Protein	Stearic
wheat	wheat	**canola**	3	**1430**	**25**	257	649	19	41	407000	22	7	52	63	3	21	2
wheat	soybean	**canola**	4	**1817**	**57**	282	548	21	41	367000	23	8	49	61	4	22	2
		LSD @5% leve		**108**		NS	NS	NS	NS	NS	NS	NS	2	NS	NS	NS	NS
		CV(%)		3		21	14	7	5	17	12	31	2	8	31	7	22

Rotation				Ht(in.)		Stand[6]
2013	2014	**2015**	TRT#	6/24/15	harvest	6/24/15
wheat	wheat	**soybean**[5]	1	6	29	192000
wheat	canola	**soybean**[5]	2	6	28	192000
		LSD @5% leve		NS	NS	
		CV(%)		10	2	

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 0-24"

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

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

[5]-Soybeans were not harvested.

[6]Stand=Counted plants per acre

Table 6.

2015 Canola Row Spacing-Seeding Rate Study

Roseau,Mn.

Trt.#	Row Spacing	Seeding Rate PLS/Ft.2	Seeding Rate #/acre	Seeding Rate pls/ac.	**Yield[1] #/acre**	Stand[2] 6/18	%survival[3] 6/18	Lodging[4] at harvest	Harvest Ht.(in.)	ESV[5] 6/23	% ground cover 6/23	First bloom	End bloom
1	6"	3	1.6	131000	**2518**	126000	96	2.0	52	6.0	53	7/11	7/28
2	6"	6	3.2	261000	**2636**	175000	67	2.0	54	7.0	78	7/10	7/27
3	6"	9	4.8	392000	**2850**	232000	59	2.0	54	8.3	90	7/9	7/27
4	6"	12	6.4	523000	**3194**	318000	59	2.3	53	8.8	88	7/9	7/27
5	12"	3	1.6	131000	**2692**	79000	60	2.0	53	6.5	53	7/11	7/28
6	12"	6	3.2	261000	**2972**	153000	58	2.3	52	7.3	78	7/10	7/27
7	12"	9	4.8	392000	**2901**	172000	44	2.3	51	8.3	83	7/9	7/26
8	12"	12	6.4	523000	**3337**	235000	44	3.0	51	8.5	88	7/9	7/26
9	24"	3	1.6	131000	**2898**	72000	55	2.3	52	7.0	43	7/10	7/28
10	24"	6	3.2	261000	**2561**	134000	51	3.3	52	7.5	50	7/10	7/27
11	24"	9	4.8	392000	**2822**	176000	45	4.8	52	8.3	58	7/10	7/27
12	24"	12	6.4	523000	**3018**	238000	45	4.8	50	7.8	53	7/9	7/26
	LSD @5% level				**518**	79	5	1.1	3	1.0	13	1	1
	CV(%)				12	16	16	29	4	8	13	7	3

Planting date- May 23-2015

Canola variety- InVigor LL-252 (82100 PLS/#)

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

[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

Table 7.

Cost per acre for canola production[1]

Direct cost:Total	**$265.46**
Seed(treated)	$51.25
Herbicides	$20.70
Fungicides	$18.00
Fertilizer[2]	
135-40-40-20s	$123.00
Insurance	$14.80
Fuel	$14.38
Repairs	$17.49
Interest and miscellaneous	$5.84
Indirect cost:Total	**$96.44**
Land	$56.50
Machinery investment	$12.11
Machinery depreciation	$20.72
Misc. overhead	$7.11
Total production cost: $361.90	
Crop Price per LB.	**$0.18**

[1]-Source for production costs-NDSU Extension Service for North east North Dakota

[2]-Fertilizer cost-University of Minnesota

Cost basis-
Urea=$430/t
ESN=$560/t
MAP(11-52-0)=$565/t
Potash(0-0-60)=$415/t
Agrotain=$67/gal