2017 Minnesota Canola Production Center (CPC)

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

2017 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, 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 Northern Resources Cooperative for providing the land and Magnusson Farms and Tony Brateng providing seedbed prep for the small plot canola trials. Also, a special thanks to Tony Brateng for the land and extra efforts facilitating the planting and harvesting treatments to the large plot canola trials.

SITE INFORMATION - 2017 MN Canola Production Center (CPC)

Location: West side of Roseau, MN city limits

Cooperator: Northern Resources Cooperative

Previous Crop: Spring Wheat

Soil Test Results:

Nitrogen - 0-6'	14 #/acre
Nitrogen – 6-24"	24#/acre
Phosphorous -	4 ppm
Potassium -	144 ppm
Target Yield:	2500 #/acre
Fertilizer Applied (#/acre):	N - 130; P - 40; K - 40; S - 20s
%Organic Matter:	4.2
Soil pH:	8.1

Tillage Operations: In the fall of 2016, a disc chisel operation was performed on the entire area. Spring tillage included a multiweeder operation prior to fertilizer applications and a harrow operation prior to seeding.

Fertilizer Applied: All small plot trials received 26-40-40-20S. Fertility trial and Bang for the Buck trials had variable N rates, sources and timings as listed on trial protocols. All other plots received an additional 114-0-0 for a total of 140-40-40-20S.

Seeding Method: Small plot trials were seeded a 5' Hege plot seeder. Precision planted plots were planted with a custom made Plains Grain 10' seeder.

Herbicides Applied: Section 2 at 5 oz/ac + 1% crop oil was applied to the entire area for general grass control on 6/7/2017. The various herbicides listed below were applied to the appropriate canola varieties.

A) Clearfield hybrids - Beyond @ 4 fl. oz/ac + NIS 0.25% v/v + 2.5% AMS 6-15-2017

B) Liberty Link hybrids - Liberty 280SL @ 22 fl. oz/ac + AMS @ 3.0 lbs. /acre 6-12-2017

C) Roundup Ready hybrids - Roundup PowerMax @ 16 fl. oz/acre + AMS @ 17 lbs. /100 gal 6-12-2017

D) Sulfonylurea hybrids - Draft 0.3oz/ac+ 0.5%AMS+.5%NIS 6-15-2017

Comments: Early spring soil moisture conditions were above normal but April and May precipitation was below normal (Source: Minnesota State Climatology precipitation network). June rainfall was above normal with 5.55" recorded at the Magnusson Research Farm-northwest of Roseau and Fox –NDAWN site. Precipitation during July and August was below average with less than 1.0" rainfall in each month. Temperature means for the canola growing season May-July were about normal averaging -1F below long term averages (Source: NDAWN). These conditions were generally favorable for canola growth and development in the Roseau area.

Canola stands were generally good with adequate soil moisture level and timely rainfalls after planting. Annual crops, including canola, in the area were generally seeded during April and into May. Once fields dried out in the spring, planting proceeded at a rapid pace with no prolonged periods of rainfall.

In early canola plantings, cool early season temperatures caused seed coating treatments for flea beetle control to not persist adequately to stay ahead of flea beetle predation. Consequently, many canola fields developed populations above threshold levels and required a post emergence insecticide treatment.

After a relatively heavy white mold infestation in 2016, 2017 infestations were light at the CPC. Other diseases and insect problems were generally at low to moderate levels. The Minnesota CPC had two field locations in 2017. The small plot replicated canola research trials were conducted on the west side of Roseau on land owned by Northern Resources Cooperative. The large plot conventional vs. precision planting and swathing vs. direct harvest trials were located on the Tony Brateng farm south of Roseau.

The public canola trials conducted at the 2017 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
- Small plot precision planting rates and row spacing
- Small plot liquid fertilizer additives
- Large plot conventional vs precision planting
- Large plot swath/combine vs. straight harvest

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. Clearfield and SU tolerant lines are considered non-gmo 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 20, 2017. 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. Grass herbicide (Section 2) was applied for grass control to all plots on 6/7/2017. Liberty and Roundup were applied 6/11/2017 and Beyond and Draft were applied 6/15/2017 to the appropriate varieties prior to elongation(bolting). Proline at 5.7 oz/ac was applied to all plots on 7/6/2017 for white mold control. The SU(Sulfonylurea) canola was swathed on 8/26/17 and harvested on 9/7/16. All other canola varieties were swathed on 8/17/17 and harvested on 9/2/17. 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 24 canola lines were entered in the 2017 CPC (Table 1). A breakdown of the canola varieties: 13 Roundup Ready, 3 Sulfonylurea, 5 Liberty Link and 2 Clearfield canola entries. Canola yields ranged from 2,500 to 3,951 #/acre. The trial average yield was 3,139 #/acre. This mean was almost 1,000#/acre above the 2016 trial average.

The top-yielding canola variety was a Brett Young Clearfield variety- 5545 CL, which was statistically higher than all other lines in the trial. Using the trial average of 3,139 #/acre, and canola price of $0.18/LB, that be a gross dollar return of $565/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 17th to August 3rd. Plant height

ranged from 39 to 55 inches. Oil content ranged from 44.1% to 48.4%. Breakdown of oil components and other agronomic information is summarized in Table1.

Variety Trial Shattering Evaluation

Objective

The ability of canola to hold pods on the plant and not dehisce (shatter) seed, is a desirable trait in current varieties. The ability or option to direct harvest the crop makes the crop potentially easier to handle and available to more producers to grow that do not have swathers.

Background:

In 2016, a trial was initiated to evaluate seed shattering and pod drop in this northern Minnesota environment. Companies entering lines in the variety trial were invited to also enter lines in the shattering trial. The same trial was initiated in 2017 with the addition of 2 check lines that were thought to be more likely to shatter.

Materials and Methods:

The 12 canola lines that were submitted for testing and 2 checks were seeded on May 20, 2017. Plots were seeded in 12" rows at 9 PLS/ft.2. Plots were maintained using best management practices in the same manner as the variety and systems trial. On August 9, 2 plastic 7" x 13" collection boxes were placed between rows in each plot. 8 collection boxes per variety. Beginning on August 18, seed and pods were collected and counted for each box on a weekly basis. Seed loss on a per acre basis was calculated for both the seed shattered directly to the ground(seed) and seed contained in pods dropped from the plants to the ground(pod). Data from this trial is in table 2.

Results:

Seed loss was relatively minor until September 6 when a few lines and a check began to drop significant amounts of seed. A rain and wind event on September 4 and rain event on September 16 did cause seed loss on some varieties but not as much as may have been expected to most varieties? It is likely that harvest could have been completed by this time. There would be an advantage for lines to hold seed longer in case weather or other factors prevented harvest. The last seed and pod shatter collection was completed on September 18. The last 2 columns of table 2 contain total seed loss due to pod drop and total seed lost due to pod drop + seed shattered directly to the ground.

Nitrogen Fertility Trial

Objective:
To evaluate canola yield response from various rates of urea applied PPI, and post emergence (3-5 leaf canola). In 2017, 28% UAN was an additional post emergence treatment applied with streamer nozzles to 3-5 leaf canola. Post emergence urea with the nitrogen stabilizer Limus was applied on 6/12/17 and 28%N applied on 6/16/17. Urea nitrogen was also applied PPI in combinations with a coated urea product ESN (environmentally smart nitrogen) as per treatment protocols. To validate results under different conditions and over time, this trial was conducted in 2013-2017.

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; 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 and liquid nitrogen (28%).

Methods:
In 2017, the canola variety InVigor L140P was seeded at 12 PLS/ft.2 on 5/23/2017. 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 38 #/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 Limus and liquid nitrogen (28%) applied at 45, 90 and 135 #/acre. All plots were swathed on 8-17-2017 and harvested on 9-1-2017. Harvested canola plots were individually cleaned, weighted and sampled for moisture and oil content.

Results:
This trial established uniformly but 180# dry N rates seem to stress seedlings somewhat as indicated by % ground cover. Leaf burn from the liquid fertilizer was present as indicated by ratings on table 6. Stream jet treatments had less leaf burn than flat fan applications. Liquid applications yielded slightly less than dry pre-emergent applications in 2017.

The canola fertility trial average yield in 2017 was 3268 #/ac. All supplemental nitrogen treatments produced a higher yield of canola than the untreated with an LSD (0.05) of 315#/ac. Generally canola yields tended to increase as the nitrogen rate increased to a rate of 180#/ac, regardless of nitrogen formulation, or time of application. In

2017,however, optimum yields were achieved with the 135#/ac. N rates as seen on table 6. Table 6a has the nitrogen fertilizer costs for rates applied over the base rate of 26-40-40-20s in 2017. With cost basis used in this table, the 135#/ac. N rate applied as dry fertilizer, was the most profitable in 2017. Nitrogen applied before planting also was the most efficient in this trial. In past 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. Depending on things such as expected rainfall, yield potential, and time availability, better nitrogen use efficiencies and higher profits may be obtained by split timing applications.

The reason for doing these management trials, particularly fertility trials multiple years, is that every year is different and results may vary significantly. Over time, though, general guidelines for best management practices will emerge. Also important is the weather and how it interacts with various fertilizer applications. With this in mind, better informed decisions can be made on deviating from standard practice based on best currently available information.

Canola Return on Investment (Bang for the Buck) Trial

The objective of this trial is to evaluate 3 high and 3 lower cost management options a producer has and where the production input $$ can be best spent.

Background:

The 3 variables being examined are: High vs. Low

1-Seeding rate-12 PLS in 6” rows vs. 9 PLS in 12” rows (conventional seeding)

2-Nitrogen rate-160#/acre vs 120#/acre

3-Fungicide application- Proline early+Priaxor late vs. Topsin M early

Methods:

Experimental design was a RCB with four replications. The canola variety in this trial was InVigor L140P seeded on 5/23/2017. Individual plot size was 6’ wide by 27’ long, end trimmed to 5’ x 20’. After an initial application of 26-40-40-20s was applied to the entire area, individual plots were staked out. An additional of urea was then hand spread as per plan to each individual plot. Stakes were then pulled and final seedbed tillage was then preformed. Plots were then staked again and seeded according to row space and seeding rates per plan. Post emergence fungicides were applied with hand boom sprayer with flat fan nozzles delivering 17 gpa @ 30 psi. The treatments were applied as listed in Table 5.

Results:
Yield results and other agronomic data for individual treatment groupings are presented in Table 5. The yields and economic return of individual main plot treatment means is listed on table 5a. Also listed are seed, fertilizer and fungicide costs used to achieve the returns listed.

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**. The 2 premium fungicide applications also increased return by $29.52 but with an added cost of $35.68 for a loss of $-6.16. Adding fertilizer from 120# - 160#/ac did not increase yield at all and at a cost of $30.15 so was at a loss of $-35.18.

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 2017. Even so, the addition of Proline at first bloom and Priaxor at first pod set increased overall yields by 164#/acre.
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.

Convention vs. Precision Planted Row Spacing 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. 2017 gave us 1 more year of data for a higher level of confidence in overall results. Also in 2017, we are able to compare precision planting with similar conventional plantings.

Objective:
These are the trial variables being examined:

1) Conventional planting vs. precision planting
2) Row spacing comparison of each method
3) Seeding rates of each row spacing

Materials and Methods The precision planting in this trial was done by Jayden and Travis Messer with Plains Grain in North Dakota. The seeder used was 10' wide with precision depth control in 10" or 20" row spacing. The seeder also precisely removes individual seeds from planting plates making possible precise, singulation planting. The treatments include 10" or 20"rows with either 3PLS/ft.2 or 6PLS/ft.2.

The conventional portion of the trial was seeded with a Hege small plot seeder in either 6",12", or 24" rows. These treatments will include the 3pls/ft.2 and 6pls/ft.2 and also the more conventional higher seeding rates of 9pls/ft.2 and 12pls/ft.2 All seeding was done on 5-19-2017. Experimental design was a randomized complete block with 4 replications.

Results:
Data for 2017 only is listed on Table 3. Canola early season vigor had scores generally increased as seeding rate increased from 3 to 12 PLS/ft2 at all three row widths. Plant emergence on precision planted plots was excellent. Conventional plantings also germinated well. Early season vigor on June 7 was very good to excellent on all plots as well. Plant counts /ft.2 would also indicate a high rate of emergence both on June 7 and after harvest on September 29.
Yield of all plots was good with a trial mean of 3129#/acre. Precision planted plots generally were slightly higher than conventional plantings at equivalent seeding rates but not significantly so. The narrower 10" rows also yielded better than 20" rows. The conventional plantings in 24" rows were lowest yielding at all seeding rates. The highest yields were obtained with conventional plantings in 6" or 12" and high seeding rates of 9PLS-12PLS/ft.2.

Table 4 has yield data and cost budgets for the conventional seeding only from 2015-2017. The budget table on lower portion of the page has profit margins for each treatment in each year. The last 2 columns of the table have the highest seeding rate(12pls/ft.2) in each row spacing compared to the other treatments(3,6,&9pls/ft.2) In conventional planting, the wide 24" rows generally had the lower yields. If we just focus on the 6" and 12" row spacing, in 2015 and 2017 generally the higher seeding rates of 9PLS and 12PLS paid for the added seed cost and produced additional profit. 2016 had higher profits with the lower rates. Take home message—with conventional equipment narrow rows and higher seeding rates are generally better. Also, in this 2017 trial, we

did not show a significant yield advantage with precision planting over conventional planting.

Liquid Popup Fertilizer and Precision Canola Planting

Background:

Travis and Jayden Messers' precision canola planter has the capability of applying liquid fertilizer over the row at planting. A trial adjacent to the planting rate study was initiated on 5/19/2017. This trial was set up separately from the seeding rate trial but the treatments are identical except for the addition of ortho polyphosphate at rate of 5 gallons/acre 6-24-6. The trial was also managed the same way as the seeding rate trial. Design of the trial was randomized complete block with 2 reps. Yield and other data are presented on table 7a. Only the fertilized plots are analyzed on this table but reciprocal treatment data from the seeding rate trial without fertilizer is also presented.

Results:

The liquid fertilizer plots were swathed on 8/17/2017 and combined on 9/2/2017 with small plot equipment. Yield results of the trial were not statistically different at 5% level but the trend seemed to be that higher seeding rates along with the application of ammonium polyphosphate produced higher yields. Positive results from the liquid application may have been reduced because the entire area had been fertilized prior to planting with 26-40-40-26s.

Ammonium Thiosulfate Post Emergent Application to Canola

Background:

Sulfur is an essential element that normally needs to be added to canola to achieve maximum yields. Until recently, most added sulfur was applied prior to seeding as ammonium sulfate in conjunction with other dry fertilizer applications. Recently, other methods and sources of sulfur application have been explored and used by producers. One of the methods being used is a post emergent flat fan spray application of 12-0-0-26S at the 3-5 leaf stage. The thought being that the foliar/soil application may be more available to the plant and more economical than other sulfur formulations.

Methods and Results

The site of this evaluation was the border of the canola seeding rate trial. Variety used was of InVigor L140P. There were 2 plots sprayed with 10 gallons of 12-0-0-26s and 2 plots were untreated. Treatments were applied with a 6' backpack sprayer with an output of 18GPA. Plot size was 6' x 20'. All other production management was done uniformly to all plots. Plots were swathed and combined with small plot equipment at maturity. An average clean seed yield increase of 110#/acre was measured in the treated vs. the untreated plots. This increase is not statistically different.

Large Plot Trials

Background:
In 2017, two large plot canola trials were performed cooperatively by the University of Minnesota and Tony Brateng on his farm south of Roseau. All plot treatments and general field management operations were done by Tony.
University personal were on hand during planting and harvesting to oversee and recording important treatment information.

Convention vs. Precision Planting

2 planting systems were used in this trial. The conventional planting consisted of 4 randomized 40' strips seeded at 5#/acre using an air seeder in 7.5" rows. The other 4 strips and the remainder of the field were planted with a 45' precision singulation planter.

Results:
Average yield of the precision planting was significantly higher at 2610#/ac vs 2309#/ac. for the conventional planting. In this field, an extra 301#/ac yield was harvested with the precision planting. Using seed cost of $13/LB, almost $30/acre were saved on planting cost. With a selling price of $.18/LB. an extra $54/ac. would have been harvested. Adding the seed cost and added yield an extra profit of $84/acre were realized on these large plots. Protein and oil levels also measured higher in the precision planted plots which may have added additional profit. Seed yield and other agronomic data are presented in table 8.

Convention Harvest vs. Direct Combining

The objective of this trial was to compare the conventional 2 step harvest operation involving swathing, leave in field to dry down and pickup with combine vs. combining standing crop directly in one operation. Time and money can be saved if harvesting can be done in one operation. Direct harvesting can also be less vulnerable to wind damage if varieties resistant to shatter are used.

Results:
Seed yield of direct harvest plots yielded slightly higher than the conventional plot harvest. The yield difference was not significant, however. Protein and oil content was also not significantly different. Equal or higher yields of canola using direct harvest is a viable option for many growers. The time may be coming when direct harvest can be relied on if conventional swathing equipment is not available. This could potentially interest new growers.

Table 1.

2017 Spring Canola Variety Trial

Location- Northern Resources Cooperative-West Plant, Roseau,Mn.

University of Minnesota

	Herbicide*		Seeding *	Yield[1]				Oil components(%)[2]					% ground		Test WT		Flowering		
Company	tolerance	Variety	Rate (#/ac)	#/acre	% of mean	% protein	% oil[2]	Palmitic	Stearic	Oleic	Linoleic	Linolenic	cover[3]	ESV[4]	#/bu.	Ht.(in.)	begin day	end day	# of days
BrettYoung	CL	5545 CL	6.0	3951	**126**	18.9	45.0	4.4	1.8	63.5	19.0	8.6	89	8.5	51.8	54	7/4	7/22	19
Mycogen	CL	Nexera 2022CL	6.7	3226	**103**	20.1	46.1	4.2	2.2	61.9	15.2	3.3	80	7.3	51.8	43	7/5	7/22	17
Cibus	SU	C5507	4.2	2518	**80**	20.4	44.4	4.1	1.9	65.0	18.3	9.0	78	7.8	50.8	41	7/7	8/2	26
Cibus	SU	C5522	4.6	2564	**82**	20.1	44.2	4.1	1.9	64.3	18.2	9.0	80	7.8	51.0	43	7/8	8/2	26
Cibus	SU	C5513	3.5	2500	**80**	20.8	44.1	4.3	1.7	64.0	19.2	9.1	65	6.5	52.4	44	7/9	8/3	26
CROPLAN	RR	HyClass 930	5.5	3077	**98**	16.0	48.3	4.3	2.1	48.9	19.7	8.0	73	7.3	51.3	39	7/1	7/17	15
CROPLAN	RR	HyClass 955	5.3	3369	**107**	17.0	47.0	4.4	2.0	53.2	19.5	8.0	85	7.8	51.6	41	7/1	7/17	16
CROPLAN	RR	HyClass 970	6.0	3595	**115**	17.5	47.5	4.4	2.0	54.7	19.2	8.1	78	7.8	51.9	47	7/3	7/20	17
Dekalb-Monsanto	RR	DKL70-10	6.3	3343	**107**	17.6	47.2	4.5	1.9	60.4	18.8	8.0	86	8.3	51.5	46	7/3	7/20	17
Dekalb-Monsanto	RR	G15P9374	5.0	3261	**104**	17.8	47.3	4.5	1.9	62.7	18.9	8.0	88	7.5	51.4	42	7/5	7/22	17
Dekalb-Monsanto	RR	DKL35-23	6.4	3464	**110**	19.0	46.9	4.5	1.8	60.5	20.2	8.4	83	7.8	52.1	46	7/2	7/17	16
Dekalb-Monsanto	RR	DKL71-14BL	5.5	3341	**106**	17.4	47.4	4.5	1.8	54.8	20.5	8.7	80	7.5	51.9	44	7/2	7/20	18
DuPont Pioneer	RR	45CS40	5.0	3623	**115**	18.2	47.2	4.5	1.8	66.0	19.5	9.5	80	8	51.1	55	7/5	7/21	16
DuPont Pioneer	RR	45M35	5.0	3453	**110**	16.4	47.8	4.4	1.9	51.0	20.1	8.7	78	7.8	51.4	48	7/3	7/21	17
Integra Seed/Wilbur Ellis	RR	7257	4.7	3232	**103**	17.7	47.0	4.5	1.8	59.5	20.0	9.1	73	7	52.0	43	7/3	7/20	17
Proseed	RR	300 Magnum	5.0	3362	**107**	17.9	47.0	4.6	2.0	57.6	19.2	7.7	63	6.5	51.8	49	7/4	7/22	18
Proseed	RR	PS 5000	5.0	3298	**105**	16.3	47.6	4.5	1.9	65.8	18.9	8.6	73	7.3	51.5	47	7/4	7/21	18
BrettYoung	RR	6074 RR	5.2	3628	**116**	16.5	47.0	4.8	1.8	63.0	20.0	8.8	83	8.3	52.1	48	7/4	7/23	19
Bayer CropScience	LL	InVigor L233P	5.3	3220	**103**	18.0	45.5	4.5	1.9	65.2	19.2	8.3	85	8.3	51.7	51	7/3	7/17	14
Bayer CropScience	LL	InVigor L140P	5.2	3164	**101**	17.1	45.8	4.2	2.0	63.2	18.7	7.8	83	8	50.8	50	7/4	7/19	16
Bayer CropScience	LL	InVigor L252	5.6	3261	**104**	16.3	48.4	4.5	1.7	66.3	20.2	9.7	83	7.8	51.5	51	7/5	7/21	16
Bayer CropScience	LL	InVigor L230	5.5	3391	**108**	16.8	47.7	4.5	1.8	65.3	19.7	8.6	85	8.3	51.7	49	7/2	7/17	15
	LL	Shatter check	5.0	3499	**112**	17.5	47.2	4.6	1.7	65.0	20.3	9.0	83	8.3	51.7	52	7/5	7/22	17
		LSD @ 5% Level		318	10	1.2	1.1	0.1	0.1	7.6	1.0	0.7	10	0.9	0.4	3.9	1.2	1.2	1.2
		CV(%)		6.8	7	5	2	2.8	5.1	8.9	3.8	6.3	9	8	0.6	6	22	4	5

Experimental Design: RCB w/4reps

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

**Seeding rate=12PLS/Ft.[2]

[1] Yields corrected to 8.5% moisture

Mean trial yield =3139#/acre

[2]All quality on dry matter basis

[3]% ground cover June 14

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

Herbicide Treatments:	Herbicide tolerance	Date of Application
Draft- .3oz. + .5% NIS	SU	6/15
Beyond- 4oz.+ .25%NIS+2.5%AMS	CL	6/15
Liberty-- 22oz.+ 2.5%AMS	LL	6/12
Roundup PowerMax 16oz.+.25%AMS	RR	6/12
Section 2 --5oz. + 1%COC	all plots	6/7

Table 2.

2017 Canola Variety Shattering Trial

Northern Resources Cooperative-Roseau,Mn

University of Minnesota

Company	Herbicide tolerance	Variety*	Yield[1] #/acre	Seed Loss--(#/acre)[4] 8/18 seed[2]	8/25 seed[2]	9/2 seed[2]	9/2 pod[3]	9/6 seed[2]	9/6 pod[3]	9/10 seed[2]	9/10 pod[3]	9/18 seed[2]	9/18 pod[3]	Total Seed Lost: Pod only	Total Seed Lost: **Total**
Bayer CropScience	LL	InVigor L233P	3220	0	1	1	0	14	0	21	9	9	3	12	**58**
Bayer CropScience	LL	InVigor L140P	3164	0	1	3	0	12	8	38	40	13	8	55	**122**
Integra Seed/Wilbur Ellis	RR	7257	3232	1	6	30	7	63	12	77	111	183	21	151	**509**
Cibus	SU	C5507	2518	0	1	3	0	34	12	76	40	84	6	58	**255**
Cibus	SU	C5522	2564	0	0	6	0	22	9	60	32	112	19	60	**258**
Cibus	SU	C5513	2500	0	0	3	0	46	6	149	42	101	10	58	**357**
CROPLAN	RR	HyClass 930	3077	0	3	16	0	40	8	65	74	104	8	90	**318**
CROPLAN	RR	HyClass 955	3369	1	4	14	3	55	16	78	61	97	5	84	**333**
CROPLAN	RR	HyClass 970	3595	0	3	31	34	74	129	166	653	237	47	862	**1374**
Dekalb-Monsanto	RR	DKL70-10	3343	0	2	16	6	44	10	69	126	110	29	170	**411**
Dekalb-Monsanto	RR	G15P9374	3261	0	3	22	3	71	24	98	186	157	29	241	**592**
Dekalb-Monsanto	RR	DKL35-23	3464	0	2	11	3	18	0	46	19	54	7	24	**159**
Check 1[5]		Shatter check-1	3499	1	7	89	0	143	18	255	58	197	29	105	**799**
Check 2[5]		Shatter check-2	3300	1	6	29	0	72	31	84	182	120	19	232	**544**
		LSD @5% level	318	1	3	12	10	23	29	32	112	73	28	155	**215**
		CV(%)	7	206	69	44	160	32	99	24	67	45	114	125	35

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

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

Pod seed actually weighed or calculated 24-30 seeds per pod depending on date

[4]Lost seed= direct seed shatter + pod seed shatter would =total lost seed

[5]Check varieties thought to have less shatter tolerance than other lines in trial

Table 3.

2017 Canola Conventional vs Precision Planting[1]

Northern Resources Cooperative-West Plant-Roseau,Mn

Seeding	Row	Seeding rate		Yield	plants/ft2[2]		Plants/acre(X1000)		on dry matter basis			% ground	Test WT		Flowering(July)		
Method	Spacing	PLS/Ft.2	#/acre	#/acre	7-Jun	29-Sep	7-Jun	29-Sep	Protein	oil	ESV[3]	cover[4]	#/bu.	Ht.(in.)	begin day	end day	# of days
singulation	10"	3	1.3	3174	3.1	2.8	138	123	18.8	44.8	7.3	63	50.5	51	4	22	18
singulation	20"	3	1.3	2899	2.4	2.4	103	103	18.8	44.7	7.3	43	50.6	53	4	23	19
singulation	10"	6	2.7	3237	4.6	4.9	202	212	18.5	45.1	7.5	73	50.5	53	3	21	17
singulation	20"	6	2.7	3013	4.2	3.6	183	157	18.9	45.0	8.0	50	50.4	51	3	20	17
conventional	6"	3	1.3	2886	3.9	3.9	172	172	19.1	44.2	6.3	25	51.0	50	4	24	20
conventional	6"	6	2.6	3524	5.6	6.4	245	278	18.9	44.4	7.3	60	50.8	53	3	23	20
conventional	6"	9	3.8	3312	7.5	8.3	327	359	18.6	45.2	7.5	70	50.8	50	3	21	18
conventional	6"	12	5.2	3454	9.4	10.5	408	457	18.4	45.4	8.0	80	50.8	50	3	20	17
conventional	12"	3	1.3	2971	2.3	2.4	98	106	19.0	44.3	6.5	40	50.8	51	4	24	20
conventional	12"	6	2.6	3071	4.0	4.2	175	184	18.3	45.1	7.8	53	50.8	50	4	22	18
conventional	12"	9	3.8	3688	5.1	5.7	221	249	19.0	44.7	8.0	63	50.7	52	3	22	19
conventional	12"	12	5.2	3591	6.6	7.1	286	310	19.0	44.6	7.5	63	50.8	50	3	20	17
conventional	24"	3	1.3	2502	1.7	2.3	76	100	19.0	44.1	7.3	28	50.6	55	4	22	18
conventional	24"	6	2.6	2778	3.8	3.5	163	151	19.3	44.4	8.5	38	50.7	54	3	23	20
conventional	24"	9	3.8	2916	4.3	4.7	185	206	18.8	44.7	8.3	33	50.6	51	4	22	18
conventional	24"	12	5.2	3043	5.4	5.8	234	253	19.4	44.3	8.8	40	50.7	53	3	21	18
		LSD @ 5% leve		389	1	1	33	38	1	1	1	12	NS	3	1	1	1
		CV(%)		9	16	17	16	17	3	1	7	17	1	4	12	4	5

Design=RCB with 4 reps Mean trial yield=3129#/acre

Canola variety- L140P

[1]-Conventional planter done with a Hege small plot cone seeder with double disk openers

Singulation planting done with 10' Plains Grain precision planter by Travis Messer of Plains Grain

[2]- Two plant counts per plot (plants/ft.2)

[3]-ESV(early season vigor) 6-7-2017

[4]-% Ground cover 6-12-2017

Table 4a.

2015-17 Canola Conventional Planting Row Space x Seeding Rate Trial

Roseau,Mn.

Row Spacing	Seeding Rate PLS/Ft.2	Seed Yield(#/ac.)[1] 2015	2016	2017	3Yr. Ave.
6"	3	2518	2706	2886	**2703**
6"	6	2636	2787	3524	**2982**
6"	9	2850	2533	3312	**2898**
6"	12	3194	2590	3454	**3079**
12"	3	2692	2498	2971	**2720**
12"	6	2972	2310	3071	**2784**
12"	9	2901	2695	3688	**3095**
12"	12	3337	2500	3591	**3143**
24"	3	2898	2568	2502	**2656**
24"	6	2561	2391	2778	**2577**
24"	9	2822	2376	2916	**2705**
24"	12	3018	2475	3043	**2845**
LSD @5% level		518	318	366	**233**
CV(%)		12	8	8	6

Planting date- May 23-2015

2015 Canola variety- InVigor L 252 ; 2016-17 InVigor L 140P

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

Table 4b.

2015-17 Canola Row Space/Seeding Rate Management Budgets

Profit Margins for Reduced Seeding Rates

Roseau,Mn.

Row Spacing	Seeding Rate* PLS/Ft.2	2015#/ac	2016-17#/ac	Net return of treatments 2015	2016	2017	2015-17	Net return[1]	**Net return[2]**
6"	3	1.6	1.3	$62.09	$91.90	$175.19	$109.73	($51.70)	**($12.05)**
6"	6	3.2	2.6	$62.19	$89.29	$272.74	$141.41	$45.85	**$19.63**
6"	9	4.8	3.8	$76.69	$35.69	$218.62	$110.33	($8.27)	**($11.45)**
6"	12	6.4	5.1	$110.69	$27.76	$226.89	$121.78	$0	**$0**
12"	3	1.6	1.3	$88.19	$60.70	$190.49	$113.13	($61.06)	**($19.52)**
12"	6	3.2	2.6	$112.59	$17.74	$191.20	$107.18	($60.35)	**($25.47)**
12"	9	4.8	3.8	$84.34	$59.99	$286.30	$143.54	($34.75)	**10.89**
12"	12	6.4	5.1	$132.14	$14.26	$251.55	$132.65	$0	**$0**
24"	3	1.6	1.3	$119.09	$71.20	$106.07	$98.79	($46.84)	**$16.22**
24"	6	3.2	2.6	$50.94	$29.89	$138.46	$73.10	($14.45)	**($9.47)**
24"	9	4.8	3.8	$72.49	$12.14	$147.34	$77.32	($5.57)	**($5.25)**
24"	12	6.4	5.1	$84.29	$10.51	$152.91	$82.57	$0	**$0**

*Seeding Rates based on pure live seed(PLS)per pound

[1] Net return= 2017 High seeding rate vs. lower seeding rate comparison in each row spacing treatment.

[2]Net return=2015-17 High seeding rate vs. lower seeding rate comparison in each row spacing treatment.

Seed cost used in for net returns are $13.30/LB in 2017, $12.30/LB in 2016 and $11.00/LB in 2015

Canola price $.18/LB in 2017

Seed cost of L140P is $12.30/LB in 2016

Seed cost used for L252 in 2015 was $11.00

Production cost used to calculate returns without seed cost=$298.01 in 2015-16 and $327 in 2017

Table 5a.

2017 Spring Canola Return on Investment(Bang for the Buck)
Northern Resources-West Plant Roseau,Mn
University of Minnesota

Management	Seed Rate*	Fertilizer	Fungicide	Yield #/acre	% of mean	ESV[1] 7-Jun	%Ground[2] cover	# Days[3] in Bloom	Harvest Ht.(in.)	Plants/Ft.2 Stand[4]	dry matter basis %Protein	% Oil
L/L/L	3.8#/ac.- 12"rows	120-30-30-20s	Topsin M	2951	89	7.8	45	19	55	5.3	19.2	44.4
L/L/H	9PLS/ft.2- 12"rows	120-30-30-20s	Proline/Priaxor	3477	104	7.3	40	18	55	5.4	19.5	44.5
L/H/L	9PLS/ft.2- 12"rows	160-40-40-20s	Topsin M	2951	89	6.8	30	18	53	5	18.8	44.2
L/H/H	9PLS/ft.2- 12"rows	160-40-40-20s	Proline/Priaxor	3099	93	6.5	35	19	53	5.6	19.7	44
H/L/L	5.1#/ac.-6" rows	120-30-30-20s	Topsin M	3357	101	7.8	78	17	51	11.3	18.6	44.5
H/L/H	12PLS/ft.2-6" rows	120-30-30-20s	Proline/Priaxor	3553	107	7.8	75	18	52	10.8	19.2	44.4
H/H/L	12PLS/ft.2-6" rows	160-40-40-20s	Topsin M	3687	111	7.0	78	17	54	11.3	19.4	44.1
H/H/H	12PLS/ft.2-6" rows	160-40-40-20s	Proline/Priaxor	3472	105	7.5	75	17	51	10.3	19.5	43.9
			LSD @5% level	619	18	0.9	13	1	3	2	0.7	NS
			CV(%)	12	12	8	15	4	4	20	2	1
			Mean yield	3318#/acre								

Table 5b.

Main Plot Treatments **Seeding Rate**	Management Level	Cost	#/acre	Increase with Premium Treatment Yield(#/A)	$$ Gross	Add cost	**Net $$ gain**
12" row	Low	$51.87	3120				
6" row	High	$69.16	3517	397	$71.46	$17.29	**$54.17**
Fertility							
120-30-30-20s	Low	$72.08	3334				
160-40-40-20s	High	$102.23	3302	-32	-$5.76	$30.15	**($35.81)**
Fungicide							
Topsin M	Low	$11.25	3236				
Proline/Priaxor	High	$46.93	3400	164	$29.52	$35.68	**($6.16)**

Experimental Design: RCB with 4 reps
Canola variety- InVigor L140P
*- 3.8#/acre= 9PLS/ft.2 ; 5.1#/acre=12PLS/ft.2 (Conventional planting)
[1]ESV- Early season vigor 6-7-2017
[2]-%ground cover 6-12-17
[3]-Number of days from first bloom to end bloom
[4]-Number of plants/Ft.2 6-7-2017---2 plant counts per plot
Proline or topsin applied 7-6-2017 early flower
Priaxor @ 6oz. Applied 7-18-2017 late bloom
Fertilizer applied prior to final seedbed preparation
All treatments applied as per best management practices

Prices used for budgeting--Cash prices November 2017

Fertilizer costs

per ton		$$/acre of blended product	
Urea	$360	120-30-30-20s	$72.08
ESN	$490	140-40-40-20s	$94.43

InVigor L140P $665./50# 13.30/LB
Canola selling price-CHS Hallock $.18/LB

Treatment	Use rate	Cost	Treatment cost
Topsin 4.5FL		$48.75/gal	$13.54
Topsin M WSB	20oz.	$9/#	$11.25
Proline	5.7oz.	$532/gal	$23.65
Priaxor	6oz.	$497/gal	$23.28

Table 6a.

2017 Canola Fertility Trial- University of Minnesota

Northern Resources Cooperative- Roseau,Mn[1]

N Rate[1]	#/ac	Yield as % of Mean						Leaf		%Ground	Begin	End	Days in	Harvest		
All PPI- 100%urea	2017	2017	2016	2015	2014	2013	5 Yr.	Burn[3]	ESV[4]	cover 6/17	Bloom	Bloom	Bloom	Ht.(in.)	%Protein	% Oil
0	2954	90.4	67	72	76	73	**76**	0	7.0	70	2-Jul	18-Jul	16	48	18.3	45.7
90	3295	100.8	98	95	99	96	**98**	0	7.3	78	3-Jul	19-Jul	16	51	17.6	46.1
135	3416	104.5	108	98	110	106	**105**	0	6.5	60	3-Jul	20-Jul	17	50	19.2	44.7
180	3474	106.3	105	105	106	111	**107**	0	5.8	48	4-Jul	21-Jul	17	51	19.0	44.9
						Mean=	**103**									
All PPI- 50%Urea+50%ESN																
90	3317	101.5	99	87	95	98	**96**	0	7.3	78	3-Jul	19-Jul	16	51	18.5	45.4
135	3427	104.9	102	106	110	109	**107**	0	7.3	78	3-Jul	19-Jul	16	51	17.9	45.0
180	3280	100.4	114	117	104	120	**111**	0	6.5	63	3-Jul	20-Jul	17	52	19.1	45.0
						Mean=	**105**									
PPI urea/+Post liquid streamer(UAN 28%N= 3#N/gal)[5]																
45/+45	3267	100.0	98	n/a	n/a	n/a	**99**	8	7.0	73	3-Jul	20-Jul	17	49	18.9	45.1
45/+90	3262	99.8	96	n/a	n/a	n/a	**98**	11	7.3	80	3-Jul	20-Jul	16	51	19.5	44.5
45/+135	3086	94.4	107	n/a	n/a	n/a	**101**	27	7.0	78	4-Jul	21-Jul	17	48	19.5	44.5
PPI/+Post liquid flat fan (UAN 28%N= 3#N/gal)																
11 45/90	3180	97.3	n/a	n/a	n/a	n/a	n/a	53	7.0	73	4-Jul	21-Jul	17	47	18.8	44.7
PPI Urea/+ Post Urea+Agrotain Ultra																
45/+45	3182	97.4	91	103	104	96	**98**	0	7.5	80	3-Jul	19-Jul	16	49	18.7	45.0
45/+90	3394	103.9	106	107	107	112	**107**	0	7.3	78	3-Jul	18-Jul	15	49	18.4	45.5
45/+135	3216	98.4	108	115	118	115	**111**	0	7.3	73	3-Jul	19-Jul	16	49	18.6	45.1
							105									
LSD @ 5% level	315	9.6	10	17	9	15		6	0.9	10	NS	1	1	3	0.3	0.4
CV(%)	7	7	7	12	7	10		58	9	10	11	5	6	4	2	1
Average #/acre yield each year		3268	2658	2854	3007	2344	2826									

Experimental Design: RCB w/4reps Canola variety- InVigor L140P

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

[2] 5 year average yield per treatment; Each 1% difference =28#/acre

[3]Leaf burn from post liquid nitrogen applications 6/23/2017

[4]ESV(Early Season Vigor) 6/7/2017 -visual rating 1=least ;9=best

Soil Nitrate test 5/2017

0-6" 14#/acre

6-24" 24#/acre

Fertilizer applications-

26-40-40-20s to all plots 5/10/2017

Pre-emergent fertilizer 5/15/2017 prior to final seedbed prep

Post emerge dry fertilizer 6-12-17

post emerge liquid fertilizer 6-16-17

Table 6b.

2017 Canola Fertility Budgets

N Rate	#/ac 2017	N treat[1] cost $$	Net $$[2] Return	Treatment Explanation
All PPI- 100%urea				
0	2954	$0.00	$340.00	Check- no added N
90	3295	$35.10	$366.28	90#N-urea source -Preplant incorporated(Low)
135	3416	$52.65	$370.51	135#N-urea source-Preplant incorporated(Standard)
180	3474	$70.20	$363.40	180#N- urea source-Preplant incorporated(High)
All PPI- 50%Urea+50%ESN				
90	3317	$42.75	$362.59	45#N-urea + 45#ESN- Preplant incorporate(Low)
135	3427	$64.13	$361.01	67.5#N-urea+67.5#N-ESN- Preplant incorporate(Standard)
180	3280	$85.50	$313.18	90#N-urea+90#N -ESN-Preplant incorporate(High)
PPI urea/+Post liquid streamer(UAN 28%N= 3#N/gal)[5]				
45/+45	3267	$38.70	$357.64	45#N urea-preplant incorporate+45#N(28% UAN source) liquid stream jet-4 leaf stage
45/+90	3262	$59.85	$335.59	45#N urea-preplant incorporate+90#N(28% UAN source) liquid stream jet-4 leaf stage
45/+135	3086	$81.00	$282.76	45#N urea-preplant incorporate+135#N(28% UAN source) liquid stream jet-4 leaf stage
PPI/+Post liquid flat fan (UAN 28%N= 3#N/gal)				
45/90	3180	$59.85	$320.83	45#N urea-preplant incorporate+90#N(UAN source) flat fan application-4 leaf stage
PPI Urea/+ Post Urea+Agrotain Ultra				
45/+45	3182	$37.80	$343.24	45#N urea-preplant incorporate+45#N urea+Agrotain Ultra-4 leaf post emergent
45/+90	3394	$58.05	$361.15	45#N urea-preplant incorporate+90#N urea+Agrotain Ultra-4 leaf post emergent
45/+135	3216	$78.30	$308.86	45#N urea-preplant incorporate+135#N urea +Agrotain Ultra- 4 leaf post emergent

[1]Nitrogen fertilizer cost basis

per ton	
Urea	$360
ESN	$490
28%N	$260
Agrotain Ultra	$62

Total cost basis (excluding N fertilizer)=$191.72/acre

Seed cost of L 140P is $13.30/LB in 2017

Canola price $.18/LB in 2017

[2]Net profit margin per acre (includes added N fertilizer cost)

Table 7a.

2017 Canola Popup Fertilizer added to Precision Planted Canola[1]
Northern Resources Cooperative-Roseau,Mn

Added[2]	Seeding	Row	Seeding rate		Yield	plants/ft2	dry matter basis			% ground		Flowering(July)	
Popup	Method	Spacing	PLS/Ft.2	#/acre	#/acre	29-Sep	Protein	oil	ESV[3]	cover[4]	Ht.(in.)	begin day	end day
0	singulation	10"	3	1.5	3174	2.8	18.8	44.8	7.3	63	51	4	22
0	singulation	20"	3	1.5	2899	2.4	18.8	44.7	7.3	43	53	4	23
0	singulation	10"	6	3.0	3237	4.9	18.5	45.1	7.5	73	53	3	21
0	singulation	20"	6	3.0	3013	3.6	18.9	45.0	8.0	50	51	3	20
3-13-3	singulation	10"	3	1.5	2919	3.6	17.8	45.6	7.0	70	54	4	22
3-13-3	singulation	20"	3	1.5	2991	3.2	18.2	45.0	8.5	50	58	3	23
3-13-3	singulation	10"	6	3.0	3445	6.9	18.5	45.1	8.5	80	53	3	20
3-13-3	singulation	20"	6	3.0	3237	4.6	18.2	45.7	9.0	60	55	2	20
		LSD @ 5% level			NS	1.5	NS	NS	1.8	2	NS	1	1
		CV(%)			6	10	4	2	7	1	6	12	2

Variety-InVigor L 140P

6-24-6 Treatments set up as separate trial so 0 added treatments can not be directly compared

Experimental design: RCB with 2 reps

[1]-5 gal/acre of 6-24-6(3-13-3) Ortho Polyphosphate applied over the row as popup starter fertilizer

[2]Liquid fertilizer rate per acre applied over the top of row at planting

[3]ESV- Early season vigor 6-7-2017

[4]-%ground cover 6-12-17

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

Table 7b.

Ammonium Thiosulfate Added Early Post Emergent to Canola
Added to Border Plots of Seeding Rate Trial

Post[1] Liquid	Yield[2] #/acre
12-0-0-26s[3]	3541
0	3451

Variety-InVigor L 140P--Seeding rate=12PLS

[1]Post liquid application-flat fan sprayer 6-16-2017

[2]Treatment applied to 1/2 of the border plots of the seeding rate trial

[3] 10gal/ac of 12-0-0-27s(13-0-0-28s)

Table 8.

Conventional Compared to Precision Planting of Canola in 2017
Tony Brateng Farm-2 miles south of Roseau

				Plants/Ft. of Row		Plants / Ft.2	
Plant Method	Yield(#/ac)[3]	Protein	Oil	13-Jun	at Harvest	13-Jun	at Harvest
Conventional[1]	2309	17.7	42.4	10.5	6.6	16.7	12.1
Precision[2]	2610	20.2	44.2	15.4	5.6	9.7	3.5
LSD @5%	111	2.4	1.3	1.6	0.9	6.3	4.5
CV(%)	2	6	1	5	4	6	7

Experimental Design;RCB W/4Reps
Planting date= May 5,2017
[1]Conventional=Precision planted with air seeder in 7.5"rows @ 5#/acre
[2]Precision=Precision planted in 22" rows @ 2.7#/acre
[3]Yield in #/acre at 8.5% moisture
Entire canola field was seeded with an air seeder, 7.5 inch rows @ 5#/A.
All plots were direct harvested with a combine header width of 35 feet.
Harvested area in each strip was 0.49 acres.
Each strip was weighted separately (grain cart with scale) and a sub-sample taken for quality analysis.

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Table 9.

2017 Swathing Compared to Direct Harvest of Canola
Tony Brateng Farm-3 Mi. South of Roseau

	Yield(#/ac)[3]	Protein	Oil
Standard[1]	2619	17	45.2
Direct[2]	2679	17	44.7
LSD @5%	NS	NS	NS
CV(%)	4	0.3	0.5

Experimental Design;RCB W/4Reps
[1]Standard=Swath at maturity and combine after dry down
[2]Direct=Direct combine at maturity
[3]Yield in #/acre at 8.5% moisture
Entire canola field was seeded with an air seeder, 7.5 inch rows @ 5#/A.
Swath width was 21 feet and direct harvest was 35 feet.
Direct harvested area was 1.54 acres and swath was 0.94 acres.
Each strip was weighted separately (grain cart with scale) and a sub-sample taken for quality analysis.