2004

University of Minnesota Canola Research

TABLE OF CONTENTS

MINNESOTA CANOLA PRODUCTION CENTRE RESULTS

ADDITIONAL UNIVERSITY OF MINNESOTA CANOLA RESULTS

I ACKNOWLEDGEMENTS AND FUNDING

Minnesota Canola Production Centre

The Minnesota Canola Production Centre is a public-private international partnership between the University of Minnesota, the Minnesota Canola Council, and the Canola Council of Canada.

This year's Canola Production Centre was funded by a grant from the North Central Regional Canola Research Program.

Many thanks to all of our local and regional sponsors for their donations of cash, products and services. Their continued generous support has made the Minnesota Canola Production Centre a reality.

Thank you all!

II LOCAL AND REGIONAL SPONSORS

Dave LeGare, Scientist - Agronomy Dept. - University of Minnesota
Dr. Paul Porter, Assoc. Prof. - Agronomy Dept. - Univ. of Minnesota

Location: Roseau - 39 acres

Land: Kelman Kvien

Seed: Bayer CropScience - InVigor 2733 (2 bags)
Interstate Seed - Hyola 401, Hyola 357 Magnum (2 bags)
Monsanto - DKL 3455, DKL 3585

Fertilizer: Agriliance (39 acres)

Pesticides: BASF - Ronilan (39 acres), Beyond (3 acres)
Bayer CropScience - Liberty (10 acres)
Dupont - Assure II (14 acres)
Monsanto - Roundup Ultra Max II (35 acres)
Syngenta - Warrior (39 acres)

Equipment and Labor: Dave Severson - cement mixer
Kelman Kvien - New Holland TX68 combine, combine operator, and grain truck
Farmer's Union Oil Co., West Plant - fertilizer application, soil testing, soil analysis, weigh wagon
Mike Hagen - Grain truck, drying the canola, trucking dried crop to the elevator
Salol Elevator - semi-truck to haul crop to the dryer

Field Day: Roger Wiskow - hay racks, Arlan Tveit - bales, Geroy's Bldg Center - parking

Meal and Golf events:

ADM	Citizens State Bank – Ros.	Monsanto
BASF	Dow AgroSciences	Northwest Grain
Bayer CropScience	DuPont Crop Protection	Pioneer Hi-Bred Int'l Inc.
Border State Bank – Ros.	Farm Credit Services	Proseed, Inc.
Brett-Young Seeds Ltd.	Farmers Union Oil – Ros.	Roseau Farm Service
Bunge Canada	FMC	Syngenta Seed Trtmt.
CerexAgri	Gustafson, LLC	
Cheminova	Interstate Seed Company	

Comments: We would like to thank **Christian Nelson, Andrew Plaine, Jonathan Gorentz** and **Karen Andol** for all of their hard work and dedication throughout the growing season. Thanks to **Wayne Brateng** and the crew at **West Plant** for their assistance. Thanks to the staff of the **Minnesota Canola Council** for organizing the field day. Many thanks to **Kelman Kvien** for his help combining fill. We would also like to thank **Derwyn Hammond** of the Canola Council of Canada for his ideas and assistance with reviewing this report. And a special thank you to Dave's family (**Sue, Laura** and **Katie**) for their patience with him during the long growing season.

III INTRODUCTION

The Canola Council of Canada initiated Canola Production Centres to address the ongoing need for canola production technology transfer as identified during the Grow with Canola program (1985-1990). The Canola Production Centres were a joint effort between producer groups, industry representatives, and government and extension personnel. Field scale agronomic trials utilizing commercial farm equipment were conducted at the sites, and the information generated was utilized for extension activities throughout the year.

Following tours of the Canola Production Centre near Carman, MB in 1996 and 1997 the Minnesota Canola Council sought funding for a joint project between the Minnesota Canola Council, University of Minnesota and Canola Council of Canada. The purpose of the project was to establish a Canola Production Centre site in Minnesota, and the role of the Canola Council of Canada was to provide expertise and supervisory support. This would help ensure that activities at this site would be consistent with activities at the Canadian CPCs. This allowed the information from all sites to be easily shared. Funding for the project was approved in April 1998, and the Minnesota Canola Production Centre program was born.

During the first two years of the project, the Minnesota Canola Production Centre was located near Roseau, MN. In 2000, the site was moved to Thief River Falls, MN where it stayed through 2002. In 2003 and 2004, the CPC returned to the Roseau area. This year, the field day tour was held on July 28 and included a lunch, tour of the site and a golf tournament after the lunch. All trials were signed and copies of site plans were available at the entrances to allow for self-guided tours at any time other than scheduled tour date.

Information obtained from the Canola Production Centre included many agronomic factors such as yield and quality data, early season plant counts, lodging indices and harvestability ratings on varieties.

Canada has not had Production Centres since 2002. In the fall of 2002 the Canola Council of Canada (CCC) initiated some strategic planning, and the Canadian canola industry identified a goal of achieving a sustained production and market demand base of seven million tonnes of canola by 2007. For the crop production area of CCC this has meant a shift from the Canola Production Centre program of field scale agronomy trials to a new extension focused program called Canola Advantage. This program focuses on providing producers with production information targeted at improving profitability, in order to make canola one of their best cropping options. Activities within the new program fall into one of five key areas including just-in-time information, skill development, optimizing production practices, production solutions, and research. Growers that would like to receive the "Canola Watch" report (via e-mail) can sign up by e-mailing the Canola Council of Canada at admin@canola-council.org and asking for it.

It should be noted that the material contained in this report is a collection of agronomic information from a specific location and only from one site year. Therefore, it should be observed and understood accordingly.

IV DEFINITIONS

Brassica napus varieties: Argentine varieties

Co-efficient of variation (CV): The standard deviation expressed as a percentage of the mean.

Contribution margin: The amount of total revenue less variable costs that directly relate to the business operation available to contribute to fixed costs and return on investment, labor and management.

Contribution margin per acre: The amount of revenue remaining per acre after variable costs have been serviced, allowing the producer to manage other financial commitments, such as fixed costs.

DAP: Days after planting

Days to maturity: Actual calendar days from the date of seeding to approximately 30% seed color change on the main stem.

Fixed costs: Costs that remain relatively unchanged regardless of the volume of production (e.g. land taxes, mortgage interest and machinery depreciation).

Height: The average plant height in inches at swathing time.

Growing degree-days (GDD): Heat accumulated above canola's base temperature. The heat accumulated each day is determined by adding the maximum and minimum temperatures and dividing the total by two to obtain a daily average. The base temperature for canola of 0°C is subtracted from the average to arrive at the number of growing degree-days. The total growing degree-days required for Argentine canola on average is 1432 to 1557 growing degree-days.

Least significant difference (LSD): The difference required for one treatment to be statistically different from another at the **95%** confidence level, expressed in identical units. For example, if Variety A yielded 1900 lb/ac and Variety B yielded 2050 bu/ac and the LSD for that trial was 112.5, then Variety A is statistically different from Variety B because 2050 - 1900 = 150, which is greater than 112.5. If the difference were less than 112.5, then the varieties would not be statistically different from each other.

Lodging rating: A measure of the lodging resistance of a particular variety where 1 = erect and 9 = flat on the ground.

Opportunity costs: The opportunity cost of a resource is the return the resource can earn when put to its best alternative.

Variable costs: Costs that vary directly with the volume of production or activity (e.g. seed, fertilizer, fuel and repairs).

V ECONOMIC ANALYSIS

A. *Canola Pricing System* ***(Based on price one month after harvest when most of this crop was delivered to the elevator, in U.S. dollars)***

Green Seed (%)	$/100 lb At Elevator	$/bu
0 - 2.0	10.02	5.01
2.1-3.0	9.83	4.92
3.1-4.0	9.74	4.87
4.1-5.0	9.65	4.83
5.1-6.0	9.56	4.78

Note 1: *The green seed was determined by using 2-300 seed crush strip tests done on each sample from every plot within a particular project trial.*

B. *Cost Calculations & Assumptions*

The following costs were used in calculating economic returns for the various trials and treatments, and are expressed in **U.S. dollars**. Fertilizer and crop protection product prices were obtained from the local dealer for summer 2004.

Equipment costs were obtained from the University of Minnesota Extension Service and are estimated equipment variable costs for Minnesota. There has been no value allocated for capital and fixed costs.

CANOLA VARIETY SEED COSTS

B. napus	$/lb	Distributor	*B. napus*	$/lb	Distributor
45H21	5.55	Pioneer Hi-Bred	Hyola 401	4.06	Interstate Seed
46A76	3.95	Pioneer Hi-Bred	InVigor 4870	5.75	Bayer CropScience
DKL223	5.10	DeKalb/Monsanto	InVigor 5630	5.69*	Bayer CropScience
DKL35-85	4.00	DeKalb/Monsanto	SW Marksman RR	4.86	Interstate Seed
Hyola 357 Magnum	5.26	Interstate Seed			

Note: Seed costs may vary. Prices reflect the Minnesota suggested retail for spring of 2004 with Helix Xtra or Prosper 400 seed treatment.

* This variety was not sold in the USA in 2004, so the 2005 bare seed price plus 2004 Prosper 400 price were used with permission of the distributor.

PRODUCT INFORMATION			
Product	**Active Ingredient**	**Manufacturer/ Distributor**	**$/Unit Cost**
Assure II	quizalofop-p-ethyl	DuPont Agri. Prod.	124.00/gal
Ammonium Sulfate	ammonium sulfate	Agriliance	0.60/lb
Beyond	imazamox	BASF	504.00/gal
Helix XTra	fludioxonil + mefenoxam + difenoconazole + thiamethoxam	Syngenta	1.36/lb seed
Muster	ethametsulfuron	DuPont Agri. Prod.	31.00/oz
Liberty	glufosinate ammonium	Bayer CropScience	63.84/gal
Preference	non-ionic surfactant	Agriliance	22.50/gal
Prime Oil	crop oil concentrate	Agriliance	7.00/gal
Prosper 400	carboxin + thiram + metalaxyl + clothianidin	Gustafson	1.45/lb seed
Ronilan	vinclozolin	BASF	20.82/lb
Roundup Ultra Max II*	glyphosate	Monsanto	54.00/gal
Stinger	clopyralid	Dow AgroSciences	490.00/gal
Tactic	sticker/spreader	Loveland Ind.	64.00/gal
Warrior	lambda-cyhalothrin	Syngenta	287.50/gal

*Note: $18/ac CUA (Canola Use Agreement) includes two applications of Roundup Ultra Max II (11oz/ac).

Numerous references to pesticide applications will be found in this report. We advise everyone to consult with recommendations and product labels for complete instructions.

CANOLA FERTILIZER COSTS			
Fertilizer	**Analysis**	**$/Ton**	**$/lb of Nutrient**
Ammonium Sulfate	21-0-0-24	190.00	0.29 (of N)
Ammonium Sulfate	21-0-0-24	190.00	0.14 (of S)
Phosphate	18-46-0	270.00	0.17
Urea	46-0-0	270.00	0.29

Machinery Cost:

Conventional tillage: $ 36.13/ac
Extra spray pass: add $ 0.55/ac

Additional Machinery Costs: (Custom Application)

Aerial $ 6.25/ac
Fertilizer application $ 4.25/ac

Note: Machinery costs were obtained from the University of Minnesota Extension Service and are estimated operating costs (such as fuel, lubrication and repairs) for Minnesota. High fuel costs for 2004 were taken into account.

Drying costs: Costs from a local elevator for drying wet canola to 9% moisture.

Grain moisture	cost for drying
10.1 – 11.0%	$0.23/cwt
11.1 – 12.5%	0.45/cwt
12.6 – 14.0%	1.36/cwt
16.0%	3.30/cwt estimated

Minnesota State Check-off:

$0.06 per 100 pounds of canola.

Interest/Opportunity Cost:

This cost calculation demonstrates the cost of money borrowed and charged on crop inputs and machinery-operating costs. In 2004, 6.5% per annum over six months was used.

C. *Economic Results Report (example)*

Site: Roseau, MN

Variety and System Comparison Trial: ***Hyola 401***

CALCULATION OF VALUE OF PRODUCTION				
Yield (lb/ac)	X	Price ($/cwt)	=	Value of Production
1920		10.02		192.38

CALCULATION OF VARIABLE COSTS ($/ac)	
Seed	21.92
Fertilizer	54.95
Herbicides	46.15
Fungicides	22.27
Insecticides	6.74
Machinery	36.13
Drying costs	8.64
Green seed discount	5.37
Check-off	1.15
Interest/opportunity	6.12
Total Variable Costs	209.44

CALCULATION OF CONTRIBUTION MARGIN				
Value of Production ($/ac)	-	Variable Costs ($/ac)	=	Contribution Margin ($/ac)
192.38		209.44		(17.06)

Note: Brackets indicate a negative contribution margin.

This example was developed and prepared with assistance from Royal Bank of Canada agrologists.

VI SITE INFORMATION

THIS IS GENERAL SITE INFORMATION THAT MAY CHANGE FOR SPECIFIC TRIALS.

Co-operator: Kelman Kvien

Previous crop: Wheat

Soil test results: (AGVISE Laboratories)

Organic matter content: 2.4 %

Macronutrient Levels: (0-6", 0-24")

Nitrogen -	11, 24 lb/ac
Phosphorus -	48 lb/ac
Potassium -	444 lb/ac
Sulfur -	14, 48 lb/ac

Micronutrient Levels: (0-6")

Boron -	1.0 lb/ac
Copper -	1.6 lb/ac
Iron -	63.6 lb/ac
Zinc -	1.7 lb/ac
Chlorine -	88 lb/ac (0-24")
Manganese -	8.8 lb/ac

Recommended Fertilizer Applications - (lb/ac of actual nutrient):

Target Yield (lb/ac)	Probability of Precip. (%)	Precip. Required (inches)	Nitrogen	Phosphate	Potash	Sulphur
2000	N/A	N/A	116	0	0	30

Target yield: 2000 lb/ac

Fertilizer applied:

Systems: N - 120 lb/ac P - 30 lb/ac K - 20 lb/ac S - 20 lb/ac
Top-dress: N - 40 lb/ac P - 30 lb/ac K - 20 lb/ac S - 20 lb/ac
MicroEss.: N - 120 lb/ac P - 0 lb/ac K - 20 lb/ac S - 0 lb/ac
Seed placed: N - 7 lb/ac P - 35 lb/ac K - 0 lb/ac S - 0 lb/ac

Soil association/zone:

Systems: Augsburg Loam, Garnes Fine Sandy Loam, and Zipple Very Fine Sandy Loam
MicroEssentials: Roliss Loam
Topdress : Roliss Loam and Garnes Fine Sandy Loam

Soil texture: Loam to sandy loam

Soil pH: 7.8

Salinity: 0.25, 0.36 mmho (0-6", 0-24") (slightly saline)

Tillage operations: The field was chisel plowed in the fall of 2003. It was cultivated with an S-tine harrow after part of the spring application of fertilizer. Rains for the next month delayed seeding and a second light cultivation with an S-tine harrow was done before seeding to help dry out the soil.

Seeding method: The field was seeded with a John Deere 9350 double disc press drill.

Dates: June 17 and June 19, 2004
Depth: 1/4 to 1 inch deep
Rate: 5.4 lb/ac with the following exceptions:
4.3 lb/ac - InVigor 4870 and InVigor 5630

Herbicides applied:
A) Conventional variety - Assure II (12 oz/ac), crop oil concentrate (13 oz/ac), Stinger (6 oz/ac), Muster (0.35 oz/ac)
B) Liberty Link varieties - Liberty (28 oz/ac), Assure II (6 oz), ammonium sulfate (1.5 lb/ac)
C) Clearfield variety - Beyond (4 oz/ac), non-ionic surfactant (3.2 oz/ac), ammonium sulfate (2.5 lb/ac), Stinger (5 oz/ac)
D) Roundup Ready varieties in the systems, MicroEssentials, and top-dress trials - Roundup Ultra Max II (11 oz/ac), ammonium sulfate (1.0 lb/ac) in a split application at the 2 to 3 leaf stage and 7 days later at the 5 to 6 leaf stage

Fungicides applied: Ronilan (12 oz/ac) + Tactic (3.2 oz/ac) on August 3 at 15 to 50% bloom

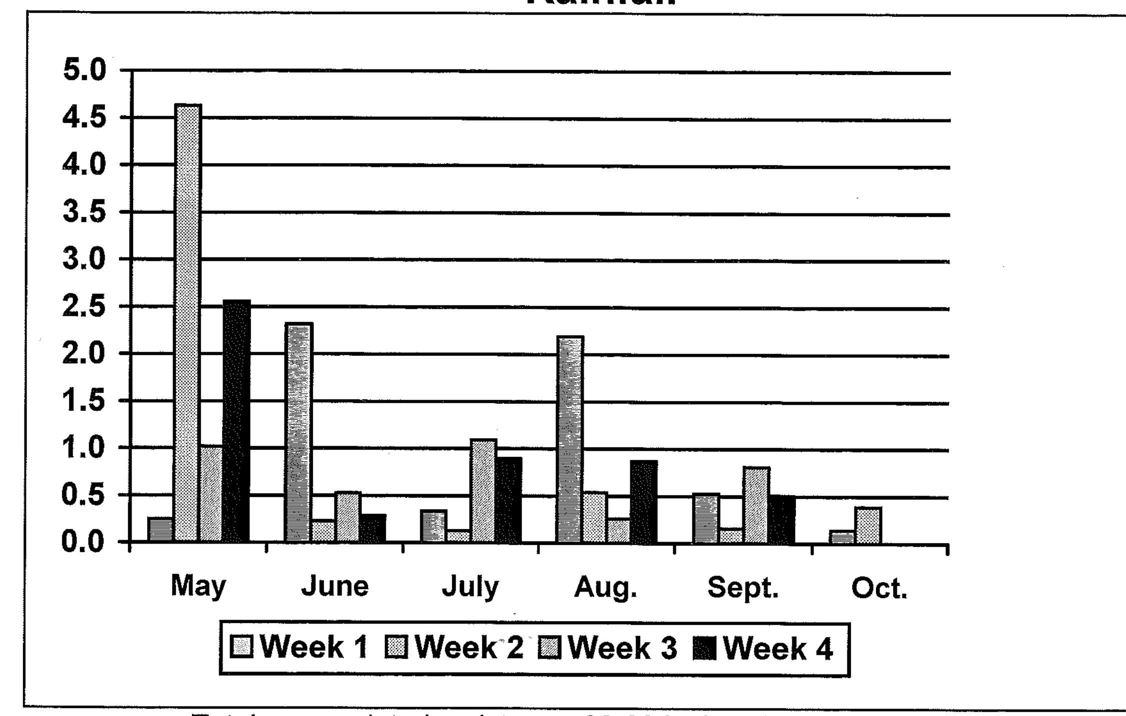
Insecticide applied: Warrior (3 oz/ac) on August 3 to control lygus bugs

Swathing: Started: September 20 Finished: September 29

Combining: Started: October 11 Finished: October 13

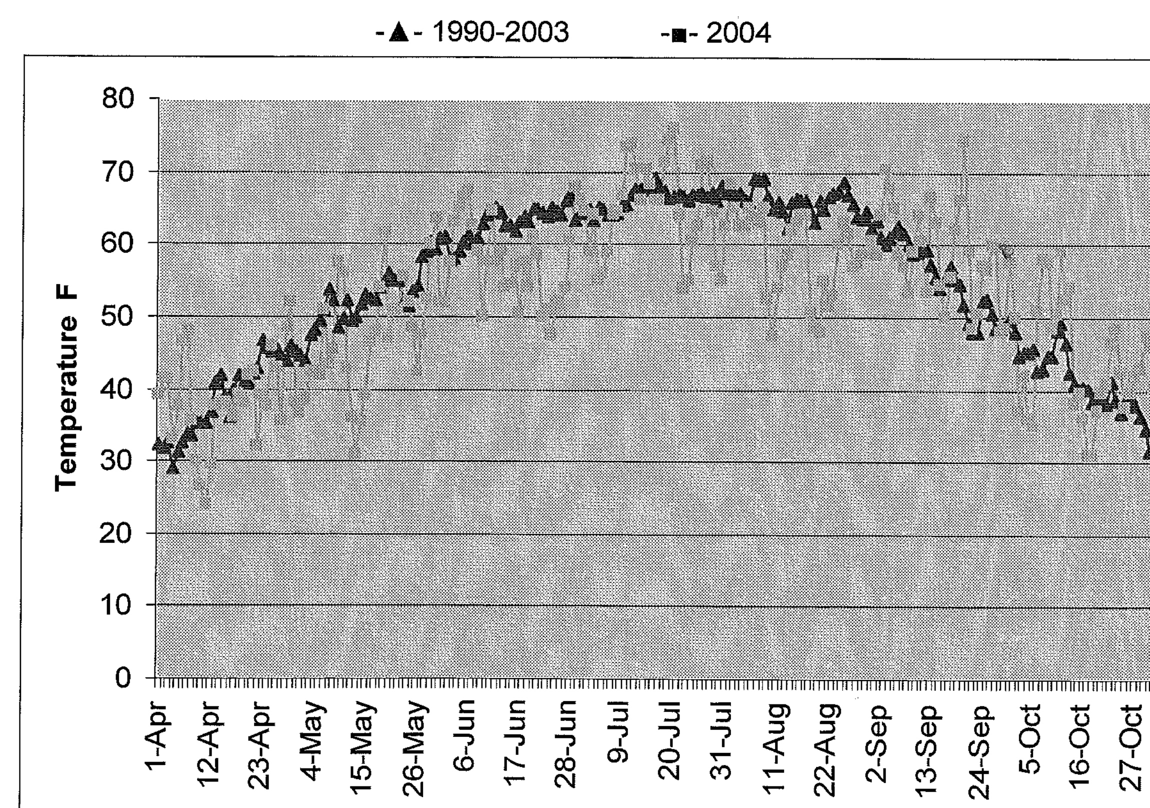
Comments: Broadcast fertilizer was applied the morning of May 10 to the Variety and Systems trial. The entire site was cultivated that afternoon. The PPI fertilizer treatments for the remaining trials were applied later that day. A cold wet period starting May 11 delayed seeding until mid June. The rains on May 11 should have done an adequate job of incorporating the nitrogen and sulfur into the soil. The field was marginally ready for tillage on June 14, but was tilled to open up the soil to quicken the drying process. Soil compaction became a problem in some of the areas of the field that were still wet. Seeding was done in between light rain showers, so there was good moisture at seeding time. The crop came out of the ground very quickly and reached canopy closure and early bloom very quickly (36 to 38 days after planting). There was fair to good moisture throughout the summer with very cool temperatures, especially in August during the bloom period. An unusually warm September allowed the crop to finish off and reach physiological maturity before swathing. Plots were swathed at about 40 % seed color change to help reduce the probability of green seed at combining time. There was very little sclerotinia or lodging and swathing was easy with light showers during the swathing period. Conditions after swathing were somewhat favorable for seed color change, considering the lateness of the season. The Variety and Systems Comparison trial was combined before the plots had a chance to dry completely or properly change seed color due to concerns regarding a poor weather forecast and the potential for not completing the harvest and losing the yield data.

Rainfall



Total accumulated moisture = 20.69 inches (525.5 mm)

Daily Average Temperature



Temperatures were generally below normal during May thru August and above normal in September and October, 2004.

VII VARIETY AND SYSTEMS COMPARISON TRIAL

Objective: To establish agronomic criteria for choosing among varieties and herbicide options.

Background: The availability of canola with innovative traits (herbicide tolerance, specialty oils) has given producers many options for variety selection. Yield, crop quality, lodging resistance, harvestability and disease resistance are important variety traits to consider in the selection process. The greatest economic return will occur by choosing the most appropriate combination of suitable varieties and appropriate herbicides for each field. Factors to consider beyond the performance of the variety include specialty oil premiums, weed spectrum, tillage system and herbicide rotation.

Methodology: All varieties were seeded at 5.4 lb/ac with the exception of the InVigor varieties, which were seeded at 4.3 lb/ac. The trial was laid out as a modified RCB design with four replicates. Roundup Ready varieties were grouped together to facilitate timely herbicide spraying and reduce drift damage to non-Roundup Ready plots, which were also grouped together. All varieties were treated with either Helix Xtra or Prosper 400 seed treatment and had the same tillage, fertilizer and post-emergent fungicide and insecticide treatments. The check variety for this trial was Hyola 401, treated with conventional herbicides. All the herbicide tolerant varieties were sprayed with their respective herbicides (see *Site Information – Herbicides applied*). Swathing commenced when seed color change was about 40% on the main stem, and harvest was completed when suitable conditions existed.

Observations: The trial was fertilized and S-tine harrowed once on May 10. Heavy and frequent rains prevented any other field work until June 14 when the site was S-tine harrowed again to open up the field to assist in drying. The soil became compact in some areas because of the wet conditions during tillage. This resulted in a seeding depth that was not always uniform (1/4 to 1 inch deep) when the trial was seeded on June 19. However, a few light rain showers the week after seeding provided good conditions for a quick and uniform emergence. A few flea beetles were present, but did not warrant a post emergent spray treatment. Weed pressure was moderate with the primary weeds being white cockle, quack grass, Canada thistle, wild buckwheat, and eastern black nightshade. However, the shallow tillage operation on June 14 did not do a complete job of controlling the weeds that had been growing due to the wet conditions. The harrowing allowed seeding to progress, but did result in some weed escapes that were very large at herbicide application time. InVigor 5630, 45H21, SW Marksman RR and DKL 35-85 were the first to reach canopy closure at 27 DAP. DKL223 was the slowest to reach canopy closure at 30 DAP. Weed control was good in all the plots except the conventional and Clearfield plots which had many white cockle escapes. Lygus bugs were at threshold levels at the time of fungicide spraying, so the trial as sprayed with Warrior (3 oz/ac) and Ronilan (12 oz/ac) on August 3, when the plots ranged from 20 to 60% bloom. No sclerotinia was observed in the trial at swathing time.

Note that InVigor 5630 was PHS02-563 on the CPC site maps that were available during the season.

Results:

VARIETY AND SYSTEMS COMPARISON TRIAL
Roseau, MN

System / Variety	Yield (%)	Yield (lb/ac)	Contrib. Margin ($/ac)	Green Seed (%)	Oil (%)	Harvest Moist. (%)	GDD	Days To Mature
Conventional (Check)								
Hyola 401	100	1920	(17.06)	3.8	42.7	11.3	1515	95
Liberty Link								
InVigor 5630	113	2160	34.89*	2.7	43.5	10.5	1515	95
InVigor 4870	110	2106	22.91	3.0	43.4	12.2	1567	99
Clearfield								
Pioneer 46A76	106	2032	(35.15)	5.1	43.1	15.9	1584	100
Roundup Ready								
DeKalb DKL223	110	2120	28.15	3.1	40.8	10.6	1515	95
Hyola 357 Magnum	110	2105	25.86	3.8	41.4	10.1	1515	95
Pioneer 45H21	107	2048	18.84	3.2	43.5	10.4	1515	95
SW Marksman RR	105	2017	17.90	4.5	43.1	10.4	1538	97
DeKalb DKL35-85	102	1967	11.90	5.2	42.6	12.1	1552	98
LSD (0.05)		124.8		1.80	1.36	1.47		0.8
CV%		4.2		32.3	2.2	8.7		0.6

* Note: A 2004 seed price was not available for InVigor 5630, so the 2005 bare seed price plus the 2004 Prosper 400 price were used for calculating contribution margins (with Bayer CropScience's permission).
Note: Brackets indicate a negative contribution margin. GDD = Growing Degree Days (see *Definitions*).

Discussion: InVigor 5630 had the highest yield and the highest contribution margin. The negative contribution margin for Hyola 401 is primarily due to the high cost of the conventional herbicide treatments ($46.15/ac) compared to the Roundup ($19.15), Liberty ($21.23) and Clearfield ($ 33.97) treatments. Contribution margins reflect differences in seed costs, herbicide costs, drying costs, green seed discounts and yield. Even though InVigor 4870 was similar in maturity to Pioneer 46A76 and DKL35-85, InVigor 4870 had significantly lower green seed levels. InVigor 5630, InVigor 4870 and Pioneer 45H21 had the highest oil content and DKL223 had the lowest. Very mild temperatures during swathing in September allowed all the varieties to reach physiological maturity before swathing, despite the late planting date. However, the late maturing varieties had high moisture levels at harvest time. These varieties required extra drying, which added to the costs of production. This was especially true with Pioneer 46A76.

VIII HARVESTABILITY TRIAL

Objective: To compare the harvestability of varieties entered in the variety and systems comparison trial.

Background: A number of varieties have very similar yield and quality traits. In choosing a variety a grower needs to consider additional traits like lodging and harvestability. Harvestability is the measurement of swathing and combining ease. Currently, there is no meaningful scientific measurement for harvestability. Therefore, a standardized criterion for a subjective measurement was used.

Methodology: The entries in the variety and systems comparison trial were all scored for lodging and harvestability. The **lodging score** was a visual score in which 1 = erect and 9 = flat. Varieties that were standing well and had a 'high yield tip' were given a score of two or three. Varieties that had severe uneven lodging with patches standing upright and laying flat were given a seven or eight, depending on the severity. **Harvestability** was evaluated as swathing and combining were completed. Swathing and combining were each evaluated on a scale of one to five. The following criteria were considered; lodging, height, straw stiffness, straw strength, stand uniformity, swath fluffiness (pod dispersion), tendency to clump, flowability, feeding and speed of operation.

The following ratings were subjective. Crop conditions, weather and time of day can affect the harvestability of a variety.

Ratings:
1 = much better than average
2 = better than average
3 = equal to average
4 = worse than average
5 = much worse than average

Observations: There was very little lodging this year. The plots were swathed with an 18 foot Versatile 400 swather equipped with a pick-up reel and side cutter bar. Most of the plots were swathed in the rain or when they were wet. They were harvested with a New Holland CR960 combine.

Results:

HARVESTABILITY TRIAL
Variety and Systems Comparison Trial
Roseau, MN

Treatment	Height (inches)	Lodging score	Swathing Rating	Combining Rating
DEKALB DKL223	41	3.8	2.8	2.5
DEKALB DKL35-85	47	3.8	2.6	2.8
Hyola 357 Magnum	38	3.0	2.3	2.5
Hyola 401	38	2.3	1.3	2.3
InVigor 4870	55	4.0	3.3	3.9
InVigor 5630	48	2.8	2.0	2.4
Pioneer 45H21	43	2.8	2.3	2.5
Pioneer 46A76	48	3.8	2.6	2.8
SW Marksman RR	45	3.3	2.1	2.9
LSD (0.05)	3.2	0.87	0.66	0.72
CV%	4.9	18.3	19.3	18.1

Discussion: DKL223 had lower pod placement and had to be swathed noticeably closer to the ground than the other varieties to get all the pods. Hyola 401 was the easiest to swath and combine. InVigor 4870 was a little more difficult to swath than the other varieties because it tended to clump instead of flow smoothly through the throat of the swather.

IX MICROESSENTIALS TRIAL

Objective: To evaluate the effects of seed-placed MicroEssentials S15 (13-33-0-15) on stand establishment, maturity and yield, as compared to MAP (11-52-0) plus AMS (21-0-0-24).

Background: Growers that have high levels of residual nitrogen but are lacking sulfur could use another option to apply that sulfur with the seed at seeding time. Using a mixture of ammonium sulfate (21-0-0-24) and MAP (11-52-0) can result in hot spots and skips in the field, if blending is not uniform or segregation occurs in the applicator. MicroEssentials S15 is a product that has an analysis of 13-33-0-15 (N-P-K-S) for each prill. This eliminates uneven distribution during seeding and should allow for greater safety to emerging seedlings. Half of the sulfur in MicroEssentials S15 is in the sulfate form for immediate use and half is in the elemental form for possible use later in the season. Microbial action is required to break down elemental sulfur into the sulfate form for the plant to use it. This process can take 24 to 48 months, particularly from applications in bands.

Methodology: A spring soil test of the field indicated 11 and 24 lb/ac of nitrogen at 0-6" and 0-24" depths, respectively. Phosphorous (24 ppm) and potassium (222 ppm) levels were high at 0-6 inches deep. Sulfur tests indicated 14 and 48 lb/ac at 0-6" and 0-24" depths, respectively. The canola variety Hyola 357 Magnum was seeded at a rate of 5.4 lb/ac. The trial was laid out in a randomized complete block (RCB) design with four replicates. All fertilizer treatments were applied through the fertilizer tube on the drill openers. The trial consisted of the following treatments:

Trtmt	lb/ac	Fertilizer Source	Target Analysis applied (N-P-K-S)
1.	0	(Check) no Seed Placed Fertilizer	NA
2.	64 62	Monoammonium Phosphate (MAP) Ammonium Sulfate (AMS)	(7-33-0-0) (13-0-0-15)
3.	100	MicroEssentials S15	(13-33-0-15)
4.	150	MicroEssentials S15	(20-50-0-23)

Stand counts were taken in multiple 2 foot X 2 foot areas and marked with a flag. Counts were taken at the exact same locations in the plots on two dates (12 and 20 DAP).

Observations: This trial was broadcast fertilized (120-0-20-0, N-P-K-S) on May 10 using a 12 foot drop spreader. Tillage incorporation of the fertilizer was not possible until June 14 due to frequent heavy rains which started the night of May 10. A few days prior to seeding, the entire trial was cultivated to incorporate the fertilizer and facilitate drying. The trial was seeded on June 17 into good moisture conditions. A light shower of approximately 0.30 inches fell a few hours after seeding. Plants in the check treatment were significantly delayed compared to the other treatments at 10 and 18 DAP. Fertilizer costs for the treatments were as follows: MAP + AMS

($14.17/ac), 100 lb/ac MicroEssentials ($15.50/ac), and 150 lb/ac MicroEssentials ($24.34/ac). Some canola plants appeared to be dying from the Roundup application made 20 DAP. For this reason, only two spring stand counts were taken. There were no differences in lodging. Green seed levels ranged from 0.7 to 1.0 percent.

Results:

MICROESSENTIALS TRIAL
Roseau, MN

Treatment	Stand counts - plants/ft^2		Bloom - DAP		Height
	12 DAP	20 DAP	Begin	End	(inches)
No Seed Placed Fertilizer (Check)	7.3	7.4	37	64	33
64 lb/ac MAP + 62 lb/ac AMS	7.0	7.3	38	61	38
100 lb/ac MicroEssentials S15	6.8	7.1	38	61	38
150 lb/ac MicroEssentials S15	7.7	8.0	38	61	39
LSD (0.05)	1.02	1.05	0.4	0.5	4.3
CV%	8.9	8.8	0.7	0.5	7.2

MICROESSENTIALS TRIAL
Roseau, MN

Treatment	Yield (%)	Yield (lb/ac)	Oil (%)	Test weight (lb/bu)	Contr. Margin ($/ac)	Days To Mature
No Seed Placed Fertilizer (Check)	100	1659	42.6	49.8	9.22	94
64 lb/ac MAP + 62 lb/ac AMS	132	2195	42.6	50.4	47.93	93
100 lb/ac MicroEssentials S15	132	2190	42.2	50.4	46.07	93
150 lb/ac MicroEssentials S15	136	2252	42.4	50.4	43.11	93
LSD (0.05)		190.2	0.65	0.30		0.5
CV%		5.7	1.0	0.4		0.3

Discussion: There was no difference in stand count among the treatments, probably due to the ideal moisture conditions. Emergence problems from seed placed fertilizer usually occur during periods of dry weather. The check bloomed a day earlier and four days longer than the other treatments. The check was also significantly shorter than the other treatments.

All the seed placed fertilizer treatments yielded significantly higher than the check. There were no significant yield differences among the MicroEssentials treatments and the MAP+AMS treatment. There was an obvious economic advantage to putting fertilizer with the seed in this trial, with little difference in contribution margins among the fertilized treatments. Contribution margins reflect differences in yield and fertilizer costs. There was no difference in oil content among any of the treatments. Test weights of the fertilized treatments were significantly higher than the check. The check matured a day later than the other treatments.

X NITROGEN TOP-DRESS TRIAL

Objective: To evaluate the potential yield and economic benefit of top-dress nitrogen compared to pre-plant incorporation (PPI).

Background: A recent study indicated that nitrogen (N) accumulation in canola increases from about 20 lb/ac to 100 lb/ac in a 30 day period beginning twenty days after emergence, with the most N accumulation (about 110 lb/ac) occurring 55 days after emergence (Phil Thomas, 2000). Rainfall prior to and during this period of rapid nitrogen accumulation could result in N losses due to denitrification or leaching of soil N beyond the canola-rooting zone. A split application of N, with a portion applied preplant and the remainder applied at pre-bolt, may be more efficiently utilized by the plants. A split application of N could also provide growers an additional month to evaluate their canola crop prior to purchasing and applying the additional N.

A 2001 study conducted at two locations in North Dakota showed a yield increase of up to 30% when split applications of N were used (Bob Henson, personal communications). The trial was repeated in 2002 with an average yield increase of 9% across four site-years when all or part of the N was applied at the 3 to 5-leaf stage (Eric Eriksmoen, personal communications).

In 2003, an extensive nitrogen application trial, including 7 nitrogen levels PPI and 4 nitrogen levels top-dressed, was conducted at 7 locations in North Dakota. Results from this trial showed significant yield increases from top dressing at one location (John Lukach, personal communications), and significant yield reductions in some cases. In 2004 this trial was repeated with significant yield increases from top dressing occurring at two of the seven locations. The only locations that demonstrated increased yield from topdressing were in the higher rainfall areas. Of the three sites that have higher rainfall amounts (Langdon, Valley City and Carrington, ND), top dressing provided significantly higher yields three out of ten site years.

Methodology: A spring soil test of the field indicated 11 and 24 lb N/ac at 0-6" and 0-24" depths, respectively. The trial was S-tine harrowed on May 10 to open up the field prior to the **base fertilizer** (40-30-20-20, N-P-K-S) application and the 60 and 90 lb N/ac PPI treatments. Treatment 1 did not receive the base fertilizer. The base fertilizer was used to bring the trial area up to a fertility level of 64-78-464-68 (N-P-K-S, 0-24 inches) Tillage incorporation of the fertilizer was not possible until June 14 due to frequent heavy rains which started the night of May 10. A few days prior to seeding, a treatment was added (Base + 60 lb N/ac - Urea PPI applied June 14) as a means of determining if significant nitrogen was lost from the heavy spring rains that occurred after May 10. The entire trial was cultivated June 14 to incorporate the fertilizer and facilitate drying. The canola variety Hyola 357 Magnum was seeded at a rate of 5.4 lb/ac. The trial was laid out in a randomized complete block (RCB) design with four replicates. All treatments received 67 lb/ac MAP (7-34-0-0) with the seed.

All top-dress treatments were applied on July 14 at the 5 to 6-leaf stage of the canola. The ammonium nitrate treatment was used as a measure of nitrogen loss from possible volatilization if the weather remained dry after top dressing. The trial consisted of the following treatments:

Trt	PPI	Top-dress at 4 to 6 leaf stage	N source	Date Applied
	-Applied lbs N/ac -			
1.	0	0	No PPI or top-dress fertilizer	
2.	0	0	Base fertilizer only - No extra N	May 10
3.	60	0	Base + Urea PPI Late	June 14
4.	60	0	Base + (46-0-0) Urea (Check)	May 10
5.	90	0	Base +(46-0-0) Urea (Check)	May 10
6.	0	60	Base + (46-0-0) Urea	July 14
7.	0	90	Base + (46-0-0) Urea	July 14
8.	0	60	Base + (34-0-0) Ammonium Nitrate	July 14

Note: all treatments received 67 lb/ac MAP (7-34-0-0) with the seed

All PPI and top-dress fertilizer was applied with a 12 foot drop spreader.

Observations: This trial was seeded on June 17 into good moisture conditions. A light shower of approximately 0.30 inches fell shortly after seeding. Emergence was quick and uniform. The top-dress treatments were applied the afternoon of July 14. The 12-foot wide drop spreader was pulled with the tractor on the edge of the plots to minimize wheel tracks in the portion of the plots sampled for yield. A rain event totaling 0.24 inches of rain started about 25 hours after the application of the top-dress treatments. Between the time of application and the rain, the temperature reached highs of 80° F on the 14th and 15th. No leaf burning was observed after the top-dress treatments. Treatment numbers 1 and 2 started blooming one day earlier than any of the other treatments. All the top-dress treatments bloomed for 26 days, compared to all the other treatments which bloomed for 24 days. The 90 lb N/ac top-dress treatment had a significantly higher test weight than treatments 1, 2, 4 or 6.

Results:

NITROGEN APPLICATION TRIAL Roseau, MN								
Nitrogen Treatment	Yield (%)	Yield (lb/ac)	Oil (%)	Contrib. Margin ($/ac)	Fert. Cost ($/ac)	Begin Bloom (DAP)	Height (in)	Days To Mature
No Added Nitrogen								
No Fertilizer ##	70	1518	44.5	24.93	9.08	37	32	93
Base* + 0 lb N	82	1781	44.1	23.65	35.71	37	33	92
Urea (46-0-0) - Preplant incorporated								
Base* + 60 Late	97	2121	43.2	39.53	53.13	38	36	94
Base* + 60 lb N	100	2178	43.9	45.21	53.13	38	37	94
Base* + 90 lb N	102	2227	43.3	41.81	61.09	38	36	95
Urea (46-0-0) - Top-dress								
Base* + 60 lb N	101	2194	43.3	42.39	57.38	38	36	96
Base* + 90 lb N	102	2223	42.4	37.01	65.34	38	36	97
Ammonium Nitrate (34-0-0) - Top-dress								
Base * + 60 lb N	101	2209	42.7	32.56	68.31	38	36	96
LSD (0.05)		113.7	0.83			0.4	3.9	1.0
CV%		3.8	1.3			0.8	7.6	0.7

* Base fertilizer (40-30-30-20, N-P-K-S) ## All treatments received 67 lb/ac seed placed MAP

Discussion: There were yield differences between PPI fertilized and the equivalent top-dressed treatments. There was also no difference in yield between 60 and 90 lb/ac N above the base line. A significant yield increase of 263 lb/ac was observed with the base fertilizer application compared to no base. However, that added yield did not pay for the extra cost of the fertilizer. The highest contribution margin came with the 60 lb N/ac PPI application that was made on May 10. Contribution margins reflect differences in yield and fertilizer costs. An application cost of $4.25/ac was included in the fertilizer costs of each application other than the seed placed fertilizer. The application cost of the top-dress treatments equaled $8.50/ac because they required two fertilizer applications.

The yield similarity between the 60 lb N/ac treatments applied on May 10 and June 14 shows that any loss of nitrogen from the heavy spring rains that occurred after the May 10 fertilizer application had no impact on yield.

Oil content was significantly higher on the treatments that had little or no fertilizer applied. This was expected because higher nitrogen levels usually lead to higher protein levels at the expense of oil production. The no fertilizer treatment was slightly shorter and earlier in maturing than the other treatments.

XI CPC SUMMARY

The seventh year of the Minnesota Canola Production Centre (CPC) program was another success despite the late planting date. The warm fall allowed the crop to compensate for the cold, wet spring and cool summer. The trials at the Roseau site were chosen to demonstrate basic canola production principles as well as investigate new technologies and techniques. All of the results will provide good focal points for discussions at extension meetings throughout the winter. Since the grant we received for this year was only for one year, a new proposal has been written to seek funding to support a similar size CPC in 2005 near the Grygla, MN area. If you have any questions, ideas or comments about the Minnesota CPC program please feel free to contact Dave LeGare or Paul Porter who are listed in the Staff Information section at the end of this report.

XII VARIETAL TOLERANCE TO SCLEROTINIA

Funding:
This trial was funded by a grant from the Sclerotinia Initiative and from fees paid by companies for testing their varieties.

Procedures:
This study was located at the Red Lake Falls, MN misting site. The site was fertilized on April 27 with 100-40-60-30 and treated with Trust (1.5 pt/ac). This trial was seeded on April 28 into good moisture. There were 26 varieties entered in the sclerotinia variety evaluation trial (see Results). All varieties were seeded at 14 viable seeds per square foot. Plots were 6 ft x 30 ft with the center 6 ft x 15 ft used for yield and disease evaluation. An application of Quadris (18 oz/ac) and Capture (1.5 oz/ac) was made on June 4 to control blackleg and flea beetles. No post emergence herbicide was necessary at this site. The canola started to flower on June 20 and the misters were started on June 23. Misting occurred 12 times per day for 5 to 8 minutes per mist cycle, depending on weather conditions. Multiple light applications of ascospores were made on June 28, July 1, July 7, July 12 and July 21. Dates when temperatures reached above 85 °F were avoided for inoculating to protect the spores from too much heat. Misting continued until August 6. The plots were evaluated for sclerotinia on August 10. Plots were swathed between August 10 and August 23. Combining occurred between August 21 and August 31.

There were 8 check varieties in this trial that have been included in the variety screening since the trial started in 2001. They include: 44A89 (super susceptible), 46A76, Hylite 201 (apetalous), DKL34-55, Hyola 357 Magnum, Hyola 401, and InVigor 2663. HyCLASS 601 was added to the list in 2002.

Disease and severity notes were taken on 50 plants per plot from 2 middle rows of each plot using the following severity scale:

Severity:
- 1 = superficial lesions or small branch infected
- 2 = large branch dead
- 3 = main stem 50% girdled
- 4 = main stem girdled but plant produced good seed
- 5 = main stem girdled with much yield loss

Incidence (percent infection) was calculated by multiplying number of infected plants by 2. Field severity was calculated as follows.......

$$\frac{\text{Incidence (\%) X Average severity}}{5} = \text{Field severity}$$

Results:
There was very little lodging this year and disease levels were much lower than desired at the mist site. Carrington, ND had even lower levels of sclerotinia in their nursery in 2004 with field severity levels no higher than 4. Conditions in 2003 were much more favorable for sclerotinia development at both locations and therefore show a better range in severity among varieties. Hylite 201 (apetalous) was not reported at Carrington in 2003 because it accidentally had petalled border plots that contaminated the HyLite 201 with petals. Therefore, the HyLite 201 could not use the avoidance mechanism (no petals) that it needs for reduced infection.

There was little yield loss from sclerotinia in 2004 at the Red Lake Falls site. Pioneer's 44A89 had the highest levels of infection, but even those levels did not cause much yield loss. Infection levels in 2003 were much higher and resulted in yield losses in

some of the varieties. It is unknown how much yield loss was occurring with a specific level of field severity because each variety is probably able to compensate differently. A study at the CPC in 2001 showed that 10 to 20 % incidence caused significant yield loss when compared to fungicide treated plots. However, the amount of crop saved did not compensate for the cost of the fungicide application. Generally, a fungicide needs to save at least 220 lb/ac to pay for the application. At the CPC in 2000, Ronilan treated plots had 37% incidence and the check had 62%. The fungicide treatment provided 560 lb/ac yield increase and $40/ac extra profit.

Yield and Disease Levels from Varieties Tested for Sclerotinia Tolerance in 2003 and 2004.

	Red Lake Falls, MN 2004				Red Lake Falls, MN 2003			Carrington, ND 2003		
Variety	Yield (lb/ac)	Incid. (%)	Severity (1-5)	Field Severity (0-100)	Yield (lb/ac)	Incid. (%)	Field Severity (0-100)	Yield (lb/ac)	Incid. (%)	Field Severity (0-100)
44A89	1894	25	4.7	24	1198	76	76	812	90	65
45H21	2979	9	4.6	8	----	----	----	----	----	----
46A76	1935	1	0.8	0	1499	21	16	1370	51	26
46H02	2597	6	3.5	4	----	----	----	----	----	----
46H23	2277	7	4.1	6	----	----	----	----	----	----
DKL 3455	2123	3	3.5	3	1341	29	25	1401	53	30
HyClass 601	2272	10	4.1	8	1522	25	19	1428	48	27
HyLite 201	2117	2	1.8	1	1067	4	3	----	----	----
Hyola 357 Mag.	2522	7	4.3	6	1719	18	17	1695	61	31
Hyola 401	2449	7	4.1	6	1745	11	7	1926	55	28
InVigor 2663	2532	4	3.3	3	1628	30	28	1553	62	34
ProSeed 2013	2147	5	4.3	4	----	----	----	----	----	----
ProSeed 2066	2334	17	4.4	14	----	----	----	----	----	----
SW Marksman	2362	13	4.6	12	----	----	----	----	----	----
SW Patriot	2319	12	4.5	11	----	----	----	----	----	----
X395	2262	3	4.5	3	999	5	3	1192	52	32
X401	2121	20	4.5	18	1262	34	24	883	74	40
X402	2166	5	3.5	5	----	----	----	----	----	----
X403	2255	7	3.4	6	1365	21	18	1377	59	32
X465	2088	8	3.6	6	----	----	----	----	----	----
X500	2663	11	3.9	9	1156	24	21	1254	80	49
X515	2233	11	4.0	8	----	----	----	----	----	----
X545	2198	8	3.0	7	----	----	----	----	----	----
X555	2256	11	3.9	9	----	----	----	----	----	----
X565	2120	12	4.0	9	----	----	----	----	----	----
X575	2378	10	3.8	9	----	----	----	----	----	----
mean	2292	9	3.8	8	1366	24	21	1310	57	32
LSD (0.05)	298.5	9.1	1.75	8.6	208.3	19.0	18	390	18.7	12.4
CV%	9.2	73.8	32.8	81.9	10.8	55.8	63	21.0	23.2	27.6
Pr > F	0.0001	0.0002	0.0099	0.0002						

Current work:
In 2005 we will move the mist site to a location that should be more effective in achieving desired results. The new location has softer water, good drainage and trees all the way around the plot area. These improvements should allow us to get better sclerotinia infections in the future.

XIII CROP ROTATION AND SCLEROTINIA IN CANOLA

Funding:
This trial was funded by grants from the Agricultural Utilization and Research Institute (AURI) and the Sclerotinia Initiative.

Background:
Research began in 2003 near Thief River Falls, MN to better understand the effect of crop rotation and a rye cover crop on white mold development in canola. The primary objective was to evaluate sclerotinia incidence and severity in canola when grown in a number of cropping sequences with and without the presence of a fall-planted rye cover crop. A three-year field study was initiated in 2003 at one site (03CRye) and again in 2004 at a second site (04CRye) about a mile from the first site.

The 03CRye field study involved eight cropping-sequence treatments the first two years, after which the plots were divided allowing for sixteen cropping-sequence treatments the third year:

Treatments in 2003-04	2003	2004	2005	Treatments in 2005
	------------------- Crop year		-------------	
1. W- C	W	C	-&+ rye[1] C	1. & 9.
2. W- W	W	W	-&+ rye C	2. & 10.
3. W-rC	W	rye + C	-&+ rye C	3. & 11.
4. W-rW	W	rye + W	-&+ rye C	4. & 12.
5. C- C	C	C	-&+ rye C	5. & 13.
6. C- W	C	W	-&+ rye C	6. & 14.
7. C-rC	C	rye + C	-&+ rye C	7. & 15.
8. C-rW	C	rye + W	-&+ rye C	8. & 16.

[1] The plots were split following harvest in 2004, with half planted to the rye cover.

Procedures:
The trial was top-dress fertilized with 130-0-0-30 (N-P-K-S) and seeded on May 4, 2004 into good moisture and without any cultivation to maintain the rye residue. Canola (HyLite 292 CL, Clearfield variety) was seeded at 5.5 lb/ac with 60 lb/ac seed placed MAP fertilizer (7-31-0-0, N-P-K-S). Wheat (Hanna) was seeded at 120 lb/ac with 80 lb/ac seed placed MAP fertilizer (9-42-0-0, N-P-K-S). Each sub-plot (16 treatments for 2005) was 20 feet wide by 50 feet long and consists of 3 - 6 foot by 50 foot planted strips. The middle strip was used for yield and disease monitoring and the side strips were used as borders and buffers from the other treatments. An application of Roundup Ulta Max II (16 oz/ac) was applied on May 7 to kill the winter rye in the canola and wheat plots. A few rye plants did not die with the Roundup application and regrew later in the season. These rye plants were hand weeded in early June. Grass control in the canola and wheat was done using Puma (0.4 oz/ac) on June 9. Flea beetles were controlled on June 4 with an application of Capture (1.5 oz/ac). The canola plots were swathed and disease notes taken on August 19. The canola was combined on September 1 and the wheat on September 9. The residue from the wheat and canola was flailed on September 10 and the plots were chisel plowed 2 times the same day. Winter rye (Homil 21) was seeded on September 13 at a rate of 120 lb/ac at a depth of 1 to 2 inches into good moisture.

Results:

Canola yields and agronomic measurements from 03CRye – 2004.

	Yield (lb/ac)	Test weight (lb/bu)	Bio mass (lb/ac)	Sclero. Disease (%)	Disease Severity (1-5)	Height (inches)	30% Flower (DAP)	Oil (%)	Prot. (%)
2003 Crop- averaged across Rye									
Canola	1682	49.5	1847	2	2.4	44	64	41.3	26.4
Wheat	1660	49.4	1957	3	2.7	43	64	41.8	26.2
Rye - across 2003 crop									
NoRye	1811	49.6	2372	4	3.1	45	64	41.3	27.2
Rye	1531	49.3	1431	1	2.1	42	65	41.8	25.4
2003 Crop - winter cover									
Canola - NoRye	1823	49.7	2417	3	2.5	46	64	41.2	27.4
Canola - Rye	1542	49.4	1276	1	2.4	42	65	41.4	25.5
Wheat - NoRye	1799	49.6	2328	5	3.7	44	63	41.4	27.1
Wheat - Rye	1520	49.3	1586	1	1.8	41	65	42.2	25.4
mean	1671	49.5	1902	3	2.6	43	64	41.6	26.3
LSD (0.05)	76.0	0.5	448.3	1.4	1.6	1.3	0.5	0.7	0.4
CV%	6.2	1.3	32.1	76.0	82.4	4.2	1.0	2.3	2.1
Pr > F:									
2003 Crop	0.5399	0.5996	0.6146	0.3743	0.7197	0.0598	0.0140	0.1554	0.3086
Winter Cover	0.0001	0.1745	0.0003	0.0004	0.1827	0.0001	0.0001	0.1677	0.0001
Crop x Cover	0.9840	0.8858	0.3641	0.2176	0.2447	0.7375	0.1225	0.4359	0.4617

Treatments in 2004 involved canola and wheat following either 2003 canola or 2003 wheat with and without a 2003 fall-planted rye cover crop. On May 6, rye biomass on 2003 canola ground was 898 lb/ac, rye biomass and fall emerged volunteer spring wheat was 722 lb/ac, and biomass from fall emerged volunteer spring wheat alone was 325 lb/ac.

Previous crop (2003 season) had no influence on mid-season (July 8) canola biomass (see tables), but when rye was grown as a cover the canola biomass was reduced by 39.7% compared with no cover crop (2372 vs. 1431 lb/ac). Previous crop influenced early-season wheat biomass: it was reduced by 12.8% with wheat following wheat (2048 vs. 1787 lb/ac). Early-season wheat biomass was reduced by 28.8% when grown following a rye cover (2240 vs. 1594 lb/ac). For early-season biomass there was no previous crop by rye cover interaction for canola, but there was an interaction for wheat (the wheat biomass decreased more after canola and a rye cover than after wheat and a rye cover).

Canola yield was not influenced by previous crop, but was reduced by 15.5% when rye was grown as a cover crop (1811 vs. 1531 lb/ac). Wheat yield was reduced by 9.1% when grown wheat on wheat compared with wheat on canola (56.3 vs. 51.2 bu/ac). Wheat yield following a rye cover was reduced by 9.0% compared with no cover (56.3 vs. 51.2 bu/ac). For grain yield, there was no previous crop by rye cover interaction for either wheat or canola.

The rye cover resulted in a reduced canola protein content in the seed (by 15%) compared with no cover (27.2 vs. 25.4%). Previous crop had no influence on protein content.

Sclerotinia disease levels were quite low in 2004. The number of infected plants at swathing was less than 5%, yet there was some indication that infection levels were actually decreased following the rye cover crop compared with no cover crop.

Wheat yields and agronomic measurements from 03CRye – 2004.

	Yield bu/ac	Test weight lb/bu	Bio mass lb/ac	Scab Disease (%)	Scab Disease Severity	Height inches	1% Headed DAP
2003 Crop- averaged across Rye							
Canola	56.3	60.6	2048	13	62	43	65
Wheat	51.2	60.4	1787	13	64	42	65
Rye - across 2003 crop							
NoRye	56.3	60.7	2240	11	67	43	65
Rye	51.2	60.4	1594	15	59	41	65
2003 Crop - winter cover							
Canola - NoRye	58.8	60.5	2504	11	59	44	65
Canola - Rye	53.9	60.7	1592	16	65	42	65
Wheat - NoRye	53.8	60.8	1977	12	74	43	64
Wheat - Rye	48.6	60.1	1597	14	54	41	65
mean	53.8	60.5	1917	13	63	42	65
LSD (0.05)	1.88	0.24	237.3	4.7	19.8	0.6	0.5
CV%	4.7	0.5	16.8	49.2	42.7	1.8	1.0
Pr > F:							
2003 Crop	0.0001	0.1095	0.0326	0.8911	0.8001	0.0290	0.0048
Winter Cover	0.0001	0.0159	0.0001	0.1422	0.4580	0.0001	0.3051
Crop x Cover	0.8982	0.0005	0.0299	0.4959	0.1839	0.8169	0.3051

A second 3-year study (04CRye) identical to this one was initiated in 2004 about a mile from the 03CRye study and will conclude in 2006.

XIV CROP ROTATION AND WINTER RYE IN SOYBEAN

Soybean Following Canola, Wheat and Soybean With and Without a Rye Cover Crop.

In 2003, a two-year crop rotation study was initiated near Thief River Falls, MN with six treatments where canola, wheat and soybean were grown that year and followed after harvest either with or without a fall–planted rye cover crop. Soybean was planted in 2004 to document the influence of previous cropping system on soybean productivity. The soybeans (DKB 500-51) were no-till planted on May 13, 2004. Each plot was 20 feet wide by 50 feet long and consisted of 3 - 6 foot wide passes made with a Hege 1000 small plot cone seeder. The middle pass was used for data collection and the outside passes were used as borders. Roundup Ultra Max II (15 oz/ac) was applied on May 18 to kill the winter rye. Roundup Ultra Max (13 oz/ac) was applied on July 8 to control weeds.

The soybean following soybean treatment had the highest yield (16.3 bu/ac). There was no difference in yield between soybean following wheat or soybean following canola treatments. No rye treatments (averaged across previous crops) yielded 12.5% more than the rye treatments (15.4 vs. 13.5 bu/ac). Test weight and soybean seed oil content was unaffected by either the 2003 crop or the rye cover crop. No rye treatments (averaged across previous crops) had greater seed protein content than the rye treatments (38.7 vs. 38.0 %). Soybean plant height tended to be taller in the no rye treatments than in the rye treatments, and the days to soybean maturity tended to be less.

2004 soybean yield, test weight, oil content, protein content, height and days to maturity in the two-year rotation study involving soybean following canola, wheat and soybean with and without a rye cover crop.

2003 & 2004 crops	Yield bu/ac	Test weight lb/bu	Oil %	Protein %	Height inches	Maturity DAP
Canola - Soybean	15.1b	54.8	14.3	38.8	24	131
Canola-Rye-Soybean	13.6c	54.5	14.9	37.8	18	128
Wheat - Soybean	14.9b	54.8	14.7	38.5	18	128
Wheat-Rye-Soybean	13.3c	55.2	14.7	38.1	19	126
Soybeans - Soybean	16.3a	54.8	14.4	38.9	22	129
Soybean-Rye-Soybean	13.6c	54.8	14.7	38.0	17	124
mean	14.5	54.8	14.6	38.3	20	127
LSD (0.05)	1.2	0.74	0.52	0.72	1.9	3.2
CV%	5.3	0.9	2.4	1.2	6.6	1.7
Pr > F	0.0004	0.6295	0.1958	0.022	0	0.006

Current work:
In 2004, soybean growth and yield were influenced by the relatively cool spring and summer months. This study is being repeated in 2004-05 near the 04CRye study.

XV WINTER CANOLA

Funding:
This work was funded in part by a grant from the North Central Regional Canola Research Program (NCRP).

History:
Winter canola has the potential to provide exceptionally high yields compared to spring canola, especially in years when spring rains prevent early seeding of spring canola. Winter canola has been tested in northwestern Minnesota with limited success over the last 15 years. Newer varieties with better winter hardiness are coming out of some of the breeding programs such as at Kansas State University. These newer varieties were tested in 2001-02, 2002-03 and in 2003-04. The 2001-02 trial was completely winter killed, perhaps because the trial was seeded late into dry soil and plants didn't get enough growth in the fall to survive the harsh and open winter that year. In 2002-03, a seeding date X seeding rate trial was conducted near Morris, Waseca and Red Lake Falls, MN with very good winter survivability. There was more snow cover that winter at Red Lake Falls and temperatures were not extremely low. Yields that year were 2200 lb/ac for the cultivar Wichita.

Procedures and Observations:
In 2003-04 the seeding date X seeding rate trial was repeated near Thief River Falls, MN. Seeding rates of 4 and 8 lb/ac were used again and the seeding dates were August 19, 26 and September 4, 2003. A 30 entry variety trial was also conducted at the same location and was seeded on August 26 at a rate of 5 lb/ac. Most of the canola was at the 5 to 6 leaf stage going into the winter. No fertilizer was applied in fall. There was at least some snow cover from approximately November 26, 2003 to March 26, 2004, with depths of 8 to 12 inches from mid-December to late February. However, cold temperatures in January caused soil temperatures to drop to 25 °F 2-inches below the soil surface and 26 °F 4-inches below the soil surface. Another possible determining factor in the survivability of the plants in the trial was when the soil surface temperature dropped below 15 °F for 10 hours on November 24, 2003. In the spring, the soil surface temperature dropped to 22 and 23 °F on April 22 and 24 after reaching 82 °F on April 19. Spring applied fertilizer (130-0-0-30,N-P-K-S) was top-dress applied on May 4, 2004 when the canola was at late rosette.

Results:
Yields from surviving plots ran between 2000 and 3000 lb/ac with less than two plants per square foot. There were not enough good quality plots to run statistical analysis on the trials, so the yields listed below are simple averages of the varieties that made it through the winter. Varieties are grouped by how many plots were harvested. Varieties with more surviving plots were mostly in a better location in the field and not necessarily more winter hardy. KS2004 and Largo were probably the most winter hardy varieties in the trials. They survived in parts of the field where nothing else survived. Largo is a low yielding Polish (*B. rapa*) variety. The only area that had relatively consistent survivability was in the range along the gravel road that was near the front of each of the trials. One possible explanation for this is that there may have been slightly more snow caught in that area which could have provided a little bit of extra protection. The results listed below are strictly averages of surviving plots. Some varieties had 1 surviving plot, some had 3, some had none.

Average yields of plots that survived the National Winter Canola Variety Trial at Thief River Falls, MN – 2003-04.

Variety	One plot Yield (lb/ac)	Variety	Two plot Ave. Yield (lb/ac)	Variety	Three plot Ave. Yield (lb/ac)
ARC90016-PR377	2290	Abilene	1854	ARC91019-50-E2	2592
ARC92007-2	2405	ARC92004-1	2532	KS2004	1745
Banjo	2497	Casino	2384	KS9124	2153
Ceres	1954	Kronos	3009	KS9183	2413
Jetton	2503	KS2002	1739		
Maestor	1967	KS2427	1367		No plots Survived
Talent	2237	KS7436	2140		
Titan	1973	KS8367	1674		
VSX-1	2568	KS9135	2293	Rasmus	0
Wotan	2401	Largo	1114	VSX-2	0
		Plainsman	2540	Wichita	0
		Sumner	1786	Wotan	0
		Viking	2343		

Average yields of plots that survived the Seeding Date X Seeding Rate Trial at Thief River Falls, MN – 2003-04.

Aver. across rates Variety	Date	One plot Yield (lb/ac)	Aver. across rates Variety	Date	Three plot Ave. Yield (lb/ac)	Variety	Rate	Date	Three plot Ave. Yield (lb/ac)
Plainsman	8/29	1825	Witchita	8/20	2068	Largo	4 lb	8/20	1120
Largo	8/29	1406	Plainsman	8/20	2787	Largo	8 lb	8/20	659
Witchita	9/4	2409	Witchita	8/29	1875				

Current work:
For each of the last three years, the winter canola was seeded into wheat stubble to provide a means of snow catch. In 2001-02, the field was harrowed to spread out the heavy straw residue. Too much residue prevented good seed-soil contact and slowed emergence. In 2002-03 and 2003-04, the wheat straw was baled off to reduce residue levels on the field and provide better seed-soil contact for improved germination. Some seed companies that have tried winter canola in the Langdon, ND area reported having better success when winter canola was seeded into a tilled field than when direct seeded into wheat stubble. There is currently a study established east of Thief River Falls to determine if seeding into plowed soil will provide better survivability of winter canola than direct seeding into small grain stubble. We have already noticed that the crown of the canola stays at or below the soil surface in the plowed ground, but rises about ½ inch above the surface in the stubble plots. A higher crown is more likely to be damaged by low temperatures. Color coded pin flags were placed in 50 plots next to plants that showed different crown heights above the soil surface. Survivability of the flagged plants should provide some understanding of the importance of crown height for winter survival.

XVI SEED PLACED FERTILIZER TRIAL

Procedures:
This trial was located near Roseau, MN and was on the same area of the field as the MicroEssentials S15 Trial on the Canola Production Centre. A spring soil test of the field indicated 11 and 24 lb/ac of nitrogen at 0-6" and 0-24" depths, respectively. Phosphorous (24 ppm) and potassium (222 ppm) levels were high at 0-6 inches deep. Sulfur tests indicated 14 and 48 lb/ac at 0-6" and 0-24" depths, respectively. The canola variety Hyola 357 Magnum was seeded at a rate of 5.0 lb/ac. The trial was laid out in a randomized complete block (RCB) design with four replicates. Plots were 6 ft x 70 ft with 6 inch row spacing. Fertilizer treatments were put down the seed tube with the seed. Early cotyledon growth is recorded as a decimal of leaf stage (0.3 = early cotyledon, 0.7 = late cotyledon, 1 = first leaf). Plots were end trimmed so that harvested area was 6 ft x 60 ft.

The MicroEssentials S15 (MES15) and test products used in this trial are from Mosaic. Products and rates applied were as follows: ACT44A (92 lb/ac), ACT44B (106 lb/ac), ACT50 (118 lb/ac), MAP (64 lb/ac), MAP + AMS (64 + 62 lb/ac), MicroEssentials S15 (100 lb/ac), No fertilizer (check). All rates were applied at a uniform level of phosphorous based on the formulation of MicroEssentials S15 (13-33-0-15).

The trial was broadcast fertilized (120-0-20-0, N-P-K-S) on May 10 using a 12 foot drop spreader. Tillage incorporation of the fertilizer was not possible until June 14 due to frequent heavy rains which started the night of May 10. A few days prior to seeding, the entire trial was cultivated to incorporate the fertilizer and aerate the soil to facilitate drying. The trial was seeded on June 17 into good moisture conditions using a Hege 1000 small plot cone seeder. A rain shower of approximately 0.30 inches fell a few hours after seeding.

Results:
The plants treated with ACT44B and MAP+AMS showed slower growth and lower stand counts at 10 and 19 DAP. ACT44A and ACT50 produced larger plants and more plants early in the season. The no fertilizer treatment had the best early stand count but was quite delayed through canopy closure. The MAP and no fertilizer treatments had longer bloom periods and lower test weight. Even though ACT44B was the highest yielding treatment in the study, all the treatments were statistically similar yielding except the MAP and no fertilizer treatments. The MAP treatment provided a 400 lb/ac yield boost over the no fertilizer treatment. The AMS in the MAP+AMS provided another 200 lb/ac yield boost over the MAP only treatment. Both of these yield increases were significant. The no fertilizer treatment was shorter than all of the other treatments except ACT44A. The MAP treatment had the lowest oil content.

Early season growth and bloom data from Seed Placed Fertilizer Trial at Roseau, MN – 2004.

Treatment	10 DAP Growth decimal	10 DAP Stand plt/sq ft	19 DAP Growth Leaf	19 DAP Stand plt/sq ft	95% Canopy DAP	Begin Bloom DAP	End Bloom DAP	Bloom Duration Days
ACT44A	0.8	7.3	3.2	7.2	28	37	61	24
ACT44B	0.5	5.6	2.9	5.8	27	37	60	23
ACT50	0.7	6.9	3.3	7.1	28	37	61	24
MAP	0.7	6.5	2.9	6.7	30	37	62	25
MAP+AMS	0.5	5.4	3.1	5.4	29	38	61	23
MES15	0.7	5.7	3.3	6.2	27	37	61	24
No fertilizer	0.5	7.6	2.6	7.1	31	37	62	25
mean	0.6	6.4	3.0	6.5	28	37	61	24
LSD (0.05)	0.19	1.52	0.53	1.26	1.08	1.27	0.91	0.97
CV%	26.8	20.1	14.8	16.5	2.6	2.2	1.0	2.7
Pr > F	0.0690	0.9150	0.4192	0.9121	0.0001	0.6512	0.0016	0.0233

Yield and agronomic data from Seed Placed Fertilizer Trial at Roseau, MN – 2004.

Treatment	Yield (%)	Yield lb/ac	Test wt lb/bu	Height Inches	Lodging (1-9)	Physio. Maturity DAP	protein % DM	oil % DM
ACT44A	138	1897	50.1	35	3	94	22.0	45.3
ACT44B	150	2065	50.2	37	3	94	22.8	44.5
ACT50	147	2019	50.1	37	3	94	21.9	45.5
MAP	131	1793	49.9	36	3	95	22.6	43.4
MAP+AMS	145	1995	50.3	39	3	95	22.6	44.1
MES15	145	1989	50.2	38	3	94	22.9	44.4
No fertilizer	100	1373	49.7	32	3	94	22.6	44.9
mean		1876	50.0	36	3	94	22.5	44.6
LSD (0.05)		134.7	0.27	3.9	0	0.88	0.72	1.17
CV%		4.8	0.4	7.3	0.0	0.6	2.2	1.8
Pr > F		0.0001	0.003	0.0293		0.0387	0.0701	0.0209

Current work:
This trial will likely be conducted again in 2005, possibly with some new experimental fertilizer formulations.

XVII STAFF INFORMATION

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XVIII FARMER COOPERATORS

We would like to express our great appreciation to the farmer cooperators who have allowed us to use their land for the trials this year. **Thanks to you all.**

Location	Grower	Studies
Crookston	Jim Reitmeier and Dan Cooley	Blackleg nursery – fungicide evaluation, fungicide economic trial
Grygla	Todd Stanley	Variety trials
Kennedy	Rob & Tim Rynning	Variety trials
Red Lake Falls	Monte Casavan	Sclerotinia misting site – variety evaluation, fungicide evaluation
Roseau	Kelman Kvien	CPC, variety trials, seed place fertilizer trial, niger VT
Roseau	Magnusson Farms	Soybean VT
Thief River Falls	Ken & Connie Mehrkens	03-04 winter canola trials, 03CRye, 04CRye, soybean VT, niger VT
Thief River Falls	Lyle Olson	04-05 winter canola trials