Western Applied Research Corporation

2009 Summary of Research Results and Events

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Western Applied Research Corporation

The Western Applied Research Corporation (WARC) was incorporated in 2003 and is directed by a seven member Board of Directors. The seven directors are local producers that represent both livestock and grain producers from each of the seven Agriculture Development and Diversification (ADD) districts in NW Saskatchewan.

WARC is a producer based organization that facilitates practical field research and demonstration. It also ensures the transfer of technology from research to farm level for the benefit of producers in NW Saskatchewan and the province. In addition to the field trial analysis the economic implication for the technology is evaluated.

WARC is affiliated with Agriculture and AgriFood Canada (AAFC) at Scott. The Scott Research Farm acts as the main site for research and demonstration as well as coordination of the projects. Another location accessible to WARC through AAFC at Scott is Glaslyn. In addition to Glaslyn, there are seven other sites that are accessible through the AgriARM program: Indian Head, Redvers, Canora, Rosthern, Swift Current, Prince Albert, and Melfort.

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Steve Dueck	Technician, AAFC Scott

Scott Research Farm

The Scott Research Farm was established in 1910 by the Federal Department of Agriculture's Experimental Farm Service. In the 1970's organizational restructuring within Agriculture and Agrifood Canada Research Branch resulted in Scott Research Farm becoming a sub-station of Saskatoon Research Centre.

The farm consists of approximately 340 hectares (840 acres) of dark brown loam soil (pH ranging from 5.0-6.5). In addition to this land base there were two Project Farms operated on leased land in northwest Saskatchewan. One located near Lashburn (Black climatic zone) and the other near Loon Lake (Grey climatic zone). These project farms were closed at the end of 2006. In 2007, a new Project Farm near Glaslyn (Grey climatic zone) was started.

In the early years, there were research programs in livestock, horticulture and field crop production. Along with specialization in the agriculture industry, Research Centres also specialized. As a result, the livestock and horticulture programs have been transferred to other AAFC Research Centres. Scott Research Farm now specializes in crop production systems.

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Statistics

Statistics are very important for agricultural research. They allow a person to understand how different treatments relate to one another. Statistics is a mathematical way to determine if the differences between treatments are a real effect or random effect. The mean of a treatment is the same as the average. The mean is affected by the treatment applied, environment it occurs in, and error. The environment is the years and locations that the experiment takes place. For agricultural research a significance level of $\alpha=0.05$ is used. This means that if there is a significant difference, the difference is expected to occur 95 percent of the time. For example if the yield of variety A is larger and statistically different from variety B, variety A is higher yielding 95% under the environmental conditions of the experiment. Least significant difference (LSD) will be used in the WARC annual report to show differences among treatments like varieties and herbicides. To compare treatment averages you subtract one treatment average from another. If the difference is greater than the LSD the treatments are statistically different. Table 1 shows an example of three different treatments.

Table 1 A statistical example of using LSD to determine significant differences between treatments.

Treatment	Average
A	10
B	8
C	5
LSD(0.05)	2.5

treatment A (10) – treatment B (8) = difference (2)
2 is less than LSD of 2.5 so treatment A is not statistically different than treatment B

treatment A (10) – treatment C (5) = difference (5)
5 is greater than LSD of 2.5 so treatment A is statistically higher than treatment C

treatment B (8) – treatment C (5) = difference (3)
3 is greater than LSD of 2.5 so treatment B is statistically higher than treatment C

Statistical differences can also be presented by letters next to the average. Treatment averages with the same letter are not different but treatment averages with different letters are significantly different (Table 2). Treatments A and B are not significantly different but they are both significantly different from treatment C.

Table 2 A statistical example using letters on treatment averages to denote significant differences.

Treatment	Average
A	10^{a}
B	8^{a}
C	5^{b}
LSD(0.05)	2.5

Statistical significance is usually shown as error bars on graphs. If the error bar reaches as high as another average the treatments are not statistically different. If the error bar does not reach as high as another average they are significantly different. Treatment A and B are not significantly different but both are different from treatment C.

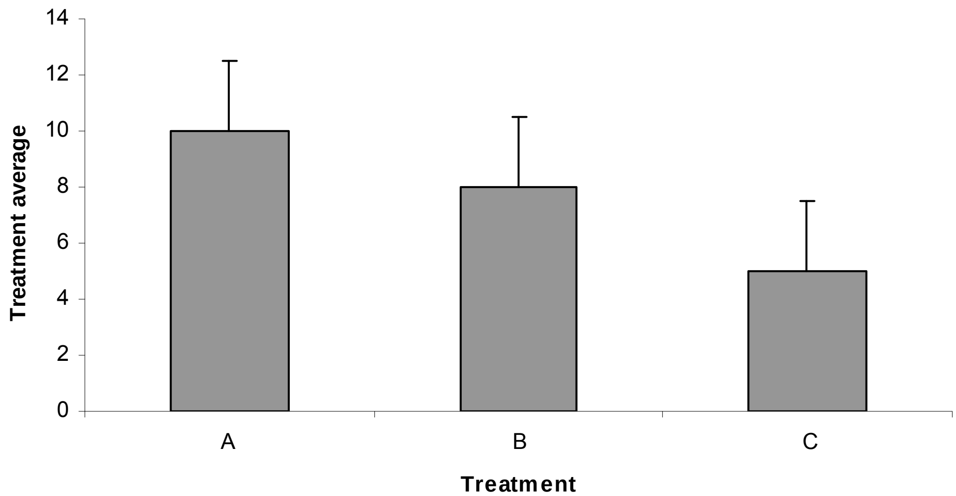

Figure 1 A statistical example using error bars on treatment averages to denote significant differences.

If treatment averages are not significantly different under the conditions of the experiment it is assumed that the environment of the experiment explains more of the treatment differences than do the treatments themselves. When there is no significant difference it is difficult to predict which treatment will perform better.

Two important factors that influence how precise an experiment is, the number of locations used and the number of years the experiment occurred in. The more site years (multiply number of sites by the number of years) an experiment occurs in the more precise the results. Experiments with few sites and few years do not have many different environments to compare. More conclusive results are obtained by experiments with more site years of data.

Weather Report for Scott, Saskatchewan 2009

Soil Information:

Dark Brown Chernozemic (Typic Boroll)
Association: Scott
Texture: Loam

sand: 31%
silt: 42%
clay: 27%

Organic Matter: 4%
Soil pH: 6.0

Table 1 Air temperature, growing degree days, and precipitation at Scott for 2009.

Year	April	May	June	July	Aug	Sept	Oct	Season Total
Air Temperature (°C)								
2009 mean	3	9	14	16	15	15	1	
98 year mean	3	10	14	17	16	10	4	
Growing Degree Days								
2009 mean	19	131	272	336	324	297	7	1386
98 year mean	42	170	285	380	346	174	48	1445
Precipitation (mm)								
2009 mean	15	19	28	75	58	30	31	256
98 year mean	23	36	61	61	45	31	16	273

Last spring frost: June 9 (-0.2°C)

First fall frost: September 28 (-6.1°C)

Rainfall of greater than 10 mm (April-October):

June 21 (13mm)
July 8 (26mm)
July 13 (12mm)
August 7 (12mm)
August 15 (32mm)
September 6 (19mm)
October 18 (12mm)

Scott Field Day

The Scott Field Day on July 15th at the AAFC Scott Research Farm was once again a success. Approximately 230 producers and agronomists were in attendance for day that was organized by Western Applied Research Corporation and the Saskatchewan Canola Growers Association. Various topics were covered as outlined below.

Alternative Oilseeds-Eric Johnson, AAFC Scott

A study is underway to compare different oilseed crops for there ability to produce biodiesel based on yields from Scott, Saskatchewan. Ten different types of oilseeds were included. They were polish canola, argentine canola (Invigor), canola quality mustard, two varieties of soybean, yellow and oriental mustard, ethiopian mustard, and camelina. In the past soybean has not produced very well at Scott (1-6 bu/ac). In 2008 argentine canola produced the highest seed and oil yield. Camelina is a new crop with a large potential. It has an earlier maturity than canola, better frost tolerance, and performs well in drier areas like Swift Current. Some research has been conducted like seeding rates and weed control. There are no registered products for broadleaf weed control in camelina but several work well for control of grassy type weeds. Ethiopian mustard is a crop that is starting to receive more efforts for improvement from AAFC plant breeders. It is later maturing with good drought tolerance. Canola quality mustard had better vigor in the spring and tolerated spring frost better than canola.

Novel Mustards-Eric Johnson, AAFC Scott

This demonstration included 20 different types of mustard from around the world. Many of them are consumed as a vegetable and the seed is not eaten. The goal is to find some type of herbicide tolerance from one of the mustard types. If herbicide tolerance is found, the goal will be to use plant breeding to transfer the trait into mustard that is grown in Saskatchewan. This could give better weed control options to mustard growers.

Authority in Flax-Eric Johnson, AAFC Scott

Flax growers have no good ways to control cleavers, kochia, and red root pigweed in flax crops. Authority is a product that is applied preemergent that gives good control of these weeds. Authority and MCPA used together give the best control for flax growers of cleavers, red root pigweed, kochia, and wild mustard. Authority is not registered for use in flax yet.

Weed Control in Flax-Eric Johnson, AAFC Scott

Buctril M will control kochia if it is applied early. Cleavers are not controlled by Buctril M even though some initial injury occurs. MCPA controls wild mustard but not cleavers. Authority controls cleavers and kochia but not wild mustard. MCPA and Authority applied to the same crop gave the best control of kochia, wild mustard, and cleavers.

Chickpea Weed Control-Eric Johnson, AAFC Scott

Weed control in chickpeas is very limited. Authority gives good control of kochia but poor control of wild mustard. It is applied preemergent and needs rainfall to become active in the soil. Heat is a new product that has some residual activity and controls wild mustard. Combining Heat and Authority looks promising for weed control in chickpeas.

Ethanol Feed stocks-Brian Beres, AAFC Lethbridge

Triticale is a species that is man made from crossing wheat and rye. It may be more amenable to becoming a GM cereal because it is man made, little is grown for human consumption, and relatively few acres are grown. Pronghorn is the best performing triticale available. It is relatively resistant to fusarium head blight but susceptible to ergot. Its maturity is similar to AC Andrew. For ethanol production the starch levels are high in the seed and ethanol yields are good. Hoffman is a high yielding eastern feed variety not currently registered in western Canada. It is quite tall and susceptible to lodging. AC Sadash is a new SWS variety that may replace AC Andrew because it is generally higher yielding. The earliest maturing SWS variety is Bhishaj.

Barley Variety Trials-John Ippolito, Saskatchewan Agriculture

There are several new six row barley varieties. Kamsack is a malt variety with good yield but a disease resistance package similar to the check varieties. Mayfair has an increase in yield and higher malt extract. Chickwell is a six row feed variety with high forage and grain yield and better disease resistance than the checks. There are also several new two row barley varieties. CDC Cowboy is a feed variety with high forage yield. Champion is a feed barley variety that has an increase in shatter resistance. Recently brewers and maltsters have partnered with breeding agencies to develop barley varieties that fit specific needs. CDC Reserve is a variety that was developed in partnership with Prairie Malt Ltd. and Sapporo. It has a yield increase over the checks. CDC Meredith is a malt variety with good yield potential and some resistance to fusarium head blight.

Oat Variety Trial-John Ippolito, Saskatchewan Agriculture

Oat breeding has seen a partnership between industry and breeding institutions. Jordan is a high yielding oat in the black soil zone but has late maturity. Minstrel is high yielding with good straw strength but rust susceptible. Trophy is a lower yielding oat variety but will fit well into an identity preserved program paying premiums for the oat. Hi Fi has lower yield potential but has leaf rust resistance.

Wheat Variety Trial-Sherrilyn Phelps, Saskatchewan Agriculture

2010 will be the first year wheat midge tolerant wheat is available. Unity and Goodeve are two of the varieties. They are blends of two varieties. The first variety is wheat midge tolerant and constitutes most of the seed. The second variety is wheat midge susceptible. It is included to slow wheat midge resistance to the wheat. There may be a visual difference between the two types of wheat in the field. Fieldstar is a wheat midge tolerant variety available in 2011.

Durum Variety Trial-John Ippolito, Saskatchewan Agriculture

Durum breeders are currently breeding for better disease resistance, increased gluten strength, and increased fusarium head blight resistance. Seed treatment on durum seed is important because of loose smut. Eurostar and Brigade are two new durum varieties with good yield potential and strong gluten strength.

Proper Canola Plant Density-Steve Shirtliffe, University of Saskatchewan

Steve performed a meta analysis. This is a technique that uses currently published data. He found that three pounds per acre seeding rate yielded four percent less on average than five pounds per acre. Four plants per square foot is the minimum density before yield begins to drop. Hybrid canola tolerates lower plant densities better. One plant per square foot will produce about 65 percent of maximum yield potential for hybrid canola. Weed control becomes more important as canola plant density decreases. Thin plant density also increases the days to maturity.

Straight Cutting Canola-Doug Moisey, Canola Council of Canada

Two main losses of canola seed are pod drop and pod shatter. Pod sealants are supposed to reduce pod shatter. Fields that have the canola knitted together, some lodging, and even are good candidates for straight combining. Fields that have thin plant stands or have had hailstorms during the season are poor candidates for straight combining. If using pod sealants 20 gallons/acre of water is needed to have good coverage.

Insect Update-Scott Hartley, Saskatchewan Agriculture

In 2009 cutworms caused some crop damage. In most years cutworms cease to be an issue at the end of June. In 2009 damage was still occurring in July. Grasshoppers are expected to be an issue in areas of Saskatchewan in 2010. Wheat is susceptible to wheat midge when the any part of the head is visible during heading until the head has undergone anthesis.

Fababean and Barley Intercrop-Sherrilyn Phelps, Saskatchewan Agriculture

Fababean is an excellent crop for N fixation. It can even have more N fixed than it requires. One of the main diseases that causes yield loss in fababean is chocolate spot. When fababean and barley are grown as an intercrop good economic results have been noted. If the cost of N fertilizer is high it can be more profitable to have a fababean barley intercrop compared to either crop grown as a monocrop.

Alternative Seed Treatments-Sherrilyn Phelps, Saskatchewan Agriculture

Several different chemical and organic seed treatments were applied to chickpea. The comparisons include some of the popular chemical seed treatments with several different organic products with different modes of action. An untreated check was also included. Early and late seeding was used to provide different environments. The best stand establishment occurred for late seeding and the chemical seed treatments. Some potential exists for some of the organic products.

Canaryseed-Sherrilyn Phelps, Saskatchewan Agriculture

The two types of canaryseed are hairy and glabrous. The hairy canaryseed is itchier than the glabrous types. Current breeding objectives include better disease resistance and higher yield. Few options exist for wild oat control in canaryseed. Research was conducted with Puma Super but the crop injury could be severe and was unpredictable when it would occur.

Crop and Weed Competition-Steve Shirtliffe, University of Saskatchewan

Good agronomy equals good weed control. Even herbicides require crop competition to kill weeds. Increasing seeding rates helps reduce weed competition. Most crop species are more competitive than annual weeds. Narrow row spacing also makes crops more competitive. Competitive crops in Saskatchewan include canola, barley, wheat, and oats. Lentil and flax are less competitive crops.

Thanks to the Sponsors for the Scott Field Day

Agriculture & Agri-Food Canada

Saskatchewan Ministry of Agriculture
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Weed Tour

Sherrilyn Phelps, Saskatchewan Ministry of Agriculture

The Weed Tour was held on July 16th as a training opportunity for agronomists and researchers on new weed control technologies. Forty people attended the tour which covered topics such as new herbicides being screened, minor use pesticide registration projects, using agronomics for pest management and managing herbicide resistant weeds. This event was put on in partnership with Saskatchewan Ministry of Agriculture and the University of Saskatchewan. Speakers included Eric Johnson (AAFC Scott), Dr. Steve Shirtliffe (U of S), Ken Sapsford (U of S), Dan Ulrich (AAFC Scott), Dr Hugh Beckie (AAFC Saskatoon) and Clark Brenzil (Sask. Agric.)
Thanks to **BASF** for sponsoring the lunch.

Glaslyn Field Tour

Sherrilyn Phelps, Saskatchewan Ministry of Agriculture

On July 22nd a Field Tour at Glaslyn was organized by AgriTeam Services. Approximately 45 producers and agronomists were in attendance. The tour included the AAFC off station site at Glaslyn where varieties, insect, weed and disease management were discussed as well as canola agronomics and potential for straight cutting. Thanks to **AgriTeam Services** from Glaslyn for organizing such a successful tour.

Crop Opportunity and Scott Research Update

Sherrilyn Phelps, Crop Specialist, Saskatchewan Ministry of Agriculture

The Crop Opportunity and Scott Research Update is scheduled for March 2nd, 2010 at the Goldridge Centre in North Battleford.

Effect of Penergetic P and Penergetic K on wheat yield

Phelps, S.M.[1], L. Neilsen[2], E. Johnson[2], D. Pratt[3], B. Davey[4]
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[4]WARC

Funded by Penergetic Canada

Introduction

Penergetic P and Penergetic K are products that are advertised to increase yield of many field crops grown around the world, including wheat. The products are applied to soil preseeding (Penergetic K) or sprayed onto the foliage post emergent with herbicides (Penergetic P). Little independent research has been conducted to determine if the products increase yield and protein of cereals in western Canada.

The objective of this project was to determine if either Penergetic P or Penergetic K would increase wheat seed yield and/or protein at Scott, Saskatchewan.

Materials and Methods

The project was set up as a randomized complete block design, with four blocks. The plots were 4 m x 15 m with 2 m guards on either side. It was grown in the summer of 2009 at Scott, Saskatchewan. The fertilizer levels applied were determined by soil analysis by ALS Laboratory Group (Saskatoon, Saskatchewan) basing wheat yields on 2700 kg ha^{-1}. Table 1 depicts each treatment used. CDC Imagine was the variety of wheat used. It was seeded May 25 at 112 kg ha^{-1}. If fertilizer was applied to the treatment it was side banded. Glyphosate was applied on May 8 as a preseed burnoff for weed control at 0.6 L ha^{-1} and water volume of 113 L ha^{-1}. Penergetic K was applied with the glyphosate burnoff where applicable at a rate of 250 g ha^{-1}. Penergetic P was applied, where applicable, as a foliar spray in crop with Buctril M (Bayer, Calgary, Alberta) on June 19. Penergetic P was applied at 250 g ha^{-1}. Buctril M was applied at 1.0 L ha^{-1}. The crop stage on June 19 was the three leaf stage.

Table 1 Penergetic product and fertilizer rates applied to each treatment in the Penergetic project at Scott in 2009.

Treatment	Penergetic	P_2O_5 applied (kg ha^{-1}) (relative rate)	N applied (kg ha^{-1}) (relative rate)
Control-no fert	-	0 (0%)	0 (0%)
Control-50% fert	-	21 (50%)	56 (50%)
Control-100% fert	-	44 (100%)	113 (100%)
PenK-50% fert	K preseed	21 (50%)	56 (50%)
PenP-50% fert	P in crop	21 (50%)	56 (50%)
PenP+K-0% fert	K preseed and P in crop	0 (0%)	0 (0%)
PenP+K-50% fert	K preseed and P in crop	21 (50%)	56 (50%)
PenP+K-100% fert	K preseed and P in crop	44 (100%)	113 (100%)

Results

Figures 1 and 2 show the wheat yields of the different Penergetic products. There were no significant differences among the treatments for plant density. There was a positive response to fertilizer in that as fertilizer was applied yields increased. Grain yield was significantly higher for 100% fertilizer compared to the plots receiving no fertilizer. The 50% fertilizer rate produced higher yields than 0% fertilizer but it was not a significant difference.

There was no significant response to Penergetic products when both products were applied at each of the fertilizer rates (Figure 1). When the products were applied separately at the 50% fertilizer rate the Penergetic P treatment was significantly lower than the 50% fertilizer check (Figure 2). All of the Penergetic products had statistically similar yields except for Penergetic P/50% fertilizer.

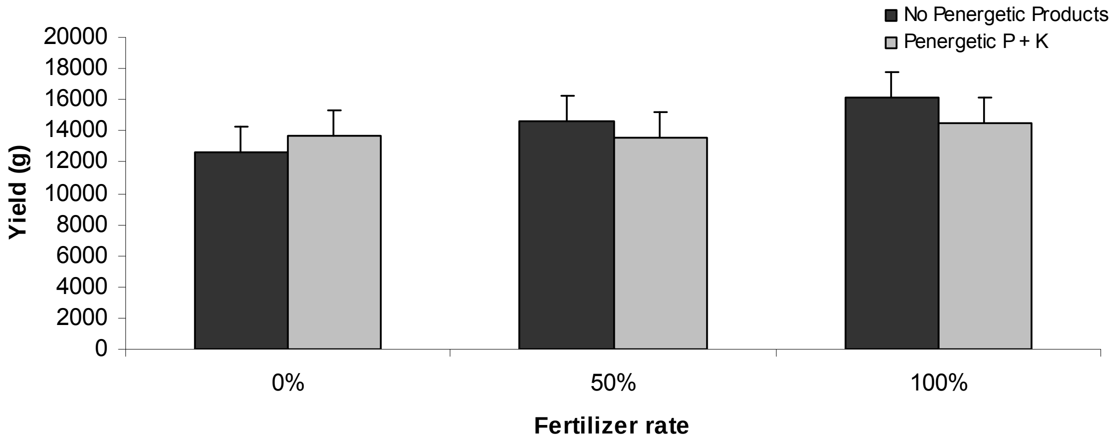

Figure 1 Comparison of wheat yields between the inclusion of Penergetic products at three fertilizer rates.

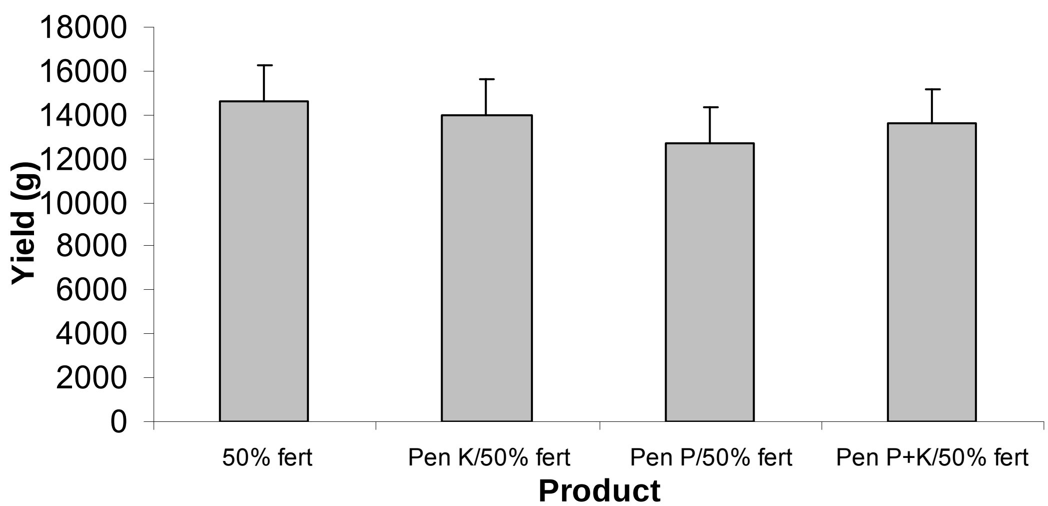

Figure 2 Wheat yield for the different Penergetic products at the 50 percent fertilizer level.

There was a significant difference for the wheat seed protein content among the treatments. The Penergetic P+K/100% fertilizer produced significantly higher seed protein content than all other treatments except the 100% fertilizer treatment.

Conclusions

There was no advantage to using a Penergetic product in this project at this location in 2009. Scott had an uncharacteristic season in 2009. Spring and summer were both cooler and drier than normal and less accumulation of growing degree days resulted in delayed growth pattern in the wheat plots. The adverse conditions may have impacted the effectiveness of the spring applied products. In this trial there was no advantage to using a Penergetic product, but this trial only contained one site year of data so results may not be conclusive.

Future Work

More site years of research with Penergetic products needs to be done to give a better indication of how these products work under a variety of conditions.

Fababean and Barley Intercrop

Phelps, S.M.[1], H. Schell[2], C. Gampe[2], A. Kapiniak[2], E. Johnson[2], B. Davey[3]
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[3]WARC

Funded by Saskatchewan Ministry of Agriculture – AgriARM Program

Fababean (*Vicia faba*) is a crop that is seeing renewed interest in western Canada. It is a pulse crop that produces a seed that is most often used for feed in western Canada but in some cases may be exported for human consumption. The reason it is seeing renewed interest by both producers and researchers in western Canada is that it produces the most plant available nitrogen compared to other pulse crops grown in western Canada. It also has the ability to produce high grain yields in high rainfall areas. In 2008 and 2009 nitrogen fertilizer recorded all time high prices in Canada. Producers began actively seeking other fertilizer options other than chemical fertilizer. Some producers began intercropping pulse and cereal crops.

A fababean barley intercrop test was seeded in 2008 and 2009. It was seeded in a RCBD with four blocks at Scott, Saskatchewan in both years. The treatments used included two barley varieties, three seeding rates, and two different harvest techniques (Table 1). One barley variety was taller (Copeland) than the other (Bold). The three seeding rates used were 0, 20, and 40 kg ha^{-1} (0X, 0.25X, and 0.5X of generally recommended seeding rates). Swathing and straight cutting the plots were the two harvest types used. The fababeans were seeded early May. The barley was seeded perpendicular to the fababeans but 14 days later. Granular inoculant was applied with the fababeans. There was no previous crop on the land as it was chemfallow the year previous to the test. Swathing occurred 10 days prior to harvest for the selected plots.

Table 1 Barley variety, seeding rate, and harvest type used for each treatment.

Treatment	Barley Variety	Barley Seeding Rate	Harvest Type
1	N/A	None (0X)	Swathed
2	N/A	None (0X)	Straight cut
3	Copeland	20 kg ha^{-1} (0.25X)	Swathed
4	Copeland	20 kg ha^{-1} (0.25X)	Straight cut
5	Copeland	40 kg ha^{-1} (0.5X)	Swathed
6	Bold	20 kg ha^{-1} (0.25X)	Swathed
7	Bold	20 kg ha^{-1} (0.25X)	Straight cut
8	Bold	40 kg ha^{-1} (0.5X)	Swathed

No significant difference (α=0.05) was seen between swathing and straight combining for barley, fababean, or total yield. It was expected that swathing would have produced a higher yield of fababean because of reports from producers. Shattering at harvest time has caused yield losses for some producers who planned on straight combining fababean. No significant difference was seen between Copeland and Bold. It was expected that the taller Copeland would be more competitive and reduce fababean yield compared to Bold. When barley and fababean were intercropped the yield of fababean was significantly reduced compared to fababean monocrop (fababean alone). The seeding rate of barley had a significant effect on fababean yield. Fababean yield decreased when barley seeding rates were increased. The test had barley seeding rates set too high. Total yield was not affected by changing the barley seeding rate from 0.25X to 0.5X. Barley is worth less money than fababean so the ideal barley seeding rate will be lower than 0.25X so that fababean yields will increase, barley yields decrease, but total yield will remain the same (Table 2).

Table 2 Means of the different barley seeding rates, barley variety, and harvest type for fababean, barley, and total yield.

Treatment	Fababean Yield ($kg\ ha^{-1}$)	Barley Yield ($kg\ ha^{-1}$)	Total Yield ($kg\ ha^{-1}$)
Barley Seeding Rate			
0 $kg\ ha^{-1}$ (0X)	2555 a	0 a	2555 a
20 $kg\ ha^{-1}$ (0.25X)	802 b	3895 b	4696 b
40 $kg\ ha^{-1}$ (0.5X)	483 c	4169 b	4652 b
Barley Variety			
Copeland	684 e	3949 e	4633 e
Bold	707 e	4024 e	4731 e
Harvest Type			
Straight Combine	1385 f	2756 f	4140 f
Swath	1026 f	3130 f	4156 f

An economic analysis was done comparing barley and fababean monocrop to barley and fababean intercrop (Table 3). The yield used in the barley monocrop did not come from this experiment. The yield was the average yield of the barley cultivars included in the variety testing done at Scott, Saskatchewan in 2008 and 2009. Feed prices were used as the commodity price for both fababean and barley. Seed cost was assumed to be 50% higher than the selling price of the commodity. Fertilizer and inoculant cost was based on how much of each product was actually applied in 2008 and 2009. The seeding cost was taken from the Saskatchewan Ministry of Agriculture Farm Machinery Custom and Rental Rate Guide 2008-2009. Seed cleaning cost was based on local rates in the Scott area. Barley monocrop had the highest net return at \$528 ha^{-1} while fababean monocrop had the lowest return at \$315 ha^{-1}. The intercrop of barley and fababean had a return of \$354 ha^{-1}.

Table 3 Economic comparison of barley and fababean monocrop and barley and fababean intercrop.

	Monocrop Barley	Monocrop Fababean	Intercrop Barley	Intercrop Fababean
Total Yield (kg/ha)	5580	2555	4674	
Separate Yield (kg/ha)	5580	2555	4046	643
Price ($/kg)	0.11	0.17	0.11	0.17
Revenue ($/ha)	614	434	554	
Seed cost ($/ha)	13	69	74	
Fertilizer/inoculant ($/ha)	34	12	12	
Seeding Cost ($/ha)	38	38	77	
Seed Cleaning ($/ha)	0	0	38	
Net Income ($/ha)	528	315	354	

Fababean Nitrogen Replacement

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[1]AAFC Scott, [2]WARC

Funded by Saskatchewan Ministry of Agriculture – AgriARM Program

Fababean is a pulse crop that Saskatchewan producers are becoming more interested in growing. Little is known about the effect of crops grown on fababean stubble the following year. Pulse crops form symbiotic relationships with bacteria which produce nitrogen for the pulse crop. As the stubble and root mass decays following the crop some of the nitrogen is released into the soil solution and can be used by following crops. Producers often seed wheat crops on pulse stubble.

A study was set up to determine if wheat crops planted on fababean stubble produced higher yields compared to canola stubble. The data presented is from Scott, Saskatchewan for 2008 and 2009 but the test is still on going. Fababeans and canola were seeded in 2007 and 2008 with the wheat plots seeded into the fababean or canola stubble from the previous year. Three N fertilizer rates were used 0, 45, and 90 kg ha^{-1}, all of the nitrogen fertilizer was placed in mid row bands. The wheat variety used was AC Lillian seeded at 100 kg ha-1 with 29 kg ha^{-1} of P placed below the seed. It was seeded on May 20, 2008 and May 10, 2009. Harvest occurred September 8, 2008 and September 21, 2009.

Plant density and yield were both affected by the use of fertilizer on the wheat plots seeded on the canola and fababean stubble. As fertilizer rates increased on both stubbles the average plant density decreased. The highest yields were seen at 45 kg ha^{-1} of N for both the fababean and canola stubble. The higher rate of 90 kg N ha^{-1} produced yields that were less, not significantly, than the 45 kg N ha^{-1}. Fababean stubble produced significantly higher wheat yields compared to canola stubble for each corresponding N rate. The highest average yield was on fababean stubble with 45 kg N ha^{-1} producing a wheat yield of 2772 kg ha^{-1}. The lowest wheat yield was on canola stubble with 0 N fertilizer added (Figure 1).

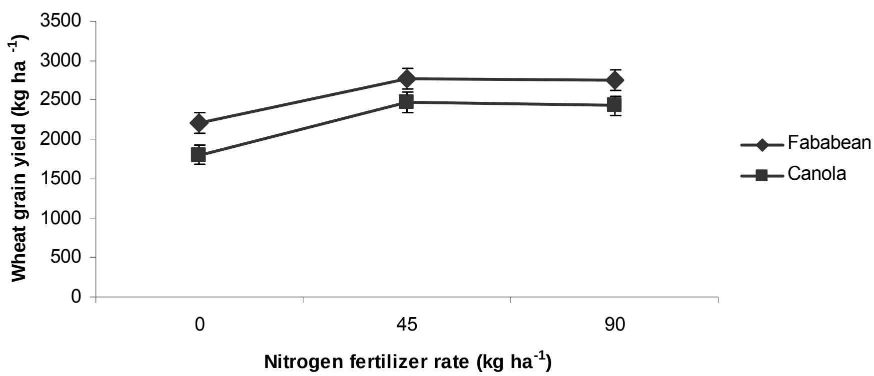

Figure 1 Wheat yield for three fertilizer rates grown on canola and fababean stubble.

This study is going to continue at Scott in 2010. From the preliminary research fababean stubble produces wheat yields higher than canola stubble when using the same fertilizer regime. It is unknown the cause of wheat yield increase when planted on fababean stubble compared to canola stubble.

Hemp Variety Trial

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Objective

Hemp does well in a variety of soil types, but does not tolerate drought, flooding, saturated, or saline soils. It is tolerant to light spring frosts. Tests show that hemp grows well in the Dark Brown to thin Black soils of Saskatchewan with medium texture, high soil moisture and a long growing season. Maturity ranges from 80 to 120 days depending on variety and seeding date. Hemp is photosensitive which means that flowering is triggered by shorter day lengths after June 21. This means crops seeded earlier produce taller plants with higher yield potential but do not mature earlier than later seeded crops. Optimum seeding date is May 15th. This project evaluates new hemp varieties for suitability for production in Dark Brown and Black soils zones of Saskatchewan.

Materials and Methods

A variety trial for hemp was conducted at Scott and Melfort in 2007, 2008, and 2009. The trial was set up at randomized complete block design with four replicates. Both short and long season hemp varieties were included as directed by Ontario Hemp Trade Alliance. The varieties included were both breeding lines from hemp breeders and currently available varieties.

Variety Descriptions:
Early Varieties:
Finola is a very early dioecious grain variety adapted for production north of 48th latitude. Finola is lower yielding and shorter in height than CRS-1 and also has a smaller seed size. This variety is owned and sold by Hemp Oil Canada.
CFX-1 is a dioecious early grain variety that is about the same height as Crag. Its maturity is slightly earlier than Crag but seed size is similar to Crag. CFX-1 is owned and sold by Hemp Genetics International and is developed for easier threshing and harvest management.
CRS-1 is a dioecious early grain variety that is slightly later and taller than CFX-1 and considerably higher yielding. Grain yield of CRS-1 is competitive with Anka but considerably earlier and shorter. This variety has potential as an early variety in Ontario and Quebec. Seed size is similar to Anka. Owned and sold by Hemp Genetics International.

Late Varieties
Alyssa is a monoecious, dual purpose variety adapted for Manitoba for grain and fiber production. It is earlier and shorter than Anka with below average grain yield and seed size. Owned and sold by Parkland Hemp Growers.
Anka is a monoecious grain variety with large seed and high yield potential. It is adapted for grain in Ontario and Quebec with high fiber potential in prairie the provinces. Anka is a taller variety with an excellent nutty flavour. This variety is owned and sold by Ontario Hemp Alliance.
Jutta is a monoecious grain variety that is very uniform and has higher yield potential than Anka. Seed size, fatty acid profile and high oil content is similar to Anka. Adapted to Ontario and Quebec for grain. Owned and sold by Ontario Hemp Alliance.

Yvonne is a monoecious dual purpose variety. It is a high yielding grain variety similar to Anka with same seed size as Anka but taller in height. Yvonne has potential as fiber variety in the Prairies and in Ontario and Quebec. Owned and sold by Ontario Hemp Alliance.
Heidrun is a dioecious grain variety that is very high yielding. It has large seed and is similar to Anka in height and fatty acid profile. This variety has potential as fiber variety on the Prairies as well as in Ontario and Quebec. Owned and sold by Ontario Hemp Alliance.

Results from variety trials at Melfort and Scott in 2007, 2008 and 2009 are summarized in Table 1. The varieties performed consistently across locations and years in Saskatchewan. When comparing days to flower the average of the early maturing lines (51 days) was significantly less than the late maturing lines (65 days). The shortest days to flower was Finola at 46 days. The longest days to flower was Jutta at 68 days. In general the late maturing varieties had too long of maturity for the climate, as demonstrated by the lower yields. Some of the late varieties were not harvested because of maturity length.

In terms of height, the later maturing varieties were taller. For hemp grain production in Saskatchewan plant height is important as shorter varieties tend to be easier to harvest. Finola, currently available to producers was the shortest variety at 90 cm. The tallest variety was Yvonne at 176 cm. The average height difference between early maturing (115 cm) and late maturing lines (164 cm) was significant.

In Saskatchewan the early maturing lines produced a significantly higher yield (969 kg ha^{-1}) than late maturing lines (783 kg ha^{-1}). The highest yielding line was the early maturing CRS-1. The lowest yield was produced by the late maturing Heidrun.

Table 1 Yield, height, and days to flower for hemp varieties in the yield trial.

Variety	Maturity Type	Days to Flower (days)	Height (cm)	Yield (kg ha^{-1})
Finola	Early	46	90	816
Crag	Early	54	131	982
CFX-1	Early	49	110	987
CRS-1	Early	53	130	1090
Heidrun	Late	63	168	534
Yvonne	Late	67	176	630
Anika	Late	65	163	884
Alyssa	Late	62	156	888
Jutta	Late	68	158	981
	LSD (α=0.05)	2.8	14.9	169.2

Conclusions

For hemp to be successful in Saskatchewan the early maturing hemp varieties should be grown. The early maturing lines are shorter in stature, have less days to flower, and produce higher yield compared to the late maturing lines. Maturity length is important in Saskatchewan where frost free days are limited. In a year where an early fall frost occurs many of the later maturing lines would set little seed making them a higher risk to grow.

Chemical Control of Leafy Spurge

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Leafy spurge is a noxious weed that has been invading grassland in Saskatchewan. Areas that are affected have reduced grass production. Most grazing animals do not find leafy spurge palatable and selectively graze the grass around the leafy spurge. This allows the leafy spurge to have a competitive advantage and infected areas of the grassland expand. The goal of the study is to determine the effectiveness on controlling leaf spurge by new chemistry from Dupont in comparison to existing chemical control.

Materials and Methods

This study was conducted near North Battleford, Saskatchewan in 2009. It is a multi year study and will be continued in 2010. The test was set as a randomized complete block design with four replications. Plot size was 2 m x 5 m. The leafy spurge population was high and even across the whole test at approximately 40 plants m^{-2}. Plant size ranged from 20-65 cm tall with most plants at 40 cm tall. A CO_2 powered sprayer was used with air mix nozzles applying 220 L ha^{-1} of water. The herbicide treatments were applied June 24 (Table 1). Control ratings were taken 22, 34, 54, and 77 days after application. Herbicides consisted of new active ingredient from Dupont at various rates, Remedy, Grazon, and aminopyralid + 2,4-D.

Results

Visual injury of the grass was evident early with Remedy and Grazon. Other treatments also injured grass but not to the same extent. Visual injury symptoms were gone at the 77 days after application rating but the grass was shorter than the control plants. Insufficient control was noted for most of the treatments 22 days after application. Some treatments were beginning to control leafy spurge 34 days after application.

Maximum control of leafy spurge was seen at 77 days after application. From the preliminary data it appears that all products produce good control of leafy spurge. Remedy and Grazon both produce good control of leafy spurge but some injury to the grassland will occur. The new active from Dupont also provides good control of leafy spurge and looks promising as a low risk herbicide as it is active at fairly low rates.

Future Work

The trial will be monitored into 2010 and possibly longer to evaluate the long term control of leafy spurge.

Chemical Control of Night Flowering Catchfly

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Night flowering catchfly is a weed that has seen an increased presence in northwest Saskatchewan. Control methods for it are not understood well. The goal of the research was to determine if any currently available herbicides will produce sufficient control of night flowering catchfly and to test different tank mixes.

Materials and Methods

The trial occurred in producer field near North Battleford. The experimental design was randomized complete block. It was only done at one site in 2009. Six different treatments were used (Table 1). They were a combination of different herbicides already registered in western Canada. All of the treatments were applied as a preseed burnoff on May 8 in an attempt to control night flowering catchfly. The density of night flowering catchfly was even across the trial at 90 plants m^{-2}. They ranged in size from 2-5 cm with the majority at 3 cm. Control ratings were taken at 10, 25, and 54 days after application.

Table 1 Treatment components and amount of active ingredients used for comparing control of night flowering catchfly.

Treatment number	Treatment	Rate (g ai/ha)
1	Untreated check	
2	Express SG + glyphosate	7.5 + 450
3	Express Pro + glyphosate	7.5 + 4.5 + 450
4	glyphosate	450
5	glyphosate	900
6	Prepass + glyphosate	4.94 + 450

Results

All of the chemical treatments had acceptable levels of control compared to the untreated check. Effects of all chemical treatments were positive 10 days after application. However cool conditions delayed complete death of plants until 25 days after application. The 25 days after application ratings show that all herbicide treatments gave acceptable levels of control (Figure 1). Glyphosate at 900 g ai/ha was significantly better than the 450 g ai/ha rate at 25 days after application. At 54 days after application there was still acceptable control for all treatments when the individual plants were rated. Residual activity with Express Pro and Prepass gave better control of the night flowering catchfly that germinated after the treatments were applied.

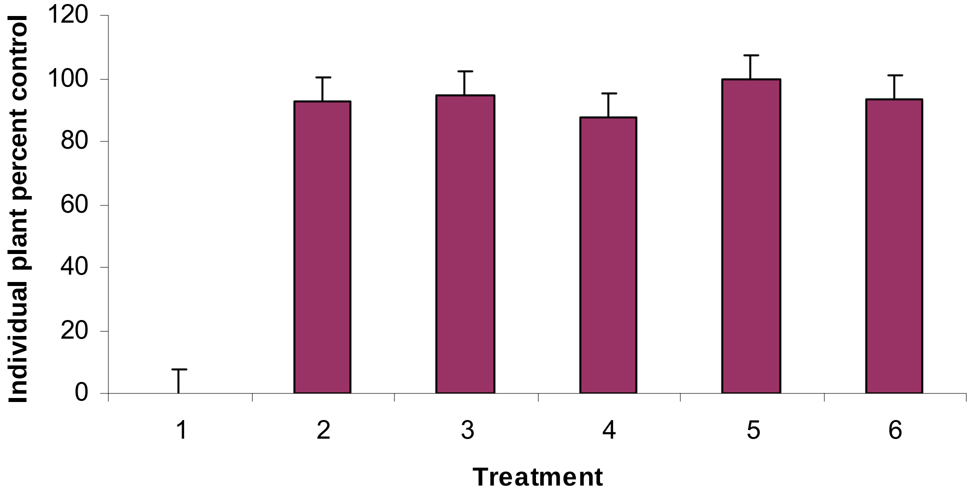

Figure 1 Percent control of treated night flowering catchfly plants for the six treatments used 25 days after application.

Alternative Chickpea Seed Treatment Trial

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Registered chemical seed treatments are proven effective at controlling seedling diseases but can not be used by organic growers. The objective of this project was to evaluate some alternative products for potential use in Western Canada.

CB-QGG is a liquid, natural seed treatment and root growth promoter that is said to increase the respiration activity of seeds causing them to germinate more quickly and more fully when compared to non treated seeds and is produced by EcoChem. Rootshield is a preventative biofungicide registered for use in greenhouse crops. The active ingredient is a patented hybrid fungus, *Trichoderma harzianum*, strain T-22 that protects roots from many pathogens and is produced by BioWorks Inc. Heads Up by Plant Protectants Inc. is a biofungicide registered for use on soybeans, corn, potato, tomato, peas, beans and wheat. Heads Up is a signaling plant activator that is said to stimulate a warning signal to the germinating plant and protects against *Rhizoctonia, Pythium* and *Fusarium*.

Kabuli chickpeas are very sensitive to seedling diseases and seed rots and often result in reduced plant densities. Due to their sensitivity kabuli chickpeas were chosen to evaluate the effectiveness of alternative seed treatment options.

Materials and Methods

The chickpea seed treatment test occurred at Scott, Saskatchewan in 2007, 2008, and 2009. It was grown in a randomized complete block design with four blocks. Two seeding dates were used for each seed treatment and the untreated check. The early seeding date was in early May while the late seeding date was late May. Chemical weed control was used to provide some level of weed control.

Results

The treatments containing Apron (alone and in combination with Crown) produced the highest plant densities and grain yields for the early seeding date. For the late seeding date it was the treatments containing Crown (alone and in combination with Apron) that produced the highest plant densities and grain yields. This suggests that with the early seeding date *Pythium* species may have been more prevalent and in the later seeding dates *Ascochyta, Fusarium or Rhizoctonia* may have been the more prevalent organisms leading to seed rots and blights. In all cases later seeding produced higher plant density than earlier seeding. However, in terms of yield the early seeded treatment with combination Crown + Apron gave yields statistically similar to those of the highest yielding later seeded treatments. This suggests that by controlling seedling diseases in chickpeas we may be able to plant early and still have good yields and possibly earlier maturity.

In terms of the alternative seed treatments, there was an improvement over the untreated control in plant stand and yield with Heads Up and Rootshield at the earlier seeding date but no significant response with CB-QGG. The densities and yields obtained for early seeding date with the alternative products were similar to the Crown only chemical seed treatment but were not as good as that obtained with the combination of Apron + Crown.

Although there was no increase in plant stand at the later seeding date, yield was significantly higher than the untreated check with all three alternative products, but not as good as the highest yielding Crown treatment. RootShield was the only alternative product that had yields statistically similar to the Crown + Apron treatment.

Table 1 Plant density and grain yield for both early and late seeding for each treatment in the chickpea seed treatment trial.

Seed Treatment	Early Plant Density (plants m^{-2})	Late Plant Density (plants m^{-2})	Early Grain Yield (kg ha^{-1})	Late Grain Yield (kg ha^{-1})
Untreated check	16	25	868	1024
Apron	32	36	1467	1191
CB-QBB	19	27	1074	1279
Crown	22	30	1268	1654
Crown + Apron	33	40	1581	1530
Heads Up	22	27	1331	1285
Rootshield	21	28	1279	1309
LSD (α=0.05)	4.3	4.3	234.6	234.6

Differences in plant density explained some of the yield variation noted in the chickpea seed treatment trial. As plant density increased so did grain yield (Figure 1). This was expected as reduced plant stands due to seed borne disease could reduce grain yield. The R^2 of the regression was 0.451. This means that plant density explained 45% of the grain yield variation and other factors were also playing a role in determining yield. One possible explanation could be that seed treatments that seen a decrease in plant population compared to Crown + Apron may have had weaker plants that were more affected by environmental factors like weather, diseases, and pests.

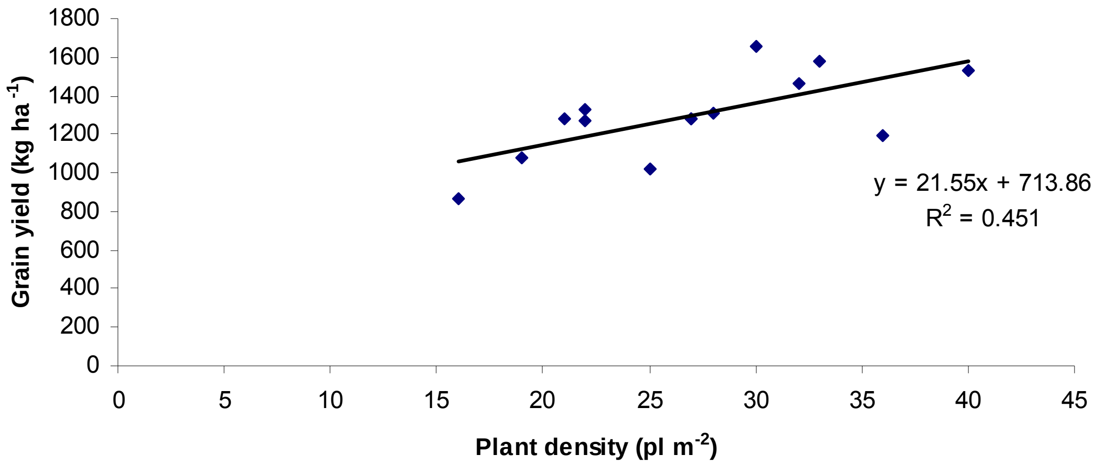

Figure 1 Regression between chickpea grain yield and plant density for the chickpea seed treatment study.

Conclusions

The alternative seed treatments Heads Up and Rootshield did give some protection to seeds or seedlings and improve emergence at early dates but are not as good as the best chemical control options. CB-QGG did not show any improvement to emergence over the untreated control, but did improve the yields at the later seeding date. Therefore, the alternative products even though they are not as good as the best chemical treatments do provide some protection and could be options for organic growers.

Future Work

Further work evaluating these alternative products under a variety of conditions needs to be undertaken. However, funding needs to be sought for this to occur.

Winter Wheat Variety Trial

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With the suitability of winter wheat for use as feed stocks for ethanol production there is interest to compare winter wheat varieties to spring wheat varieties, especially the high yielding soft white wheat. Little information is available to wheat growers in northwest Saskatchewan regarding the comparison of winter and spring wheat. Most research only includes one type because of the difficulty in the logistics of the trial. The objective of this project was to demonstrate the suitability of winter wheat varieties for northwest Saskatchewan and compare the yield potential to spring wheat.

Materials and Methods

The winter wheat variety trial was seeded in the fall of 2007 and 2008. The spring wheat was seeded in the spring of 2008 and 2009. Harvest occurred in the fall of 2008 and 2009. Current and older winter wheat varieties were included along with three spring wheat varieties from three different market classes (Table 1). It was seeded in a randomized complete block design with four blocks.

Results

The highest yielding wheat variety in the test was the soft white spring wheat AC Andrew at 3604 kg ha^{-1}. It was significantly higher yielding than all of the other varieties in the test. The lowest yielding variety was the winter wheat variety CDC Falcon at 1871 kg ha^{-1}. CDC Falcon was significantly lower yielding than all of the other varieties in the trial. AC Barrie was significantly lower yielding than AC Andrew, CDC Ptarmigan, Norstar, and AC Radiant. All of the spring wheat varieties, AC Barrie, AC Vista, and AC Andrew, had a significantly larger thousand kernel weight than all of the winter wheat varieties except AC Radiant. Sawfly was generally not an issue in the trial except for CDC Falcon. CDC Falcon had a high infestation at 70 percent of the stand estimated to have sawfly infection. The only other variety with any amount was CDC Ptarmigan at 13 percent of the wheat stems infected with sawfly. There was some difference in lodging between varieties but lodging in general was not a major concern. CDC Falcon, AC Barrie, AC Vista, McClintock, AC Radiant, and AC Andrew all had similar lodging that was significantly less than the other varieties in the trial. This trial only has two site years of data therefore exact rank and differences may differ if the trial was conducted at multiple sites and years. From this data AC Andrew appears to be more suited to producing high yielding low protein wheat for ethanol production and animal feed near Scott, Saskatchewan than winter wheat.

Table 1 Grain yield, thousand kernel weight, sawfly infection, and lodging of selected winter wheat and spring wheat varieties grown at Scott in 2008 and 2009.

Variety	Class	Yield (kg ha^{-1})	Yield (% of AC Barrie)	1000 kernel weight (g)	Sawfly Infection (% infected)	Lodging (1-5 scale)
CDC Falcon	winter	1871	76	30.6	70	1
AC Barrie	CWRS	2453	100	35.3	0	1
CDC Buteo	winter	2577	105	33.5	4	2
AC Vista	CPSW	2753	112	42.9	0	1
McClintock	winter	2756	112	31.8	0	1
CDC Kestral	winter	2881	117	32.5	0	2
AC Radiant	winter	2929	119	35.6	3	1
Norstar	winter	3009	123	33.1	3	2
CDC Ptarmigan	winter	3010	123	33.6	13	2
AC Andrew	SWS	3604	147	40.2	0	1
LSD (α=0.05)		464.2	18.9	1.09	14.4	0.4

Winter Wheat Seeding Depth and Date

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Winter wheat is a crop that is getting more producer interest than in the past due to the demand of high yielding low protein wheat for ethanol production. At Scott in 2008 a demonstration was seeded to attempt to show producers the proper seeding date and depth for northwest Saskatchewan.

Materials and Methods

Both the winter wheat seeding date and seeding depth demonstration trials were planted in the fall of 2008. The seeding depth trial was planted early September. It had four different seeding depths: 0.6, 1.3, 2.5, and 5.0 cm. Currently recommended depth is 1.3 cm. It was seeded in a randomized complete block design with four blocks. It was harvested early September. The seeding date trial had five seeding dates September 5, 19, October 3, 17, and 31. The recommended seeding date in northwest Saskatchewan is September 5. The seeding date trial was seeded in a randomized complete block design with four blocks. It was harvested early September.

Results

The results of both the seeding depth and seeding date demonstration were unexpected. In both cases the dry fall of 2008 affected plant densities in the early seeding and the shallow seeding. For the seeding depth demonstration the highest yielding winter wheat was from the 5.0 cm seeing depth (Figure 1). It was also significantly higher yielding than the other three seeding depths. This was due to the dry fall in 2008 where the shallower depths had poor emergence and thin plant stands and were unable to reach maximum yield potential.

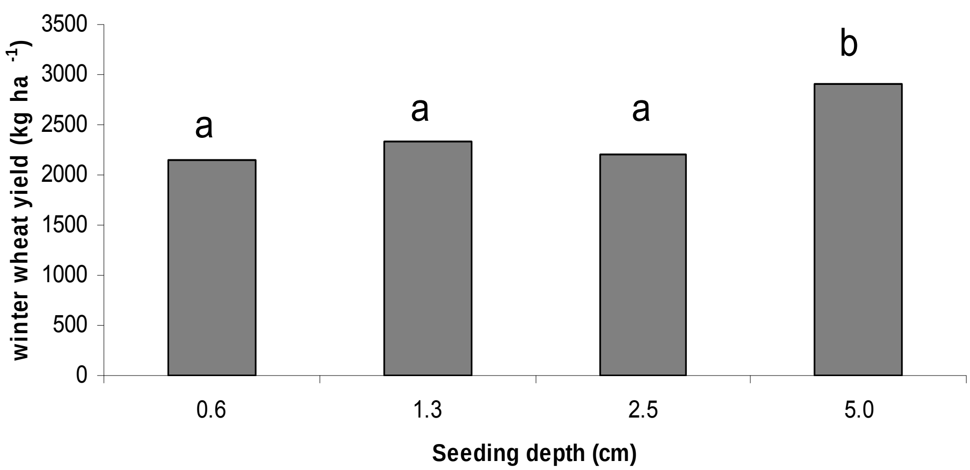

Figure 1 Winter wheat yield at Scott in 2009 at four different seeding depths.

The recommended winter wheat seeding date in northwest Saskatchewan is September 5. This allows the crop to become established and form a healthy crown that is more resistant to winter kill. In the seeding date demonstration there was no statistical difference in any of the yields when comparing seeding date. The highest yield was produced by the October 3 seeding date.

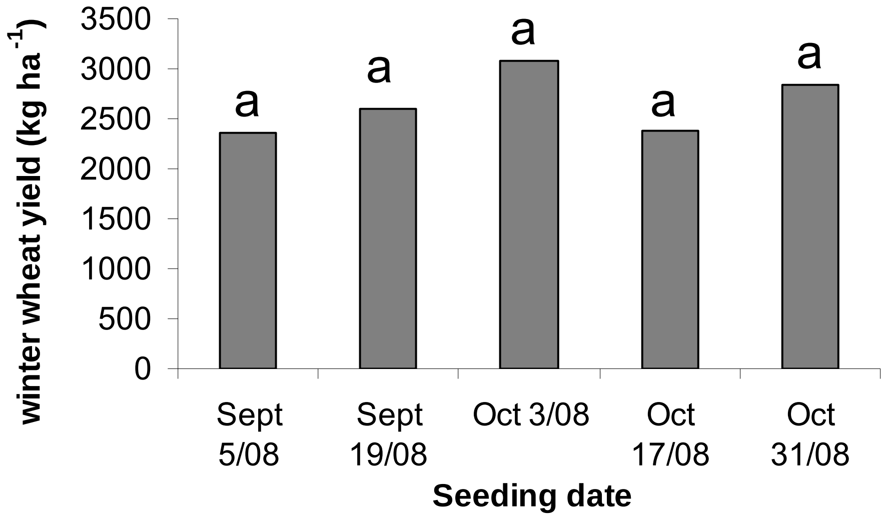

Figure 2 Winter wheat yield at Scott in 2009 for five different seeding dates.

This trial is just one year at one location and goes against the recommendations for seeding winter wheat. Recommendations are based on multiple sites and multiple environments. If the trial had included multiple years and sites it would be expected that the September 5 seeding date would produce the highest yield and 1.3 cm would be the optimum seeding depth. However, under certain situations one has to adjust the recommendations to suite the situation. In 2008 with a dry fall it was better to hold off seeding until the moisture was better (Oct 3), or seed to moisture (deep seeded).

Future work

There are other winter wheat trials underway at Scott that are looking at fertility. Results to be out in winter 2010/2011.

Broadleaf Weed Control in Chickpea

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Chickpea growers in Saskatchewan face a large challenge when growing the crop. Few options are available for weed control that allow good weed control and crop safety. One of the major weeds that affect chickpea is kochia. As the incidence of group 2 resistant kochia increases fewer options are left for control of kochia in chickpea.

Materials and Methods

Three sites were used for this trial: Scott, Saskatoon, and Lethbridge. It occurred in 2008 and 2009. Lethbridge was only included in 2008. Chickpeas were seeded in plots in a randomized complete block design with four blocks. Specific weed populations were seeded into each plot to provide uniform weed populations across the trial. When the pre emergent glyphosate was applied the different rates and tank mixes of Heat and Authority were applied (Table 1). Chickpea injury and weed control ratings were taken 23, 38, and 56 days after application.

Table 1 Treatment number with corresponding herbicide and surfactant rate and tank mix.

Treatment number	Herbicide	Herbicide Rate (g ai ha^{-1})	Surfactant	Sufactant Rate (% v/v)
1	untreated check (no herbicide)	N/A	N/A	N/A
2	Authority + glyphosate	70 + 450	ammonium sulphate	2
3	Authority + glyphosate	140 + 450	ammonium sulphate	2
4	Heat + glyphosate	18 + 450	Merge	0.5
5	Heat + glyphosate	36 + 450	Merge	0.5
6	Heat + glyphosate	50 + 450	Merge	0.5
7	Heat + glyphosate	100 + 450	Merge	0.5
8	Authority + Heat + glyphosate	70 + 18 + 450	Merge	0.5
9	Authority + Heat + glyphosate	70 + 36 + 450	Merge	0.5
10	Authority + Heat + glyphosate	70 + 50 + 450	Merge	0.5
11	Authority + Heat + glyphosate	140 + 18 + 450	Merge	0.5
12	Authority + Heat + glyphosate	140 + 36 + 450	Merge	0.5
13	Authority + Heat + glyphosate	140 + 50 + 450	Merge	0.5
14	Authority + Converge + glyphosate	140 + 80 + 450	N/A	N/A

Results

Due to varying weed populations at each site the statistical analysis was for each site separately. Visual injury to the chickpea crop was not noted for any treatment at any time. All 14 treatments proved visually safe for chickpea. Stinkweed control was acceptable for some of the treatments in Saskatoon (Figure 1). Authority did not provide sufficient control at any rate but Heat had good control of stinkweed. For stinkweed control to last 38 DAA at least 50 g ai ha^{-1} of Heat was required. When Authority and Heat were tank mixed sufficient control was noted when Heat was included at 50 g ai ha^{-1}. At lower rates of Heat control declined at 38 DAA.

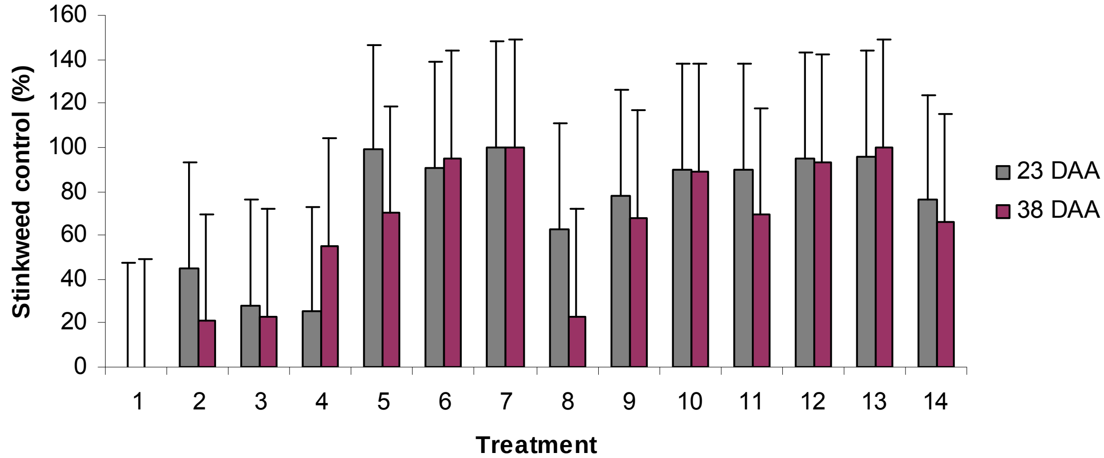

Figure 1 Stinkweed control by the 14 treatments at Saskatoon in 2008 and 2009.

Kochia control was excellent with Authority. Any of the rates used gave excellent control for 56 DAA. Heat did not have much control of kochia except at 100 g ai ha^{-1}, but was still not as good as Authority (Figure 2).

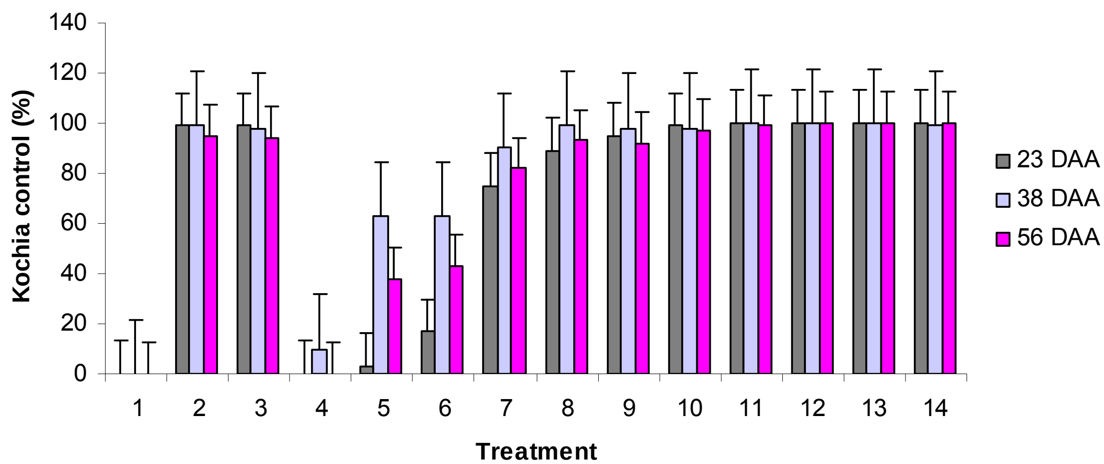

Figure 2 Kochia control by the 14 treatments at Scott in 2008 and 2009.

Wild buckwheat control was insufficient with Authority alone. Heat provided control greater than 80 percent at 50 and 100 g ai ha^{-1}. Control increased for some of the tank mixes. For wild buckwheat control to remain above 90 percent Authority at 140 g ai ha^{-1} and Heat at 36 or 50 g ai ha^{-1} (treatments 12 and 13) was required.

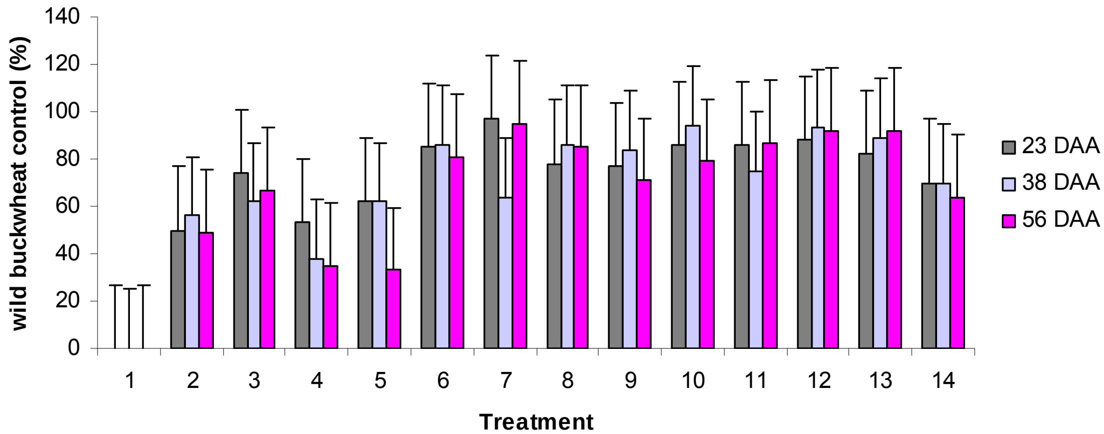

Figure 3 Wild buckwheat control by the 14 treatments at Scott for 2008 and 2009.

Broadleaf weed control in chickpea is possible with a tank mix of Authority and Heat applied with glyphosate preseed. A larger spectrum of broadleaf weeds could be controlled compared to either product alone. Best control was seen at the higher rates included in the test but some recropping restrictions may arise from the higher rates.

Effect of Pod Sealants

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Introduction

Canola is a major cash crop in western Canada. One of the major production issues is perception of the need to swath the crop when it gets close to maturity to prevent large seed loss due to pod drop and seed shatter. Recently two companies have come to the marketplace with pod sealants. They provide a protective layer around the pod that allows water to leave the pod but not enter. They are supposed to reduce the amount of seed shatter that occurs when the crop is straight combined. The objective of the project was to determine if pod sealants reduce the amount of seed shatter and make straight combining canola profitable.

Materials and Methods

This study was conducted in 2009 at four sites: Scott, Indian Head, Swift Current, and Melfort. It was seeded in a randomized complete block design with three blocks. Five canola varieties were used: 5440 LL, 45H26 RR, 5020 LL, 4362 LL, and 8571 CL. 8571 CL was included because it is a canola quality juncea that is considered to be well suited to straight combining. Each of the five varieties had four treatments applied: Pod-Stik, Pod Ceal DC, swathed, and untreated. The canola was seeded near the beginning of May. Proper agronomic practices were used to care for the crop. At 60 percent seed color change the treatments were applied. When the treatments were applied trays were placed inside each plot to catch any seeds and pods that would have reached the ground. At proper harvest timing one half of each plot was harvested and yield measurements taken. Approximately two weeks after harvest the trays were measured for dropped seeds and pods.

Results

This trial has four site years of data. Canola yields were high and not statistically different for both Indian Head and Scott. Canola yields at Melfort were lower and Swift Current had the lowest yield (Figure 1). Both were significantly different

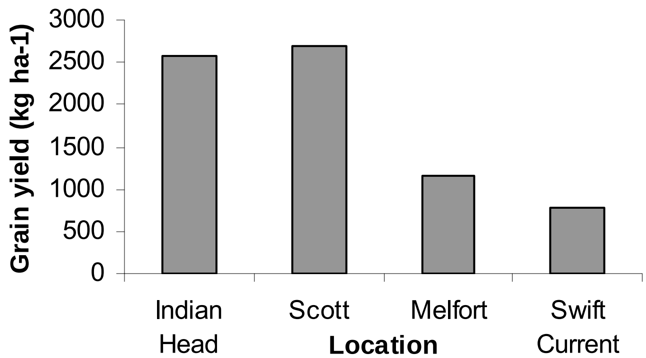

Figure 1 Average canola yield for each site in the pod sealant trial.

The five varieties produced yields that ranked the same from highest to lowest at each site. The highest yielding variety was 5440 LL at 2507 kg ha^{-1}. The lowest yielding variety was 8571 CL at 1468 kg ha^{-1} (Figure 2). 5540 LL and 45H26 RR had similar yields. Both were significantly higher than the other three varieties. 5020 LL produced the third highest yield and was significantly different than all of the other varieties.

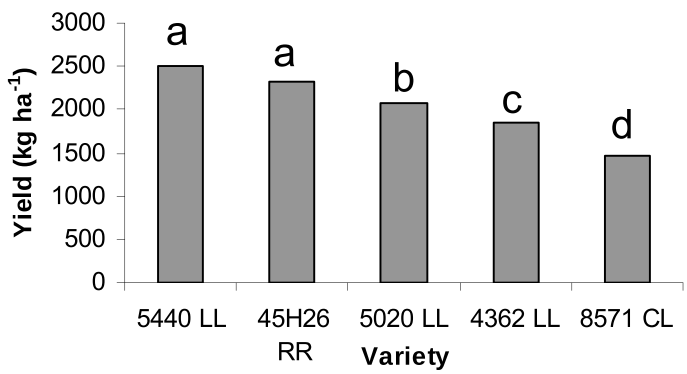

Figure 2 Average canola yield of the five varieties across the four locations for the pod sealant trial.

Over the four sites there was not a significant difference between the four treatments of swathing, untreated check, Pod Ceal, and Pod-Stik (Figure 3). Slight yield increases were seen on average by applying both Pod Ceal and Pod-Stik. All four sites had straight combining produce equal to or higher canola yields than the swathing treatment. At both Swift Current and Scott straight combining produced yields significantly higher than swathing. Swathing did not produce higher yields than straight combining even at Melfort where harvest occurred in mid November and all of the canola had an extreme period of weathering. There was no significant interaction between variety and treatment, meaning none of the treatments performed significantly better than the other treatments for a specific variety.

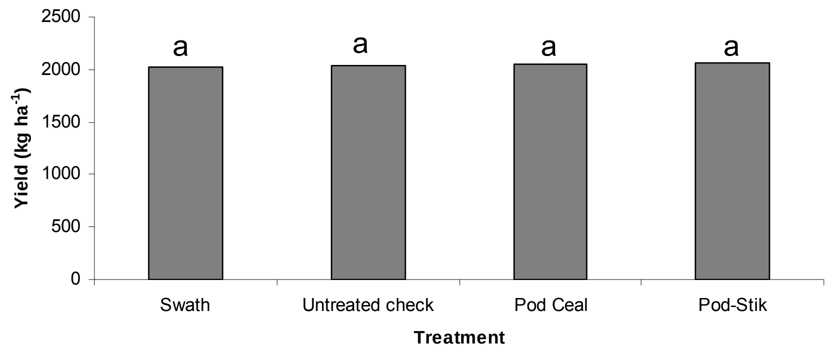

Figure 3 Canola yield for the four treatments combined for all four sites.

Pod drop and pod shatter are the two types of seed loss that occur to canola when the crop is left standing for straight combining. There was not a significant difference between the untreated check, Pod Ceal, or Pod-Stik when comparing pod shatter or pod drop. The amount of pod shatter and pod drop presented in Figure 4 is from the time of treatment application until two weeks post harvest. For seed shatter the range was 18 kg ha^{-1} with Pod Ceal having the least shatter and Pod-Stik the most. The range for pod drop was 2 kg ha^{-1}.

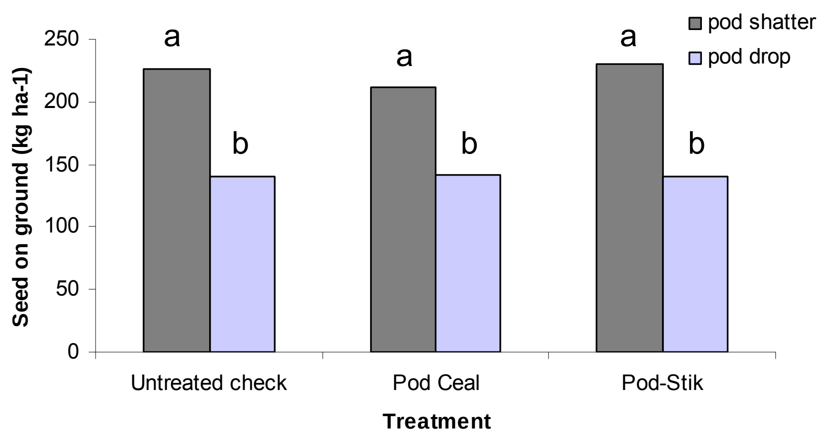

Figure 4 Amount of canola seed that was lost due to pod shatter and pod drop for the three straight combined treatments.

When comparing pod shatter and pod drop between different varieties large differences appeared. 4362 RR, 5020 LL, and 8571 CL all had similar levels of pod shatter that were significantly higher than 5440 LL and 45H26 RR (Figure 5). 5440 LL had significantly less pod shatter than 45H26 RR. 5440 LL and 8571 CL had significantly less pod drop than the other varieties included in the study. 4362 RR and 5020 LL had similar levels of pod drop. 45H26 RR had the largest amount of pod drop. The range in pod shatter was 196 kg ha^{-1} while the range in pod drop was 315 kg ha^{-1}. 5440 LL at all sites produced the least amount of pod shatter and pod drop. This shows that variety choice is very important when deciding if a canola crop should be straight combined. Less pod drop and pod shatter contribute to why 5440 LL was the highest yielding cultivar in the test. When comparing the amount of canola seed that was lost to total harvested yield 5440 had the least loss at five percent. 5020LL had total seed loss at 17 percent of yield while the other three varieties had seed loss at 18 percent of yield (Figure 6). It was unexpected that 8571 CL had the same amount of seed loss when straight combining as the other two worst varieties because it is claimed to be well suited to straight combining.

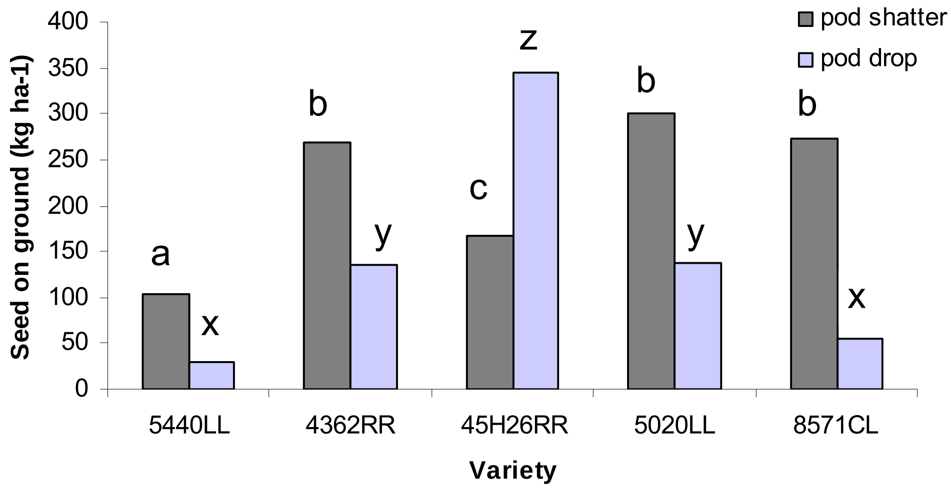

Figure 5 Amount of canola seed that was lost due to pod shatter and pod drop for the five varieties.

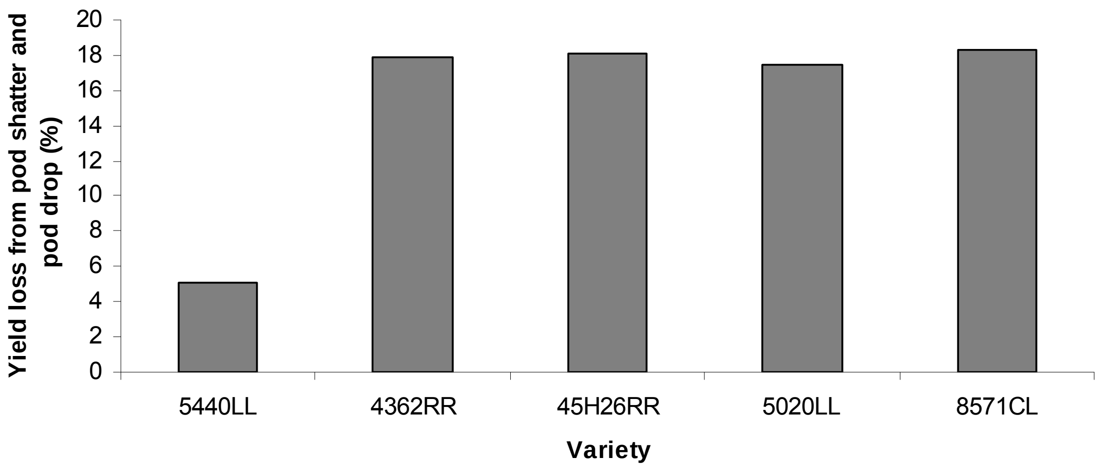

Figure 6 Percent of total yield loss for each variety due to pod shatter and pod drop.

This data shows that currently available canola varieties can be straight combined. Pod sealants do not appear to be required when analyzing one year of data. It is more important that canola to be straight combined be harvested at the optimal timing to prevent long periods of weathering and reducing the potential of pod drop and pod shatter. If straight combining canola it would be good to have a test strip of a pod sealant compared to an untreated strip to compare the effects of pod sealants on your own farm.

Control of sclerotinia stem rot of canola using varietal resistance and fungicides

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The development of canola [*Brassica napus* L.] cultivars resistant to sclerotinia stem rot [*Sclerotinia sclerotiorum* (Lib.) de Bary] is a valuable strategy that may complement fungicide application to control this disease. In addition, new fungicide products have been registered for sclerotinia stem rot control in canola. The objectives of this experiment were to determine the effectiveness of a new resistant canola cultivar and new fungicide products to control sclerotinia stem rot at multiple locations in the Parkland region of the prairies.

Materials and Methods

This study was conducted in 2009 at Melfort, Lacombe, and Glaslyn. It was set up as a randomized complete block design with four blocks. The two Roundup Ready canola varieties used were 45S51 and 45H26. The fungicide treatments were Proline 480 SC, Serenade Max, and an untreated check. Glaslyn was seeded May 21, Lacombe May 7, and Melfort May 26 all at 150 seeds m^{-2}. All sites had fertilizer applied based on soil tests and average area yields. The fungicides were applied July 14 at Glaslyn, July 15 Lacombe, and July 16 at Melfort.

Results

The 2009 crop year was characterized by cool, dry conditions throughout May and June. Precipitation and cool temperatures occurred throughout the summer and prolonged flowering. A warm, relatively dry September allowed the crop to mature, although flowers were observed in the crop late in the season. October was cold and wet prohibiting harvest.

Petal testing for the presence of the pathogen was conducted weekly during flowering, which began in early-mid July and continued until at least mid-August. The percentage petals infected were: 10, 27, 29, 23 and 44 on July 13, July 20, July 27, August 4 and August 10, respectively, indicating a relatively low risk of infection throughout flowering, although an increased risk appeared in the last week. At Lacombe the percentage of petals infested were 8.3, 5.2, 5.2, and 1.0 on July 6, July 13, July 20, and July 27, respectively, indicating a low risk of stem rot.

Seedling emergence was low at both Lacombe and Glaslyn and moderate in Melfort. A frost at Melfort on June 4th likely reduced the number of seedlings before the emergence counts were taken (Tables 1 and 2). Dry conditions and spring frosts at Lacombe also reduced emergence counts at Lacombe. Normally an emergence of approximately 100 plants m^{-2} is expected from a target seeding rate of 150 seeds m^{-2}. Seedling emergence of 45S51 was only about 50% that of 45H26 at Lacombe. Differences between cultivars were not observed at Glaslyn or Melfort. Plant populations, which were assessed after swathing were very similar to the number of plants observed at emergence at Lacombe and Glaslyn, but were somewhat higher at Melfort. This likely reflected later flushes of emerging seedlings (after seedling emergence counts were conducted) at Melfort due to the dry soil conditions. The combined analysis indicated differences between the cultivars for seedling emergence reflecting the situation at Lacombe. As expected, there were no interactions of fungicide x cultivar for seedling emergence or plant population at any of the sites or in the combined analysis.

The incidence of sclerotinia was at a low to moderate level only at Melfort. Very few symptoms were observed at Lacombe and few at Glaslyn. Differences between cultivars in disease incidence or severity were not observed at Melfort. Proline fungicide reduced both disease incidence and severity from that of the check. There was no difference between the check and Serenade Max fungicide for disease incidence or severity, nor was there any interaction between fungicide treatment and cultivar.

Lodging as measured by the ratio of canopy to plant height indicated differences between cultivars at Lacombe and Glaslyn, but not Melfort. At Lacombe 45H26 had a slightly greater lodging score than 45S51. This might reflect the greater yield of 45H26 than 45S51 and possibly heavier crop canopy as a result of greater plant population. The opposite was observed at Glaslyn, where 45S51 had a marginally greater lodging score than 45H26, although the severity of lodging was minimal at this site. An interaction between fungicide treatment and cultivar was detected at Melfort (data not shown), where lodging was greater for45S51 than 45H26 when no fungicide was applied and lodging was reduced in 45S51 when either Proline or Serenade Max was applied, but lodging increased for 45H26 when either fungicide was applied. The fungicide x cultivar interaction was also significant ($P < 0.03$) in the combined analysis. Here there was little difference in lodging score between cultivars in the check or Proline treatments, but 45H26 had a higher lodging score than 45S51 when treated with Serenade Max.

Yield of 45H26 was greater than 45S51 at Lacombe, with the same trend at both Glaslyn and Melfort. The difference in seedling emergence and plant population may have contributed to the difference in yield observed at Lacombe (emergence and plant population was approximately double for 45H26 as it was for 45S51). The combined analysis indicated a statistically significant difference between the cultivars, with a 15% greater yield for 45H26 (3415 kg ha^{-1}) than for 45S51 (2969 kg ha^{-1}) in the combined site analysis. There were no differences in yield among fungicide treatments, even at Melfort, where sclerotinia stem rot was observed. This indicated that the disease had little impact on yield, which likely was due to the late development of the disease, as reflected by relatively low severity scores. Most of the infection of the crop was in the upper canopy. The fungicide x cultivar interaction was not significant for yield at any site or in the combined analysis.

There was no impact of cultivar or fungicide treatment on thousand seed weight at Lacombe; however, at Melfort thousand seed weight was greater for 45S51 than 45H26. In the combined analysis of these 2 sites differences between cultivars were not detected for thousand seed weight, but Proline fungicide resulted in slightly greater thousand seed weight than the check treatment, while there was no difference between Serenade Max and the check.

Table 1 Emergence, plant population, lodging, yield, and thousand seed weight for 45S51 and 45H26 combined for all three sites.

Variety	Emergence	Plant Population	Lodging (%)	Yield (kg ha^{-1})	1000 seed weight (g)
45S51	21.5	27	24.2	2969	3.6
45H26	26.9	29.4	25.7	3415	3.4
LSD (α=0.05)	5.3	7.0	4.5	264	0.2

Table 2 Emergence, plant population, lodging, yield, and thousand seed weight for the fungicide treatments combined for all three sites.

Treatment	Emergence	Plant Population	Lodging (%)	Yield (kg ha^{-1})	1000 seed weight (g)
Check	26	28.7	24.2	3169	3.4
Serenade Max	23.8	28.4	25	3134	3.5
Proline	22.8	27.6	25.6	3274	3.6
LSD (α=0.05)	4.4	5.7	2.6	203	0.1

Conclusions

This trial was done at 3 locations that were all affected by reduced emergence and 45S51 seemed to be more affected than 45H26. Therefore, the yield difference of the varieties may be an artefact of different emergence. Other work supports no yield difference in the absence of disease pressure.

Future Work

This trial needs to be repeated under higher disease pressure and under better conditions for emergence.

Ethanol Feedstock Comparison

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The demand for ethanol feedstock has increased dramatically in western Canada. Most ethanol plants in western Canada want to use a low protein, high starch wheat as the feedstock. The goal of this project was to determine which variety of wheat yielded the highest for farmers in northwest Saskatchewan. It also included triticale to determine the suitability of triticale as an ethanol feedstock. .

Materials and Methods

Twelve different wheat and triticale varieties were grown at Scott, Lashurn, or Glaslyn from 2005-2009. In 2005 they were grown at Lashburn and Scott, 2006 at Lashburn, 2007 at Scott, 2008 at Scott and Glaslyn, and 2009 at Scott. All of trials were set up as a randomized complete block design with three or four blocks. Each year fertilizer was added based on soil tests. Herbicides were used for weed control at each site.

Results

As expected a large variation in yields occurred between the different varieties grown (Table 1). AC Barrie, was the lowest yielding wheat variety. AC Sadash was the highest yielding wheat variety. Pronghorn, triticale, was the highest yielding variety in the test. Hoffman a good performing feed wheat from eastern Canada produced an average yield that was similar to the average yield of the whole test when grown in northwest Saskatchewan. When comparing market classes CWRS produced the lowest yield, CPS was next, and SWS was the highest yielding wheat market class. In general the triticale varieties were the tallest in the test. This did not seem to impact lodging as it was similar for all varieties in the test. There was also no difference in this test for susceptibility to ergot between any of the varieties. Where the plots were grown ergot must not have been a major concern for any crop because it would be expected that triticale would have some level of infection if the disease was present. Triticale had the longest maturity in the test. The days to maturity for Tyndal averaged 120 days. AC Vista and AC Barrie had the shortest days to maturity interval at 108 days. Depending on the season, longer days to maturity will increase the risk of a fall frost causing yield damage to the crop.

Table 1 Yield, thousand kernel weight, plant height, and days to maturity for the varieties grown at Lashburn, Glaslyn, and Scott from 2005-2009.

Variety	Market Class	Grain Yield (kg ha^{-1})	Yield (% of AC Barrie)	1000 kernel weight (g)	Plant Height (cm)	Days to Maturity (days)
AC Barrie	CWRS	3558	100	35.2	87	108
AC Superb	CWRS	3819	107	39.2	81	111
5700PR	CPSR	4218	119	40	80	114
AC Crystal	CPSR	4234	119	38.9	77	109
AC Vista	CPSW	4259	120	39.5	79	108
Hoffman	Eastern Feed	4484	126	40.3	93	114
Bhisaj	SWS	4626	130	35.6	86	110
AC Ultima	Triticale	4736	133	41.3	92	113
AC Andrew	SWS	4834	136	36.3	81	111
Tyndal	Triticale	4852	136	42.3	99	120
AC Sadash	SWS	5176	145	35.1	84	110
Pronghorn	Triticale	5211	146	39.1	103	118
	LSD (α=0.05)	486.2		3.95	9.2	5.0

More information will become available with this test that includes more sites in western Canada. Information will also become available on the suitability of each variety to being fermented into ethanol. Analysis will also be done on the pentosans in triticale and the effect on the fermenting process in producing ethanol.

Future work

This is just a glimpse of the results for northwest Saskatchewan. There are 25 sites across Canada that have been involved in the projects and the final reports are expected to be out in winter of 2010/2011.

Optimum Seeding Rates and Plant Densities for *Brassica carinata*

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Objective

To determine the optimum seeding rate and plant density in *Brassica carinata*.

Methods and Materials

Studies were designed as a RCBD factorial with cultivar (070768EM and 070760EM) and planting density (12, 25, 50, 100, 200, 400, 800, and 1600 seeds m^{-2}) as main factors. Each treatment was replicated 4 times. The sites were the Scott Research Farm (2008, 2009), Glaslyn Project Farm (2008, 2009), Beaverlodge Research Farm (2008) and the University of Saskatchewan (2008, 2009).

The studies were seeded on summerfallow due to lack of broadleaf weed control options. Weed control was achieved at some locations with a spring application of trifluralin or ethafluralin (not registered); however, most of the weed control was achieved through hand weeding. Actual seeding densities were based on viable seeds and thousand kernel weights. Germination percentages of the cultivars were 93 and 80% for 070768EM and 070760EM, respectively in 2008 and 97 and 94% for the respective cultivars in 2009.
Data collection included plant establishment, days to 10% flowering, days to final flower, lodging, days to maturity, and yield.

Results and Discussion

The results from the ANOVA indicate that there was a cultivar, seeding rate and cultivar by seeding rate interaction for many of the variables measured (Table 1). There was no cultivar X seeding rate interaction for days to flowering, days to final flower, and days to maturity. Since the cultivars generally interacted differently with seeding rate, the cultivar data is not combined.

Table 1: ANOVA for *Brassica carinata* seeding rate trial 2008-09.

Source	Plant emergence	Lodging	Days to Flowering	Days To Final Flower	Days to Maturity	Seed Yield
Cultivar	0.0016	0.01	0.0088	0.2619	0.0167	0.0204
Rate	<0.0001	<0.0001	0.0031	<0.0001	<0.0001	<0.0001
Cultivar X rate	<0.0001	<0.0001	0.1552	0.7128	0.64	<0.0612

Plant emergence

When averaged over locations, cultivars and densities, 55 % of the planted seeds emerged (Table 2). The percent emergence was higher at lower planting densities and declined as planting density increased (Table 2).

There was a cultivar by rate interaction for plant emergence (Table 1). Cultivar 070760EM had overall higher emergence than 070768EM with the interaction indicating increased emergence at higher seeding rates (Fig. 1). The reason for the higher emergence for the one cultivar is not understood at this time. It has slightly larger seed (higher Thousand Kernel Weight of 0.1g) but this small difference should not account for the difference. Germination percentages for 070760EM were lower and equal to 070768EM in 2008 and 2009, respectively so this does not explain the differences either.

Table 2: Percent emergence of two *Brassica carinata* cultivars at different seeding rates. Mean of seven sites. 2008-09.

	070768EM		070760EM	
Seed Rates (seeds m^{-2})	Emerged Plants (m^{-2})	Percent Emergence	Emerged Plants (m^{-2})	Percent Emergence
12	7	61.3%	9	71.1%
25	14	56.3%	14	56.9%
50	27	53.1%	31	62.3%
100	43	42.7%	50	50.1%
200	94	47.1%	119	59.6%
400	205	51.3%	236	58.9%
800	371	46.3%	469	58.6%
1600	721	45.0%	863	54.0%
MEAN		**50.4%**		**58.9%**

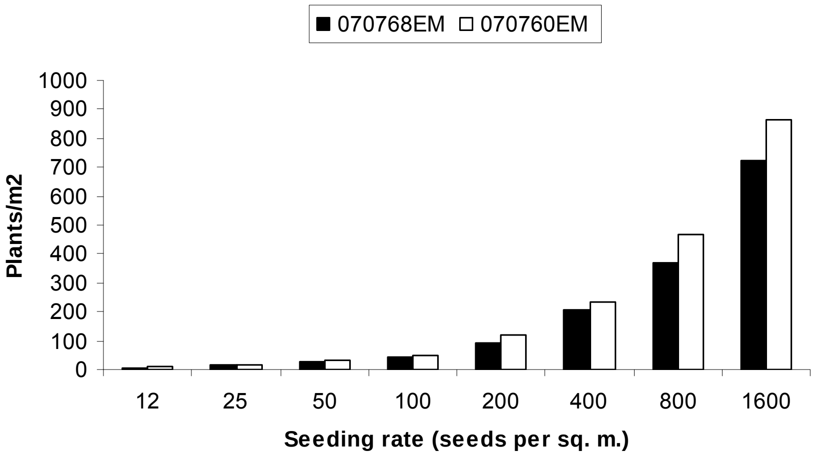

Figure 1: Interaction of cultivar and seeding rate on plant emergence of *Brassica carinata.* Mean of 7 sites. 2008-09.

Lodging

Lodging was evaluated visually using a scale of 1-5 with 1 being erect and 5 being flat on the ground. The cultivar 070760EM had a higher lodging rating of 2.9 compared to 1.9 for 070768EM. Lodging ratings declined as planting density increased from 12 to 100 seeds per m^{-2}; but increased at rates above 100 seeds per m^{-2} (Fig. 2). The cultivar X seeding rate interaction indicates a higher degree of lodging for 070760EM at the higher seeding rates; with less difference between the two cultivars at the lower seeding rates (Fig.2).

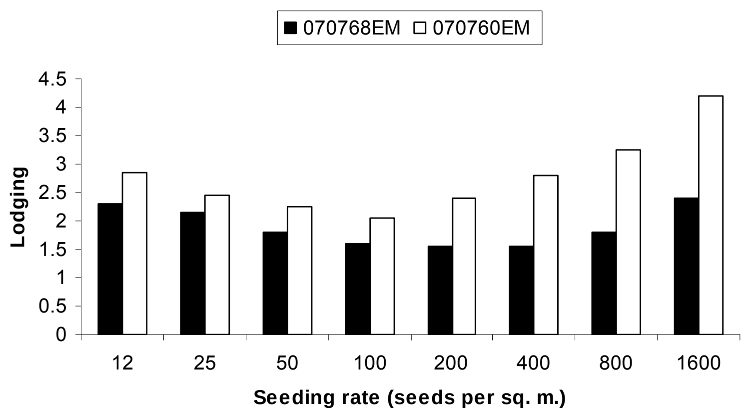

Figure 2: Effect of cultivar and seeding rate on lodging ratings in *Brassica carinata.* Mean of 7 sites. 2008

Days to Flowering (10% of plants have 1 flower open)

When averaged across sites, 070768EM began to flower one day earlier than 070760EM (Table 3). Both cultivars responded similarly to seeding rate, with higher seeding rates shortening the days to flowering by about one day.

Days to End of Flowering Period

Both cultivars ceased flowering after 90 days (Table 4). Increasing seeding rate from 12 seeds to 200 seeds m^{-2} reduced the flowering period by 3 days. Seeding rates of > 200 seeds m^{-2} did not cause a further reduction in the days to the end of the flowering period.

Table 3: Days to first flower of two *Brassica carinata* cultivars at different seeding rates. Mean of seven sites. 2008-09.

Seed Rates (seeds m^{-2})	Days to First Flower		
	070768EM	070760EM	Mean
12	49.4	48.6	49.0
25	48.9	48.4	48.6
50	48.8	47.9	48.3
100	48.3	47.5	47.9
200	48.2	47.5	47.9
400	48.2	46.9	47.5
800	48.2	47.1	47.6
1600	48.3	47.7	48.0
MEAN	48.5	47.7	

Table 4: Days to final flower of *Brassica carinata* at different seeding rates. Mean of two cultivars and seven sites. 2008-09.

Seed Rates (seeds m^{-2})	Days to Final Flower
12	92.3
25	91.3
50	90.7
100	89.8
200	89.3
400	89.1
800	88.9
1600	89.3
MEAN	90.1

Days to Maturity

Cultivar 070760EM matured 3 days earlier than 070763EM (Table 5). Days to maturity decreased by 6 days as seeding rates increased from 12 to 400 seeds m^{-2} with higher rates having little effect (Table 5).

Table 5: Days to maturity of two *Brassica carinata* cultivars at different seeding rates. Mean of two cultivars and seven sites. 2008-09.

Seed Rates (seeds m^{-2})	Days to Maturity		
	070768EM	070760EM	Mean
12	119	118	119
25	118	116	117
50	118	114	116
100	116	113	115
200	115	112	114
400	115	111	113
800	114	111	113
1600	114	111	113
MEAN	116	113	

Seed Yield

When averaged across densities and sites, 070768EM yielded 11% higher than 070760EM (respective yields of 1901 and 1713 kg ha^{-1}). A parabolic model was used describe the relationship between seeding rate or planting density and seed yield was employed. The parabolic response means that a maximum yield was reached at a certain density and yield declined at higher densities. The data is presented by cultivar due to cultivar X seeding rate interactions.

070768EM

When averaged across sites, a maximum seed yield of approximately 2200 kg ha^{-1} was achieved at seeding rates of 572 seeds m^{-2} (Fig. 3) and 252 plants m^{-2} (Fig. 4). Yields declined after these seeding rates and densities were achieved. Yields declined by greater than 10% when seeding rates dropped below 80 seeds or 42 plants m^{-2}.

070760EM

When averaged across sites, a maximum seed yield of approximately 1960 kg ha^{-1} was achieved at seeding rates of 379 seeds m^{-2} (Fig. 5) and 213 plants m^{-2} (Fig. 6). This reflects the higher emergence percentage of this cultivar compared to 070768EM. Yields declined after these seeding rates and densities were achieved. Yields declined by greater than 10% when seeding rates dropped below 65 seeds or 40 plants m^{-2}

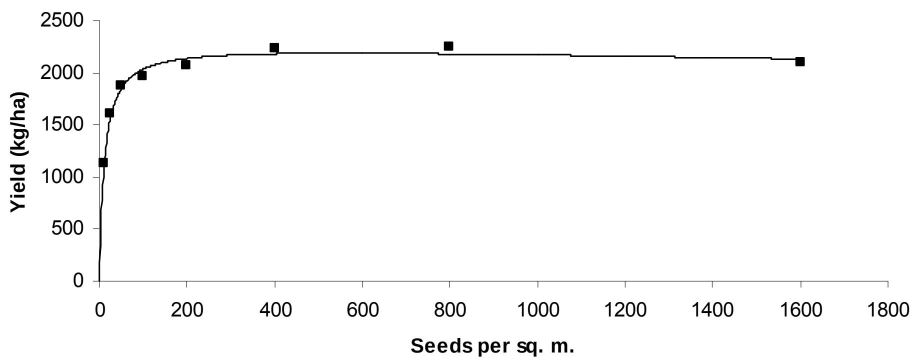

Figure 3: Effect of seeding rate on yield of *Brassica carinata* cultivar 070768EM. Mean of seven sites. 2008-09.

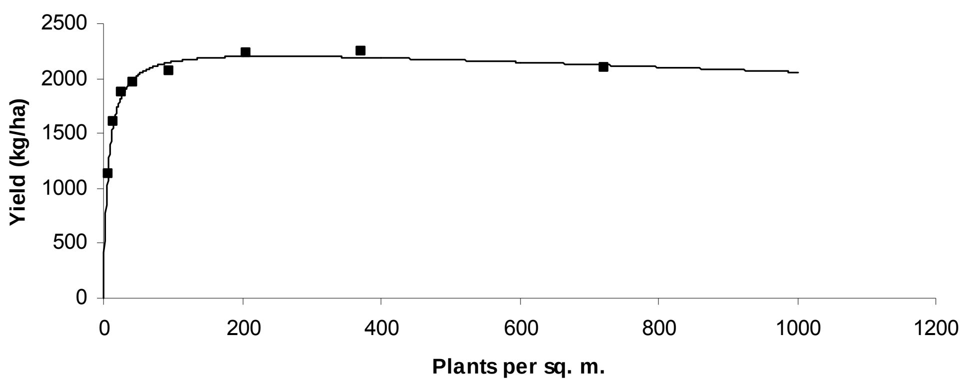

Figure 4: Effect of plant density (plants m^{-2}) on yield of *Brassica carinata* cultivar 070768EM. Mean of seven sites. 2008-09.

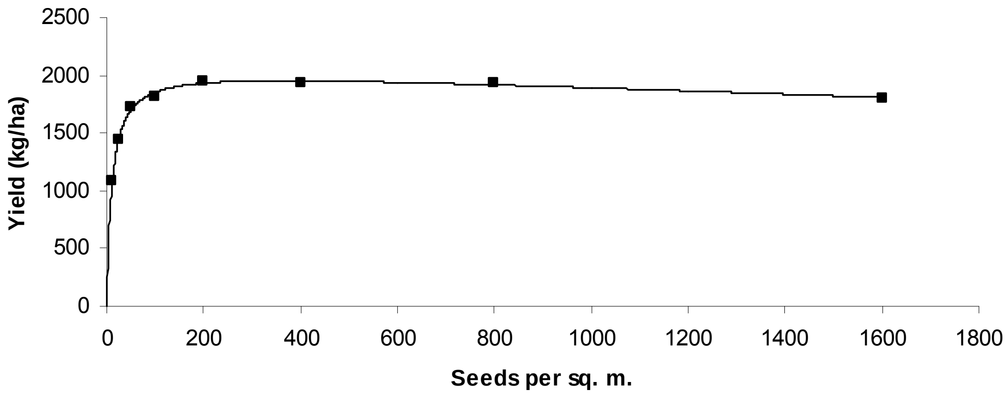

Figure 5: Effect of seeding rate on yield of *Brassica carinata* cultivar 070760EM. Mean of seven sites. 2008-09.

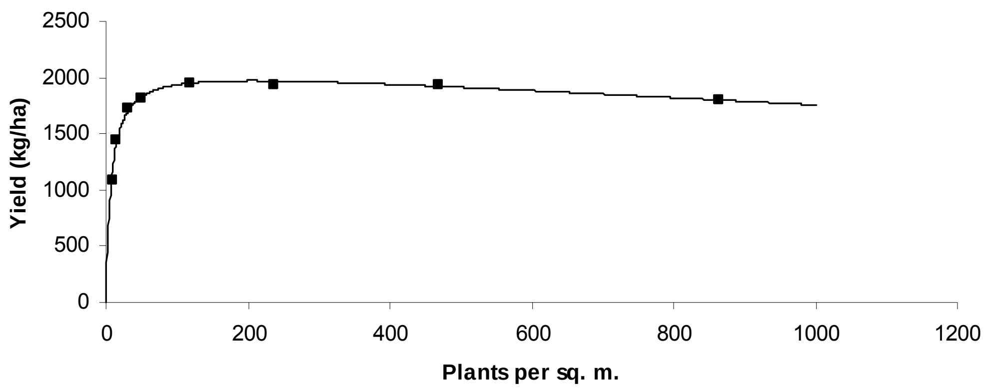

Figure 6: Effect of plant density (plants m^{-2}) on yield of *Brassica carinata* cultivar 070760EM. Mean of seven sites. 2008-09.

Conclusion

Densities of 200 to 250 plants m^{-2} are required to optimize yield of *Brassica carinata.* These densities also hasten maturity and reduce the risk of crop failure from fall frosts. Seeding rates of 350 to 500 seeds m^{-2}. Using an average thousand kernel weight of 4.5g would result in recommended seeding rates of 16 to 23 kg ha^{-1} (14 to 20 lbs/acre). Considering the late maturity of this crop, it is imperative to maintain an adequate plant population as populations below 200 plants m^{-2} result in a considerable delay in plant maturity.

Optimizing Nitrogen Rates in *Camelina sativa* and *Brassica carinata*

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Background

Camelina is being promoted as a low-input crop. The nitrogen requirements to optimize yield of both camelina and *B. carinata* on the Prairies are not known. The study was conducted at five locations in 2008: Scott, Melfort, Lethbridge (University of Alberta), Swift Current (Wheatlands), and Vanguard (Westwind Ag Research). The Vanguard site was badly hailed so the data was not included. In 2009, the study was conducted at Scott, Melfort, and Indian Head (camelina only).

Materials and Methods

In 2008, two different experiments were set up. In experiment 1, nitrogen rates of 0, 40, 80, 120 and 160 kg ha^{-1} were applied to camelina and *B. carinata* seeded on cereal stubble in one experiment. Experimental design was a split-plot with crop type being the main plot and nitrogen rate being the sub-plot. Another experiment (experiment 2) was conducted in conducted in conjunction with a graduate student from the Nova Scotia Agricultural College. This experiment was conducted at Scott only (2 seeding dates for camelina). Nitrogen rates of 0, 25, 50, 75, 100, 125, and 150 kg ha^{-1} were used. Nitrogen treatments were applied in a RCBD design to camelina and *B. carinata* in separate experiments. In 2009, it was decided to combine the two experiments and expand the range of N rates. Nitrogen rates of 0, 25, 50, 75,100,125,150 and 200 kg ha^{-1} were applied in a RCBD design to camelina and *B. carinata* in separate experiments. Crop yield is the only variable measured that will be reported in this annual report. Data from experiment one were combined from all locations and analyzed separately from data from experiment two and 2009 data. Data from experiment two and 2009 experiments were combined from all locations as well. Both datasets were analyzed with PROC Mixed and a quadratic plateau response model was used to describe the response. The model calculates a join point, which is basically the nitrogen rate at which yields reach a plateau.

Results

Camelina sativa

In experiment 1, camelina responded to nitrogen rates and yields began to level off at 116 kg ha^{-1}, which is the join point (Fig. 1). The yield reached a plateau of 2035 kg ha^{-1}. Experiment 2 and 2010 data resulted in similar yields. A yield plateau of 2460 kg ha^{-1} was achieved at a rate of 111 kg ha^{-1}.

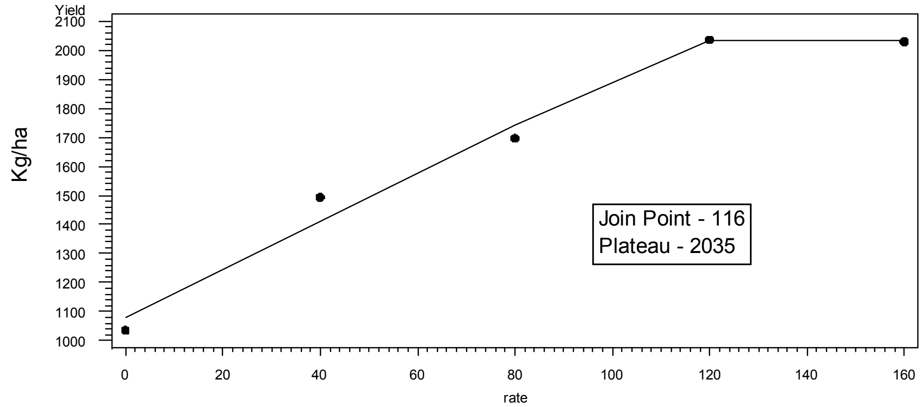

Figure 1: Response of *Camelina sativa* to nitrogen rate (Experiment 1). Data generated at 5 locations in Saskatchewan and Alberta. 2008.

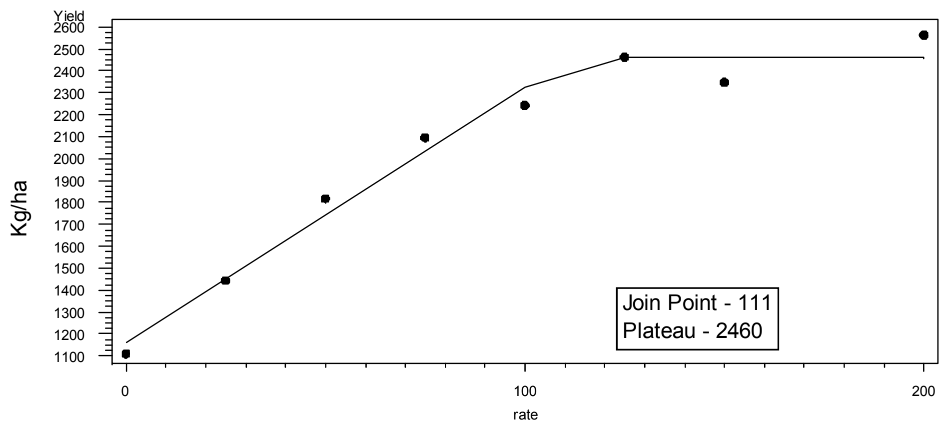

Figure 2: Response of *Camelina sativa* to nitrogen rate (Experiment 2 / 2009). Data generated at 5 locations in Saskatchewan. 2008-09.

Conclusion

Preliminary results from 2008 indicate that both camelina and *B. carinata* are quite responsive to nitrogen and their nitrogen requirements to achieve maximum yield are similar to other *Brassica* oilseeds.

Brassica carinata

In experiment 1, *B. carinata* responded to nitrogen rates and yields began to level off at 108 kg ha^{-1}, which is the join point (Fig. 1). The yield reached a plateau of 2158 kg ha^{-1}. Experiment 2 and 2010 data resulted in a yield plateau of 2054 kg ha^{-1} which was achieved at a rate of 139 kg ha^{-1}.

Studies by Gan et al. (2007) reported that other *Brassica* crops reached a plateau at nitrogen rates of 100 kg ha^{-1} so this preliminary work indicates that N requirements for camelina and *B. carinata* are similar to *Brassica napus* canola, *Sinapis alba*, and *Brassica juncea*.

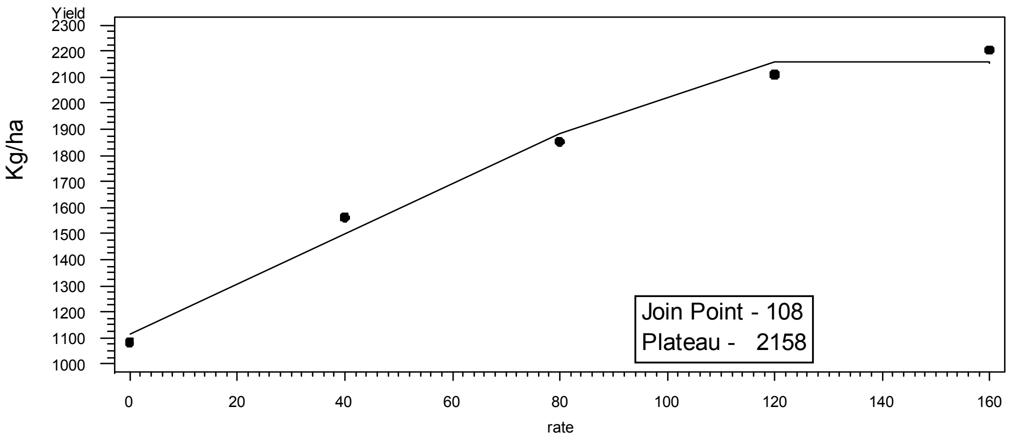

Figure 3: Response of *Brassica carinata* to nitrogen rate (Experiment 1). Data generated at 4 locations in Saskatchewan and Alberta. 2008.

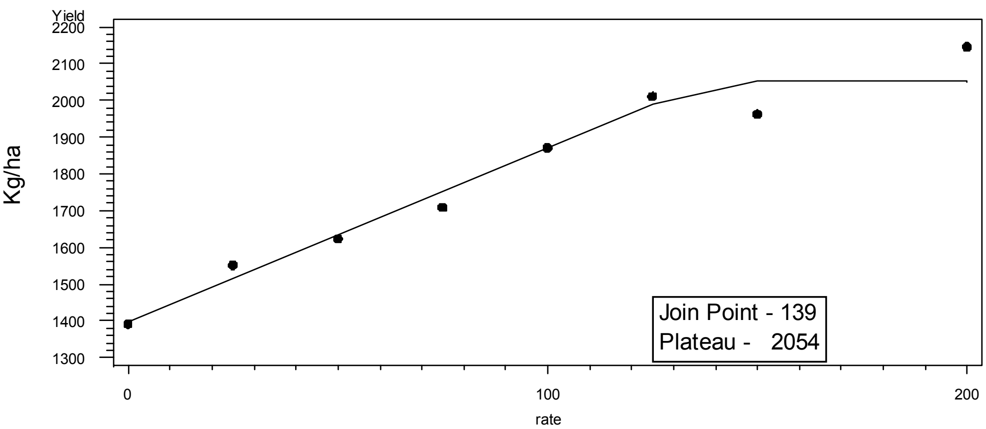

Figure 4: Response of *Camelina sativa* to nitrogen rate (Experiment 2 / 2009). Data generated at 3 locations in Saskatchewan. 2008-09.

Conclusion

Studies on camelina were very consistent over years with seed yields reaching a plateau at 111 to 116 kg ha^{-1}. *B. carinata* was a bit more inconsistent with seed yields reaching a plateau at 108 to 139 kg ha^{-1}. Studies by Gan et al. (2007) reported that other *Brassica* crops reached a plateau at nitrogen rates of 100 kg ha^{-1}. These studies indicate that respective N requirements for camelina and *B. carinata* are similar to and slightly higher than *Brassica napus* canola, *Sinapis alba*, and *Brassica juncea*.

Herbicide Screening in *Brassica carinata*

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A chloracetamide herbicide from Eastern Europe was evaluated in *Brassica carinata* at Scott in 2009. The active ingredient is propisochlor and it was evaluated at a range of rates and applied both as a pre- and post-emergence herbicide. *Brasicca carinata* was tolerant to propisochlor when applied pre-emergence or post-emergence (4-leaf stage) up to rates as high as 2880 g ai/ha. Some leaf burn was evident with the post-emergence treatments. Evaluations of cleavers, kochia, redroot pigweed, and wild buckwheat control revealed unacceptable control up to June 16th for pre-emergence treatments where dry conditions are considered to have been a contributing factor. Subsequent ratings resulted in generally better control for post-emergence treatments then pre-emergence treatments. Post-emergence application of propisochlor suppressed cleavers at 1440 g ai/ha 14 days after application (DAA) and controlled cleavers at 25 DAA at 2880 g ai/ha. Propisochlor suppressed redroot pigweed at rates of 1440-2880 g ai/ha and greater when applied pre-emergence and rates of 720-2880 g ai/ha when applied post-emergence. Control of Kochia and wild buckwheat was very low (less than 20%) regardless of timing or rate of application. Improvements in cleaver and redroot pigweed control following rainfall suggests that further research under a range of environmental conditions is required to better evaluate the impact of propischlor on weed control.

A number of *Brassica carinata* lines were screened to determine if there was any natural variability in tolerance to sulfentrazone, fluroxypyr, and dicamba. None of the lines were injured by sulfentrazone since the spring was so dry and the herbicide did not activate. All lines exhibited unacceptable injury to fluroxypyr. All lines exhibited similar injury to dicamba; however, overall injury to *Brassica carinata* appeared lower than injury to adjacent *Sinapis alba* and *Brassica juncea* lines. Further screening will be done in 2010 to quantify injury and yield loss from dicamba application in *Brassica carinata.*

Future

There is sufficient data on the *Brassica carinata* seeding rate trial to provide growers with recommendations. Therefore, it will not be repeated in 2010. The nitrogen response trials will be repeated in four locations 2010. Further herbicide screening in *Brassica carinata* will be conducted in two locations in 2010.

Acknowledgements

The funding support of the Prairie-Wide Canola Agronomy Research Agreement and the Saskatchewan Ministry of Agriculture Development Fund is greatly appreciated.

2009 Pesticide Minor Use Program

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The federal Minor Use Pesticide program assists in the registration of pesticides, be they herbicides, fungicides or insecticides, where returns on investment are insufficient for a private chemical company to conduct the work. Projects typically involve small acreage crops (minor crops) but can also involve a major crop where a minor pest is an issue. Projects are producer driven through a priority setting process in which all stakeholders including producers, chemical representatives, provincial and federal representatives participate. With an emphasis on pursuing the registration of effective low risk chemistries the ultimate goal is to provide Canadian producers with safe effective tools to control pests and remain competitive on the world stage.

AAFC Scott is one of 9 federal minor use pesticide research sites in Canada. Since 2003, approximately 250 minor use field trials have been conducted on crops such as grasses for forage and hay production, legumes, herb and spices, oil seeds, vegetables and small fruits. Pesticide registrations require supporting field research data that shows the intended crop will tolerate the pesticide, that the target pest is controlled, and that the end product is safe for human consumption.

In 2009 28 minor use field trials were conducted with 7 trials focused solely on evaluating crop tolerance, 17 trials evaluating level of pest control and crop tolerance, 2 desiccation studies and 2 residue trials. Residue trials are conducted to generate a harvested product sample on which pesticide residue levels can be measured. The table below summarizes the results of crop-pesticide evaluations in 2009 at AAFC Scott. Each row of the table represents a project. Under a project one or more field trials may have been conducted. For each project the following information is listed; the crop and crop stage of application, product (pesticide) evaluated, level of crop tolerance, target pest, and level of pest control. For a crop tolerance project where pest control is not evaluated the columns for target pest and level of pest control are grayed out. Under the headings of 'Crop Tolerance' and 'Pest Control' a '*' indicates that the crop tolerance is acceptable or level of pest control is acceptable to support a registration. If crop tolerance is not acceptable the type of injury observed is listed. If the level of pest control is not acceptable it receives a label of 'unacceptable'. Insufficient pest pressure for the purposes of evaluating pest control does occasionally occur.

The year 2009 was very successful year in terms of generating data to support minor use registrations. Much of the work focused on screening products to identify potential solutions where currently none or very few options exist for pest control. The following are a list of potential crop-pesticide combinations that producers may want to consider supporting as candidates for minor use registration based on positive results from the 2009 field trials: Everest on seedling Coriander and Caraway, PrePass and Express SG+glyphosate applied pre-seed for perennial ryegrass seed production, Apron Max RTA as a seed treatment on cumin to enhance crop establishment, and Kixor or Heat on dry bean as a pre-harvest desiccant. For potatoes and carrots a number of products were identified as potential candidates for control of cleavers (see table). From trial work conducted to support the registration of projects stemming from national priority setting process the following crop-pesticide combinations produced favorable results; Assure II on Saskatoon berries and camelina, and 2,4-D Ester on red potato for color enhancement and color retention in storage. A search for solutions to dandelion and Canada thistle control in alfalfa and broadleaf weed control in brassica caranata (Ethiopian mustard) continues. Challenges also remain for kochia control in sunflowers. An interesting trial where Chateau (ai flumioxazin) was applied to the soil surface prior to weed emergence in the absence of a crop yielded some interesting results with the following weeds controlled at rates of 214 g ai/ha or less; green foxtail, kochia, redroot pigweed, and lamb's quarter. These trials were conducted at the request of PMRA to support existing flumioxazin submissions.

Crop (application growth stage)	Product	Crop Tolerance '*'=acceptable	Pest	Pest Control '*'=acceptable
Coriander (4 leaf)	Simplicity Velocity Everest	death death *		
Caraway (4 leaf)	Simplicity Velocity Everest	initial necrosis initial necrosis *		
Niger (pre-emerge)	Authority	stunting (no yield reduction)		
Perennial Ryegrass for seed (pre-seed)	Pre-Pass Express SG + glyphosate	*		
Potato (Red) (pre-bud)	2,4-D LV Ester 700	Stunting/deformation (enhance color)		
Saskatoon berry (flowering)	Assure II	*		
Alfalfa (2.5 cm height)	Chateau PrePass Basagran+Chateau	* (initial chlorosis) death * (initial chlorosis)	dandelion, kochia	unacceptable
Alfalfa (2.5 cm)	Phoma macrostoma (biofungicide)	*	dandelion	unacceptable
Alfalfa (fall09- dormant)	Florasulam Pardner Florasulam+Pardner Frontline XL FrontlineXL+MCPA EHE Florasulam+Fluroxypyr PrePass	Under evaluation	dandelion	under evaluation
Brassica Carinata (Pre-emerge 1-2 lf)	Proponit	*	cleaver rr pigweed Kochia wild buckwheat	suppression suppression unacceptable unacceptable
Camelina (4 leaf)	Assure II	*	grassy weeds	*
Carrot (Pre-seed Pre-emerge Post emerge- 2cm height Post emerge- 2cm height)	Nortron SC Command, Authority Accord Aim EC	* * wilting, stunting necrosis, death	cleaver	* * unacceptable *
Cumin (In furrow at seeding Seed treatment)	Root shield (granule) Apron Maxx RTA	* *	damping off seedling blight	unacceptable *
Dry beans :Pinto, Navy (80% dry down)	Kixor Aim EC		desiccation	*
Potato (Pre-emerge Post- 7.5 cm height)	Command, Authority Accord	* leaf cupping, stunting	cleaver	* unacceptable
Prairie carnation (Seed treatment)	Metconazole Agrox FL (ai captan)	Reduced emergence *	seedling blight	unacceptable unacceptable
Sunflower (pre-emerge)	KIH 485	*	kochia	unacceptable
No crop	Chateau Aim EC		kochia	* unacceptable
No crop	Chateau (53-840 g ai/ha)		green foxtail, kochia, redroot pigweed, lamb's quarter	* (@ 214 g ai/ha)

Arysta Fungicide and Group 2 Resistant Kochia

E. Johnson, H. Schell and C. Gampe, Scott Research Farm

No fungicide work was conducted in 2009 with Arysta. A number of tank-mix partners provided improved control of RR canola and kochia with PrePare herbicide. Generic formulations of fluroxypyr performed similarly to registered formulations.

Screening for Herbicide Resistance in Mustard

E. Johnson, D. Ulrich, G. Ford, and A. Kapiniak, Scott Research Farm.

Propisochlor, an Arysta herbicide was evaluated in Ethiopian mustard. It suppressed cleavers and redroot pigweed but did not control kochia, wild buckwheat or wild oat. It requires rainfall to be effective and dry spring may have reduced its efficacy. A number of cultivars were evaluated to determine if there was differential tolerance to dicamba, fluroxypyr, and Authority. The tests were also run at Saskatoon. Further evaluation is required before any conclusions can be drawn.

Developing Sulfentrazone (Authority) Tolerance in Lentil

E. Johnson[1], A. Kapiniak[1], F. A. Holm[2], and K. Sapsford[2]
[1]AAFC, Scott Research Farm; [2]University of Saskatchewan, Saskatoon, SK.

Dry spring at Scott did not activate sulfentrazone (Authority) in spring; therefore, all lines evaluated appeared tolerant. At Saskatoon, 5 to 6 lines of lentil were identified as having higher levels of visual tolerance to sulfentrazone.

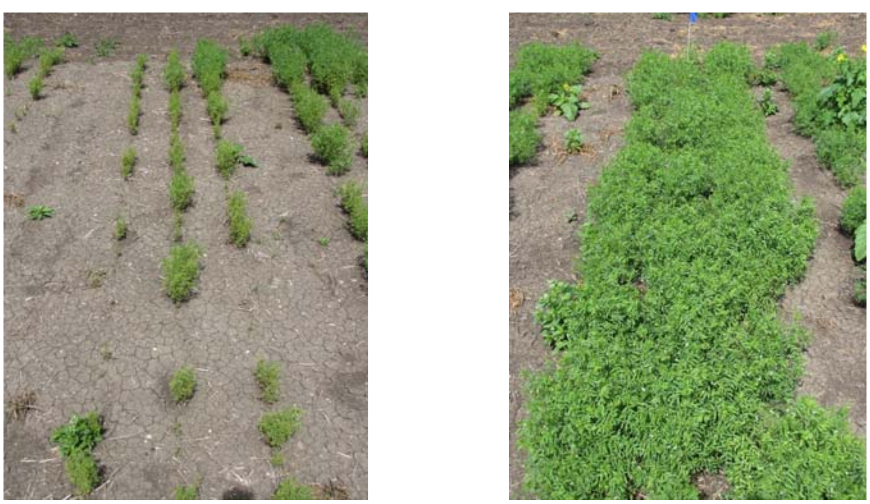

Figure 1: Visually susceptible (left) and tolerant (right) lines of lentil. Sulfentrazone applied at 280 g ai/ha (2X rate required for kochia control) photo: Ken Sapsford, Saskatoon

Screening for Herbicide Resistance in Flax

E. Johnson[1], A. Kapiniak[1], F. A. Holm[2], and K. Sapsford[2]
[1]AAFC, Scott Research Farm; [2]University of Saskatchewan, Saskatoon, SK.

Screening at Scott and Saskatoon indicates that some lines appeared to have higher levels of tolerance to dicamba. This will be investigated further.

Group 2 Resistant Kochia Trial

This is led by Linda Hall at the University of Alberta. It is an integrated study involving herbicide timing and spring wheat planting density. There were very low kochia densities at Scott; therefore, it is difficult to provide any preliminary observations

Validation of the Mustard Root Bioassay for Detection of New Group 2 Herbicides

E. Johnson[1], J. Schoenau[2] , F. A. Holm[2], and K. Sapsford[2]
[1]AAFC, Scott Research Farm; [2]University of Saskatchewan, Saskatoon, SK.

Lab work is underway to determine if the mustard root bioassay developed by Dr. Jeff Schoenau at the University of Saskatchewan will detect residues of Simplicity and Velocity herbicide. The mustard root bioassay will be used to determine breakdown of these products and compare their dissipation with Everest. In the field, Everest, Simplicity, and Velocity were applied to wheat. The area will be re-cropped to lentil in 2010. The study is also being conducted at Saskatoon.

Mechanical Weed Control

E. Johnson and L. Nielson, Scott Research Farm

This project will evaluate the effectiveness of the precision shallow cultivation tool (PSCT) developed in 2008 under controlled small plot research. Initial look at the PSCT showed tremendous promise for pre-emergence weed control under stubble and fallow conditions. The PSCT was developed to provide very shallow cultivation to allow removal of weeds prior to crop emergence with deep seeded crops such as pea or spring wheat. 2009 was a set-up year for the study. An area was seeded to wild oat and wild mustard, and then over-seeded to spring wheat. Natural populations of lambs-quarters and cow cockle were also present in the field. Seed produced by the weeds were allowed to shatter naturally in the field prior to harvesting the wheat. This will provide a uniform, naturalized weed population which should provide more relevant results. In most studies, weed seeds are seeded in the spring in which the study is initiated. This usually results in very uniform weed germination. It is anticipated that a naturalized population will closely mimic field situations. Studies on cultivation will take place in 2010.

Hybrid Poplar Demo and Willow Demo

Little was done in 2009 with these trials other than maintenance. Depending on growth in 2010 harvest may occur for the willow demonstration.

2009 Funding Support and Collaborations

Agriculture and AgriFood Canada
Arysta
BASF
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FMC
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Ontario Hemp Trade Alliance
Saskatchewan Ministry of Agriculture (ADOPT Program)
Saskatchewan Ministry of Agriculture (AgriArm Program)
Saskatchewan Ministry of Agriculture (Agriculture Development Fund)
Saskatchewan Canola Development Commission
Saskatchewan Pulse Growers
Crop Development Centre
University of Saskatchewan