Western Applied Research Corporation

2011 Annual Report
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 Agri-Food 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.

Board of Directors

Don Karstens	Wilkie, SK
Laura Reiter	Radisson, SK
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Terry Pylot	Meadow Lake, SK
Darin Egert	Cando, SK

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Eric Johnson	Weed Biologist, AAFC Scott
Dan Ulrich	Minor Use Program, AAFC Scott
Larry Sproule	Technician, WARC (summer)
Arlen Kapiniak	Technician, AAFC Scott
Lorne Nielsen	Technician, AAFC Scott
Herb Schell	Technician, AAFC Scott
Cindy Gampe	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 Agri-Food 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 North Western 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**.**

Contact Information

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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. Statistical analysis is a mathematical way to determine if the differences between treatments are a real effect or a random effect. For agricultural research a significance level of $\alpha=0.05$ is generally used. This means that if there is a significant difference, the difference is expected to occur 95 percent of the time. The following are some common statistical terms and their corresponding definition.

Mean - average of the sample being measured.

Median - the exact middle when comparing a range of numbers.

Standard error - a measure of the statistical accuracy of an estimate (often mean). The smaller the standard error the more accurate the estimate.

Experimental design - is the way a researcher designs an experiment to reduce the amount of error in a project. There are many different types with randomized complete block and split plot being the most common in WARC research.

Replication - the amount of times that an experiment is repeated at each site (also called blocks). Four is a common number of replication.

Location - where the experiment takes place, as the number of locations increase the number of different environments increase allowing for better results because the treatments were exposed to more environments (also called sites).

Experimental unit - the smallest unit that is measured in an experiment

Treatment - what is being applied to the experimental unit. The treatments are being tested in an experiment (also called entry).

Plot - in WARC related research it is the same as experimental unit

Trial - another term for experiment. It encompasses all of the plots, or treatments and blocks in a test.

For example if the yield of variety A is larger and statistically different from variety B, variety A is higher yielding 95% of the time 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.

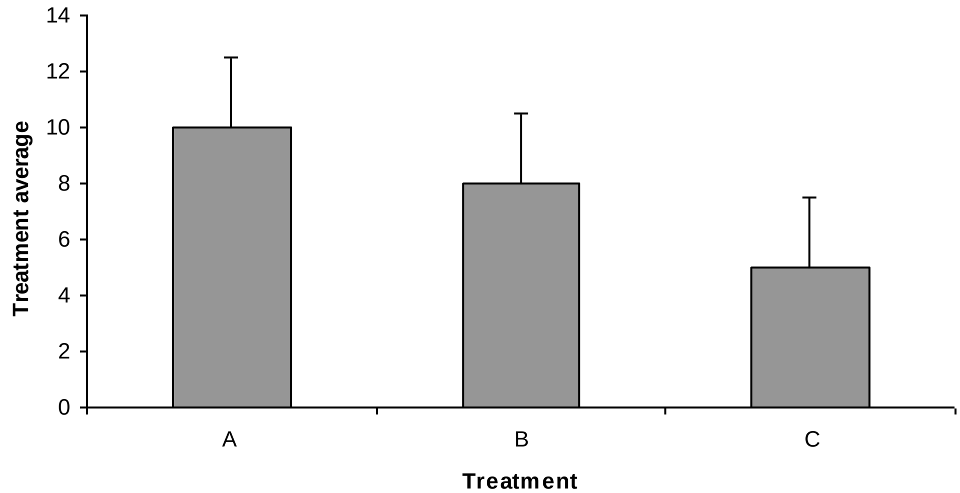

Figure 1 A statistical example using error bars on treatment averages to denote significant differences.

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. The environment is the years and locations that the experiment takes place.

Two important factors that influence how precise an experiment is are 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 2011

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 in 2011.

	Apr	May	Jun	Jul	Aug	Sep	Oct	Season Total
Air Temperature (°C)								
2011 mean	2.2	10.1	14.4	17.0	16.4	13.7	5.6	
100 year mean	3.2	10.2	14.5	17.3	16.2	10.5	3.8	
Growing Degree Days								
2011 mean	16	159	282	374	353	262	59	1505
100 year mean	42	169	285	381	346	174	48	1445
Precipitation (mm)								
2011 mean	10	32	81	80	52	4	11	270
100 year mean	23	37	62	62	45	31	16	276

Last spring frost: June 4 (-0.1°C)

First fall frost: September 13 (-2.6°C)

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

June 17 (31 mm)
June 18 (12 mm)
July 7 (17 mm)
July 20 (10 mm)
July 22 (16 mm)
Aug 11 (27 mm)

Extension Activities

Every year WARC is involved in several extension activities. Extension is a way to transfer new and relevant information about varying topics from agronomy to market outlooks to producers, agronomists and business advisors.

Extension activities (approximate number of people in attendance):

Scott Crop Opportunity and Research Update (250)
Scott Field Day (200)
Glaslyn Field tour (30)
Combine Demonstration (30)

Field days

- Scott Field Day, July 13, 2011, approximately 200 people in attendance
- Glaslyn Field Tour, August 16, 2011, approximately 30 producers in attendance
- Combine demonstration, September 28, 2011 at the Scott Research Farm. Approximately 30 people in attendance.

Extension Events

- Crop Opportunity and Scott Research Update – March 8, 2012, approximately 250 people in attendance. Research updates on AgriARM, ADOPT and AAFC projects.
- Agritopics radio spot on two radio stations (CJNB North Battleford and CJWW in Saskatoon). To date seven radio spots have been done by the research manager based on results of 2011 projects, and one radio spot was done on how to conduct on-farm research.
- Article summarizing the 2011 WARC growing season in the fall issue of SSCA Prairie Steward Newsletter
- Presentations at various events on WARC project results:
    - Agronomy Research Update – December 2011, Saskatoon.
    - Agriculture Information Day - February 8, 2012, Meadow Lake.
- In addition to the Scott and Glaslyn field days Sherrilyn Phelps presented the results of WARC ADOPT projects at the following field days:
    - Goodsoil Tour, June 30, 2011, approximately 30 producers in attendance
    - Rosthern Seeding Trends, June 3, approximately 50 producers in attendance
- Crop Production Show: January 9-12. Coordinated an Agri-ARM booth for the crop production show. This booth provided a venue for participating sites to connect with farmers and let them know about the research we are conducting
- WARC website: research results and reports are published on www.warc.ca

ADOPT Projects

Agricultural Demonstration of Practices and Technologies (ADOPT) is a program funded by the Saskatchewan Ministry of Agriculture. The goal of the program is to demonstrate new research findings around the province to show the effectiveness of the new research finding. WARC has funding for several of these projects.

Cleavers – understanding the biology and managing herbicide resistance

Anne Kirk[1], Eric Johnson[2], Sherrilyn Phelps[3], and Blaine Davey[1]

[1]Western Applied Research Corporation, Scott, SK, [2] Agriculture and Agri-Food Canada, Scott, SK, [3] Saskatchewan Ministry of Agriculture, North Battleford

Cleavers (*Galium aparin*) is a common weed in field crops in Saskatchewan and one that has been increasing in severity due to the adoption of minimum tillage. Cultivars resistant to group 2 herbicides have been identified and continued use of group 2 herbicides is of concern. The purpose of this project is to demonstrate the cleavers control options that are available that allow rotation of herbicide groups and to demonstrate the effectiveness of using tank-mixes to control group 2 resistant cleavers. Cleavers were seeded in the spring and 16 herbicide treatments were applied to show control options. All herbicide treatments were found to control cleavers. The best cleavers control was achieved with Frontline XL, Simplicity, Attain, Dicambe + 2,4-D, Trophy and Viper, while the lowest levels of control were seen with Glyphosate and Refine SG. The greenhouse study demonstrated the need to control group 2 resistant cleavers with tank-mixes. Both the field and greenhouse demonstration were successful in illustrating that producers can rotate their herbicides and still get good control of cleavers.

Acknowledgements

Funding provided through the ADOPT program from the Saskatchewan Ministry of Agriculture.

Canola seeding speeds demonstration

Sherrilyn Phelps[1], Stewart Brandt[2] and Shannon Urbaniak[3]

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Seventeen field scale demonstrations were done across Northern and Central Saskatchewan to evaluate the impact of seeding speed on canola establishment. Most sites were planted directly into standing cereal stubble, but in the Northeast region three sites were planted on pre-tilled fallow (much of the area was fallowed because it could not be seeded in 2010). Equipment varied in the level of soil disturbance from very low disturbance disc type openers, to paired row systems and spoon types which caused moderate soil disturbance. Low disturbance was found with knife, atom jet, paralink and seedhawk type systems. Seedbed moisture conditions were good to excellent at most locations. Several sites were affected by frost, and one site was reseeded and no furthur data taken. Out of the 17 sites, seeding speed had little or no effect on plant density at 12 sites, three showed negative response and two showed positive response. Where trends with seeding speed were noted, both increases and decreases were noted. In one instance plant density declined by 44% as speed increased from 3.5 to 6 mph, or almost 6 plants m^{-2} for each mph increase in speed. In this case densities still remained above 40 plants m^{-2}, the level below which we would expect yield to be adversely affected, and no affect on yield was found. At the seven sites harvested there was no real evidence that seeding speed affected yield at any location.

This project suggests that under favorable seeding conditions with good moisture producers may be able to speed up if they are pressed for time to get the crop in the ground. With increased seeding speed it is important to ensure the seeding rate and fertilizer rates are adjusted accordingly as some equipment did start to drop in rates as speeds increased. Because these results challenge conventional thinking about seeding speeds for canola, the demonstrations need to be repeated to generate more information under a broader range of conditions.

Acknowledgements

Funding for this project was provided through the Saskatchewan Ministry of Agriculture's ADOPT program. Thank you to Amber Bernauer at Cavalier Agro in Meadow Lake for looking after the two locations in Goodsoil and Meadow Lake. We would also like to thank the Saskatchewan Crop Insurance Corporation adjustors who were involved in the plant counts and depth measurements at the 9 sites in NW Saskatchewan.

Inputs to target very high canola yield

Stewart Brandt[1], Anne Kirk[2], Sherrilyn Phelps[3] and Blaine Davey[2]

[1]Northeast Agricultural Research Foundation, Melfort, SK, [2]Western Applied Research Corporation, Scott, SK, [3]Ministry of Agriculture, North Battleford, SK

Most progressive growers attempt to optimize inputs and management practices to target high canola yield. There are a number of practices and products that have the potential to enhance yield but many growers are reluctant to use them because information on economic returns is limited. This demonstration was conducted to determine if economic yield benefits in canola can be achieved by adding inputs or management practices in which information on economic return is uncertain. The demonstration was conducted at Melfort and Scott and started with an input/management package that targets optimum yield. Additional inputs were added individually to see if yields could be enhanced further. The additional inputs added were micronutrients, Avail treated phosphorus, increased nitrogen rates, increased seeding rates, foliar fungicide, bioboost seed treatment and soil fracturing. The final treatment was a combined application of all additional inputs. Increasing the N rate lengthened the flowering period and resulted in denser growth during flowering and podding. Yields did not differ significantly between treatments at either Scott or Melfort, indicating that applying additional inputs did not provide an economic return. Results of this demonstration suggest that growers wishing to target high yields should first ensure that their practices optimize tried and true technologies like recommended rate of seed, fertilizer and pesticides combined with optimal application methods. With a lack of yield response, the economics of any of these practices were not favourable.

Acknowledgements

Funding for this project was provided through the ADOPT program from the Saskatchewan Ministry of Agriculture.

. Seed placed ESN and Agrotain treated urea for wheat

Anne Kirk[1], Bryan Nybo[2], Stewart Brandt[3], Sherrilyn Phelps[4] and Blaine Davey[1]

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Seed placed urea fertilizer causes damage to seeds and seedlings through ammonia toxicity. There are circumstances where producers may want to apply higher rates of N fertilizer than the guidelines for safe application allow. Treated urea products such as ESN and Agrotain are of interest to producers because they are said to increase the amount of N that can be safely placed with the seed. The objective of this project is to demonstrate the increased safety of ESN and Agrotain treated urea over untreated urea fertilizer when placed with seed. This project took place at Scott, Melfort and Swift Current. Untreated urea, ESN treated urea and Agrotain treated urea were placed with the seed at 20 (the maximum recommended safe rate for the equipment used), 40, 80 and 160 lb/ac. Urea was pre-banded on all treatments to bring the combined total N to 160 lb/ac. Increasing the rate of seed-placed urea decreased plant density and wheat yield at Scott and Swift Current. Agrotain treated urea did not provide a benefit at Scott and Swift Current, while ESN did provide better seed safety, particularly at Swift Current. Melfort received rain in early June that flushed away the soluble N which allowed the plants to recover. Therefore, there was no difference in yield at Melfort between urea products at the different seed placed application rates. Environmental conditions played a large role in damage to seeds and seedlings at each site. It is recommended that producers follow the guidelines for maximum safe rate of seed applied N. This project will be repeated in 2012 to gather more insight into how the treated urea products influence grain yield and plant density at different rates of seed applied N.

Acknowledgements

Funding provided through the ADOPT program from the Saskatchewan Ministry of Agriculture.

Maximizing benefits from foliar fungicides on wheat and barley

Anne Kirk[1], Colleen Kirkham[2], Randy Kutcher[3], Stewart Brandt[4] and Sherrilyn Plehps[5]

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Leaf spotting diseases are believed to reduce yield and quality of cereal crops in Northwest Saskatchewan. Industry agronomists suggest that producers in Northern Saskatchewan consider applying foliar fungicides to cereals as a routine practice. This demonstration was conducted to assess the impact of fungicide and genetics on the level of leaf spotting disease, yield and quality of barley and wheat. For each crop three varieties that differed in resistance to leaf diseases were planted and three fungicides were sprayed on each at flag leaf. Leaf disease levels differed between fungicide treatments more than varieties. Varieties with greater genetic resistance tended to yield higher than varieties with lower levels of disease resistance. A field scale demonstration was also conducted to evaluate timing of fungicide application on wheat. The field scale treatments consisted of no fungicide, a half rate of fungicide at herbicide timing, fungicide at flag leaf, and fungicide applied at both herbicide timing and at flag leaf. In the field scale demonstration the greatest yield resulted from a half rate of fungicide at herbicide timing combined with a full rate at the flag leaf stage. Fungicide application only at herbicide timing resulted in the greatest net return. It is recommended that producers plant disease resistant varieties and use proper crop rotations as a first line of defense against leaf spotting diseases.

Acknowledgements

Funding provided by the ADOPT program from the Saskatchewan Ministry of Agriculture.

Micronutrient seed dressing effects on various crops

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Grain farmers on the Prairies have access to many new products and practices claiming to increase profitability. Many products which are currently being marketed do not have independently verified research results. The Indian Head Agricultural Research Foundation (IHARF) heads a project called 'Yield-Busters' to evaluate specific products or practices. Micronutrient seed primers were tested in 2010 and 2011 at four sites across Saskatchewan, Indian Head, Canora, Swift Current and Scott. The objective of this project is to evaluate the effects of micronutrient seed dressings on the establishment and seed yield of spring wheat, canola, lentil and field pea.

Micronutrient seed primers were not found to positively affect plant density, crop establishment or grain yield. The results of this study would not justify a recommendation to use micronutrient seed dressings, even in cases where soil tests show potential for the applicable nutrients to be limiting. Nonetheless, many different products are available, formulations change and the eight sites where this study was conducted cannot be representative of every potential field or situation; thus, it is possible that benefits could exist under the right circumstances. However, predicting when a positive response is likely to occur and identifying specific situations where a seed dressing might provide a benefit may prove difficult. While it makes some sense that the potential benefits to seed dressings may be improved when the relevant nutrients are deficient, it is unlikely that they could supply enough nutrients to correct a serious deficiency and would have to be supplemented with a soil-applied or foliar fertilizer application.

Acknowledgement

Funding for this project was through the Saskatchewan Ministry of Agriculture AgriARM program.

Optimum camelina seeding dates

Sherrilyn Phelps[1], Anne Kirk[2], William May[3], Eric Johnson[4], Bryan Nybo[5], Arlen Kapiniak[4] and Blaine Davey[2]

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Camelina is a new crop to Saskatchewan and more research is needed to determine the best agronomic practices for this crop. Seeding date affects crop establishment and the yield potential of camelina. The objective of this project is to demonstrate the most suitable fall and spring seeding dates for camelina. This project occurred at three locations in 2010 and two locations in 2011. Camelina was planted at eight seeding dates in both years. In 2010 the Indian Head site showed no significant difference in yield between spring and fall seeding; however, the latest fall seeded treatment yielded the highest overall. At Scott in 2010 fall seeded treatments increased in yield and plant density as seeding was delayed. At Swift Current in 2010 spring seeded treatments had significantly greater plant density than fall seeded treatments. Early spring seeding resulted in the greatest yield. In 2011 at both Scott and Indian Head spring seeding resulted in greater yield and plant densities than fall seeding. In five of six site years spring seeding resulted in the highest yield, and at all six site years spring seeding resulted in higher plant densities than fall seeding. It is recommended that producers seed camelina in the spring for the most consistent results.

Acknowledgements

Funding provided through the ADOPT program from the Saskatchewan Ministry of Agriculture.

Reclamation of saline soil using perennial forages

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Saline areas are a significant concern for Saskatchewan producers. Saline areas contain salts in the soil at concentrations that affect the growth and production of agricultural crops in Saskatchewan. They seldom affect large areas of fields. Often the only plants that are adapted to these areas are agricultural weeds such as kochia. One option that has been used in the past is to seed perennial forages into the affected area. This has occurred with mixed results because of the lack of perennial forages that are salt tolerant. Recently, AC Saltlander has been registered and alfalfa varieties with increased tolerance have been identified. When perennial forage is established on saline areas less agricultural weeds are allowed to grow reducing the weed seed produced and added to the seed bank of the field. Hence, previously unproductive saline areas become economically productive areas of the field. The objective of this project is to show producers with saline areas how to map the areas and to demonstrate the effectiveness of perennial forages with increased saline tolerance at colonizing a saline site. Salinity mapping of the trial area occurred in July 2011 and ten perennial forages treatments were seeded in the fall. Forage growth will be monitored throughout the 2012 growing season.

Acknowledgements

Funding provided through the ADOPT program from the Saskatchewan Ministry of Agriculture.

Faba beans as a green manure crop

Sherrilyn Phelps[1] and Anne Kirk[2]

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A typical crop rotation in the Northwest region of Saskatchewan is a pulse-cereal-canola-cereal rotation. This project will evaluate the use of faba beans in the pulse section of the rotation. This information is relevant to producers as the cost of commercial nitrogen fertilizer has been near long term high prices. With these high prices it may be beneficial to look to pulses as a supply source for this nitrogen as they are able to fix N from the air. The objective of this project is to evaluate faba bean as a green manure crop to build soil nitrogen levels in order to offset the need for inorganic nitrogen fertilizer. A secondary objective is to determine if it is economical to replace peas in a rotation with faba bean.

This demonstration project was to take place over a two year period. In the first year three treatments were planted in unreplicated strips across the producer's field. The three treatments are: field peas (control), faba bean green manure (terminated with herbicides at late flower), and faba beans harvested for grain.

Due to a very wet spring this field was unable to be planted until late June. As a result of the wet conditions and late planting the field pea and faba bean treatments were frost killed prior to maturity. In the second year of this demonstration a cereal was to be planted across the trial area to assess the effect of the field pea and faba bean treatments on the yield of a following cereal crop. This project will be redone in 2012, with a cereal planted in the trial area in 2013.

Acknowledgements

Funding provided through the ADOPT program from the Saskatchewan Ministry of Agriculture.

Precision inter-row seeding

Anne Kirk[1] and Eric Johnson[2]

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Inter-row seeding and RTK-guided technology is gaining in popularity as more producers are interested in the potential benefits of inter-row seeding and precision fertilizer and herbicide application. The objective of this project is to demonstrate the effect of precision seeding between the rows of last year's stubble compared to seeding with no consideration of stubble row on crop establishment and yield. The effect of seeding direction and stubble height will also be studied.

Plots for the 2012 growing season were set up in the spring of 2011. The eight treatments were randomized and wheat was seeded into four replicate blocks of 10 x 10 m plots at the AAFC Scott Research Farm. Treatments included different combinations of three factors: seeding direction, stubble height and precise or random seeding. At physiological maturity the wheat was harvested with the stubble cut tall or short. In the spring of 2012 canola will be seeded into the plots following the direction of seeding in 2011. Canola will be seeded either precisely between the rows of last year's stubble or randomly with no consideration of stubble location.

Acknowledgements

Funding provided through the ADOPT program from the Saskatchewan Ministry of Agriculture.

Response of canola to low plant populations and evaluation of reseeding options

Blaine Davey[1], Anne Kirk[1], Sherrilyn Phelps[2], Eric Johnson[3], Steve Shirtliffe[4], Cecil Vera[5], Chris Holzapfel[6] and Bryan Nybo[7]

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Introduction

Hybrid canola has become widely grown by producers and information on minimum plant stands required for establishment is important for producers when it comes to reseeding decisions. Previous research suggests 45 plants per meter square as a minimum plant population to achieve 90% of maximum yields. Saskatchewan Crop Insurance uses 20 plants per square meter as a minimum plant stand under which crops are no longer covered for yield loss, but little research is available to support this number. When it comes to reseeding low plant stands of canola, little research has been done to evaluate the options. Most previous research suggests using the earliest maturing varieties when reseeding canola, but little research has been conducted on using hybrid canola when reseeding a poor canola stand.

Objectives

1) Determine the plant population at which canola hybrid yields at 90% of the maximum yield
2) Determine the effect of plant populations on maturity, seed size and green seed count
3) Determine minimum plant density at which reseeding would be recommended for hybrid canola
4) Determine what the risks are with each reseeding option in terms of maturity, yield and quality

Materials and Methods

This experiment occurred at Scott, Swift Current, Indian Head, Melfort and Saskatoon in 2010 and 2011. 2012 will be the final year of this experiment. The experimental design is a randomized complete block design with four replicates. The project was conducted as two separate experiments, the first to investigate the response of hybrid canola to low plant populations and the second to look at reseeding options.

Experiment 1: Plant density response

Hybrid canola (*Brassica napus*) was seeded as a rate of 5, 10, 20, 40, 80, 150, and 300 seeds m^{-2}. An elemental sulfur bulking agent was used to ensure even seed spread. The variety 5440 LL was used at all sites with 5770 LL also included at Scott and Melfort. Data collected throughout the growing season includes plant density, days from planting to start and end of flowering, lodging, days to 60% seed colour change, grain yield, percent green seed and thousand kernel weight. Seeds per pod and pods per plant were collected at Scott and Saskatoon.

Experiment 2: Reseeding options

Three seeding dates were used at each site. The first seeding date was early May where one treatment was seeded to 5440 LL canola at 150 seeds m^{-2} while all of the other treatments were seeded at 20 seeds m^{-2} to duplicate poor stand establishment. All but one of the treatments planted at 20 seeds m^{-2} were later killed with glyphosate prior to reseeding. After glyphosate application, canola was planted into the plot to mimic a reseeding situation in the field where a poor plant stand is terminated and canola is reseeded. Two hybrid canola varieties, 5440 LL and 9350 RR, and a Polish canola variety were planted at the two reseeding dates. The reseeding dates were early and mid-June. For a complete treatment list see Table 1.

Table 1 Seeding date, cultivar and seeding rate for each of the 8 treatments used in the canola reseeding study.

Treatment	Seeding Date	Cultivar	Seeding Rate (seeds m^{-2})
1	Early May	5440 LL	150
2	Early May	5440 LL	20
3	Early June	5440 LL	150
4	Early June	9350 RR	150
5	Early June	Polish	150
6	Mid-June	5440 LL	150
7	Mid-June	9350 RR	150
8	Mid-June	Polish	150

Data collected throughout the growing season includes plant density, days from planting to start and end of flowering, lodging, days to 60% seed colour change, grain yield, percent green seed and thousand seed weight.

Results

Experiment 1: Plant density response

Wet conditions in 2010 resulted in greater canola emergence at most sites than the seeding rate. The high emergence levels were attributed to large number of volunteer canola plants emerging from the seedbank. In 2010 canola emergence rates averaged 70 percent for the highest seeding rate of 300 seeds m^{-2}. Volunteer canola was less of a problem in 2011 on average; although, emergence rates were still very high for the lowest seeding rate of 5 plants m^{-2} (Table 2).

Table 2 Percent emergence for 2010 and 2011 averaged across all sites.

Seeding Rate	Emergence	
(seeds m^{-2})	2010	2011
5	145	100
10	111	68
20	83	45
40	98	38
80	94	36
150	88	34
300	70	34

Yield was affected by plant population in both years. On average, across all site years, 90 percent maximum yield was achieved at 22 plants m^{-2}. The broken line regression model was used to fit the 2010 and 2011 yield data, and worked well when all sites for each year were combined. The R^2 was 0.97 for both 2010 and 2011 (Figure 1 and 2). In 2010 the join point where increased plant densities did not result in increased yield was 24 plants m^{-2} (Figure 1). In 2011 this point was 20 plants m^{-2} (Figure 2). When examining each site year the join points ranged from 12 to 32 plants m^{-2} and 7 to 47 plants m^{-2} for 2010 and 2011, respectively. No seeding rate included was high enough to cause yield decreases due to plant overcrowding.

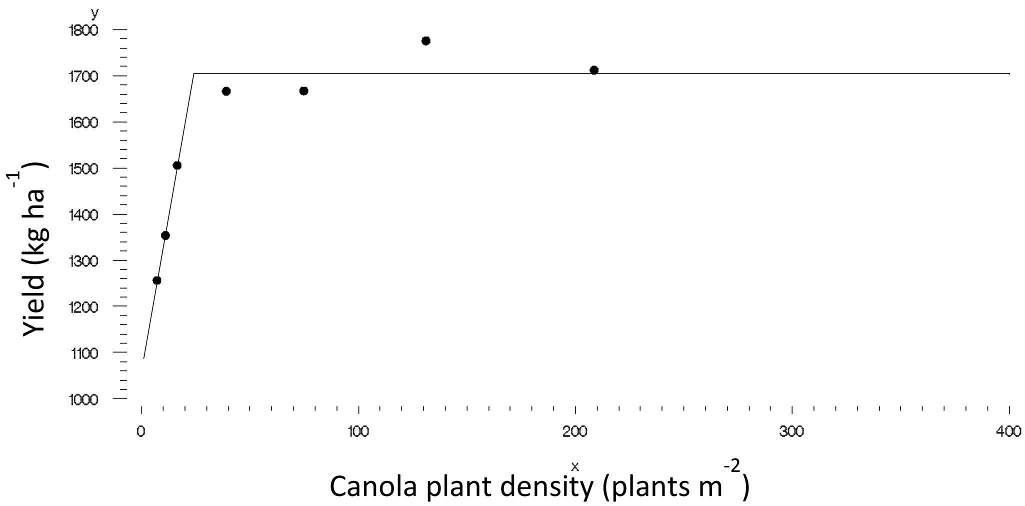

Figure 1 Regression of 2010 yield data compared to actual plant density for each seeding rate averaged across sites.

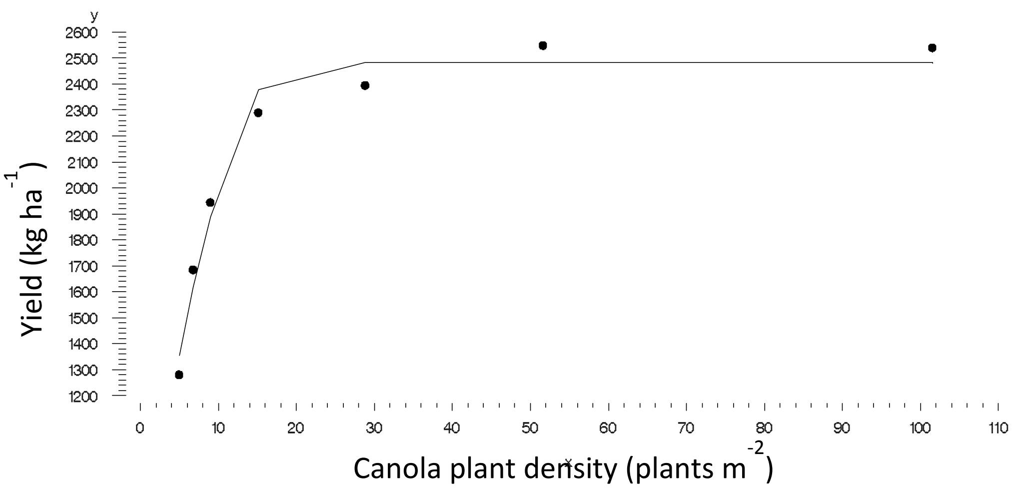

Figure 2 Regression of 2011 yield data compared to actual plant density for each seeding rate averaged across sites.

As seeding rate increased the days to maturity decreased (data not shown) and percent green seed decreased (Table 3 and 4). At Scott in 2011 the 5 seeds m^{-2} seeding rate resulted in a 17 day increase in days to the end of flower compared to the seeding rate of the 300 seeds m^{-2}. As seeding rates increased pods per plant and branches per plant decreased (data not shown). The number of seeds per pod was not affected by seeding rate.

Table 3 Spring and fall plant density, lodging ratio, thousand kernel weight and percent green seed averaged across sites for the seven different seeding rates in 2010.

	Seeding Rate (seeds m^{-2})							
	5	10	20	40	80	150	300	LSD (α=0.05)
Spring plant density (plants m^{-2})	9	14	20	41	77	133	218	21.8
Fall plant density (plants m^{-2})	8	10	16	25	44	63	105	13.2
Lodging Ratio	0.89	0.89	0.92	0.88	0.89	0.9	0.91	0.04
Thousand kernel weight (g)	2.9	3	3	3.1	3.1	3.2	3.2	0.21
Green seed (%)	2	1.3	0.3	0.3	0.1	0.1	0.1	1.17

Table 4 Spring and fall plant density, lodging ratio, thousand kernel weight and percent green seed averaged across sites for the seven different seeding rates in 2011.

	Seeding Rate (seeds m^{-2})							
	5	10	20	40	80	150	300	LSD (α=0.05)
Spring plant density (plants m^{-2})	8	10	14	20	34	57	107	15.9
Fall plant density (plants m^{-2})	10	12	17	24	42	63	103	21.5
Lodging Ratio	0.72	0.74	0.78	0.85	0.85	0.83	0.82	0.065
Thousand kernel weight (g)	3.2	3.2	3.1	2.9	3	3.1	3.1	0.19
Green seed (%)	1.8	1.4	1.7	1.0	0.9	0.3	0.7	0.89

Experiment 2: Reseeding Options

In 2010 the highest yielding treatments were 5440 LL planted in early May and early June, and 9350 RR seeded in early June (Table 5). There was no significant yield difference between 5440 LL planted at 20 seeds m^{-2} in early May, the Polish planted in early June or any of the mid June seeding dates; therefore, reseeding with Polish canola gave no advantage in terms of yield.

In 2011 there was no significant yield difference between 5440 LL planted in early May at either seeding rate, early June seeded 5440 LL and early June seeded 9350 RR (Table 6). Polish canola seeded in early June yielded significantly lower than 5440 LL but was not significantly different from 9350 RR.

In general, thousand seed weight decreased and green seed content increased as seeding was delayed (Table 5 and 6).

Table 5 Yield, plant density, lodging index, thousand seed weight and green seed content for each treatment at Scott, Saskatoon, Indian Head and Melfort in 2010.

Seeding Date	Variety	Seeding rate (seeds m^{-2})	Yield (kg ha^{-1})	Plant density (pl m^{-2})	Lodging index	1000 seed weight (g)	Green seed (%)
Early May	5440 LL	150	2020a	84ab	0.65b	3.27a	0.0a
Early May	5440 LL	40	1228b	31d	0.69b	2.98b	0.1a
Early June	5440 LL	150	2266a	102a	0.88a	2.94b	1.0a
Early June	9350 RR	150	1984a	90a	0.7b	2.77bc	0.9a
Early June	Polish	150	973b	72b	0.74b	2.4de	0.7a
Mid June	5440 LL	150	1362b	67b	0.88a	2.61cd	4.5c
Mid June	9350 RR	150	1359b	65bc	0.63b	2.34e	4.4bc
Mid June	Polish	150	1063b	44cd	0.68b	2.29e	3.1b
LSD			*448.8*	*22.8*	*0.133*	*0.231*	*1.4*

Table 4 Yield, plant density, days to 60% seed colour change, lodging index, thousand seed weight and green seed content for each treatment at Scott, Saskatoon, Indian Head, Melfort and Swift Current in 2011.

Seeding date	Variety	Seed rate (seeds m^{-2})	Yield (kg ha^{-1})	Plant density (pl m^{-2})	60% SCC	Lodging index	1000 seed weight (g)	Green seed (%)
Early May	5440 LL	150	2180a	61ab	235ab	0.89ab	3.2ab	1.4a
Early May	5440 LL	40	1683ab	21c	240ab	0.79c	3.3a	1.9a
Early June	5440 LL	150	2073a	75a	247bc	0.93ab	3.0bc	2.9ab
Early June	9350 RR	150	1649ab	75a	246bc	0.79c	2.6de	2.1a
Early June	Polish	150	1269bc	61ab	239bc	0.84bc	2.6de	2.1a
Mid June	5440 LL	150	1001c	49b	248c	0.98a	2.8cd	5.8c
Mid June	9350 RR	150	1156bc	53b	249c	0.95a	2.5e	6.0c
Mid June	Polish	150	993c	44b	246bc	0.94a	2.4e	5.1bd
Coefficient of Variation			*56.7*	*44.5*	*4.1*	*11.1*	*15.0*	*120.9*
LSD			*535.1*	*17.2*	*7.4*	*0.099*	*0.26*	*2.6*

Conclusions

The data collected to date shows that hybrid canola has a great ability to maximize yield at low plant populations. The largest drawback to having a canola crop with lower plant density is longer days to maturity. Averaged across all sites years, the plant density at which 90% maximum yield is achieved is 22 plants m^{-2}. Reseeding may be recommended if plant population's dip below that point. Data collected in the reseeding portion of this experiment indicates that hybrid canola can be seeded up to early June with no yield penalty. It is not recommended that producers plant earlier maturing Polish canola when reseeding as Polish canola did not provide a yield benefit over the hybrid canola in either year. This project will continue in 2012 at all five sites. Upon completion of the final year of this trial, 15 site years of data will be available to analysis.

Acknowledgements

Funding and support for this project was provided by the Saskatchewan Canola Development Commission and the Saskatchewan Crop Insurance Corporation.

Evaluating varietal resistance in pod shattering and pod drop for canola

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Objectives

To quantify varietal differences in seed loss due to pod shattering and pod drop under field conditions amongst 12 modern Argentine canola hybrids.

Materials and Methods

The trial is located at Indian Head, Swift Current and Scott. The experimental design is a factorial randomized complete block design with four replicates. Twelve modern Argentine canola hybrids were evaluated for days to maturity, seed losses, seed yield, green seed and seed size. Seed losses, seed yield, green seed and seed size measurements were completed at two separate times: once at or slightly before the optimal harvest stage and again 2-3 weeks past the optimal harvest date.

Results

After one year of field trials, the results of this study are still preliminary and, at this time, the data have not been extensively reviewed.

Table 1. Effects of site and cultivar on seed yield (optimal time) and seed losses (2-3 weeks past optimal harvest time).

	Type III Test of Fixed Effects			
		-------------------- Seed Loss[y] --------------------		
Effect	**Seed Yield[z]**	**Shattered**	**Dropped Pods**	**Total Seed**
	------------------------------ p-values --------------------------------			
Site	0.020	<0.001	<0.001	<0.001
Cultivar	0.015	0.012	<0.001	<0.001
Site x Cultivar	0.187	0.691	0.001	0.037
	Least Squares Means			
Site	**---- kg/ha ----**	**---------------- % of total yield -----------------**		
Indian Head (11)	3092 a	0.89 b	0.70 b	1.59 b
Scott (11)	2773 b	3.41 a	4.14 a	7.55 a
Swift Current (11)	2829 ab	1.48 b	0.90 b	2.38 b
Standard Error	68.3	0.277	0.207	0.479
Cultivar				
5440 LL	3018 ab	1.58 ab	0.61 d	2.19 d
L130 LL	2978 ab	1.25 b	1.15 bcd	2.41 cd
L150 LL	2940 ab	1.61 ab	0.87 cd	2.47 cd
45H29 RR	2948 ab	1.86 ab	3.33 a	5.19 abc
45H31 RR	2875 ab	2.05 ab	2.41 abc	4.47 abcd
73-75 RR	3178 a	2.19 ab	2.19 abcd	4.38 abcd
73-45 RR	2752 ab	3.07 ab	2.68 ab	5.75 ab
6060 RR	2825 ab	3.15 a	2.95 a	6.09 a
9553 RR	2817 ab	1.37 ab	2.27 abcd	3.64 abcd
46H75 CL	2877 ab	1.46 ab	1.71 abcd	3.17 bcd
2012 CL	2599 b	1.94 ab	0.63 d	2.58 cd
5525 CL	2970 ab	1.59 ab	2.14 abcd	3.72 abcd
Standard Error	98.2	0.410	0.366	0.649

[†]The standard error of the treatment mean for Swift Current is enclosed in parentheses. Contents of shatter trays from two replicates were discarded because of contamination from combine

Seed losses, seed yield, green seed and seed size measurements were completed at two separate times: once at or slightly before the optimal harvest stage and again 2-3 weeks past the optimal harvest date

Cultural, chemical, and mechanical weed management for controlling herbicide resistant broadleaf weeds in lentil

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The occurrence of group II herbicide resistance in wild mustard and kochia threatens lentil production. The objectives of this project are to determine optimum management of herbicide resistant broadleaf weeds in lentil through a combination of physical, chemical and cultural methods as well as developing an integrated weed management program that will reduce herbicide selection pressure in lentil. An integrated weed management system that combined high seeding rates, Heat, ½ rate of Sencor and rotary hoeing resulted in lentil yield equivalent to full rate of Sencor. The optimum seeding rate in lentil may be a function of the weed control system. A more robust weed control system will probably require a higher seeding rate and incorporate alternative weed control strategies. This experiment will continue for 2012 and 2013.

Acknowledgements

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Control of leafy spurge (Euphorbia esulaesula L.) with aminocyclopyachlor in grassland

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Leafy spurge (Euphorbia esula L.) is a perennial noxious weed that is problematic in forages and rangeland in the Northern Great Plains. Leafy spurge is not palatable to most grazing animals; therefore, they selectively overgraze the interspersed forage. This selection pressure leads to leafy spurge dominance in the ecosystem. Aminocyclopyrachlor, a new pryimidine carboxylic acid herbicide under development by E.I. DuPont Canada Company, has exhibited activity on a wide range of non- cropland broadleaf weed species. Its attributes include low use rates, low animal toxicity, and low environmental impact.

The objective of this project is to evaluate the efficacy of the two aminocyclopyrachlor formulations, DuPont™ Rejuvra XL™ and DuPont™ Truvist™, on controlling leafy spurge and injury to grass in comparison to industry standards (Grazon and Tordon).

Materials and Methods

Field studies were conducted near Battleford, Saskatchewan in 2009 and 2010. Treatments were applied when leafy spurge plants were 30 to 60 cm tall with approximately 80 percent of the plants flowering. Treatments included:

1) Untreated check
2) Rejuvra XL™ at 45 g ai ha^{-1}
3) Rejuvra XL™ at 90 g ai ha^{-1}
4) Truvist™ at 100 g ai ha^{-1}
5) Grazon™ at 2135 g ai ha^{-1}
6) Tordon™ at 2160 g ai ha^{-1}

Visual control ratings were done at 2, 4 and 6 weeks after application (WAA). Long-term control was assessed at 53 WAA.

Results

At two, four and six WAA the greatest leafy spurge control was achieved with Tordon™ and Grazon™ (Figure 1). Two WAA Tordon™ and Grazon™ achieved significantly better leafy spurge control than the Rejuvra XL™ and Truvist™ treatments, while at 4 WAA control achieved with Tordon™ was comparable to the full rate (90 g ai ha^{-1}) of Rejuvra XL™. Six WAA the full rate of Rejuvra XL™ and Truvist™ were comparable to Grazon™ and Tordon™. The Truvist™ achieved statistically similar leafy spurge control to both Grazon™ and Tordon™, while the full rate of DuPont™ Rejuvra XL™ achieved control similar to Tordon™ only (Figure 1). Control of leafy spurge with Grazon™ was reduced one year after application and was similar to control achieved with the half rate of Rejuvra XL™. One year after application the greatest leafy spurge control was achieved with Tordon™, although there was no significant difference between Tordon and the full rates of Rejuvra XL™ and DuPont™ Truvist™.

Application of Grazon™ and Tordon™ resulted in severe injury to the mixed grass at 2, 4 and 6 WAA (data not shown). In the Grazon™ treatments the mixed grass recovered by the next growing season, while severe injury was still evident in the Tordon™ treatments.

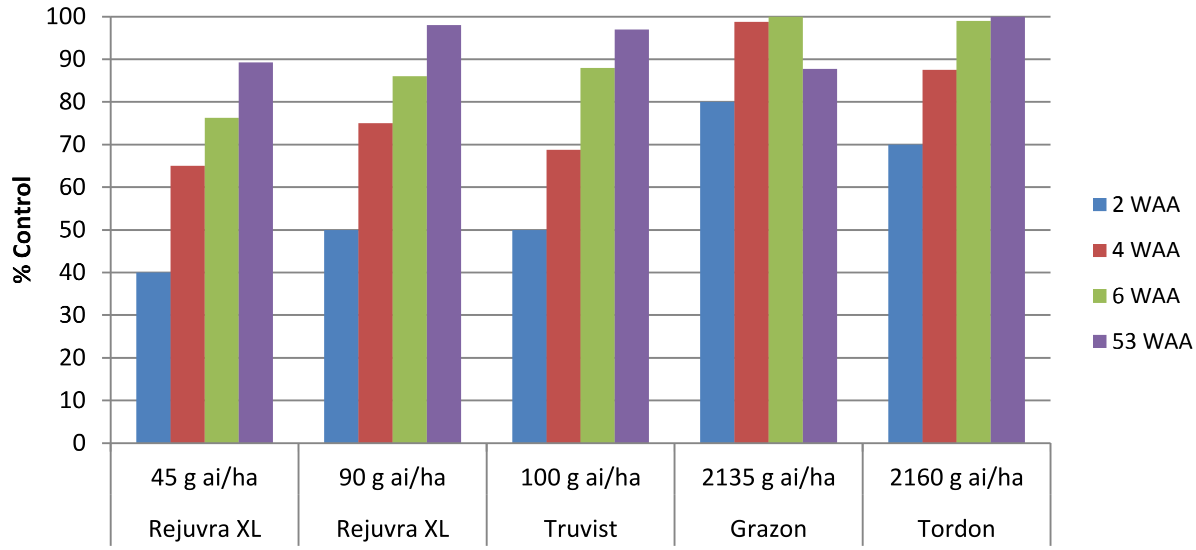

Figure 1 Control of leafy spurge with Rejuvra XL at full and half rates, Truvist, Grazon and Tordon.

Conclusions

Acceptable long-term control of leafy spurge in mixed grassland was achieved with the full rates of Rejuvra XL™ and Truvist™. Rejuvra XL™ and Truvist™ were slower acting than Tordon™ and Grazon™ but had less injury to the mixed grass species present.

Combinations of sulfentrazone (Authority) and saflufenacil (Heat) for an improved spectrum of broadleaf weed control in chickpea

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Executive Summary

Chickpea growers in Saskatchewan have faced many production challenges. Few herbicide options were available that provided good weed control and crop safety Authority and Heat are two new herbicides that are available to chickpea growers. The effect of tank mixing the two products is unknown on broadleaf weed control efficacy. In 2008, a probe study was conducted at Lethbridge, Saskatoon, and Scott, to determine if combinations of Authority and Heat provided a broader spectrum of weed control than Authority applied alone. There was sufficient evidence to conduct further trials and the Saskatchewan Pulse Growers approved a 2-year project to conduct further studies at Scott and Saskatoon. 2009 and 2010 were challenging years to grow chickpea at Scott and Saskatoon due to above normal precipitation; however, useful weed control data were collected. A second objective of the study was to determine if combinations of Heat and Authority resulted in higher levels of injury to lentil in a re-cropping situation. The current recommendation for lentil re-cropping is 36 months following Authority application. Therefore, re-cropping lentil 12 months after application is extremely risky; however, it provides a worse case scenario to determine if the two herbicides could result in additive re-cropping injury. Lentil re-crop studies were conducted in 2010 and 2011.

It was decided to include the results from the 2008 chickpea studies and 2 studies conducted in field pea at Scott and Lethbridge in 2009. Including these studies provides additional data for drawing conclusions.

Weed control efficacy summary:

- Both chickpea and field pea had excellent tolerance to Heat and Authority combinations.
- Adding Heat to Authority improved wild mustard control compared to Authority alone in 4 out of 5 trials where wild mustard was present.
- Adding Heat to Authority improved kochia control in 4 of 5 trials where kochia was present. In 2 of the cases, the improvement in kochia control was when Authority rate was reduced.
- Wild buckwheat and redroot pigweed control was improved in 5 of 6 and 3 of 3 trials, respectively when Heat was added to Authority. In 2 of the 3 trials where redroot pigweed was present, adding Heat to a reduced rate of Authority resulted in acceptable control.
- Stinkweed control was improved with the addition of Heat to Authority in 2 of 2 trials.

Lentil re-cropping

- In 2011, none of the treatments resulted in unacceptable injury to the lentil or a reduction in lentil seed yield at both locations.
- In 2010, there was some indication that adding Heat to the highest rate of Authority tested (140 g ai ha^{-1}) resulted in higher levels of visual injury than Authority alone. However, none of this resulted in reduced lentil yields.

Further research is required to refine the rates of Authority / Heat combinations under different soil and climatic conditions. However, there is enough evidence from this research to suggest growers apply 36 g ai ha^{-1} of Heat with label rates of Authority to provide broad-spectrum weed control in chickpea. The addition of 36 g ai ha^{-1} to Authority may be beneficial in field pea production if Group 2 broadleaf weeds are problematic.

Acknowledgements

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Persistence of cow cockle in the soil

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Cow cockle has been investigated as a potential crop for the Prairies. Since it can also be a weed, research is required to understand its biology. It is unknown how long the seed can persist in the soil so a study was initiated in the fall of 2008 to answer the following questions:

How persistent is the seed in the soil?
Is there a difference in persistence between semi-domesticated seed (known as Prairie Carnation) and wild cow cockle seed?
Does tillage system have an impact on persistence?

Semi-domesticated Prairie Carnation and wild cow-cockle seed were broadcast in the fall of 2008 at rates of 1200 seeds m^{-2}. These rates were based on estimates of harvest losses from field scale plots grown at Scott. The study is a 2 x 2 factorial with seed source (semi-domesticated and wild cow cockle seed) as one factor and tillage system (spring pre-seed tillage and zero tillage) as the second factor. Treatments were replicated 6 times. The site was seeded to spring wheat, Roundup ready canola, and barley in 2009, 2010, and 2011, respectively. The zero-till treatments received a pre-seed glyphosate application while the spring pre-seed tillage plots received one cultivator pass prior to seeding. In-crop broadleaf weed control consisted of registered rates of Refine SG, Roundup, and Buctril-M in the wheat, canola, and barley, respectively.

Prairie Carnation and cow-cockle plants were counted in the treatments four times during the growing season. Plants were counted just prior to spring tillage or glyphosate burnoff; in-crop prior to post-emergence spraying; 3 weeks after herbicide application; and post-harvest. Plants surviving the post-emergence application are removed after counting so they don't produce seed and return fresh seed to the seedbank.

Results from Scott are shown in Tables 1, 2, and 3. In 2009, plant numbers were very low prior to pre-seeding tillage or pre-seed glyphosate application (less than 1 plant m^{-2}) and there was no difference between seed source or tillage system (Table 1). At the second counting date (prior to in-crop herbicide), the spring tillage plots had much higher numbers than the zero-till plots. Plant counts were similar between seed sources. Post in-crop spraying counts were low, with respective counts of 4 and 2 plants m^{-2} in spring tilled and zero till plots, respectively. There were no surviving plants post-harvest in any of the plots indicating that late season germination and emergence of plants did not occur.

In 2010, there were no plants emerged prior to spring tillage or pre-seed burnoff (Table 2). As in 2009, the highest numbers of plants were present just prior to in-crop herbicide application. Both seed source and tillage system had an effect on plant counts at this time. The density of wild cow-cockle plants was nearly 4 times as high as the density of the semi-domesticated Prairie Carnation plants. Tillage system had a reverse effect in 2010 compared to 2009 with the zero-till plots having slightly higher numbers of plants compared to spring-tilled plots. Post in-crop spraying counts were low with the zero-till plots having slightly higher densities than the spring-tilled plots. As in 2009, no plants were present post-harvest.

Unlike 2009 and 2010, plants emerged prior to pre-seed burndown in 2011 (Table 3). There was no statistical difference between Prairie carnation and wild cow cockle emergence with pre-burndown densities of 5 to 7 plants m^{-2}. Zero-till had statistically higher densities (7 vs. 4 plants m^{-2}) than spring-tilled plots; however, this difference would be of little biological significance. Prairie Carnation densities were slightly higher than cow cockle densities prior to the in-crop herbicide stage. Zero-till densities were also higher than pre-seed till densities. The herbicide effectively controlled volunteer plants and there were no plants present post-herbicide or post-harvest.

Conclusions

This experiment is also being conducted at AAFC Lethbridge and the University of Saskatchewan. This study is part of a project for a PhD candidate at the University of Saskatchewan. Only the Scott results are presented in this report. In all years of the study, highest emergence of both cow-cockle and Prairie Carnation occurred just prior to in-crop spraying; however, pre-seed control was important in the spring of 2011. This indicates the importance of in-crop herbicide application for controlling volunteers and minimizing the number of live plants contributing new seed to the seedbank.

Soil samples were taken in the fall of 2011. The number of seeds remaining after in the seedbank will be determined in the lab. It is interesting to note that viable seed was still present after 2 years of cropping with excellent weed control indicating that both the semi-domesticated and wild cow-cockle possesses some dormancy.

Table 1 Effect of seed source and tillage system on number of Prairie Carnation and cow cockle plants in spring wheat. Scott, 2009.

2009 Results	Plants m^{-2} Pre-spring tillage or Pre- burndown	Plants m^{-2} Pre- In-crop herbicide	Plants m^{-2} Post In-crop herbicide	Plants m^{-2} Post Harvest
SEED SOURCE				
Semi-domesticated Prairie Carnation	<1	54	4	0
Wild Cow Cockle	<1	65	4	0
TILLAGE SYSTEM				
Spring pre-seed tillage	<1	110	5	0
Zero tillage	<1	8	2	0
P values				
Seed Source	NS*	0.0001	NS	NS
Tillage System	NS	NS	0.0069	NS
Seed Source X Tillage System	NS	NS	NS	NS

Table 2 Effect of seed source and tillage system on number of Prairie Carnation and cow cockle plants in Roundup ready canola. Scott, 2010.

2010 Results	Plants m^{-2} Pre-spring tillage or Pre- burndown	Plants m^{-2} Pre- In-crop herbicide	Plants m^{-2} Post In-crop herbicide	Plants m^{-2} Post Harvest
SEED SOURCE				
Semi-domesticated Prairie Carnation	0	28	3	0
Wild Cow Cockle	0	83	3	0
TILLAGE SYSTEM				
Spring pre-seed tillage	0	44	2	0
Zero tillage	0	66	4	0
P values				
Seed Source	NS*	0.0001	NS	NS
Tillage System	NS	0.03	0.0007	NS
Seed Source X Tillage System	NS	NS	NS	NS

Table 3: Effect of seed source and tillage system on number of Prairie Carnation and cow cockle plants in barley. Scott, 2011.

2011 Results	Plants m^{-2} Pre-seeding tillage or Pre-burndown	Plants m^{-2} Pre- In-crop herbicide	Plants m^{-2} Post In-crop herbicide	Plants m^{-2} Post harvest
SEED SOURCE				
Semi-domesticated Prairie Carnation	6	10	0	0
Wild Cow Cockle	5	5	0	0
TILLAGE SYSTEM				
Spring pre-seed tillage	4	4	0	0
Zero-Tillage	7	10	0	0
P values				
Seed Source	NS*	0.002	NS	NS
Tillage System	0.02	0.0002	NS	NS
Seed Source X Tillage System	NS	NS	NS	NS

Participatory wheat breeding on the Prairies

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Participatory Plant Breeding (PPB) is a dynamic collaboration between breeding institutions and farmers. The objective is to involve farmers in the breeding process and develop varieties that are locally adapted, accessible to farmers, and also to help maintain genetic diversity. Successful examples from around the world have produced varieties of crops ranging from field crops to fruits and vegetables. A participatory approach to organic variety breeding may be particularly beneficial to organic farmers due to the heterogeneous nature of organic farms.

In 2010, a Participatory Plant Breeding program for spring wheat (*Triticum aestivum* L.) was initiated by the University of Manitoba in collaboration with Agriculture and Agri-Food Canada (AAFC). The objective was to involve farmers in the wheat breeding process by providing early generation breeding material and have the farmers make selections on their own farm. In 2011, participants were located in Manitoba and Saskatchewan, including the Scott Research Farm. In the spring, participants were mailed three different populations of F3 seed to be seeded as 25 m^2 plots on their respective farms. Farmers were asked to seed, maintain, and harvest their plots, as well as make selections throughout the growing season. Ultimately, the participants took different approaches to their plots. For example, some visited their plots regularly and actively eliminated poor plants, while others did not make selections throughout the season and chose to bulk harvest the plots.

The program will continue on-farm, with farmers and researchers maintaining their own plots by seeding the F4 and F5 populations. At the F6, the seed will be returned to the University of Manitoba and AAFC to be assessed in yield trials, with the goal of producing a registered variety. This participatory plant breeding program for spring wheat is still in its early stages and the potential registration of a variety will not be for another few years. However, the interest generated by the program indicates that farmers are interested in being involved in the breeding process.

Acknowledgements

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Regional testing of cereal, oilseed and pulse cultivars 2011

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Cultivars are tested regionally to determine their adaptation to the wide range of soil and climatic conditions in Saskatchewan. These tests are conducted at approximately 12 locations each year including two by Scott Research Farm staff (Scott and Glaslyn) and one at the Melfort Research Farm. Results for the basic of cultivar recommendations – yield data can help producers assess the performance of varieties in their area. However, data from a single location can be limited, particulartly for new varieties. More comprehensive information is contained in the Saskatchewan Ministry of Agriculture publication, *Varieties of Grain Crops 2012*. Seed quantities for new varieties listed herein may be limited for 2012.

Table 1 Average yield of crop species on fallow expressed as a % of hard red spring wheat (AC Barrie) at Scott, Glaslyn and Melfort. For most crops, data presented is based on yields averaged over the past 15-20 years. Only 3 years data are averaged at Glaslyn.

Species	Cultivar	Scott		Glaslyn		Melfort	
		Yield at a % of bread wheat (kg/ha)					
Bread Wheat	AC Barrie	100	(3480)	100	(4132)	100	(3916)
Utility Wheat	AC Andrew	136	(4742)	128	(5391)	129	(5067)
Extra Strong Wheat	Burnside	121	(4225)	106	(4978)	102	(3979)
Durum Wheat	Strongfield	117	(4081)	---		107	(4190)
Triticale	AC Certa	125	(4350)	---		139	(5435)
Barley	AC Metcalfe	133	(4626)	136	(5268)	125	(4903)
Oat	CDC Dancer	154	(5363)	130	(5545)	133	(5200)
Canola	46A65	*88	(3058)	*58	(2407)	88	(3446)
Flax	CDC Bethune	*55	(1914)	*53	(2141)	54	(2103)
Mustard (Juncea)	Cutlass	*79	(2742)	---		----	
Mustard (Alba)	AC Pennant	*53	(1848)	---		---	
Field Pea	Cutlass	68	(2362)	101	(3970)	100	(3920)
Lentil	CDC Milestone	56	(1938)	---		45	(1747)

Table 2 Yield of spring wheat cultivars at Scott, Glaslyn and Melfort 2011.

	2011 Yield (kg/ha)			Long Term Average Yield (% of AC Barrie)		
	Scott	Glaslyn	Melfort	Scott	Glaslyn	Melfort
Bread Wheat						
AC Barrie	2749	3909	5910	100	100	100
Carberry	3437	4617	5620	113	118	93
Fieldstar VB	3793	4458	5997	109	111	103
Glenn	3893	4682	6306	109	121	101
Goodeve VB	3487	4539	5634	107	109	102
Muchmore	3297	4645	5644	108	117	93
Shaw VB	3983	5097	6215	113	121	112
Stettler	3408	5150	6166	111	119	106
Unity VB	3859	4979	6291	114	111	111
Waskada	3681	4537	5726	109	107	102
CDC Utmost VB	3693	4544	5769	103*	101*	106*
CDC Stanley	3455	3211	5842	110*	87*	103*
CDC Kernen	3505	4793	6252	102*	109*	106*
CDC Thrive	3487	4574	5897	107*	103*	104*
Utility Wheat						
AC Andrew	4291	6001	7079	136	130	129
Burnside	3228	5988	5971	121	120	100
Glencross VB	-------	-------	-------	124*	120*	110*
Minnedosa	3747	5644	5824	121	124	104
Sadash	5201	6389	6828	150	150	121
CDN Bison	3383	5918	7003	121	128	111
5702PR	4089	5330	6291	131	126	112

*less than 3 years of data

Table 3 Yield of durum cultivars at Scott and Melfort 2011.

	2011 Yield (kg/ha)		Long Term Average Yield (% of Strongfield)	
	Scott	Melfort	Scott	Melfort
Strongfield	3802	6834	100	100
Brigade	3945	6787	95	99
CDC Verona	3518	6078	98	98
Enterprise	3227	6389	93	97
Eurostar	3597	7029	96	111
Transcend	3578	6654	88*	98*

*less than 3 years of data

Table 4 Yield of oat cultivars at Scott, Glaslyn and Melfort 2011.

	2011 Yield (kg/ha)			Long Term Average Yield (% of CDC Dancer)		
	Scott	Glaslyn	Melfort	Scott	Glaslyn	Melfort
CDC Dancer	6411	6758	7643	100	100	100
Bradley	6274	6225	7557	101	101	105
CDC Big Brown	6055	6816	7973	113*	123*	104*
CDC Minstrel	6536	5755	7314	106	103	102
CDC Nasser	6823	6698	8100	127	121	106*
CDC Seabiscuit	6660	6321	7578	126	132	104*
Souris	6041	6025	7396	120	119	107*
Summit	6365	6387	7340	113	110	106
SW Triactor	7374	7557	8736	119	113	130

* Less than 3 years of data

Table 5 Yield of barley cultivars at Scott, Glaslyn and Melfort 2011.

	2011 Yield (kg/ha)			Long Term Average Yield (% of AC Metcalfe)					
	Scott	Glaslyn	Melfort	Scott		Glaslyn		Melfort	
Two Row									
AC Metcalfe	4485	5687	6528	100		100		100	
Bentley	6256	6892	6609	124		124		111	
Busby	5225	6168	6591	110		117		106	
CDC Austenson	7089	7725	7871	139		140		121	
CDC Carter	5251	6019	6850	114		109		107	
CDC ExPlus	4573	5099	7425	106	*	85	*	111	*
CDC Kindersley	5541	6235	7288	116	*	98	*	112	*
CDC Landis	5762	6096	7349	122		121		115	
CDC Meredith	5912	6568	6679	131		127		108	
CDC PolarStar	5636	6253	6971	122	*	119	*	107	*
CDC Reserve	5527	6709	6200	123		122		110	
Cerveza	6407	6925	7704	143	*	108	*	120	*
Major	6627	6449	7260	137	*	122	*	120	*
Gadsby	6359	6657	6969	124	*	118	*	111	*
Merit 57	5891	6757	6342	127		126		107	
Norman	5888	6291	7091	122		116		108	
Six Row									
Celebration	5470	6351	7538	127	*	103	*	104	*
CDC Anderson	5266	5919	7148	111	*	99	*	109	*
CDC Mayfair	5514	6181	6617	118		117		109	
Chigwell	6020	6530	6611	126		127		114	
Stellar ND	5129	6229	7976	114	*	100	*	124	*

* Less than 3 years of data

Table 6 Yield of flax cultivars at Scott, Glaslyn and Melfort 2010.

	2010 Yield (kg/ha)			Long Term Average Yield (% of CDC Bethune)					
	Scott	Glaslyn	Melfort	Scott		Glaslyn		Melfort	
CDC Bethune	1926	2776	2320	100		100		100	
CDC Sanctuary	1877	2927	2000	79	*	127	*	86	
FP2214	1311	2505	2190	55	*	108	*	95	*
CDC Sorrel	-----	2430	------	97		97		93	*

*Less than 3 years of data

Table 7 Yield of lentil cultivars at Scott and Melfort 2011.

	2011 Yield (kg/ha)		Long Term Average Yield (% of CDC Milestone)	
	Scott	Melfort	Scott	Melfort
Small Green				
CDC Milestone	925	2743	100	100
CDC Imvincible	1493	3380	132	125
Eston	653	2460	87	95
Medium Green				
CDC Imigreen CL	600	2335	84	89
CDC Impress CL	620	2784	96	97
French Green				
CDC Peridot	670	3027	104	100
Large Green				
CDC Greenland	583	3109	87	101
CDC Impower CL	146	2078	86	73
CDC Improve CL	348	2433	83	93
CDC Plato	89	1961	95	96
3339-3	857	3178	86*	116*
Extra Small Red				
CDC Impala CL	1429	2752	116	101
CDC Imperial CL	1235	2178	93	88
CDC Redbow	1689	3343	121	143
CDC Robin	1253	2322	93	97
CDC Rosebud	1487	3339	119	148
CDC Rosetown	1271	3260	119	121
Small Red				
CDC Imax CL	926	2467	103	84
CDC Impact CL	976	2638	86	93
CDC Maxim CL	1921	3663	123	136
CDC Redberry	1383	3452	107	120
Redcoat	1043	3786	118	112
Large Red				
CDC KR-1	893	3777	143*	123*

* Less than 3 years of data

Table 8 Yield of pea cultivars at Scott, Glaslyn and Melfort 2011.

	2011 Yield (kg/ha)			Long Term Average Yield (% of Cutlass)		
	Scott	Glaslyn	Melfort	Scott	Glaslyn	Melfort
Yellow						
Cutlass	1406	2341	6398	100	100	100
Agassiz	2803	4746	7459	124	124	107
Argus	2313	3498	6486	121*	96*	110*
CDC Golden	2067	2691	7276	115	98	104
CDC Hornet	1699	3046	7641	98	94	112*
CDC Meadow	1848	2831	5654	108	110	105
CDC Prosper	1237	1415	6823	98	97	100
CDC Saffron	2021	3145	6914	118	98	108*
CDC Treasure	2469	3380	7473	116	112	108
Hugo	2735	4296	7778	133*	103*	116*
Polstead	1869	2946	6751	114	109	103
Sorento	2131	3173	7494	100	100	96
Stella	3350	3577	5417	118*	79*	92*
Green						
CDC Patrick	2331	3969	6442	118	107	91
CDC Pluto	2738	3460	6368	101*	108*	101*
CDC Striker	2618	3018	6219	115	96	95
CDC Tetris	2089	3703	7676	119*	114*	113*
Cooper	2418	3865	8332	112	106	100

* Less than 3 years of data

Hybrid poplar and willow demo

Little was done to the hybrid popular and willow demonstration in 2011. The only activities were maintenance activities such as weeding and mowing around the trees.

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