Western Applied Research Corporation

2014 Annual Report

Summary of Research Results and Events

Compiled by: Mat Vercaigne (Research Associate) & Gazali Issah, (Research Manager)-WARC February 2015

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, Yorkton, Swift Current, Prince Albert, Melfort and Outlook.

Board of Directors

Don Karstens	Wilkie, SK
Blaine Davey	Wilkie, SK
Rob Florence	Battleford, SK
Tim Nerbas	Maidstone, SK
Carol Baillargeon	Edam, SK
Ian Sonntag	Goodsoil, SK
Sheldon Stang	Unity, SK?

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Sherrilyn Phelps	Agronomy and Seed Program Manager, Saskatchewan Pulse Growers
Larry Sproule	Technician, WARC (summer)
Herb Schell	Technician, WARC (summer)
Dan Ulrich	Minor Use Program, AAFC Scott
Arlen Kapiniak	Technician, AAFC Scott
Lorne Nielsen	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.

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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.

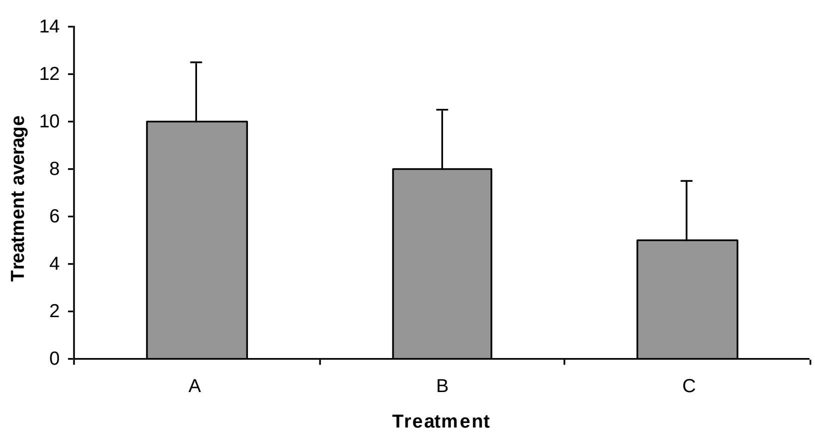

Figure 1 A statistical example using error bars on treatment averages to denote significant differences.

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, SK 2013

Soil Information:
Dark Brown Chernozemic (Typic Boroll)
Association: Scott, Elstow, Weyburn
Texture: Loam

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

Organic Matter: 3%
Soil pH: 6.0

Table 1. Mean monthly temperature, precipitation and growing degree day accumulated from April to August at Scott, SK

Year	April	May	June	July	August	Sept.	Average /Total
	---------------Temperature (°C)---------------						
2014	2.0	9.2	13.8	17.4	16.6	11.2	11.8
Long-term[z]	3.8	10.8	15.3	17.1	16.5	10.4	12.7
	---------------Precipitation (cm)---------------						
2014	41.2	23.1	60.4	128.0	30.1	23.6	282.8
Long-term[z]	21.6	36.3	61.8	72.1	45.7	36.0	237.5
	---------------Growing Degree Days---------------						
2014	17.3	144.5	264.8	384.5	363.4	188.0	1362.5
Long-term[z]	0.0	178.3	307.5	375.1	356.5	162.0	1379.4

[z]Long-term average (1981-2010)

Last spring frost: May 14, 2014
First fall frost: September 12, 2014

Extension Events

Field Days:

- Scott Field Day, July 1, 2014, ~250 people in attendance

Winter Meetings:

- American Society of Agronomy Conference (Long Beach, CA, USA), November 1-6, 2014
- Canola Discovery Forum(Saskatoon), November, 2014
- Agri-Trend Digital Farm Forum (Saskatoon), December 3 & 4, 2014
- Crop Production Show Booth (Saskatoon), January 12-15, 2015
- Agri-ARM Research Update (Saskatoon), January 15, 2015, ~80 people in attendance
- Crop Sphere (Saskatoon), January 13 & 14, 2015
- Regional Pulse Update (North Battleford), February 2, 2015
- Crop Opportunity and Scott Research Update (North Battleford), March 5, 2014, ~100 people in attendance
- Soils and Crops Workshop (Saskatoon), March 11, 2014
- CanoLAB (Brandon), March 12 & 13, 2014
- Agriculture Information Day (Meadow Lake), March 19, 2014
- Master Seeders Knowledge Event (Regina), March 21, 2014
- Crop Talk (Prince Albert), March 25, 2014
- TopNotch Farming (Melfort), March 27, 2014

2,4-D preceding canola, lentil and pea

Authors & Affiliations: Tristan Coelho, Laryssa Grenkow – Western Applied Research Corporation

Background & Objectives:

Results:

Conclusions:

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

Quantifying pod drop/ shattering resistance amongst canola cultivars

Authors & Affiliations: Chris Holzapfel- Indian Head Agriculture Research Foundation, Laryssa Grenkow, Gazali Issah- Western Applied Research Corporation, Bryan Nybo- Wheatland Conservation Area Inc., Stu Brandt- Northeast Agriculture Research Foundation

Background & Objectives:

Results:

Conclusions:

Acknowledgements: Funding provided through SaskCanola.

Mitigating blackleg disease of canola using fungicide strategies

Authors & Affiliations: Laryssa Grenkow, Gazali Issah – Western Applied Research Corporation

Background & Objectives: *Objectives*: To determine best management practices for blackleg control using currently registered fungicides and to detect fungicide insensitivity in the pathogen.

Results:

Conclusions:

Acknowledgements:

Seeding rates for precision seeded canola- done

Authors & Affiliations: Laryssa Grenkow, Gazali Issah – Western Applied Research Corporation, Gary Peng- AAFC Saskatoon

Background & Objectives:

Results:

Conclusions: Funding provided through SaskCanola.

Acknowledgements:

Wheat fungicide timing

Authors & Affiliations: Laryssa Grenkow, Gazali Issah – Western Applied Research Corporation

Background & Objectives: Recently, the incidence of leaf disease and fusarium head blight (FHB) have risen in Saskatchewan. The increase in cereal diseases has resulted in increased fungicide use. The optimum timing of fungicide application from control of leaf spotting diseases is flag leaf stage, while the optimum timing for suppression of FHB is at early flowering. Although optimum fungicide timing differs, producers are interested in the effects of a single fungicide application to control both leaf spotting diseases and FHB. Environmental conditions may also delay fungicide application past optimum timing, so a demonstration comparing fungicide application at various times is of interest to producers. Hard red spring wheat cultivars differ genetically in their resistance to fungal pathogens, and the benefits of fungicide application differ between cultivars. Fungicide application on cultivars with good leaf spot resistance will provide less benefit than the same fungicide applied on leaf spot susceptible cultivars. This project would demonstrate the effects of fungicide timing on leaf spot disease and FHB on two wheat cultivars. Two cultivars differing in their response to fungal pathogens will be used to demonstrate the benefits of planting cultivars with greater disease resistance. Shaw VB has poor resistance to both leaf spotting disease and FHB while Unity VB has good resistance to both leaf spotting disease and FHB.

The objective of this project was to demonstrate the effect fungicide timing on leaf spot diseases and fusarium head blight on spring wheat. A second objective was to demonstrate the benefit of planting cultivars with improved disease resistance.

Results: *Plant Disease Ratings*

Scott did not observe heavy levels of leaf spot disease (tan spot, septoria) in our plots in 2014. Disease ratings conducted on July 10 reported very minimal levels of disease on the flag leaf (< 1 %), as well, low to moderate (11-40 %) level of disease in the lower canopy. Disease severity was not affected by crop variety. Disease ratings conducted one week later showed slightly higher levels (25-50 %) of leaf spot disease in the lower canopy. Flag leaf disease levels did not change from the first rating. We did not witness increased control of leaf spot diseases on either wheat variety when comparing the control check to the fungicide timing application at the fully emerged flag leaf stage. We believe we did not see increased control from the foliar fungicide because the levels of leaf spot diseases were very minimal in the plots.

Fusarium head blight was detected at our site, however, the level of incidence was relatively low compared to other areas of the province in 2014. No differences in FHB incidence were observed between the two wheat varieties. Fungicide treatments did not seem to have an effect on FHB incidence or severity when compared to the control treatment. Although other areas of Saskatchewan saw extremely high levels of FHB in 2014, the same environmental conditions conducive of high FHB levels did not seem to be apparent in the NW corner of the province.

Grain Yield

Grain yields at Scott did not differ between the two varieties (*P* = 0.0626), as well, the effect yield was similar for the two varieties with no variety (V) x fungicide (F) interaction detected (*P* = 0.4615). However, grain yield was affected by varying fungicide treatments (*P* < 0.0001). An overall variety effect (*P* = 0.0004) and fungicide effect (*P* = 0.0314) were detected on test weight. Fungicide timing (*P* < 0.0001) also affected thousand kernel weight. The V x F interaction did not affect test weight or thousand kernel weight. Fusarium damaged kernels were not significantly affected by the treatments, but the overall variability in this measurement was high and the percentage of fusarium damaged kernels was low.

Table 3. Tests of fixed effects and model fit statistics for selected response variables in ADOPT
Spring wheat fungicide timing demonstration at Scott in 2014.

Source	Grain Yield	1000 Seed Weight	Test Weight	Fusarium Damage
	------------	--------p-value---------		------------
Variety (V)	0.0626	0.3774	0.004	0.7465
Fungicide (F)	<0.0001	<0.0001	0.0314	0.4985
V x F	0.4615	0.1541	0.9392	0.42

Spring wheat yields were well above average at Scott in 2014. The averaged fungicide treatments ranged from 5388-5642 kg ha^{-1} whereas the untreated controls averaged 4177 kg ha^{-1}. All three fungicide treatments were statistically different from the control treatment. The test weight was statistically different between the two wheat varieties (Unity 79.0 kg/hL, Shaw 77.7 kg/hL), whereas the thousand kernel weight was not. Fungicide treatments did statistically affect test weight and TKW. Both T2 fungicide treatments differed from that of the control with respect to test weight, whereas all three fungicide treatments statistically had a higher TKW when compared to the control. All three of the fungicide treatments increased yield substantially over the control treatment. The flag leaf timing resulted in a higher than expected yield increase compared to what has been observed in previous years (Holzapfel, 2013-Appendix C). Although the flag leaves had relatively low amount of disease pressure, the lower/ middle sections of the canopy had moderate levels of leaf disease. Head timing was as effective as the flag leaf treatment, but only had a yield increase of 1 % higher when compared to the flag leaf treatment. The treatment that had both flag leaf and head timing applications was our highest yielding treatment at 5642 kg ha^{-1}. Although the treatment yielded 6 % and 5 % higher when compared to the flag timing and head timing treatments alone, respectively, the added cost of making two passes across the field and the combined cost of the two fungicides would likely not be economically justifiable in a field situation.

Table 4. Least squares means and multiple comparisons tests for selected response variables in ADOPT spring wheat fungicide timing demonstration at Scott in 2014. Means within a column followed by the same letter do not significantly differ.

Source	Grain Yield		1000 Seed Weight		Test Weight		Fusarium Damage
Variety							
Unity	5258		33.0		77.7	b	0.07
Shaw	5059		33.3		79.0	a	0.08
Fungicide							
Untreated	4177	b	31.1	c	77.5	b	0.08
T1	5388	a	34.4	a	78.3	ab	0.11
T2	5427	a	32.6	b	78.6	a	0.05
T1 + T2	5642	a	34.6	a	79.0	a	0.07

Conclusions: While weather conditions during the 2014 growing season in Saskatchewan were conducive to the development of cereal, particularly for fusarium head blight, Scott did not observe the same environmental conditions that caused significant FHB infection. Although we did not observe a high level of FHB infection and leaf disease in our trial, our three fungicide timings had a reasonably strong response on wheat yields. Both varieties in this trial, Shaw VB and Unity VB responded similarity to all fungicide treatments as well responded the same as the untreated control. The averaged maximum yields were 29 % (5388 kg ha^{-1}) for the flag leaf treatment over the control, 30% (5427 kg ha^{-1}) for the head timing treatment over the control, and 35% (5642 kg ha^{-1}) for the combination treatment over the control. We observed a relatively large grain yield increase from all three fungicide treatments, however, this is not a typical response that has been found in other studies (Holzapfel, 2013-Appendix C).

Based on the results of this demonstration and other studies, the probability of dual fungicide applications being economically viable for spring wheat in Saskatchewan is relatively low. Fungicide applications targeting fusarium head blight will also provide protection against leaf spot disease and give the most consistent yield benefits. This may offer potential advantage of reducing the risk of grade reduction when high levels of FHB are encountered. In cases where leaf disease symptoms develop early and have potential to cause significant damage to the flag leaf prior to head emergence, the earlier fungicide application may be warranted; however, the early flowering timing seem to provide the most consistent results when combining the data from this year and previous years.

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

Winter wheat establishment and disease management

Authors & Affiliations: Chris Holzapfel- Indian Head Agriculture Research Foundation, Laryssa Grenkow, Gazali Issah – Western Applied Research Corporation

Background & Objectives: One of the greatest challenges in winter wheat production is successful establishment and overwintering of the crop. Common problems that are encountered include narrow windows for planting, dry or cool soil conditions during and following planting and winterkill, particularly when snow cover is limited. One of the more obvious and effective methods of improving winter wheat establishment is to use higher seeding rates; however the benefits to increased seeding rates ultimately need to be weighed against higher seed costs. Recent work conducted as part of the winter wheat DIAP project showed that seed treatments were also effective for improving plant stands, winter survival and yield; however the positive effect for seed treatment on yield was only observed at low seeding rates. Winter wheat response to foliar fungicide applications is not well documented in western Canada; however, foliar fungicides may provide an economic method for control of leaf and head diseases in situations where moisture conditions are favourable and yield potential is high. Recent field demonstrations and producer accounts suggest winter wheat is quite responsive to foliar fungicide; however, producers must recognize the need to choose an appropriate product and application timing for the specific disease that is being targeted.

Results:

Conclusions:

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