

# **2019 PESAI ANNUAL REPORT**



**PESAI**

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## 2019 Public / Industry Partners

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Agassiz Soil & Crop Improvement Association, Beausejour

Agriculture and Agri-Food Canada, Portage la Prairie

Agriculture and Agri-Food Canada, Ottawa

Canada Manitoba Crop Diversification Centre

Canola Council of Canada

BASIC Arborg

Nutrient Ag Solutions

Hemp Genetics International

Manitoba Corn Growers Association

Manitoba Crop Variety Evaluation Team

Manitoba Pulse & Soybean Growers Association

Manitoba Agriculture and Resource Development

Parkland Crop Diversification Foundation

Parkland Industrial Hemp Growers

Seed Manitoba

University of Manitoba

University of Saskatchewan

Westman Agricultural Diversification Organization Inc.

Ducks Unlimited

Montra Crop Science



## Who we are?

Prairies East Sustainable Agriculture Initiative Inc. (PESAI) is a not-for-profit organization (incorporated December 2005) serving the Eastern Prairie region of Manitoba. It is one of four Manitoba Diversification Centres, including Parkland Crop Diversification Foundation (PCDF) – Parkland Region, Westman Agriculture Diversification Organization (WADO) – Southwest Region and Canada-Manitoba Crop Diversification Centre (CMCDC) – Central Region.

This initiative is the product of a partnership between the agricultural community of Interlake / Eastern Manitoba and Manitoba Agriculture & Resource Development. PESAI's objective is to support innovation, diversification and value-added opportunities in the Eastern and Interlake areas. PESAI receives the majority of its funds from the Agricultural Sustainability Initiative and Canadian Agricultural Partnership programs. Additional funding comes from the MCVET committee and other Industry partners for the contract plot work that PESAI is able to provide to these organizations.

Headquartered in Arborg, PESAI also does field research at Beausejour site. PESAI focuses on applied field research, innovation, diversification, value-added, advanced technology, market development and sustainability initiatives that directly benefit local area producers. The research results are communicated by various extension programs such as plot demonstrations; crop tours, seminars and workshops, annual reports & DC's website.

*Table 1. PESAI/Manitoba Ag Staff during 2019 crop season.*

Diversification Specialist	Nirmal Hari	Manitoba Agriculture and Resource Development
Diversification Technician	James Lindal	Manitoba Agriculture and Resource Development
Diversification Technician	Britney Gilson	Manitoba Agriculture and Resource Development
Summer Research Assistant	Kate LeTexier	PESAI
Summer Technician	Eugene Delorme	PESAI
Summer Research Assistant	Arik Lindal	PESAI
Summer Research Assistant	Maggie Melnychuk	PESAI



*Left to Right: James Lindal, Arik Lindal, Eugene Delorme, Kate LeTexier, Britney Gilson, Nirmal Hari  
Missing: Maggie Melnychuk*

### Board of Directors: 2019-2020

An elected Board comprised of agricultural producers and entrepreneurs from the Eastern Prairie region directs PESAI activities. Staff from Manitoba Agriculture and Resource Development helps to carry out PESAI activities.

*Table 2. PESAI Board of Directors during 2019-2020.*

<b>Chair</b>	<b>Adrien Grenier</b>	<b>Woodridge</b>	<b>204-429-2058</b>
Vice Chair	Wayne Foubert	St. Anne	204-232-5069
Secretary	Linda Loewen	Arborg	204-376-2809
Treasurer	Andy Buehlmann	Riverton	204-378-2771
Director	Heinspeter Pausenwein	Whitemouth	204-348-7040
Director	Tim Shumilak	East Selkirk	204-482-5166
Director	Brian Kurbis	Beausejour	204-268-0239
Director	David King	Arborg	204-642-2695
Director	Scott Duguid	Arnes	204-641-4806

For more information about PESAI, please visit [www.mbdiversificationcentres.ca](http://www.mbdiversificationcentres.ca).

## PESAI Extension Activities (2019-2020)

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### Background/Objectives

PESAI does extension events every year with the objectives-

- (1) to raise awareness of PESAI in the Eastern and Interlake areas of Manitoba, including their mandate, capabilities, resources, partnership opportunities, and projects; and
- (2) to increase PESAI membership.

### Project Activities

Manitoba Agriculture & Resource Development (MARD) staff assisted PESAI in all aspects of this project, including:

- PESAI organized a Crop Tour at PESAI site on July 18, 2019 where 35 people attended. Experts from MARD and industry spoke at the tour (Table 1) related to various research topics.
- PESAI held a MCVET cereals tour on August 2, 2019 where 11 people attended. An expert from MARD spoke about the research trials and the different varieties.
- ASCIA held a MCVET cereals tour at Beausejour site on August 13, 2019 where 25 people attended. Experts from MARD and industry spoke at the tour related to various research topics including pest control.
- A soybean research tour was organized at PESAI plot site in Beausejour on September 4, 2019 where 25 people attended. Soybean variety selection and soybean agronomy were discussed during the tour.
- PESAI manned a booth entitled “Manitoba’s Diversification Centres” at Ag Days 2020, with its counter-parts from other areas of the province: Parkland Crop Diversification Foundation (PCDF) – Parkland Region, Westman Agricultural Diversification Organization (WADO) – Southwest Region and Canada-Manitoba Crop Diversification Centre (CMCDC) – Central Region.
- PESAI had a booth at Crop Connect Conference 2020 with PCDF, WADO and CMCDC. About 25 persons from other agricultural organizations and industry interacted with PESAI staff on various research topics.
- An announcement of PESAI’s project submission deadline and AGM was advertised in Eastern and Interlake areas, as well as on social media.
- PESAI’s 2019-20 Annual Report was compiled by MARD support staff and distributed to PESAI Directors, Members, project partners and MARD extension staff.
- Ag Days 2020 was a success for PESAI and the other Diversification Centres. Many people stopped by the Diversification Centre booth where we featured a common display

banner for all DCs (PESAI, WADO, PCDF, CMCDC), alternative crop seed samples and pamphlets, hemp products, and various other display material.

- PESAI tweeted for 19 times about its research and extension activities on social media.

*Table 1: The speakers and topics covered at PESAI Crop tour were as follows:*

<b>Speaker</b>	<b>Topic</b>
Michael Erb, U of M	Intercropping in the Interlake
Kevin Shale, Montra Crop Science	Use of Organic Acids on Canola
Dr. Nirmal Hari, MARD	BMP Flax and Grain Corn
Dr. Ranjan, U of M	Tile Drainage in Interlake

*Table 2: The speakers and topics covered at Cereal and Soybean Research tours (in Beausejour) were as follows:*

<b>Speaker</b>	<b>Topic</b>
John Gavloski, Provincial Entomologist, MARD	Strategies for Management of Grasshoppers, Cutworms, Armyworms, Aphids & Thistle Caterpillars
Rejean Picard, Farm Production Extension Specialist- Crops, MARD	Growing Wheat for Profit! Not just a break between Soybean Crops
Earl Bargaen, Farm Production Extension Specialist- Crops, MARD	Tours of: Spring Wheat MCVET, Oats MCVET and Barley MCVET
Tammy Jones, Provincial Weed Specialist, MARD	Tall Waterhemp- Strategies for Control
Cassandra Tkachuk, Production Specialist-East, MPSG	Review of the 2019 Soybean Growing Season – Challenges and Observations Review of MPSG Research Programming and Producer Resources
Dennis Lange, Provincial Pulse Specialist, MARD	Short Season Roundup Ready Soybean MCVET Steps for Selecting a Soybean Variety
Dennis Lange, Provincial Pulse Specialist, MARD	Conventional (Non-GMO) Soybean MCVET Steps for Selecting a Soybean Variety
Industry Partners	Soybean Variety Demonstrations

## Partner Project Reports

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*Project Reports for Partner-led Projects were submitted to PESAI by the Lead Partner listed. The information contained in the report was not verified.*

### Agriculture Awareness School Tour

**Lead Partner:** Gringo Hogs & Moonshadow Holsteins

**Allotted Funding from PESAI:** \$2000.0

**PESAI Funding Spent:** \$1363.31

**Contributors:** Manitoba Pork

#### Background/Objectives

Gringo Hogs and Moonshadow Holsteins are agricultural operations in the Eastman region of Manitoba. Since 2009, they have collaborated with local schools, PESAI, Manitoba Pork and others to increase students' agricultural knowledge through on-farm tours. **Many children do not know where their food comes from. This project allows school aged children, parents and supervisors to have a first-hand experience on a Manitoba dairy farm.**

#### Project Activities

Gringo Hogs and Moonshadow Holsteins hosted and toured two groups of students through their operations in June. Students from École Gabrielle-Roy (Ile-des-Chênes) and École Saint-Joachim (La Broquerie) schools toured on June 12 and 13, 2019. Approximately 120 students, teachers and accompanying parents participated in the tours. The students and adults were very interested in what they saw and were receptive to the agriculture facts that were presented to them. The students did not hesitate to ask questions.

Organizers had prepared take-home packages for the students and adults. Packages were filled with various informational and promotional items, which organizers were able to obtain from different agricultural organizations.

The highlights of the tours were the students being able to touch the animals, especially bottle-feeding the young calves. Some students were given a chance to try milking a cow by hand. Students were delighted to be able to climb into real farm tractors and touch farm equipment hands-on. The barbecue lunch promoting Manitoba-grown products was enjoyed by all participants. Over the lunch hour, the kids were educated about food products that were made



in part from pork and/or cattle by-products. Both students and adults were quite surprised to discover how many daily use food products comes from farm animals.

### **Results/Observations**

The tours were a wonderful success. Both groups had a great time and went back home with more knowledge and a better understanding of the farming. In order to assess the value of the tours, students were asked to fill a short questionnaire. Overall, the comments were positive.

### **Conclusions**

These tours provided opportunity to promote agriculture and help students experience how things are done at the farm level. It also increased their knowledge and awareness about origin of the food products. Gringo Hogs and Moonshadow Holsteins are planning to host the tours again next year.

## Weather Data 2019 – Arborg & Beausejour sites

*Table 1. Seasonal weather summary at Arborg site from May 1 – September 30, 2019*

	Actual	Normal	% of Normal
Growing degree days	1554	1510	103
Crop heat Units	2493	2616	95
Total precipitation (mm)	263	320	82

*Table 2. Seasonal weather summary at Beausejour site from May 1–September 30, 2019*

	Actual	Normal	% of Normal
Growing degree days	1514	1602	95
Crop heat Units	2530	2598	97
Total precipitation (mm)	348	340	102

Arborg site did receive significantly less rainfall compared to 2017 and 2018 seasons. In 2019 crop season, Arborg site received 55% of normal precipitation from May 1 to September 1. Arborg received a lot of rain in September increasing the normal precipitation to 82% of the normal. Beausejour did receive a normal amount of rainfall. However, similar to Arborg, most of the rainfall came in the month of September, which made soybean harvest difficult.

Growing degree-days (GDD) is a good indicator how crops will grow during the season. To calculate GDD, first determine the mean temperature for the day. This is usually done by taking the maximum and minimum temperatures for the day, adding them together and dividing by two. The base temperature (e.g. 0°C for cereals, 5°C for canola) is then subtracted from the mean temperature to give a daily GDD. If the daily GDD calculates to a negative number, it is made equal to zero. Each daily GDD is then added up (accumulated) over the growing season.

May was relatively a drier month. Arborg site received only 50% of the normal rainfall during seedling emergence period (May 13-June 13). September-October were relatively wet months and resulted in delayed harvesting of soybean and grain corn trials.

The beginning of May saw warm temperatures and the first seeding began May 13<sup>th</sup> in Arborg and May 9<sup>th</sup> in Beausejour. Due to land preparation at the soybean site in Beausejour the roundup ready soybean trial was written off, as plant stand was highly variable.

More information on current and seasonal weather conditions can be accessed at <https://www.gov.mb.ca/agriculture/weather/index.html>.

## Manitoba Crop Variety Evaluation Trials (MCVET Trials)

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PESAI is one of many sites that are part of the MCVET, which facilitates variety evaluations of many different crop types in this province. PESAI managed two MCVET sites (Arborg and Beausejour) during 2019 growing season.

The purpose of the MCVET variety evaluation trials is to grow both familiar (check varieties) and new varieties side by side in a replicated manner in order to compare and contrast various variety characteristics such as yield, maturity, protein content, disease tolerance, and many others.

During 2019, PESAI did variety trials in Spring Wheat, Oats, Barley and Soybeans (both Roundup Ready and Conventional) at both sites. Winter Wheat, Fall Rye, Peas, Silage Corn, Hemp, Canola and Flax variety evaluations were conducted only at Arborg site (See Table 1).

From each MCVET site across the province, yearly data is collected, combined, and summarized in the ‘Seed Manitoba’ guide. Hard copies are available at most Manitoba Agriculture and Ag Industry Offices. Seed Manitoba guide and the websites [www.seedinteractive.ca](http://www.seedinteractive.ca) and [www.seedmb.ca](http://www.seedmb.ca), provide valuable variety performance information for Manitoba farmers.

The Table 1 on the following page outlines agronomy practices followed for these trials at both sites.



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*MCVET Roundup Ready Soybeans in Arborg, MB*

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Crop Type	Stubble	Seeding Date	Fertility Applied (N-P-K in lbs/ac)	Weed Control (rate/acre)	Harvest Date	No of Plots	Other Notes	Site
Spring Wheat	Fallow	May 10	75-25-0	Curtail @ 0.8L + Axial @ 0.5 L	Aug 20	111		Arborg
Oats	Fallow	May 13	75-25-0	Curtail @ 0.8L	Aug 20	33		Arborg
Winter Wheat	Canola	Sep 6	110-30-0	2,4-D @ 360 ml	Aug 8	24		Arborg
Fall Rye	Canola	Sep 6	110-30-0	2,4-D @ 360 ml	Aug 8	15		Arborg
Barley	Fallow	May 13	75-25-0	Curtail @ 0.8L + Axial @ 0.5 L	Aug 20	33		Arborg
Peas	Fallow	May 13	0-20-0	Odyssey @ 17.3g + Merge Centurion @ 100 ml + Amigo Basagran Forte @ 0.9L	Aug 24	78	Rolled	Arborg
Conv. Soybeans	Fallow	May 21	0-20-0	Basagran Forte @ 0.9L	Oct 7	60	Rolled	Arborg
RR Soybeans	Fallow	May 22	0-20-0	Roundup @ 0.67L	Oct 8	156	Rolled	Arborg
Silage Corn	Oats	May 23	80-40-0	Roundup @ 0.67L	Written Off	90		Arborg
Flax	Fallow	May 15	50-20-0	Curtail @ 0.8L Basagran Forte @ 0.9L	Sept 16	33		Arborg
Hemp	Fallow	May 22	25-20-0	Brotex 240 @ 0.5L	Sept 17	40		Arborg
Spring Wheat	Fallow	May 9	100-30-0	Curtail @ 0.8L	Aug 21	45		Beausejour
Oats	Fallow	May 9	100-30-0	Curtail @ 0.8L	Aug 21	24		Beausejour
Barley	Fallow	May 9	100-30-0	Curtail @ 0.8L	Aug 21	18		Beausejour
Conv. Soybeans	Fallow	May 21	0-10-0	Centurion @ 125 ml + Amigo	Nov 4	60		Beausejour
RR Soybeans	Fallow	May 21	0-10-0	Roundup @ 0.67L	Written off	156		Beausejour

## Evaluating Silage corn varieties

### Project Duration

2019

### Objectives

To see production potential of different silage corn varieties in Interlake region.

### Collaborators

Manitoba Corn Growers Association (MCGA)

### Results

Silage corn varietal evaluations were done at Elm Creek, St. Pierre and Arborg sites during 2019 season. Arborg site had issues with the seed emergence and the trial was written off. Please visit MCGA at [www.manitobacorn.ca](http://www.manitobacorn.ca) for more information.

### Project Findings

Silage corn varieties evaluation will continue in 2020.

### Background / References / Additional resources

Now with the short-season corn varieties available, producers have more options to grow silage corn in Manitoba especially in Interlake region. Manitoba Corn Growers Association coordinates varietal evaluation of potential new silage corn varieties in the province. These varietal trials were done at different sites in the province and Arborg was one of the site. This trial was conducted to see production potential of different silage corn varieties in Interlake region.

### Materials and Methods

*Experimental Design* – Randomised block design with three replications

*Treatments* – 25 silage corn varieties

*Plot size* – 9m<sup>2</sup>

*Data planned to collect* – plant stand, plant height, yield

#### ***Agronomic info***

*Stubble, soil type* – cereal, heavy clay

*Fertilizer applied* – N – 80, P – 30 lbs/acre were applied at seeding.

*Pesticides applied* – Glyphosate @ 0.67L/acre

*Seeding/harvesting date* – May 23 / Trial was written off.



## Evaluating short season, cold and disease tolerant corn inbreds in Interlake region

**Project duration:** 2018-2022

### **Objectives:**

Development and release of early maturing cold tolerant corn inbreds with emphasis on the 1800-2000 CHU market.

**Collaborators:** Lana Reid, AAFC Ottawa

James Frey (PCDF), Haider Abbas (CMCDC), Nirmal Hari (PESAI), Scott Chalmers (WADO), Diversification Specialists, MARD

### **Project Findings**

This was the second year of testing. Inbred evaluations will be again done in 2020 and AAFC will share data once the project is completed.

### **Background / Additional Resources**

Canada annually produces more than 13 million metric tons of grain corn with a farm gate value greater than \$2 billion from 1.3 million ha. Historically, grain corn was concentrated in areas of the country with the highest available heat units and adequate moisture supply (i.e. southern Ontario); however many production areas in eastern and western Canada have less than 2800 CHU. Production in these heat-limited environments is expanding rapidly as demand for grain corn increases. There is a lack of suitable early hybrids with acceptable early season cold tolerance for these expanding regions of corn production. As well, climate change has resulted in a significant increase in common diseases and the arrival of new diseases to Canada. This evolving crisis will affect trade and severely damage growers and their grain customers.

This project has aimed to develop and release of early maturing cold tolerant corn inbreds with emphasis on the 1800-2000 CHU market. This objective will be achieved using conventional corn breeding methodology enhanced by double haploid inbred production and specialized screening techniques for cold tolerance. Multiple yield trials in Alberta, Manitoba, Quebec, Ontario and PEI are planned.

### **Materials & Methods**

*Experimental Design* – Randomised block design with three replications

*Treatments* – Thirty corn lines provided by AAFC Ottawa.

*Plot size* – 9 m<sup>2</sup>

*Data collected* – plant stand, disease incidence, grain yield, test weight

#### ***Agronomic info***

*Stubble, soil type* – Fallow, heavy clay

*Fertilizer applied* – N – 70 lbs/acre and P – 30lbs/acre were applied at seeding.

*Pesticides applied* – Bromoxynil @ 400 ml/acre on June 17

*Seeding date* – May 23 / Trial was written off.

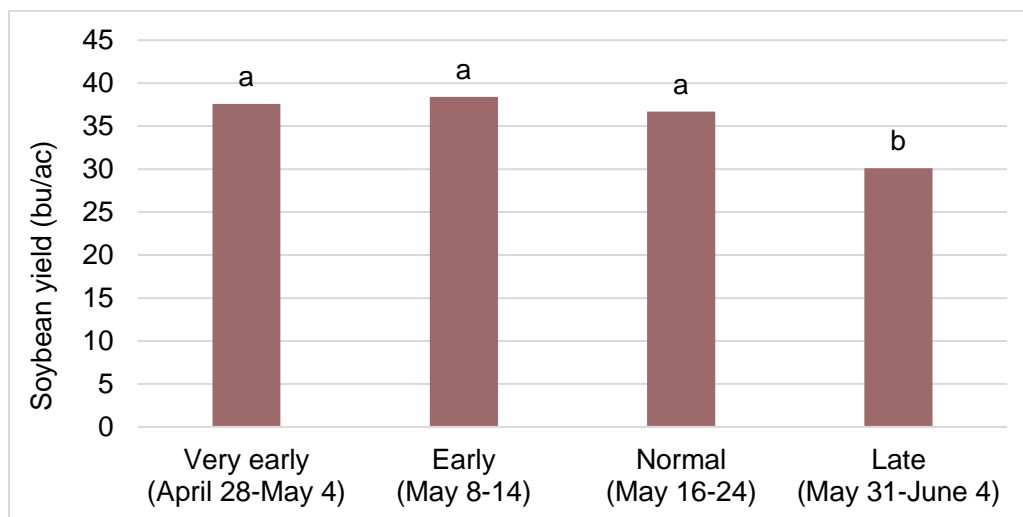
# Determining the Optimum Seeding Window for Soybeans in Manitoba

**Project Duration:** 2017 -2019

**Objectives:** The objective of this study is to determine the optimum seeding window for soybeans across Manitoba growing regions. Traditional recommendations are to plant soybeans when soil temperature has warmed to at least 10°C, which is typically May 15-25 in Manitoba (Manitoba Agriculture and Resource Development). However, farmers have started to seed soybeans earlier and recent work by Dr. Yvonne Lawley and Cassandra Tkachuk (2017) supports this trend. They evaluated seeding dates across a range of soil temperatures from 6 to 14°C in 2014 and 2015; the earliest seeding dates maximized yield regardless of soil temperature and it was concluded that calendar date is a superior indicator. To update seeding date recommendations across a wider range of environments and using defined calendar dates, this study was initiated at Arborg, Carman, Dauphin and Melita in 2017 and 2019 was the last year of testing.

**Collaborators:** Kristen P. MacMillan, University of Manitoba  
Scott Chalmers, WADO Melita

## Project Findings

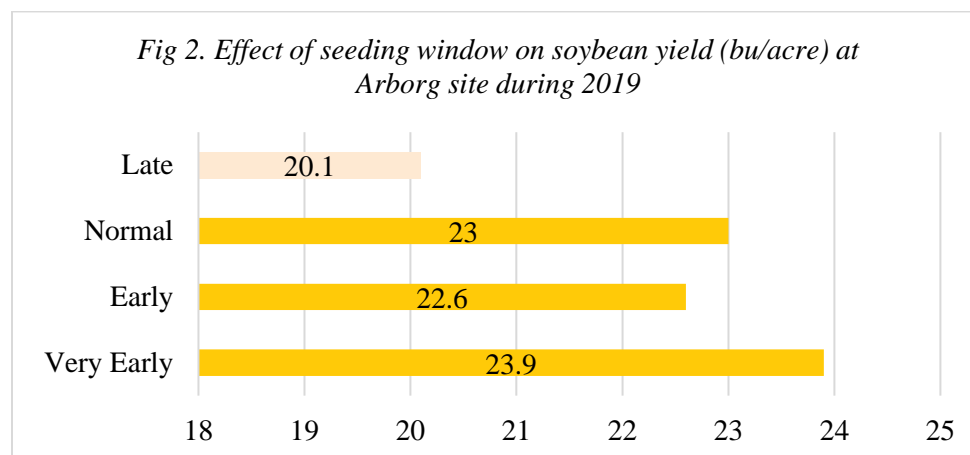


**Figure 1.** Soybean yield by seeding window among 7 site-years in Manitoba from 2017-2018. Means followed by the same letter are not statistically different at  $P < 0.05$ .

The preliminary combined analysis from 2017 to 2018 indicates that soybean yield was affected by the main effects of environment (E) and seeding date (SD), and their interaction (E x SD).

Overall, soybean yields were below average to average in these dry growing environments, ranging from 21-40 bu/ac, with the exception of Dauphin18 which yielded 64

bu/ac. Looking at individual environments (data not shown), yield maximization occurred in the first seeding window for 3 out of 7 environments, out yielding the second and third dates by 2-12%. In the other 4 out of 7 environments, yield maximization occurred in the second seeding window (early) by 1-14% compared to the first and third dates. In 2 out of those 4 environments (Carman17 and Melita17), soybeans in the first seeding date were beginning to emerge and were exposed to spring frost which is an important consideration for very early seeding. Yield differences among the first three seeding windows were statistically similar in 5 out of 7 environments and reduced yield with late seeding was consistent across all environments contributing to a meaningful overall effect of seeding date (Figure 1). Overall, soybean yield was statistically similar when seeded between April 28 and May 24, seeding beyond which reduced soybean yield by 20% on average. At Arborg18, soybean yield was statistically higher at the second seeding date compared to the first and last date. Due to this occurrence and associated frost risk observed at two other environments, farmers may want to consider waiting until the 2<sup>nd</sup> week of May to seed soybeans in Manitoba. Other measurements being collected include emergence, crop phenology, maturity and seed quality. This data continues to be analyzed to help refine overall seeding date recommendations.



During 2019, soybean yield was below average at all the seeding dates because of drier weather at Arborg site. However, yield trend was similar to overall conclusions based on 2017-2018 data. Late seeded plots had significantly less yield than all other three dates (Figure 2:  $p = 0.031$ ,  $CV = 11.0\%$ ). Variety-seeding date interactions were not significant.

### **Background/References/Additional Resources**

Traditional recommendations are to plant soybeans when soil temperature has warmed to at least 10°C, which is typically May 15-25 in Manitoba (Manitoba Agriculture & Resource Development). However, farmers are starting to plant soybeans earlier and recent work by Tkachuk (2017) supports this trend. Tkachuk investigated soybean seeding dates across a range of soil temperatures from 6 to 14°C at Carman, Morden and Melita in 2014 and 2015. At three site-years, soybean yield was optimized with the earliest planting date.

## Materials & Methods

The experimental design is a split plot RCBD, with seeding window as the main plot and variety as the split plot. The four seeding windows tested were “very early” (April 28 to May 4), “early” (May 8 to 14), “normal” (May 16 to 24) and “late” (May 31 to June 4). The short season variety S007Y4 and mid season variety NSC Richer were seeded within each seeding window.

*Data collected*- plant height, lodging, days to maturity, yield

***Agronomic Info*** (PESAI Arborg)

*Stubble, soil type* - Wheat, heavy clay

*Soil Fertility* - N= 29 lb/Ac, P= 17 lb/Ac, K= 620 lb/Ac

*Fertilizer Applied* – No application

*Pesticides Applied (doses and dates)* –

Glyphosate @ 0.67 L/acre on June 13

Silencer @34ml/acre on June 13 for the control of cutworms

Glyphosate @ 0.67 L/acre on July 2

*Seeding Dates* - May 6, May 13, May 22, June 4

*Harvest Date*- October 8

# Soybean Seeding Depth Evaluation

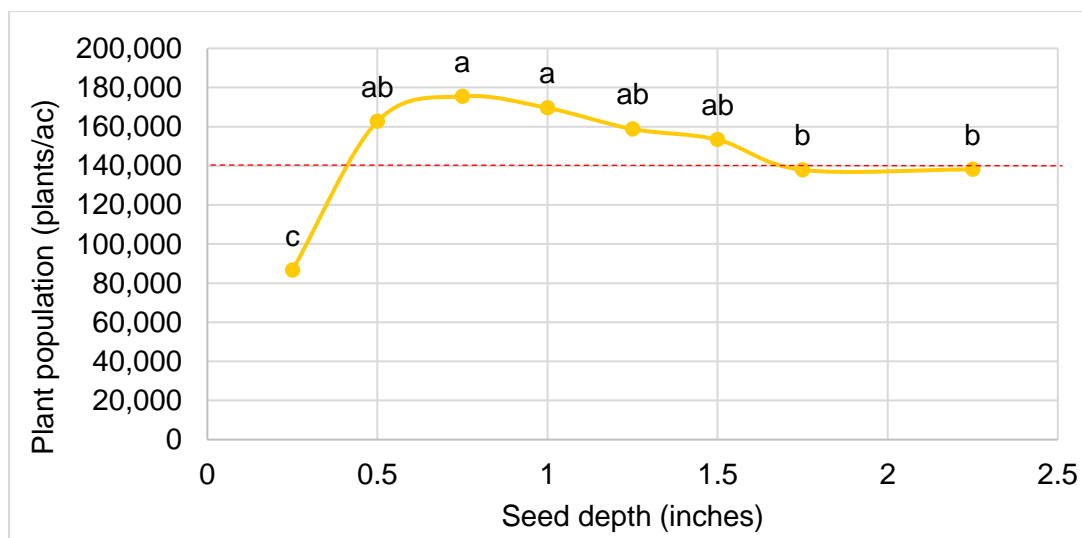
**Project Duration:** 2017-2019

## Objectives:

The objective of this study is to identify the optimum seeding depth for soybeans in Manitoba. The current recommendation is to seed soybeans between 0.75 and 1.5 inches based on guidelines from other regions. However, dry spring soil conditions often lead agronomists and farmers to ‘chase moisture’ and seed soybeans at 1.75 inches or deeper as has occurred in 2017/2018/2019. Observations on the success of this practice have been mixed - delayed emergence is a frequent observation and reduced emergence has occurred in some but not all cases. On the other hand, very wet soil conditions have led some farmers to broadcast and incorporate their seed. The yield impact (if any) of deep and shallow seeding is currently unknown in Manitoba and western Canada.

**Collaborators:** Kristen P. MacMillan, University of Manitoba

## Project Findings

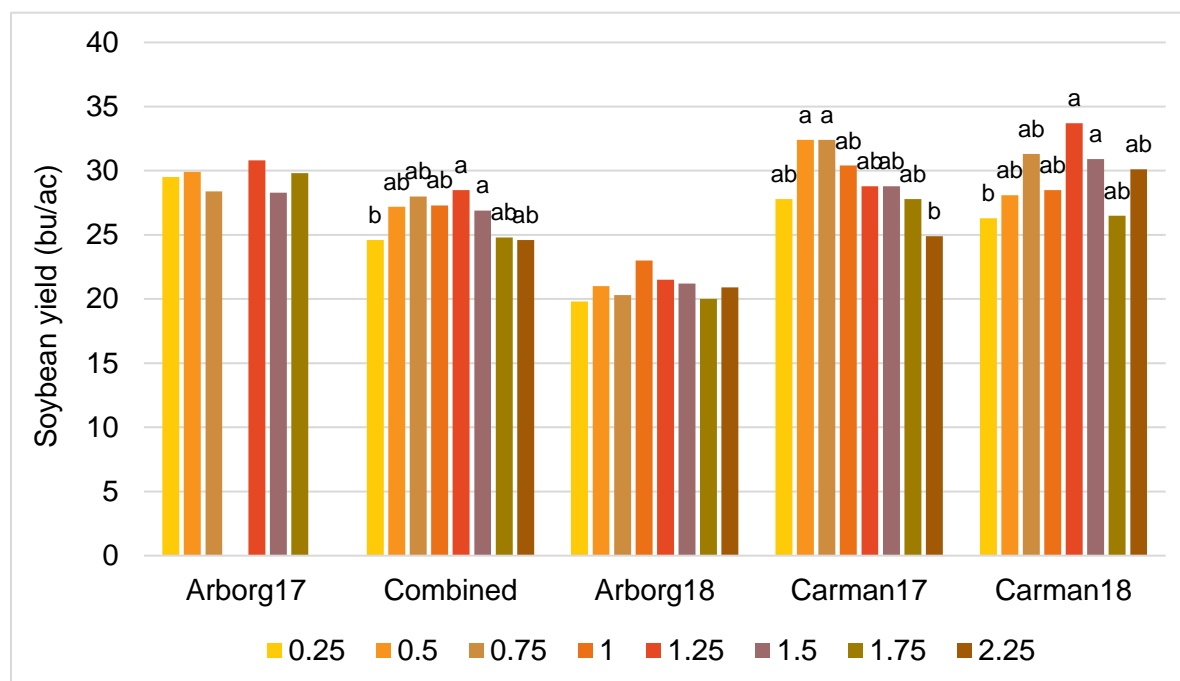


**Figure 1.** Effect of seeding depth on established plant population among environments. Means that contain the same letter are not statistically different at  $P \leq 0.05$ .

Trials were seeded with a double disc plot seeder between May 14 and May 24. At the time of seeding, moist soil was at 1.25” in 2018 and an accumulated 25mm of rain took about 14 and 21 days in 2017 and 2018, respectively. All trials were seeded into tilled stubble, except Arborg 2017 which was seeded into tilled fallow. Also, at Arborg 2017, the plot seeder could only reach a depth of 1.75”. For those reasons, Arborg17 was excluded from the combined analysis. Data was analyzed using Proc Mixed in SAS 9.4 with environment and treatment as fixed effects and block within environment as a random effect.



At Arborg17, soybean seeding depth from 0.25 to 1.75” did not affect soybean plant density or yield (28.4 to 30.8 bu/ac). This is not necessarily surprising as the depth range was narrower and the trial was seeded into tilled fallow land, which promotes loose soil that may not elicit potential impacts of deep seeding. In the combined analysis of Arborg18, Carman17 and Carman18, soybean plant density was significantly affected by seeding depth (Figure 1).



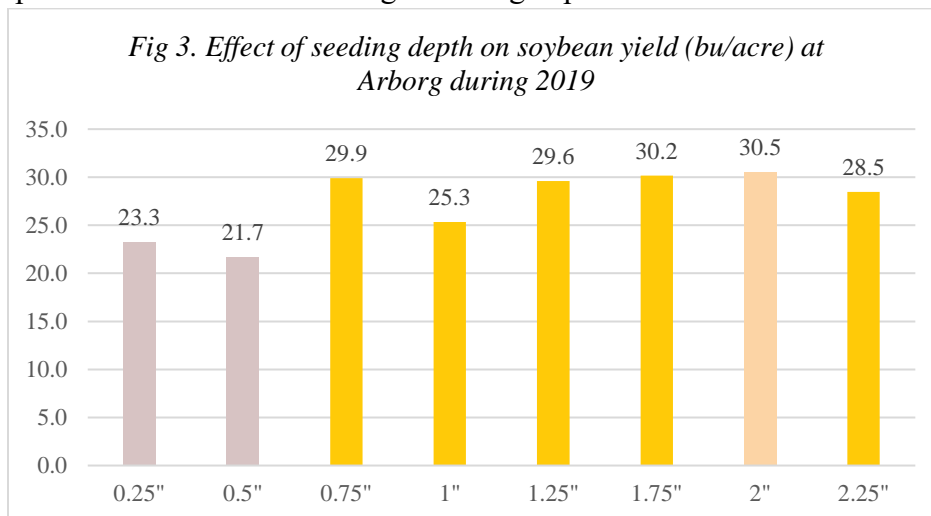
**Figure 2.** Effect of seed depth x environment and the overall effect of seeding depth (“combined”, excluding Arborg17) on soybean yield.

Soybean yield was affected by both main effects (environment and seeding depth) and their interaction (E x SD). At Carman17, soybean yield was reduced by 25% when seeded at 2.25” compared to 0.5 and 0.75” (Figure 2). The other seed depths produced yields similar to all other treatments. At Carman18, soybean yield was reduced by 20% with shallow seeding (0.25”) compared to seeding at 1.25 and 1.5”. The other depths were statistically similar to all others. At Arborg18, seeding depth did not affect soybean yield. When looking at the overall effect of seed depth on yield, the same trend exists at each environment - although to different degrees, which leads to the interaction.

Yield loss with very shallow or deep seeding is not consistent, however, when it does occur (2 out of 4 environments thus far), it is substantial (20-25%).

Delayed and reduced plant establishment and reduced seedling vigour are potential factors contributing to yield loss with non-optimal seeding depth. Shallow seeded soybeans (0.25”) are more prone to moisture fluctuations, resulting in wetting and drying of the seed which leads to poor germination and establishment. Deep seeded soybean seedlings (2.25”) show hypocotyl swelling, loss of cotyledons and chlorosis. To identify other mechanisms potentially contributing to yield differences, we measured the effect of seed depth on pod height in 2018. In 2018, seed depth did not affect pod height.

Based on the first two years of study, farmers should choose seeding depths between 0.5 and 1.5 inches depending on their soil type, management practices, equipment and rain forecast. Measuring seed depth during seeding and adjustments by field may be necessary. A post-emergent assessment to measure actual seeding depth at the cotyledon or unifoliate stage should be incorporated to ensure that the target seeding depth was achieved.



2019 yield analysis from Arborg site showed significant differences among seeding depths tested (Figure 3). It appeared that shallow seeded plots (0.25" & 0.50") suffered yield loss as compared to when soybeans were seeded at 2" depth ( $p = 0.001$ ,  $CV = 10.9\%$ ). All other seed depth treatments were similar in terms of yield. This could be partially explained due to drier weather prevalent during spring 2019 and the shallower placed seed might have not got enough moisture for germination.

### Background/References/Additional Resources

Seeding depth is important to ensure adequate moisture for germination and for good, even emergence. A soybean seed will imbibe 50% of its weight in moisture before germination. The recommended **seeding depth for soybeans is 0.75 to 1.5"**. There are certain environmental conditions and equipment factors to consider when determining if you should aim for the low or high end of this range. For example, dry soil conditions during the first week of May were leading growers to go deeper, closer to 2 inches. Going deeper than 2 inches may reduce soybean emergence and yield. Under warm, moist soil conditions, seeding shallower can result in good, rapid emergence. Understanding depth control of your equipment is also important when determining your target seeding depth. In some air seeders, depth can fluctuate from one end to the other by as much as  $\frac{1}{2}$ " resulting in uneven emergence. Additional soil cover that may result from rolling is another consideration. If depth control is not ideal on your seeding unit and/or rolling flattens deep furrows, your target seeding depth should allow for variation of 0.5".

## Materials & Methods

Soybean seeding depths between 0.25 and 2.25 inches were tested at Arborg (clay soil) during 2019. The trial was seeded into wheat stubble.

*Experimental Design* - Randomized Block Design

*Treatments* - Eight seeding depths (0.25", 0.50", 0.75", 1.25", 1.50", 1.75", 2.00" and 2.25"), four replicates

*Soil Fertility* - N= 29 lb/Ac, P= 17 lb/Ac, K= 620 lb/Ac

*Fertilizer Applied* – No application

*Data collected* - plant height, lodging, days to maturity, yield

*Pesticides Applied (doses and dates):*

Glyphosate @ 0.67 L/acre + Pursuit @ 85 ml / acre on June 12

Glyphosate @ 0.67 L/acre on July 5

*Seeding Date:* May 22

*Harvest Date:* Sep 26

# Evaluating Soybean and Peas Intercropping in Interlake

**Project duration:** 2019-2020

**Collaborators:** Kristen MacMillan, U of M

## Project Findings

This was the first year of testing and detailed results will be published after completion of 2020 testing.

## Background / Additional Resources

Intercropping is the practice of seeding, growing and harvesting two or more crops together in the same field. Relay cropping is the practice of seeding one crop, usually a winter crop, and then direct seeding another crop into the existing crop so that their growing periods overlap. Harvest may take place separately or together. These cropping practices mimic the diversity found in nature and aim to increase system productivity by identifying crops that complement one another in one or more ways.

Kristen's team had established a demonstration of various intercropping and relay cropping treatments at Carman site during 2018. Treatments were replicated three times and direct seeded into canola stubble with a plot seeder (except pea-oat, chickpea-flax, pea-canola, and monocrop peas and soybeans which were tilled before seeding). In 2018, no intercrop or relay crop combinations improved gross return or Land Equivalency Ratio (LER) compared to monocrop peas and soybeans. Drought was a limiting factor in addition to non-optimal seeding densities and weed competition in some treatments. This work was continued in 2019 and Arborg was added as one of the site to evaluate different intercropping combinations.

## Material and Methods

Twelve intercropping treatments arranged as a randomized complete block design with three replicates were evaluated at Arborg site during 2019. Treatment combinations were:

1. CL Pea monocrop (full rate = 100 seeds per m<sup>2</sup>, inoculated, starter P, 1.5" depth)
2. CL Canola monocrop (full rate = 108 seeds per m<sup>2</sup>, NPKS according to soil test, ¾" depth)  
- 115 lbs N/ac as urea based on 35 lbs/ac soil test (total N = 150 lbs/ac for 50 bu/ac)
3. Flax monocrop (full rate = 55 seeds per ft<sup>2</sup>, NPKS according to soil test, ¾" depth)  
- 45 lbs N/ac as urea based on 35 lbs/ac soil test (total N = 80 lbs/ac for 35 bu/ac)
4. RR Soybean monocrop (full rate = 49 seeds per m<sup>2</sup>, inoculated, starter P, 1" depth)
5. Pea-Canola intercrop (full rate peas, ½ rate canola, same rows, starter P, ¾" depth)
6. Pea-Canola intercrop (2/3 rate of peas, ½ rate canola, same rows, starter P, ¾" depth)
7. Soybean-Flax intercrop (full rate soybeans, ½ rate flax, mixed rows, starter P, ¾" depth)
8. Soybean-Flax intercrop (2/3 seeding rate both crops, mixed rows, starter P, ¾" depth)
9. Pea-Flax intercrop (full rate peas, ½ rate flax, mixed rows, starter P, 1" depth)
10. Pea-Flax intercrop (2/3 seeding rate both crops, mixed rows, starter P, 1" depth)
11. Pea-Oat intercrop (full rate peas, ½ rate oats, mixed rows, starter P, 1" depth)
12. Pea-Oat intercrop (2/3 peas rate both crops, mixed rows, starter P, 1" depth)

***Agronomic information***

*Stubble, Soil type:* Wheat, heavy clay

*Fertilizers applied :* P @ 15lbs/acre in all the treatments in addition to above mentioned N rates

*Pesticides used:*

- 1) Pre-emerge herbicide Authority 480 was applied in treatments 1, 3, 4, 7, 8, 9 and 10.
- 2) In-crop herbicides:
  - Sprayed Odyssey@ 17g/acre on treatments 1, 2, 5, 6 on June 14
  - Sprayed Basagran Forte @ 0.9L/acre on treatments 3, 7, 8, 9, 10 on June 14
  - Sprayed Roundup @0.67L/acre on treatment 4 on June 14
  - Sprayed Decis @ 50 ml/acre on treatments 2, 5, 6 for control of flea beetles on May 31
  - Sprayed Silencer @ 34 ml/acre on treatments 2, 5, 6 for control of flea beetles on June 6

*Data collection:*

- 1) Plant density 5 weeks after seeding (# of plants on 2m or row x 2 rows)
- 2) General observations and pictures (disease, insects, weeds, lodging)
- 3) Plant staging July 1 (stage crops on a whole plot basis)
- 4) Maturity (record date of maturity for each crop)
- 5) Grain yield and moisture

*Seeding date:* May 14

*Harvesting date:* Sep 9/Oct 9



# Assessing Fertility Program for Yield Potential of Winter Wheat Varieties

**Project duration:** 2019-2020

**Collaborators:** Ducks Unlimited, Western Ag

## Objectives

To establish a fertility program for achieving high yield in winter wheat.

## Results

Variety appeared to have influenced wheat yield and protein at three of the four sites under study in 2019. Elevate and Wildfire varieties had significantly higher yields compared to Gateway at Melita ( $P=0.001$ ) and Arborg ( $P=0.036$ ) while there were no significant differences among varieties at Roblin and Carberry. Although Gateway variety had lower grain yield, it had higher protein content of 15.8% at Melita, 13.8% at Roblin and 13.5% at Arborg compared to Wildfire and Elevate. Wildfire had higher protein content (15.2%) compared to Elevate (14.4%) at Melita while there were no significant differences between the same varieties at Arborg.

*Table 1. Analysis of variance and mean comparisons for wheat yield and protein % at different DC sites.*

	Melita		Roblin		Carberry		Arborg	
Variety / Fert. application	Yield kg ha <sup>-1</sup>	Protein%	Yield kg ha <sup>-1</sup>	Protein%	Yield kg ha <sup>-1</sup>	Protein%	Yield kg ha <sup>-1</sup>	Protein%
Elevate (1)	3974a	14.4c	4802	12.6b	4459	13.9	5860a	12.1b
Gateway (2)	3688b	15.8a	4361	13.8a	4879	13.7	5188b	13.5a
Wildfire (3)	4150a	15.2b	4646	11.4c	4621	13.8	5728a	12.3b
100% Spring appl. (A)	3901	15.2	4175b	12.2b	4442b	14.3a	5466	12.4b
Balanced appl. (B)	3974	15.2	5031a	13.0a	4864a	13.4b	5718	12.9a
1*A	4000	14.5d	4228	12.4	4470	14.5	5823	12.1
2*A	3682	15.6b	3761	13.5	4662	14.1	5140	13.0
3*A	4020	15.4bc	4536	10.6	4194	14.2	5434	12.0
1*B	3948	14.4d	5375	12.7	4449	13.4	5898	12.1
2*B	3694	16.0a	4961	14.1	5097	13.3	5235	14.0
3*B	4280	15.2c	4757	12.3	5047	13.4	6022	12.6
<b>P (Var)</b>	<b>0.001</b>	<b>&lt;0.001</b>	0.574	<b>&lt;0.001</b>	0.524	0.909	<b>0.036</b>	<b>0.001</b>
<b>P (Fert)</b>	0.324	0.891	<b>0.029</b>	<b>0.003</b>	0.182	<b>0.035</b>	0.212	<b>0.027</b>
<b>P (Var*Fert)</b>	0.213	<b>0.049</b>	0.441	0.082	0.504	0.933	0.481	0.236

*Means contain the same letter are not statistically different at  $P<0.05$ .*

Balanced application of fertilizer resulted in higher grain yield at Roblin (5031 kg ha<sup>-1</sup>) and Carberry (4864 kg ha<sup>-1</sup>) compared to 100% spring application. Balanced application of fertilizer resulted in higher protein content compared to 100% spring applied fertilizer at Roblin and Arborg sites. On the other hand, 100% spring applied fertilizer resulted in higher protein than balanced fertilizer application at Carberry.

There was a significant interaction between variety and fertilizer at Melita site for protein content, but not for wheat yield. An interaction of Gateway variety and balanced fertilizer application resulted in significantly higher protein content (16.0%) compared to other variety-fertilizer combinations.

### **Project Findings**

Based on the preliminary results from this study, balanced fertilizer application seemed to a better option to improve wheat yield and protein content at least at two sites. This testing will be repeated in 2020 to confirm proper recommendations for winter wheat producers.

### **Background / Additional Resources / References**

Management practices that can be utilized to improve winter wheat production are; increasing seeding rate and application of starter fertilizer by banding during seeding (Anderson, 2008). Fertility management, in particular nitrogen and phosphorus, remains the integral part of the overall management package aimed at achieving higher yields (Halvorson *et al.* 1987). The ideal fertility management package would help counteract escalating cost of production per unit area, which is the main goal producers aim to achieve.

There is still a knowledge gap on the rates as well as timing of application of nitrogen fertilizer, particularly in Western Canada, that would result in improved yield per given area without compromising on the quality of grain.

#### **References**

- Anderson, R. L. 2008. Growth and yield of winter wheat as affected by the preceding crop and crop management. *Agronomy Journal* 100 (4): 977-980.
- Halvorson, A.D., Alley, M. M., and Murphy, L. S. 1987. Nutrient requirements and fertilizer use: In *Wheat and Wheat Improvement – Agronomy Monograph (13) 2<sup>nd</sup> Edition*. Madison, WI 53711, USA.

### **Materials and Methods**

This testing was done at four locations; Melita, Arborg, Carberry and Roblin in Manitoba in 2018/2019 growing season.

*Experimental Design* – Randomised block design with three replications.

*Treatments* – Treatments were laid out in a 2 x 3 factorial (fertility practice x wheat varieties) design. Wheat varieties used were Gateway, Elevate and Wildfire and fertilizer treatments included Producer practice at 100 lbs of nitrogen (urea plus agrotain) per acre applied in spring and 30 lbs phosphorus banded at seeding in fall. Balanced fertility practice as per Western Ag recommendations (based on soil test) was split applied with 50% banded at seeding and the other 50% urea plus Agrotain broadcasted in spring. A summary of fertility treatments is presented in table 2:

Table 2: Fertility treatments for Balanced (high yield) and Producer practices

Practice	N	P	K	S
Balanced fertility with 50 % N applied in fall	44-0-0	11-52-0	0-0-60	20-0-0-24
Producer practice with N applied in spring	46-0-0	11-52-0		

*Plot size – 9.12m<sup>2</sup>*

*Data collected – plant height, lodging, grain yield & moisture*

An IM 9500 NIR grain analyzer was used to determine protein content on dry basis from a 500g subsample of each treatment.

***Agronomic info***

*Stubble, soil type – Canola, heavy clay*

*Fertilizer applied – Soil nutrient levels (lbs/acre): N – 21, P<sub>2</sub>O<sub>5</sub> – 41, K<sub>2</sub>O – 23*

5N-30P-70K (lbs/acre) were applied at seeding in balanced fertility practice and rest (135N-0P-0K) were applied in the spring (May 6).

*Pesticides applied – Sprayed 2,4-D @ 300ml/acre on June 2.*

*Seeding/harvesting date – Sept 5/Aug 8*

# Developing a Risk Model to Improve the Effectiveness of Fusarium Head Blight Mitigation in Western Canada

## Project duration:

2018-2023

## Collaborators:

Dr Paul Bullock, Dept of Soil Sciences, University of Manitoba, WADO, PCDF, CMCDC

## Objectives

- To develop weather-based models to assess the risk of FHB infection and DON in spring wheat, winter wheat, barley and durum crops with different FHB resistance ratings.
- To develop an interactive prairie-wide viewer and FHB/DON risk-mapping tool that is accessible to producers and industry to assist with fungicide application decisions.

## Project Findings

This was the first year of testing at PESAI site and results has been sent to U of M. Researchers are compiling data from all 15 sites (in three prairies provinces) and will report later.

## Background / Additional Resources

Fusarium Head Blight (FHB) is the most serious fungal disease affecting wheat and other cereals in Western Canada and most cropping areas of the world. Producers can lower FHB risk by growing cereals with higher FHB resistance ratings and with the application of a proper fungicide near the time of anthesis. Fungicide can reduce losses in yield, grade and mycotoxin infection such as deoxynivalenol (DON) when weather conditions favor FHB development, the crop is susceptible and *Fusarium* spp. are present in significant quantities.

When fungicide is applied when weather conditions are not conducive to FHB infection, there is a financial loss to the producer and unnecessary pesticide application with potential environmental side effects. Research has shown that fungicide application does not always provide a tangible benefit.

A weather-based decision management tool that alerts producers when FHB risk is high has the potential to improve FHB management with significant financial benefit.

## Materials & Methods

During 2019, these trials were established at 15 locations across the three Prairie Provinces. Evaluations were done on spring wheat, winter wheat, barley and durum cultivars with different FHB resistance ratings. Weather stations were installed at all the sites for getting intensive weather data for model development.

*Experimental Design* – Randomised block design with three replications.

*Treatments* – three winter wheat varieties– Emerson, AAC Gateway, Moats

three spring wheat varieties – AAC Elie, AAC Brandon, Muchmore

three barley varieties – AAC Connect, AAC Synergy, CDC Copeland

one durum wheat variety - Strongfield

*Plot size* – 8.22m<sup>2</sup> (winter wheat), 9.12m<sup>2</sup> (spring cereals)

*Data collected* – Plant density (at 3-leaf stage), growth stages (starting from BBCH 47 to 49) on weekly basis, spore traps, FHB infection rates, grain yield & moisture, DON levels in grains

***Agronomic info***

*Stubble, soil type* – Wheat stubble, heavy clay

*Fertilizer applied* – Soil nutrient levels (lbs/acre): N – 104, P<sub>2</sub>O<sub>5</sub> – 30, K<sub>2</sub>O – 680

N – 70lbs/acre and P – 25lbs/acre were applied at seeding.

*Pesticides applied* – Curtail @0.8L/acre on June 4

*Seeding/harvesting date* – Sep 15 (WW) & May 14 (spring cereals) / Aug 19



# Determining Agronomic Suitability of European Flax (linseed) Cultivars in Manitoba

**Project Duration:** 2018-2019

## Objectives

The current study was developed to examine agronomic attributes (yield, height, maturity) of European-origin flaxseed cultivars and to see if they have a competitive advantage and agro-climatic fit within Manitoba flax production areas.

## Collaborators

Manitoba Flax Growers Association (MFGA), Parkland Crop Diversification Foundation (PCDF), Prairies East Sustainable Agriculture Initiative (PESAI), Westman Agricultural Diversification Organization (WADO), Crop Development Centre (CDC), BASF (financial support) and varietal sponsors Limagrain Nederland and van de Bilt saden en vlas.

## Background

With the declining popularity of flax as a rotational crop choice in Manitoba, farmers need incentive to grow alternative crops. A longstanding complaint is that current flax cultivars are not keeping up with yield advances, similar to gains made in canola, soybeans and to a lesser extent, cereals. This disparity is what encourages a switch away from flax and into higher-yielding, more profitable crops.

Flax does have an important role to fill in Manitoba. As a non-host crop for many of the major diseases in western Canada, flax is well suited to break disease cycles and provide a stable, steady return as part of a balanced rotation. With the closure of breeding programs at Nutrien Ag Solutions and Agriculture and Agri-Food Canada (AAFC), only a single flax breeder remains in Canada at the Crop Development Centre (CDC) in Saskatoon, Saskatchewan. With the introduction and evaluation of European lines, a higher yielding cultivar, or a cultivar with more desirable quality characteristics may be found to be well suited to Manitoba's agro-climate.

## Materials & Methods

*Experimental Design* – Randomized Complete Block Design

*Locations* – Arborg (PESAI), Melita (WADO), and Roblin (PCDF)

*Treatments* – Seven flax cultivars (planted at seeding rate of 40 lbs/acre)

*Varieties* – Batsman, Biltstar, CDC Bethune, LG Aquarius, LG Lion, OVB 0815-02, OVB 1001-01

Recommended fertility and weed control practices were followed.

*Data collected* – yield, plant height at maturity, days to maturity, flowering period

### ***Agronomic information***

*Stubble, soil type* : Arborg – fallow, heavy clay soil; Melita – wheat/oats/sunflowers, Waskada loam; Roblin – oat/barley silage, Erickson clay loam

Table 1: Applied Treatment List

			Fertility (lb/acre)					
Location	Plot Size	Seeding Date	Available	Applied	Herbicides	Spray Date	Desiccation Date	Harvest Date
Arborg	9.12m <sup>2</sup>	15-May	104 N 30 P 680 K	50 N 20 P	Curtail M @ 0.8L/acre Centurion @ 0.075L/acre Reglone @ 0.7L/acre	10-Jun	06-Sep	16-Sep
Melita	12.96m <sub>2</sub>	06-May	81 N 10 P 192 K	108 N 35 P 20 K	Select @ 0.120L/acre Basagran Forté @ 0.91L/acre	10-Jun 18-Jun	--	29-Aug
Roblin	5.98m <sup>2</sup>	21-May	57 N 26 P 450 K	63 N 12 P	(PRE) Glyphosate @ 0.64L/acre + Authority @ 0.18L/acre Assure II @ 0.3L/acre + Basagran Forté @ 0.9L/acre Reglone @ 1L/acre	24-May 10-Jun	17-Sep	24-Sep

## Results

**Yield** - Yield differences were significant between European-origin lines and the Canadian-origin check, CDC Bethune, at only Melita (2018) and Roblin (2019) sites. At Melita in 2018, two European lines produced less yield than CDC Bethune while at Roblin in 2019, CDC Bethune also yielded significantly more than four of the six European lines (Tables 2 & 3). LG Lion and LG Aquarius were the only European lines to show significant yields similar to CDC Bethune at Melita in 2018 and Roblin in 2019.

**Plant height** - All three sites reported significant differences in plant height in 2018, with most lines being significantly shorter than CDC Bethune. However, the number of cultivars statistically differing from the check varied from site to site and year to year (Table 4). Roblin reported significant height differences in 2019, where CDC Bethune was statistically taller than all European-origin cultivars.

**Days to Maturity & flowering** - The number of days for flax to reach physiological maturity (75% bolls brown and rattling) at Arborg was similar in both 2018 and 2019. Melita and Roblin experienced a greater number of days required to reach the same flax maturity levels in 2019 than 2018, which may have been a factor of rainfall and environmental differences (Table 5). Length of flowering period rose in 2019 over 2018 (Table 6).

Table 2. Performance of different flax lines in European flaxseed test during 2018.

VARIETY		2018 Yield						
		Arborg		Melita			Roblin	
		kg/ha	bu/ac	kg/ha	bu/ac		kg/ha	bu/ac
CDC Bethune		1675.00	26.6	2226.67	35.4	<i>ab</i>	2057.00	32.7
OVb 1001-01		1673.67	26.6	2168.67	34.5	<i>ab</i>	1959.00	31.1
LG Lion		1717.00	27.3	2313.67	36.8	<i>a</i>	1598.33	25.4
Batsman		1559.67	24.8	1973.00	31.4	<i>cd</i>	1669.67	26.5
LG Aquarius		1357.67	21.6	2156.33	34.3	<i>b</i>	1518.00	24.1
OVb 0815-02		1361.67	21.7	2116.33	33.6	<i>bc</i>	1564.67	24.9
Biltstar		1447.33	23.0	1840.00	29.3	<i>d</i>	1608.33	25.6
GRAND MEAN		1541.72	24.5	2113.52	33.6		1710.71	27.2
CV %		9.1		3.7			14.8	
LSD		-	-	140.80	2.2		-	-
Sign Diff		No		Yes			No	

Means contain the same letter are not statistically different at  $P < 0.05$ .

Table 3. Performance of different flax lines in European flaxseed test during 2019.

VARIETY		2019 Yield						
		Arborg		Melita		Roblin		
		kg/ha	bu/ac	kg/ha	bu/ac	kg/ha	bu/ac	
CDC Bethune		2119.00	33.7	2719.00	43.2	3616.00	57.5	<i>a</i>
OVB 1001-01		1885.00	30.0	2798.00	44.5	3166.00	50.3	<i>bcd</i>
LG Lion		1960.00	31.2	2704.00	43.0	3464.00	55.1	<i>ab</i>
Batsman		1933.00	30.7	2848.00	45.3	3071.00	48.8	<i>cde</i>
LG Aquarius		1833.00	29.1	2849.00	45.3	3302.00	52.5	<i>abc</i>
OVB 0815-02		1913.00	30.4	2738.00	43.5	2689.00	42.8	<i>ef</i>
Biltstar		1844.00	29.3	2758.00	43.9	2792.00	44.4	<i>def</i>
GRAND MEAN		1926.71	30.6	2773.43	44.1	3157.14	50.2	
CV%		7.3		6.0		7.0		
LSD		-	-	-	-	395.40	6.3	
Sign Diff		No		No		Yes		

Means contain the same letter are not statistically different at  $P < 0.05$ .

Table 4. Plant height (cm) comparisons among different flax lines during 2018 &amp; 2019 testing.

VARIETY	Arborg18		Arborg19		Melita18		Melita19		Roblin18		Roblin19	
CDC Bethune	44.0	<i>a</i>	44.0		62.0	<i>a</i>	57.0		55.3	<i>a</i>	64.0	<i>a</i>
OVB 1001-01	36.0	<i>cd</i>	37.0		51.7	<i>b</i>	59.0		55.7	<i>a</i>	56.0	<i>b</i>
LG Lion	38.0	<i>bcd</i>	40.0		51.7	<i>b</i>	53.0		46.0	<i>b</i>	44.0	<i>c</i>
Batsman	40.0	<i>abc</i>	37.0		53.3	<i>b</i>	58.0		48.0	<i>b</i>	50.0	<i>bc</i>
LG Aquarius	37.0	<i>bcd</i>	38.0		49.3	<i>bc</i>	57.0		45.7	<i>b</i>	48.0	<i>c</i>
OVB 0815-02	36.3	<i>cd</i>	35.0		50.0	<i>bc</i>	54.0		46.3	<i>b</i>	48.0	<i>c</i>
Biltstar	41.7	<i>ab</i>	39.0		46.0	<i>c</i>	49.0		45.3	<i>b</i>	49.0	<i>c</i>
<b>GRAND MEAN</b>	<b>39.0</b>		<b>38.5</b>		<b>52.0</b>		<b>55.3</b>		<b>48.9</b>		<b>51.1</b>	
<b>CV %</b>	<b>6.8</b>				<b>5.9</b>				<b>7.4</b>		<b>7.3</b>	
<b>LSD</b>	<b>4.7</b>				<b>5.5</b>				<b>6.4</b>		<b>6.7</b>	
<b>Sign Diff</b>	<b>Yes</b>		<b>No</b>		<b>Yes</b>		<b>No</b>		<b>Yes</b>		<b>Yes</b>	

Means contain the same letter are not statistically different at  $P < 0.05$ .

Table 5. Days to physiological maturity during 2018 &amp; 2019 testing.

Variety	Arborg18	Arborg19	Melita18	Melita19	Roblin18	Roblin19	Average18	Average19
CDC Bethune	95	92	84	92	82	84	87	89
OVB 1001-01	98	91	86	96	81	105	88	98
LG Lion	94	92	85	93	79	106	86	97
Batsman	91	90	84	95	77	101	84	95
LG Aquarius	90	91	83	98	74	102	82	97
OVB 0815-02	91	90	84	99	79	104	85	98
Biltstar	91	92	84	100	76	119	84	104

Table 6. Length of flowering period (in days) during 2018 &amp; 2019.

Variety	Arborg18	Arborg19	Melita18	Roblin18	Roblin19	Average18	Average19
CDC Bethune	29	37	22	11	32	21	34
OVB 1001-01	31	39	25	11	34	22	37
LG Lion	20	37	15	10	29	15	33
Batsman	13	39	22	11	33	15	36
LG Aquarius	16	39	17	11	39	15	39
OVB 0815-02	16	39	22	12	34	17	36
Biltstar	16	39	12	13	33	14	36

No data from Melita during 2019.

Table 7. Precipitation and Growing Degree Day Seasonal Summary for 2018.

ENVIRONMENTAL VARIABLE	2018 Growing Season Summary					
	Arborg		Melita		Roblin	
	Actual	Normal	Actual	Normal	Actual	Normal
<b>Seeding Date to Harvest Date</b>						
Precipitation (mm)	217	270	164	256	431	279
Growing Degree Days (base 0°C)	1543	1408	1706	1529	1331	1314
<b>Seeding Date</b>	22-May		07-May		22-May	
<b>Desiccation Date</b>	06-Sep		09-Aug		14-Sep	
<b>Harvest Date</b>	20-Sep		14-Aug		11-Oct	

Table 8. Precipitation and Growing Degree Day Seasonal Summary for 2019.

ENVIRONMENTAL VARIABLE	2019 Growing Season Summary					
	Arborg		Melita		Roblin	
	Actual	Normal	Actual	Normal	Actual	Normal
<b>Seeding Date to Harvest Date</b>						
Precipitation (mm)	154	274	272	284	229	262
Growing Degree Days (base 0°C)	1373	1430	1331	1382	1283	1292
<b>Seeding Date</b>	16-May		06-May		21-May	
<b>Desiccation Date</b>	06-Sep		-		17-Sep	
<b>Harvest Date</b>	16-Sep		29-Aug		24-Sep	

Table 9. 2018 European flaxseed quality analysis by fatty acid content and iodine value.

Omega level / Fatty Acid (%)	$\Omega$ -9		$\Omega$ -6		$\Omega$ -3		$\Omega$ -9	Iodine Value
	Palmitic	Stearic	Oleic	Linoleic	$\alpha$ -Linolenic	Eicosenoic		
	C16:0	C18:0	C18:1	C18:2	C18:3	C20:1		
VARIETY								
CDC Bethune	6.00	3.8	18.75	17.5	53.94	0.0		187.57
OVB 1001-01	5.55	5.0	21.17	23.3	44.94	0.1		176.09
LG Lion	6.08	4.1	18.65	14.0	57.15	0.0		189.73
Batsman	6.39	4.2	18.50	14.4	56.39	0.1		188.35
LG Aquarius	5.82	3.8	18.21	15.6	56.53	0.0		190.53
OVB 0815-02	6.59	5.0	18.19	13.9	56.22	0.1		186.71
Biltstar	5.50	5.1	17.52	15.3	56.52	0.1		189.31
<b>GRAND MEAN</b>	5.99	4.4	18.71	16.3	54.53	0.0		186.90

**Quality** - Shannon Froese at the CDC, Saskatoon, conducted flaxseed quality analysis for the 2018 crop. Results are shown in Table 9. Higher iodine values are preferred by the industrial use buyers of flaxseed.

### **Project Findings**

Dry and drought-like conditions at the test sites contributed to overall lower yields particularly at Arborg site, as evidenced by low commercial yield across the province according to Manitoba Agricultural Insurance Corporation (MASC). Provincial average yields were 26 and 20 bu/acre in 2018 and 2019, respectively, compared to the 10-year average of 22 bu/acre. Rainfall distribution and time of arrival played an important role in crop development, affecting plant height and yield across the three test locations (Tables 2 & 3).

Short-stature flax was a result of continued moisture stress, along with overall thinner than ideal stands and the opportunity for weed competition. European flax lines were consistently shorter when compared to CDC Bethune, ranging from 4 to 10 centimeters shorter than check in both years.

Overall days to maturity (DTM) were +1 to -5 days from the 87 DTM CDC Bethune rating in 2018 (Table 5), while in 2019 all European lines took 6 to 9 days longer than the check. Correspondingly, flowering period in European flax cultivars was +1 to -7 days in variance from the average 21 days of CDC Bethune in 2018 (Table 6). In 2019, flowering period lengthened overall and European cultivars ranged from +4 to -1 days against a check variety flowering length of 34 days.

# Evaluating Organic Acids in Canola-Soybeans Crop Rotation

**Project Duration:** 2019-2021

## Objectives

The current project is planned to determine if efficacy of post emergence herbicides and crop fertilizers can be enhanced when used in conjunction with organic acid products. This project is evaluating the effects of organic acid products (MX-3, VX-8) on Canola-Soybeans crop rotation.

## Collaborators

Kevin Shale, Montra Crop Science

## Results

*Table 1: Organic acid effects on plant phenology & yield of canola & flea beetle infestation during 2019.*

<b>Treatment</b>	<b>Plant count*</b>	<b>Flea beetle damage score**</b>	<b>Leaf stage 14DAE#</b>	<b>Leaf stage 21DAE#</b>	<b>Plant height at flower (inches)</b>	<b>Plant height at maturity (inches)</b>	<b>Yield (bu/acre)</b>
MX-3 75%	11.4	1.5	3.7	5.1	39.7	40.1	40.2
MX-3 100%	10.1	1.6	3.6	4.8	39.6	39.7	39.1
VX-8 75%	12.4	1.8	3.7	5.1	39.9	42.4	38.7
VX-8 100%	10.4	1.9	3.5	5.0	39.8	40.8	38.8
CONTROL	10.4	2.1	3.6	5.0	39.8	39.4	39.1
<b>Signi. Diff. P</b>	<b>No 0.62</b>	<b>No 0.21</b>	<b>No 0.81</b>	<b>No 0.76</b>	<b>No 0.99</b>	<b>No 0.58</b>	<b>No 0.99</b>
<b>CV (%)</b>	<b>24.7</b>	<b>34.7</b>	<b>9.7</b>	<b>9.1</b>	<b>4.0</b>	<b>8.7</b>	<b>12.1</b>

75 or 100% - denotes the herbicide rate used in crop for the control of weeds.

\* Plant counts from 1m row length - average of 2 samples / plot

\*\* Flea beetle damage: <25% leaf damage = 1, 25-50% leaf damage = 2, 50-75% leaf damage = 3, >75% leaf damage = 4 (on June 13)

# Leaf stages based on randomly taken 10 plants/plot. DAE – Days after emergence

The use of organic acids did not have any influence on plant establishment, plant vigor (leaf stage data at 14 & 21 DAE), plant height and yield of canola (Table 1). Similarly, flea beetle damage did not differ among different treatments and control.

Table 2 displays the results of the plant tissue analysis performed during mid-season. Organic acid treatments did not have any effect on the concentration of any macro- and micronutrient tested in the plant foliage.

Crude protein and fat content of the canola seed were not affected by organic acid treatments (Table 3).

Table 2: Results from mid-season (at early flowering stage) plant tissue analysis.

Treatment	N %	P %	K %	S %	Ca %	Mg %	B (ppm)	Cu (ppm)	Fe (ppm)	Mn (ppm)	Zn (ppm)
MX-3 75%	5.61	0.29	3.00	0.92	1.53	0.82	20.8	4.83	46.0	37.7	19.7
MX-3 100%	5.77	0.31	2.91	0.90	1.50	0.85	20.2	5.38	52.3	40.0	23.0
VX-8 75%	5.69	0.31	2.99	0.92	1.53	0.82	20.7	5.45	50.7	40.5	23.0
VX-8 100%	5.88	0.32	3.16	0.94	1.56	0.81	21.4	5.87	52.6	40.0	22.8
CONTROL	5.61	0.30	2.81	0.90	1.50	0.81	20.6	5.48	46.3	36.3	22.6
<b>Signi. Diff.</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>
<b>P</b>	<b>0.051</b>	<b>0.27</b>	<b>0.28</b>	<b>0.97</b>	<b>0.95</b>	<b>0.96</b>	<b>0.96</b>	<b>0.23</b>	<b>0.054</b>	<b>0.18</b>	<b>0.58</b>
<b>CV (%)</b>	<b>2.2</b>	<b>6.3</b>	<b>7.3</b>	<b>10.9</b>	<b>8.1</b>	<b>10.6</b>	<b>10.0</b>	<b>11.1</b>	<b>7.5</b>	<b>6.7</b>	<b>13.0</b>

Table 3: Results from grain quality analysis of the harvest samples.

Treatment	Crude Protein %	Fat %
MX-3 75%	23.1	39.5
MX-3 100%	24.7	39.2
VX-8 75%	23.2	38.1
VX-8 100%	23.2	39.4
CONTROL	23.3	38.8
<b>Signi Diff.</b>	<b>No</b>	<b>No</b>
<b>P</b>	<b>0.26</b>	<b>0.63</b>
<b>CV (%)</b>	<b>6.7</b>	<b>4.2</b>

Table 4: Results from post harvest soil testing.

Treatment	N lbs/ac	Bray-P ppm	K ppm	S lbs/ac	Ca ppm	Mg ppm	Organic Matter (%)	Biological Quality rating*	CO2-C (ppm)#	Mineralizable N (lbs/acre)
MX-3 75%	29.8	59.25	542	104.8ab	7098	1795	6.78	3.50	43.0	29.5
MX-3 100%	28.3	54.75	485	96.3b	6958	1760	6.74	3.25	35.4	25.4
VX-8 75%	29.8	54.00	525	98.0ab	7093	1765	6.73	3.75	47.3	31.0
VX-8 100%	28.5	51.50	526	98.6ab	7029	1797	6.80	3.25	35.6	25.3
CONTROL	38.3	61.17	482	120.3a	6938	1727	6.85	3.00	36.8	27.0
<b>Difference</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>Yes</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>
<b>P</b>	<b>0.49</b>	<b>0.26</b>	<b>0.52</b>	<b>0.03</b>	<b>0.74</b>	<b>0.78</b>	<b>0.83</b>	<b>0.12</b>	<b>0.47</b>	<b>0.33</b>
<b>CV (%)</b>	<b>35.3</b>	<b>14.9</b>	<b>14.1</b>	<b>13.3</b>	<b>3.4</b>	<b>6.1</b>	<b>2.9</b>	<b>13.0</b>	<b>31.8</b>	<b>19.5</b>

\* BQR – 1-2.5 = Low soil microbial activity; 2.5-3.5 = medium soil microbial activity; 3.5-4 = Ideal soil microbial activity

#if the values are between 6-30 = moderate to low biological activity; 31-60 = moderate level; 61-100 = moderate to high biological activity

Soil sampling was done after crop harvest to see if there is any differences in the nutrient levels due to organic acid use. As shown in the Table 4, organic acids did not influence post-harvest levels of nitrogen, phosphorous, potassium, calcium and magnesium in the soil. The only significant difference was in the sulfur amounts. Canola plots that received the MX-3 (100% herbicide) treatment seemed to take up more sulfur from the soil as compared to control plots.



Organic matter, biological quality ratings and CO<sub>2</sub> –C amounts were also similar among different treatments.

### **Project Findings**

Organic acid products (MX-3 & VX-8) evaluated in this study did not exhibit any effect on canola growth and yield and flea beetle infestation. Both organic acid products were applied along with 75 & 100% rates of herbicides if their use can reduce herbicide use by 25%. Control canola plots got 100% herbicide application. Results, however, do not support the hypothesis that MX-3 or VX-8 will help reducing herbicide use.

Mid season plant tissue analysis revealed that organic acids use did not change nutrient concentration in the plant foliage. Similarly, post harvest grain analysis showed no differences in the concentration of crude protein and fats among different treatments. Organic acid products did not influence post-harvest levels of most soil nutrients except sulfur.

Organic acids need soil moisture to enter into plant system and do necessary changes in the soil biochemistry (personal communication, Kevin Shale, Montra Crop Science). Arborg site received significantly less rainfall especially during and after seeding in the spring. The site received only 55% of normal precipitation from May 1 to September 1. This could have played a factor towards inefficacy of organic acid products in the current study. Moreover, this was the first year of study and it will be interesting to see effects in the subsequent soybean crop during 2020.

### **Background/References/Additional Resources**

Humic compounds such as fulvic acid and humic acid are formed by chemical and microbial degradation of plant and animal material and are a principal component of soil organic matter (Canellas *et al.* 2015). In general, the application of fulvic and humic acid fertilizer amendments have been shown to enhance root growth, increase nutrient uptake, alleviate stress, and increase yield in various crops (Canellas *et al.* 2015). However, studies conducted in Ontario on dry bean (*Phaseolus vulgaris* L.) in 2010 and 2011 using fulvic acid (LX7<sup>®</sup>, MTS Environmental Inc.) or humic acid (Plant XL<sup>®</sup>, Alpha-Agri) fertilizers showed no response. Twenty fulvic acid field trials and 15 humic acid field trials indicated that these fertilizers were ineffective, as plant vigour, height, 100-seed weight, and yield were similar to a control treatment (Mahoney *et al* 2017).

Broadcast pre-plant or post-plant application of leonardite did not affect the emergence, chemical composition, or yield of wheat or canola in Manitoba (Dilk 2002). The efficiency of phosphorus (P) fertilizer was studied with and without humic acid, derived from leonardite. Application of leonardite in a P fertilizer band significantly increased the P concentration of canola tissue in the early stages of development. However, the increase in P concentration did not result in an increase in yield.

In the current study, product MX-3 did have 5% fulvic acid and it was sprayed in furrows after seeding. Additional sprays of this product were applied during early phase of the crop growth. Another granular product, VX-8 was applied with the seed.

## References

KJ Mahoney, C McCreary, D Depuydt, CL Gillard (2017) Fulvic and humic acid fertilizers are ineffective in dry bean. *Canadian Journal of Plant Science*, 2017, 97(2): 202-205, <https://doi.org/10.1139/cjps-2016-0143>

Canellas LP, Olivares FL, Aguiar NO, Jones DL, Nebbioso A, Mazzei P, Piccolo A. (2015) Humic and fulvic acids as biostimulants in horticulture. *Sci. Hortic.* **196**: 15-27.

Sean B Dilk (2002). Agronomic evaluation of leonardite on yield and chemical composition of Canola and Wheat. Masters Thesis, Dept of Soil Sciences, University of Manitoba.

## Materials & Methods

*Experimental Design* – Replicated block design with four replications

*Treatments:*

- 1) MX-3 100%\*: Spray in furrows after seeding on the same day @ 1 L/acre + 100% herbicide rate
- 2) MX-3 75%\*: Spray in furrows after seeding on the same day @ 1 L/acre + 75% herbicide rate
- 3) VX-8 100%\*: MX-3 bonded to Verxite for dry application (applied with seed @ 6 Kg/acre) + 100% herbicide rate
- 4) VX-8 75%\*: MX-3 bonded to Verxite for dry application (applied with seed @ 6 Kg/acre) + 75% herbicide rate
- 5) Control – 100% Herbicide rate

\*All treatments except Control got two more sprays of Montra MX-3 during early phase of crop growth.

*Variety* – L233P

*Plot size* – 9.12m<sup>2</sup>

*Data collected* – plant population, flea beetle damage, plant vigor, days to flowering and maturity, plant height at maturity, yield, plant tissue sampling, grain testing, post-harvest soil sampling

### *Agronomic information*

*Stubble, soil type* – Fallow, Heavy clay

*Fertilizer applied* – N 130 lbs/ acre, P 50 lbs/acre at the time of seeding.

MX-3 (1L/acre) sprayed on May 27<sup>th</sup> after seeding in certain treatments.

MX-3 again sprayed on June 12<sup>th</sup> in certain treatments

MX-3 again sprayed on July 9<sup>th</sup> in certain treatments

*Pesticides applied* – Liberty @ 1.35L/acre (100%) and 1L/acre (75%) against weeds –June 6<sup>th</sup>

Silencer @ 34 ml/acre against flea beetles –June 12<sup>th</sup>

Silencer @ 34ml/acre against flea beetles – June 17<sup>th</sup>

*Seeding/Harvesting date* – May 27/ Sep 6

# Linseed Coop Evaluation in Interlake

**Project duration:** 2018-2020

**Collaborators:** Dr. Helen Booker (flax breeder), CDC Saskatoon

**Funding:** Manitoba Flax Growers Association, BASF

**Objectives:** To compare newly registered cultivars (SVPG entries) and experimental lines (FP entries) from University of Saskatchewan, Crop Development Centre Flax Breeding Program with check flax varieties.

## Results

Significant differences were found among flax entries tested at Arborg site. The check entries CDC Bethune, AAC Bright and CDC Glas were relatively low yielding entries in the test. Two 3<sup>rd</sup>-year entries (FP 2567 & FP2573) and two 1<sup>st</sup>-year entries (FP 2591 & FP2593) yielded significantly higher than check flax entries.

*Table 1. Performance of different flax entries at PESAI Arborg site during 2019 season.*

Variety	Yield (00 Kg/ha)	% of CDC Glas	Overall rank (Based on Zone 3 sites)
<b><u>Checks</u></b>			
CDC Bethune	19.8a	95	7
AAC Bright	20.0a	96	13
CDC Glas	20.8ab	100	17
<b><u>SVPG Entries</u></b>			
CDC Buryu	23.0bcde	110	16
CDC Dorado	20.9abc	100	19
ND Hammond	20.0a	96	20
AAC Marvelous	23.0bcde	110	14
AAC Prairie Sunshine	20.9abc	101	18
CDC Rowland	22.8bcde	110	10
Topaz	21.1abc	101	15
<b><u>3rd Year Entries</u></b>			
FP2566	21.8bc	105	11
FP2567	24.2def	116	12
FP2573	25.6f	123	2
<b><u>1st Year Entries</u></b>			
FP2589	22.1bcd	106	8
FP2590	22.1bcd	106	6
FP2591	25.0ef	120	1
FP2592	22.6bcd	109	9
FP2593	23.2cdef	111	3
FP2594	22.7bcde	109	5
FP2595	22.8bcde	110	4
C.V. %	7.2		
LSD	2.3		

*Means contain the same letter are not statistically different at  $P < 0.05$ .*

The flax entries FP2573, FP2591 & FP2593 were also the top performing flax entries in the Zone 3, which comprised of Roblin (MB), Arborg (MB), Melfort (SK), Codette (SK) and Vegreville (AB) sites.

### **Project Findings**

The year 2019 was the second year of testing for these flax entries and the entries differed in their yield performance at Arborg site. Generally, top performing entries at this site were similar to other Zone 3 sites. Overall results will be reported after completing 2020 testing at all the sites.

### **Background / Additional Resources / References**

The coop trial was conducted at Melita, Roblin, Arborg and Carberry in Manitoba. There were other sites across Saskatchewan, Alberta and Quebec in various soil zones but they will not be discussed in this report. For more information, flax breeder Dr Helen Booker can be contacted at 1-306-966-5878.

### **Materials and Methods**

*Experimental Design* – Randomised block design with three replications.

*Treatments* – Twenty flax entries (See Table 1).

*Plot size* – 7.1m<sup>2</sup>

*Data collected* – plant height, lodging, days to maturity, grain yield, stem dry down, determinate growth habit

Only yield results are presented in the current report and other results will be reported in the overall report after completion of 2020 season testing. Subsamples were sent back to the Crop Development Centre in Saskatoon for further fatty acid and protein analysis.

#### ***Agronomic info***

*Stubble, soil type* – Fallow, heavy clay

*Fertilizer applied* – Soil nutrient levels (lbs/acre): N – 104, P<sub>2</sub>O<sub>5</sub> – 30, K<sub>2</sub>O – 680

N – 50lbs/acre and P – 15lbs/acre were applied at seeding.

*Pesticides applied* – Curtail @0.8L/acre + Centurion @75ml/acre on June 19

Sprayed with Reglone on Sep 6.

*Seeding/harvesting date* – May 15 / Sept 16

# Flooding Effects on Different Canola Varieties in the Interlake

**Project Duration** – 2019

## Objectives

This study was planned to determine how different canola varieties perform under excess moisture conditions. Six commercially grown canola varieties (RR and liberty link traits) were evaluated, and were flooded throughout the growing season. These varieties were also grown under ideal conditions (on tile drainage land) for comparisons.

**Collaborators:** BASIC

## Results

There were no differences in plant establishment among the canola varieties tested. Flooding did not have any effect on plant establishment ( $p = 0.299$ , data not shown) and days to flower ( $p = 0.430$ , data not shown); however, canola varieties differed for days to flower ( $p < 0.0001$ , Figure 1). Overall, flooded canola plots took 11 more days to mature. Plants were shorter in flooded plots and having greater lodging (Table 1). Flooding resulted in significant reduction in yield and flooded plots yielded almost one-third of the control canola plots.

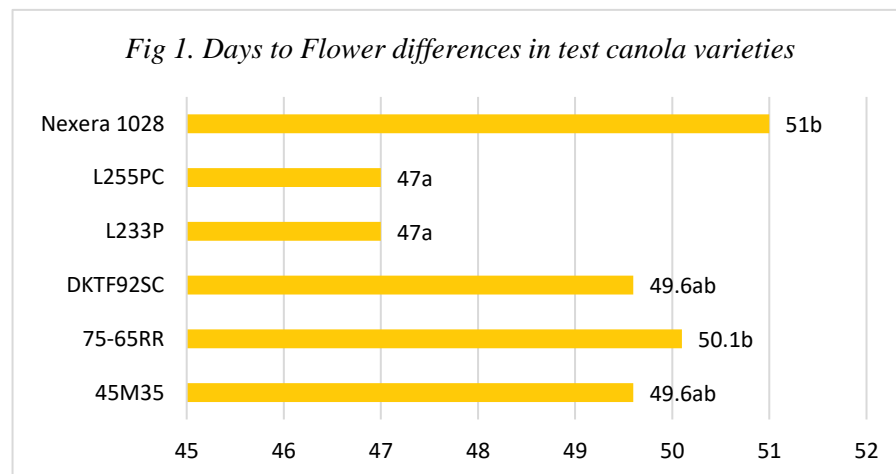
*Table 1. Effect of flooding on canola growth and yield parameters.*

Treatment	Days to maturity	Plant height (inches)	Lodging*	Yield (bushels/acre)
Flooding#	95.8a	28.1b	1.8b	15.4a
No Flooding#	84.8b	41.1a	1.1a	39.9b
P	<0.0001	<0.0001	<0.0001	<0.0001
CV (%)	2.6	11.6	9.6	12.4

\* Based on 1-5 scale; 1 = plants upright, 5 = plants flat on the ground.

#Data is pooled for all canola varieties.

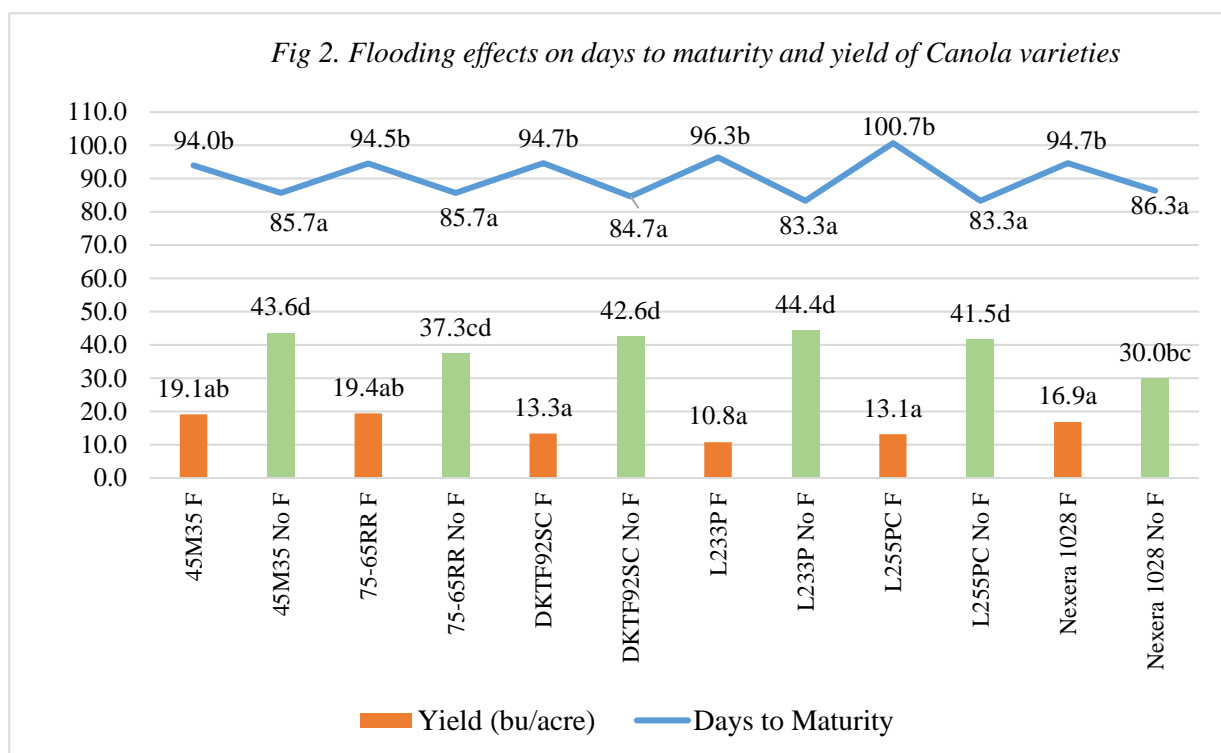
Means contain the same letter are not statistically different at  $P < 0.05$ .



Means contain the same letter are not statistically different at  $P < 0.05$ .

Variety-flooding interactions were significant for days to maturity and canola yield (Figure 2). All canola varieties took significant higher number of days to mature in comparison to when they were grown under ideal conditions.

Similarly, all canola varieties suffered yield loss when grown under flooded conditions. Canola varieties DKTF92 SC, L233P, L255P suffered most and the yields were 31.2, 24.3 and 31.5% (of control plots), respectively, when grown under flooded conditions. Flooded plots of 75-65RR and Nexera 1028 had more than 50% the yield as compared to their non-flooded plots.



### Project Findings

Test Canola varieties suffered significant yield losses from flooding. Flooded plots had shorter plants, which took more days to mature. In addition, canola plants had greater lodging, when grown under flooded conditions. In the current study, no canola variety exhibited flooding tolerance.

### Background/References/Additional Resources

Interlake region is known for extreme moisture conditions. Often, soils are poorly drained due to presence of heavy clay and crops suffer yield losses due to flooding. PESAI site has Fyala soil and this soil type is considered as Class -3 agricultural capability due to limitations in high moisture conditions. Fyala soil is a poorly drained soil due to presence of clay particles throughout the profile.

Wet soils cause an oxygen deficiency, which reduces root respiration and growth in canola plants (Canola Council of Canada). Canola is quite susceptible to water logging and shows a yield reduction with additional effects on days to maturity and plant height if exposed to excess moisture

in the earlier phase of crop growth. With wet conditions, roots may be shallow and not able to access nutrients once the soils begin to dry. A few days in waterlogged soil can be enough to kill canola plants, and yield loss is certain, although as canola plants age, they tend to be more resilient.

## **Materials & Methods**

*Experimental Design* – Replicated block design

*Treatments* – Six canola varieties grown in flooded and Non-flooded set ups.

Flooded plots got 16” simulated rainfall during June 14 – Aug 10 in addition to natural rainfall.

*Varieties* – L230, L233P, Nexera 1028, 45M35, 75-65RR, DKTF92SC

*Replications* -three

*Plot size* – 9.12m<sup>2</sup>

*Data collected* – plant population, days to flower, days to maturity, plant height at maturity, lodging, yield

### ***Agronomic information***

*Stubble, soil type* – Fallow, Heavy clay

*Fertilizer applied* – N - 100 lbs/ acre, P- 30 lbs/acre at the time of seeding.

Pesticides applied – Sprayed Liberty @ 1 L/acre and Roundup@0.67L/acre on June 26.

Decis @45 ml/acre on June 12 and June 17 (for flea beetles)

*Seeding/Harvesting date* – May 30/Sep 6/26



# Flooding Effects on Canola Growth and Yield

**Project Duration:** 2019-2021

## Objectives

Canola plots were flooded at the early and late crop stages to assess the effects of flooding on crop growth and yield. Plots were also grown under non-flooding conditions for comparisons.

## Collaborators

Canadian Agricultural Partnership funding  
Curtis Cavers, AAFC Portage la Prairie

## Results

Canola in control plots grew taller than in plots, where flooding was applied as indicated in Table 1. In addition, crop in control plots took less number of days to mature, whereas the early and late flooded canola matured much later. There was no difference in plant establishment between the control and flooded plots (data not shown). Late-flooded plots had more lodging than early-flooded or control canola plots.

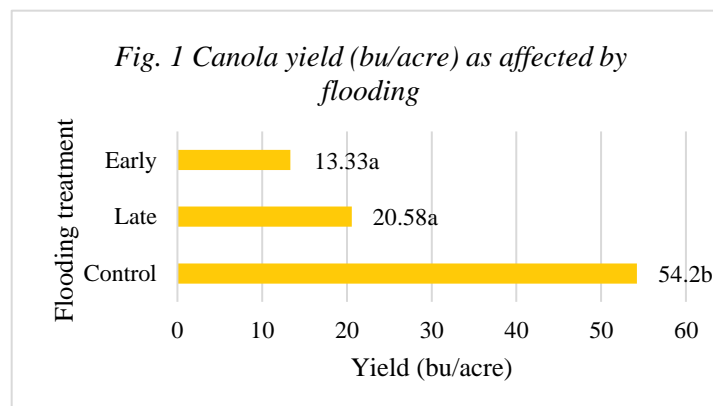
*Table 1. Effect of flooding on canola growth.*

Treatment	Days to maturity	Plant height (inches)	Lodging*
Early flooding	94.2	34.1	1.0 a
Late flooding	93.7	30.6	2.0 b
No flooding	84.0	40.4	1.0 a
P	0.0001	0.002	0.003
CV (%)	0.7	7.4	24.8

\* Lodging on 1-5 scale; 1 = plants upright, 5 = plants flat on the ground.

Means contain the same letter are not statistically different at  $P < 0.05$ .

Flooding did have significant impact on canola yield and both the early and late flooding reduced canola yield (Figure 1). There was no difference in canola yield between the early and late flooded plots.



Means contain the same letter are not statistically different at  $P < 0.05$ .

### **Project Findings**

Flooding significantly affected canola yield and flooded plots produced only 25-38% yield as compared to control canola plots. Canola in control plots grew taller and matured faster than the flooded canola plots. Lodging was more evident in late-flooded canola plots. The current study had only one canola variety (L233P) but this test will be expanded in the future by including more than one canola variety.

### **Background/References/Additional Resources**

Extreme moisture in Manitoba causes significant losses to farmers. Canola is quite susceptible to water logging and shows a yield reduction if exposed to excess moisture in the earlier phase of crop growth. Wet soils cause an oxygen deficiency, which reduces root respiration and growth (Canola Council of Canada).

### **Materials & Methods**

*Experimental Design* – Replicated block design

*Treatments* – Canola grown in flooded (early and late) and Non-flooded set ups. Early flooding plots were flooded between June 20-July 4 and a total of 5 inches of flooding was applied in addition to natural precipitation. Flooding was started, when canola crop was at 2-3 leaf stage. Flooding was started in late-flooded plots on July 8, when the crop was at early flowering stage. Flooding continued until July 29 and a total of 7.5 inches of flooding was applied in addition to natural rainfall.

*Varieties* – L233P

*Plot size* – 9.12m<sup>2</sup>

*Data collected* – plant population, days to maturity, plant height at maturity, yield

#### ***Agronomic information***

*Stubble, soil type* – Fallow, Heavy clay

*Fertilizer applied* – N 100 lbs/ acre, P 30 lbs/acre at the time of seeding.

*Pesticides applied* – No application

*Seeding/Harvesting date* – May 30/ Sep 6/11

# Flooding Effects on Wheat Growth and Yield

**Project Duration:** 2019-2021

## Objectives

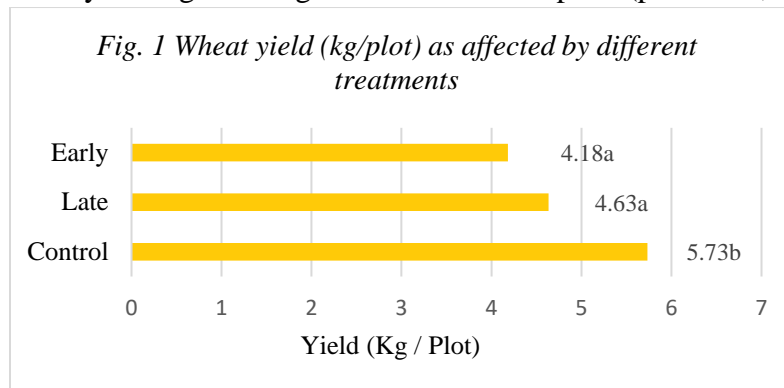
Wheat plots were flooded at the early and late crop stages to assess the effects of flooding on crop growth and yield. Plots were also grown under non-flooding conditions for comparisons.

## Collaborators

Canadian Agricultural Partnership funding  
Curtis Cavers, AAFC Portage la Prairie

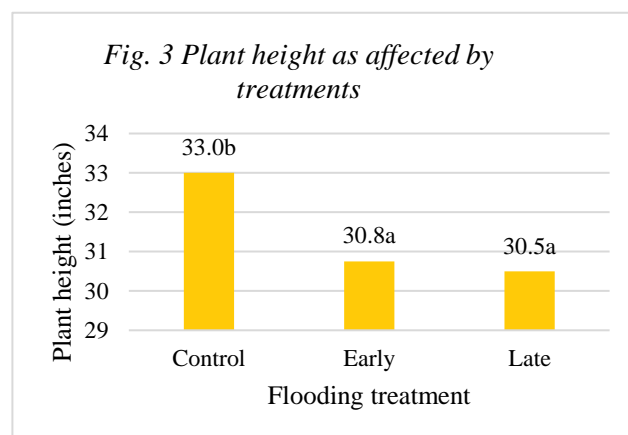
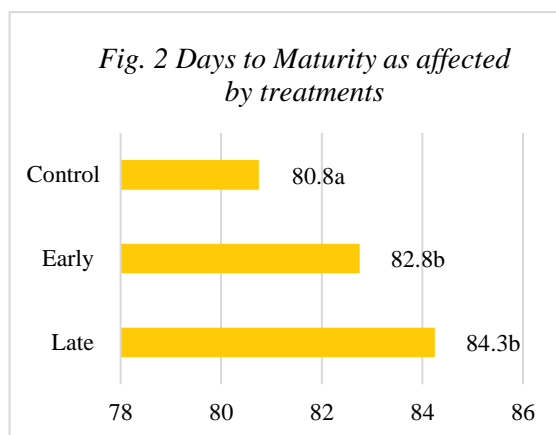
## Results

Non-flooded plots of wheat had much higher yield than flooded plots ( $p=0.008$ ). There was no difference between the early flooding and late flooding plots as seen below in Figure 1. Plant establishment did not vary among flooding and control wheat plots ( $p = 0.662$ , data not shown).



*Means contain the same letter are not statistically different at  $P<005$ .*

Both flooding treatments significantly increased the number of days to maturity ( $p=0.002$ , Fig 2). Flooding also stunted wheat growth & wheat in control plots grew much taller ( $p=0.02$ , Fig. 3).



*Means contain the same letter are not statistically different at  $P<005$ .*

## **Project Findings**

Wheat in control plots grew much taller and it took less number of days to mature. Flooding delayed wheat maturity irrespective of flooding timings. Flooding also exhibited stress on wheat plants resulted in significant yield loss. The current study had only one wheat variety and this test will be expanded in future by including more number of wheat varieties.

Although weather was exceptionally drier at the Arborg site during the 2019 summer, flooding still caused a decrease in the crop yield.

## **Background/References/Additional Resources**

Extreme moisture in Manitoba causes significant losses to farmers. From 1812-1959 historic records, show that crop losses in Manitoba were 10.2% from excess moisture and 35.6% from drought. Extreme moisture during the 1812-1959 period accounted for 45.8% of all crop losses. During 1966-2015, excess moisture accounted for 38% of all crop losses in Manitoba (MASC). Manitoba crop insurance data from 1965-1972 showed clay soils subjected to excess moisture in July experienced the highest yield loss (2-6 bu/ac/day) for barley, oats, wheat and flax crops (Rigaux and Singh, 1977).

Additionally, farmers experience loss of nutrients due to extreme moisture as well as loss of soil. Excessive soil moisture also delays agronomic operations. The impact of these losses on farm net income is significant.

*Rigaux, L. R. and Singh, R. H. Benefit-cost evaluation of improved levels of agricultural drainage in Manitoba, Volume 1-3, Research Bulletin No. 77-1, Department of Agricultural Economics and Farm Management, University of Manitoba, June 1977.*

## **Materials & Methods**

*Experimental Design* – Replicated block design

*Treatments* – Wheat grown in flooded (early and late) and Non-flooded set ups. Early flooding plots were flooded between June 20-July 4 and a total of 5 inches of flooding was applied in addition to natural precipitation. Flooding was started, when wheat crop was at 2-3 leaf stage. Flooding was started in late-flooded plots on July 8, when the crop was at soft dough stage. Flooding continued until July 29 and a total of 7.5 inches of flooding was applied in addition to natural rainfall.

*Varieties* – AAC Brandon

*Plot size* – 9.12m<sup>2</sup>

*Data collected* – plant population, days to maturity, plant height at maturity, yield

### ***Agronomic information***

*Stubble, soil type* – Fallow, Heavy clay

*Fertilizer applied* – N 100 lbs/ acre, P 30 lbs/acre at the time of seeding.

*Pesticides applied* – No application

*Seeding/Harvesting date* – May 30/ Sep 11

# Evaluating Hemp Grain and Fiber Varieties in the Interlake

**Project Duration** – 2019

**Objectives** – Assessing different hemp varieties for grain / fiber yield potential in the Interlake.

**Collaborators** – Canadian Hemp Trade Alliance  
James Frey PCDF Roblin,  
Scott Chalmers WADO Melita,  
Jeff Kostuik, Hemp Genetics International

## Results

Plant establishment did not vary when compared among different hemp varieties (Table 1). Plant stand varied from 13.3-17.8 plants per meter row length. Plant height varied among different hemp varieties and CRS-1 and Judy were taller than all other varieties. Similarly, hemp varieties also varied for their maturity and varieties Judy and X59 took more number of days to mature. Hemp variety, X59 had highest grain yield and was significantly higher than Grandi, Katani, CFX-2, and Judy. Judy had the least grain yield.

*Table 1. Hemp plant phenology and grain yield results from grain varieties trial.*

Variety	Plant stand (No of plants/1 m row)	Plant height (cm)	Days to maturity	Grain yield (lbs/acre)
Grandi	17.8a	118b	105b	947b
X59	15.8a	127b	111a	1202a
Katani	15.7a	118b	103bc	938b
CFX-2	15.6a	131b	105b	966b
CRS-1 (check)	13.5a	150a	101c	1060ab
Judy	13.3a	158a	110a	706c
<b>P (at 0.05)</b>	<b>0.185</b>	<b>&lt;0.0001</b>	<b>&lt;0.0001</b>	<b>&lt;0.0001</b>
<b>CV (%)</b>	<b>16.6</b>	<b>6.4</b>	<b>1.6</b>	<b>10.2</b>

*Different letters in each column denotes statistically significant differences among varieties.*

*Table 2. Hemp plant phenology and fiber yield results from fiber varieties trial.*

Variety	Plant stand (No of plants/1 m row)	Plant height (cm)	Days to maturity	Fiber yield (lbs/acre)
Altair	16.6	186b	108c	7798ab
CRS-1	16.3	157c	107c	6900b
Petera	13.5	207ab	121a	8942ab
Silesia	8.2	216a	111b	10217a
<b>P (at 0.05)</b>	<b>0.014</b>	<b>&lt;0.0001</b>	<b>&lt;0.0001</b>	<b>0.04</b>
<b>CV (%)</b>	<b>24.2</b>	<b>6.6</b>	<b>1.2</b>	<b>17.0</b>

*Different letters in each column denotes statistically significant differences among varieties.*

Plant establishment did vary among different hemp fiber varieties and variety Silesia had less plant stand. Silesia was also the tallest variety among fiber varieties tested, whereas CRS-1 had the shortest plants (Table 2). Fiber variety Petera took significantly more number of days to mature. Hemp varieties differed in fiber yield and CRS-1 had the lowest fiber yield.

### **Project Findings**

The test hemp varieties differed in grain / fiber yield at Arborg site. Grain yield ranged from 706 – 1202 lbs/acre for different varieties tested. For making hemp variety decisions, Interlake producers could use these testing results. These results can also be found in Seed Manitoba.

### **Background / Additional Resources / References**

The Canadian Hemp Trade Alliance (CHTA) is a not-for-profit organization, which represents over 260 growers across all 10 provinces as well as numerous processors, distributors, developers and researchers involved in Canada's rapidly growing industrial hemp industry. This current project was funded by CHTA and it looked at separate grain and fibre varieties of hemp how they perform in Interlake region.

### **Materials and Methods**

*Experimental Design* – Randomised block design with four replications.

*Treatments* – Six hemp varieties in grain trial and four varieties in fiber trial (See Tables 1 & 2).

*Plot size* – 9.12m<sup>2</sup>

*Data collected* – plant stand, plant height, lodging, days to maturity, grain and fiber yield

#### ***Agronomic info***

*Stubble, soil type* – Fallow, heavy clay

*Fertilizer applied* – Soil nutrient levels (lbs/acre): N – 51, P<sub>2</sub>O<sub>5</sub> – 28, K<sub>2</sub>O – 740

N – 70lbs/acre and P – 40lbs/acre were applied at seeding.

*Pesticides applied* – Brotex 240 @ 0.5 L/acre on June 19

*Seeding/harvesting date* – May 22 / Sept 17

# Evaluating Tile Drainage/Water Management Effects on Wheat, Canola and Soybeans productivity in Heavy Clay soils

**Project Duration:** 2019-2021

## Objectives

The main objective of this research is to assess the impact of tile drainage (15', 30' and 45' wide) and water table management on yield and quality of canola, soybean, and wheat. The data collected from this research will be used to develop computer models that can simulate tile drainage operation under different rainfall patterns, thus extending the usefulness of this research beyond the three-year period.

**Collaborators:** Dr Ramanathan Sri Ranjan, University of Manitoba  
Canadian Agricultural Partnership Program  
Dr. Nirmal Hari, PESAI

## Results

The 2019 season has been considerably dry with water table consistently remaining well below the tiles in all the plots. Despite the water table remaining below the tile, in the Soybean plots the water table at the tile was shallower than mid-spacing between the tiles. This may have been due to the impact of the tile installation disturbance of the soil creating a preferential pathway for water to accumulate compare to the soil at mid-spacing of the tile. However, the water table still remained too deep to cause an impact on the yield. In the wheat and canola fields the water table remained too deep to cause any impact on the yield. Figure 1 shows the comparison of water tables throughout the growing season in all the plots with the daily rainfall shown as a bar graph.

*Table 1. Effect of tile drainage on plant height, days to maturity and yield of wheat, canola & soybeans at Arborg site.*

Treatment	Wheat (30' spacings)			Canola (15' spacings)			Soybeans (45' spacings)		
	Pl Height (inches)	Days to Maturity	Yield (bu/acre)	Pl Height (inches)	Days to Maturity	Yield (bu/acre)	Pl Height (inches)	Days to Maturity	Yield (bu/acre)
Over Tiles	27.7a	80.0	39.3	29.1b	78.7	21.1	20.6	127.3	18.8
In bet. Tiles	23.9b	80.0	36.5	31.5ab	79.3	26.1	18.7	126.7	21.6
No tile	26.2ab	80.0	36.0	33.5a	78.3	18.4	20.5	127.3	21.3
<b>Signi Diff.</b>	<b>Yes</b>	<b>No</b>	<b>No</b>	<b>Yes</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>
<b>P</b>	<b>0.02</b>		<b>0.76</b>	<b>0.03</b>	<b>0.37</b>	<b>0.13</b>	<b>0.38</b>	<b>0.55</b>	<b>0.45</b>
<b>CV%</b>	<b>4.4</b>		<b>15.4</b>	<b>4.6</b>	<b>1.0</b>	<b>17.8</b>	<b>8.6</b>	<b>0.6</b>	<b>13.3</b>

*Different letters in each column denotes statistically significant differences among varieties.*

Tile drainage did not have any effect on yield of any crop during 2019 crop season. Wheat grown in between the tiles was, however, shorter as compared to when grown on over the tiles. Canola grown on the tiles had reduced plant height as compared to when grown on non-tiled land. This can be explained by the depth of the water table between the treatments. The shallower water table



in drained plots could have contributed to stunted growth. Tiles did not have any influence on days to maturity for any crop type.

### **Project Findings**

Arborg site received only 55% of normal precipitation from May 1 to September 1. Excess moisture was not a limiting factor in crop production this season, meaning that it was difficult to assess the effect of tile drainage on crop production. Yield was not affected by any tile drainage spacing treatment on any crop type, although plant height was affected by tiles in wheat and canola.

### **Background / Additional Information / References**

Excessive soil moisture delays agronomic operations, such as field preparations or seeding, during the early cropping season. These delays can result in a shorter cropping season and sometimes decreased yield. Excess moisture is a big constraint in crop production in Manitoba. The Manitoba Agricultural Services Corporation (MASC) reported that between 1996 and 2014, approximately 40% of crop losses were the result of excess moisture (with some reports placing that number at 55% from 2005-2014).

The presence of heavy clay soils in the Interlake contributes to high moisture content, particularly during the spring. The Province of Manitoba has identified the importance of surface drainage in peat areas of Interlake and built drains (Provincial waterways) for proper runoff after rainfall. In regions with heavy clay soils, removal of surface water alone might not be a solution to excess moisture if the soil below the surface remains saturated.

Draining water from the root zone is important to gain access to a field and to avoid loss of moisture-sensitive crops. Subsurface drainage systems help to remove excess soil moisture from the root zone. The amount of water removed daily is dependent on the drainage rate of the system, which must be carefully considered during the design process. The drainage rate determines the capability of the system to prevent soil saturation during high intensity rainfall events. Other parameters affecting the drainage rate are soil type, topography, tile installation depth and spacing of tile drains.

Tile drainage is becoming popular as a way to control excess moisture in the field to increase crop productivity. Yet, the economic return on investment (ROI) on installing tile drainage is not known for wheat, canola, and soybeans in Manitoba. This research will allow us to assess the impact of water management through controlled drainage on yield and quality of wheat, canola, and soybeans. Detailed soil moisture measurements along with water table depth at different times will help us model water flow within the rootzone and its impact on crop yield. Data collected in this study will be used to calibrate computer models (HYDRUS, DrainMOD) for this location so that weather data from different years could be modeled to assess the long-term impact of tile drainage. The Prairie East Sustainable Agricultural Initiative (PESAI) research site has drains placed at 15', 30', and 45' allowing different degrees of drainage. Rotating the three crops through these different spacings will help assess the impact of different drainage intensities.

## Materials and Methods

Wheat, Canola and Soybeans were seeded on different tile spacing plots in addition to 60m long and 20m wide control plots on non-tile land. The plots on the tiles were about 200m long and 20m wide for all the crops. Wheat was seeded on 30' tile spacing with three replicates. Wheat variety AAC Brandon was planted on May 24, 2019 with a target seeding rate of 2.5 bushels/acre. Canola variety L233P was planted on 15' tile spacing plots on May 29 with a seeding rate of 7 lbs/acre. Similarly, soybean variety Karpo R2 was seeded on 45' tile spacings on May 28 with a seeding rate of 180,000 plants/acre. Recommended fertilizers were applied during seeding based on soil test. Recommended weed control was followed for all three crops.

Level logger sensors were installed on all the tiled plots at mid-spacing between tiles as well as in the control plots. The widely spaced drains at 45' had additional level loggers installed at the tile location as well. The data from the loggers is presented in Fig. 1.

The data on plant height, days to maturity, lodging and yield were taken from different treatment plots. Wheat was harvested on August 30 followed by canola on Sep 9 and soybeans on October 8. For harvesting, two 10-metre long strips (25m long in case of soybeans) were combined from each plot on and in between the tiles. Plant phenology and yield data were analysed using MINITAB.

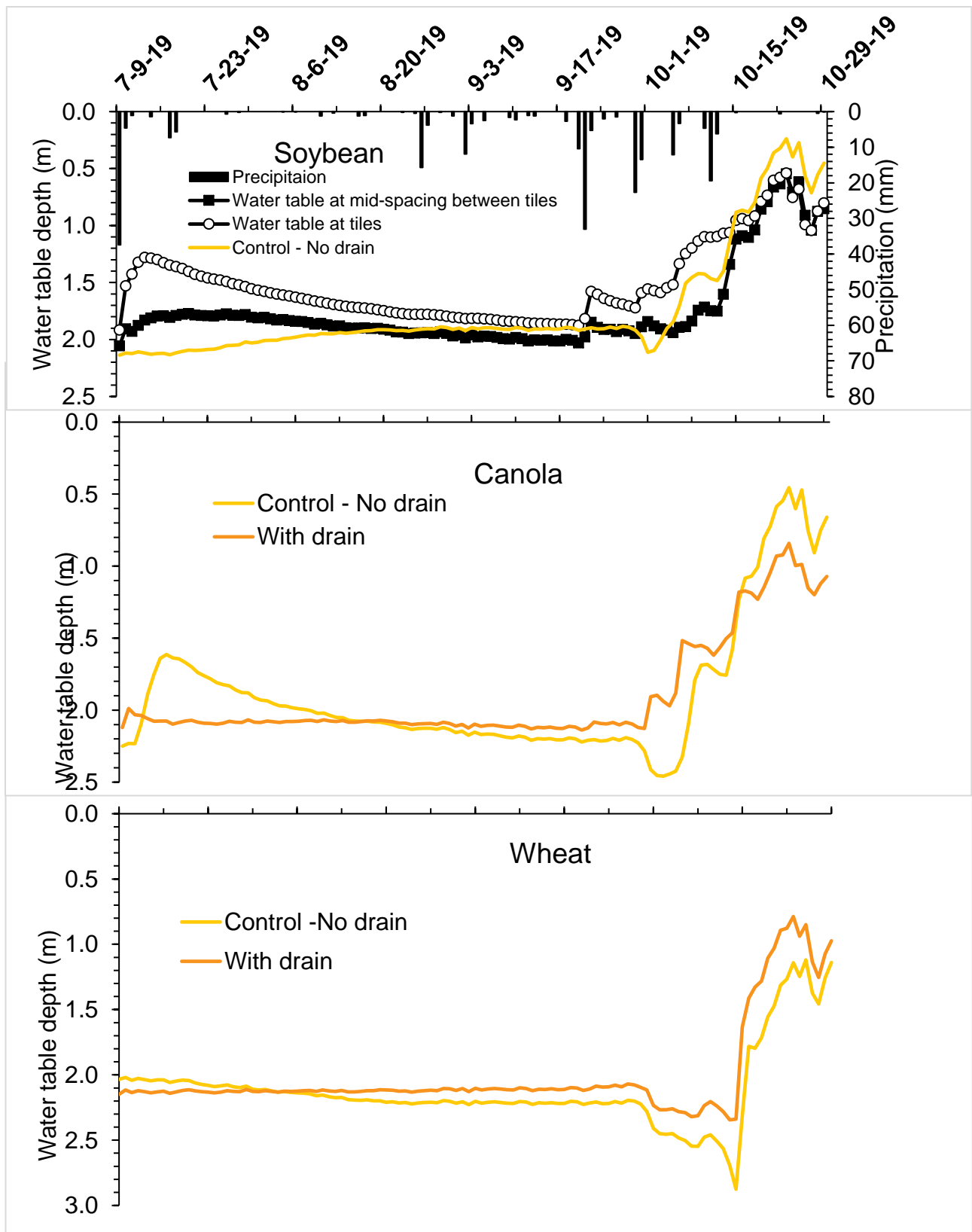


Figure 1. Comparison of water table depths and precipitation throughout the 2019 season.