PRAIRIES EAST SUSTAINABLE AGRICULTURE INITIATIVE

2018 ANNUAL REPORT

PESAI

Funded in part by *Growing Forward 2*, a federal-provincial-territorial initia

Contents

2018 Public / Industry Partners

Agassiz Soil & Crop Improvement Association, Beausejour

Agriculture and Agri-Food Canada, Brandon

Agriculture and Agri-Food Canada, Ottawa

Canada MB Crop Diversification Centre

Crop Production Services

Hemp Genetics International

Manitoba Corn Growers Association

Manitoba Crop Variety Evaluation Team

Manitoba Pulse & Soybean Growers Association

MB Agriculture

Northern Quinoa Production Corporation

Parkland Crop Diversification Foundation

Parkland Industrial Hemp Growers

Prairie Agricultural Machinery Institute

Seed Manitoba

University of Manitoba

University of Saskatchewan

Westman Agricultural Diversification Organization Inc.

Wheat and Barley Growers Association

Introduction

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. 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 Growing Forward programs. Additional funding comes from the MCVET committee and other Industry partners for the contract 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, reports and fact sheets.

The PESAI Board is open to research and project submissions from individuals and producer groups.

Table 1. PESAI/Manitoba Ag Staff during 2018 crop season.

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

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

Board of Directors 2018-19

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

Table 2. PESAI Board of Directors during 2018-19.

Chair	**Adrien Grenier**	**Woodridge**	**204-429-2058**
Vice Chair	Linda Loewen	Riverton	204-378-2771
Secretary	Wayne Foubert	St. Anne	204-232-5069
Treasurer	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	Andy Buehlman	Arborg	204-376-2809
Director	Scott Duguid	Arnes	204-641-4806

PESAI Extension Activities

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 Ag staff assisted PESAI in all aspects of this project, including:

- PESAI organized a Crop Tour at PESAI site on July 19, 2018 where 80 people attended. Experts from Manitoba Agriculture and industry spoke at the tour related to various research topics.
- Manitoba Soil Science Society held its annual tour at PESAI site on August 16, 2018. About 30 people participated in the tour and there were good discussions on soil profile, soil suitability for crop production and tile drainage.
- A soybean research tour was organized at PESAI plot site in Beausejour on September 5, 2018 where 30 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 2019, with its counter-parts from other areas of the province: Parkland Crop Diversification Foundation (PCDF) – Parkland Region, Westman Agriculture Diversification Organization (WADO) – Southwest Region and Canada-Manitoba Crop Diversification Centre (CMCDC) – Central Region.
- An announcement of PESAI's project submission deadline and AGM was advertised in Eastern and Interlake areas.
- PESAI's Annual General Meeting was held on April 10, 2019 at Red River College in Winnipeg.
- PESAI's 2018-19 Annual Report was compiled by Manitoba Ag support staff and distributed to PESAI Directors, Members, project partners and Manitoba Agriculture extension staff.
- PESAI has set up its booth at Brokenhead River Ag Conference (Feb 2019) and Arborg Ag Days (March 2019).
- Ag Days 2019 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 15 times about its research and extension activities on social media.

Conclusions

- PESAI's extension events have proven successful with positive attendance at PESAI events and the increase in membership. This promotion and awareness campaign will continue in 2019-20.

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

Speaker	Topic
Kristen MacMillan, U of M	Rethinking Seeding Depth
Anne Kirk, MB Ag	High-Yielding Management Strategies for Spring Wheat
Navneet Brar and Nate Ort, U of M Cassandra Tkachuk, MPSG	Soybean Seed Quality
Megan Boruns, U of M, Laryssa Stevenson, MPSG	Feeding Soybeans – Smart Use of Inoculant and N, P, K Fertilizers
Ingrid Kristjanson and Mitch Timmerman, Manitoba Agriculture	Tile Drainage Effects on Cereal Production

Table 2: The speakers and topics covered at Soybean Research tour were as follows:

Speaker	Topic
Tammy Jones, Provincial Weed Specialist, MB Ag	Giant Ragweed in Soybean Production - Strategies for Control
Cassandra Tkachuk, Production Specialist-East, MPSG	Review of MPSG Research Programming and Producer Resources
Dennis Lange, Provincial Pulse Specialist, MB Ag	Short Season Roundup Ready Soybean MCVET Steps for Selecting a Soybean Variety
Dennis Lange, Provincial Pulse Specialist, MB Ag	Conventional (Non-GMO) Soybean MCVET Steps for Selecting a Soybean Variety
Industry Partners	Soybean Variety Demonstrations

Partner Project Reports

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: $1147.1
Contributors: Manitoba Pork

Background/Objectives

Gringo Hogs and Moonshadow Holsteins are agricultural operations in the Eastman region of Manitoba. Since 2009, they have partnered 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, 2018. Approximately 125 students, teachers and accompanying parents participated in the tours. The kids showed interest in what they saw and were receptive to the agriculture facts that were presented to them.

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. One group even witnessed a calf being born. 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 2018 – Arborg & Beausejour areas

Table 1. Seasonal weather summary at Arborg site from May 1 – September 30, 2018

	Actual	Normal	% of Normal
Growing degree days	1668	1554	107
Crop heat Units	2646	2616	101
Total precipitation (mm)	249	320	78

Table 2. Seasonal weather summary at Beausejour site from May 1–September 30, 2018

	Actual	Normal	% of Normal
Growing degree days	1702	1620	105
Crop heat Units	2721	2634	103
Total precipitation (mm)	362	348	104

Although Beausejour site got almost near normal rainfall during 2018 cropping season, but Arborg site did receive significantly less rainfall similar to 2017 season. In 2018 crop season (May 1-Sep 30), Arborg site received 78% of the normal rainfall. However, both sites had more growing degree-days than 30-year normals (Tables 1 & 2).

Growing degree-days (GDD) is a good indicator how crop 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 drier month and Arborg site received only 58% of the normal rainfall during seedling emergence period (May 10-June 10). September-October were relatively wet months and resulted in delayed harvesting of flax, soybean and corn trials.

The beginning of May saw warm temperatures and the first seeding began May 10th in Arborg and May 8th in Beausejour. On September 9, a hailstorm significantly damaged soybeans plots at the PESAI site in Beausejour. Especially the early maturing soybean varieties were severely damaged in roundup ready and conventional soybean trials. Similarly, a storm in the last week of August resulted in shattering of excess moisture canola at Arborg site.

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)

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 2018 growing season.

The purpose of the MCVET variety evaluation trials is to grow both familiar (checks or reference) 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 2018, PESAI did variety trials in Spring wheat, Oats, Barley and Soybean (both Roundup Ready and Conventional) at both sites. Winter wheat, Fall rye, Peas, Silage corn, Hemp 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 and 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.

Crop Type	Stubble	Seeding Date	Fertility Applied (N-P-K in lbs/ac)	Weed Control	Harvest Date	No of Plots	Other Notes	Site
Spring Wheat	Canola	May 10	75-25-0	Curtail @ 0.8L + Axial @ 0.5 L	Aug 30	78		Arborg
Oats	Canola	May 11	75-25-0	Curtail @ 0.8L	Aug 24	27		Arborg
Winter Wheat	Canola	Sep 11	110-30-0	2,4-D @ 360 ml	Aug 9	21		Arborg
Fall Rye	Canola	Sep 11	110-30-0	2,4-D @ 360 ml	Aug 9	24		Arborg
Barley	Canola	May 11	75-25-0	Curtail @ 0.8L + Axial @ 0.5 L	Aug 22	27		Arborg
Peas	Canola	May 14	0-20-0	Odyssey @ 17.3g + Merge Centurion @ 100 ml + Amigo Basagran Forte @ 0.9L	Aug 24	72		Arborg
Conv. Soybeans	Fallow	May 16	0-20-0	Basagran Forte @ 0.9L	Oct 10	57	Rolled	Arborg
RR Soybeans	Fallow	May 22	0-20-0	Roundup @ 0.67L	Oct 12	180	Rolled	Arborg
Silage Corn	Wheat	May 29	80-40-0	Roundup @ 0.67L	Oct 18	90		Arborg
Flax	Fallow	May 22	50-20-0	Curtail @ 0.8L Basagran Forte @ 0.9L		33		Arborg
Hemp grain & fibre	Fallow	May 22	25-20-0	Brotex 240 @ 0.5L	Aug 30	48		Arborg
Spring Wheat	Fallow	May 8	100-30-0	Curtail @ 0.8L	Aug 13	51		Beausejour
Oats	Fallow	May 8	100-30-0	Curtail @ 0.8L	Aug 13	21		Beausejour
Barley	Fallow	May 8	100-30-0	Curtail @ 0.8L	Aug 13	15		Beausejour
Conv. Soybeans	Barley	May 23	0-10-0	Centurion @ 125 ml + Amigo	Written off	57		Beausejour
RR Soybeans	Barley	May 23	0-10-0	Roundup @ 0.67L	Written off	180		Beausejour

OILSEEDS Research Trials

Determining agronomic suitability of European flax (linseed) cultivars in agro-Manitoba

Project Duration - 2018

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

Collaborators
MFGA, PCDF, PESAI, WADO, BASF, Limagrain NL, van de Bilt zaden en vlas

Results
Immediate yield results showed no statistical difference between European-origin lines and the Canadian-derived check, CDC Bethune at two of three diversification sites. At Melita (WADO), significant differences were apparent, although no difference existed between the check variety and the highest yielding European flax variety.

Project findings
Dry, and drought-like conditions at the test sites contributed to lower overall yields in flax production, as evidenced by low commercial yield in the area according to MASC (Table 1). 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 6 to 10 centimetres shorter than check variety height at 53.7cm (Table 2). Overall days to maturity were +1 to -5 days from the check CDC Bethune (87 days) (Table 3). Correspondingly, flowering period in European flax varieties was +1 to -7 days in variance from the average 21 day flowering period of CDC Bethune (Table 4).

Table 1. Yield Comparisons in European Flaxseed Test at different diversification centres.

	2018 Yield					
	Arborg		**Melita**		**Roblin**	
VARIETY	kg/ha	bu/ac	kg/ha	bu/ac	kg/ha	bu/ac
CDC Bethune	1675	26.6	2226	35.4	2057	32.7
FX 204	1673	26.6	2168	34.5	1959	31.1
FX 305	1717	27.3	2313	36.8	1598	25.4
FX 406	1559	24.8	1973	31.4	1669	26.5
FX 511	1357	21.6	2156	34.3	1518	24.1
FX 608	1361	21.7	2116	33.6	1564	24.9
FX 707	1447	23.0	1840	29.3	1608	25.6
CV%	9.1		3.7		14.8	
LSD	-	-	140	2.2	-	-
Sign Diff	No		Yes		No	
Seeding date	22-May		07-May		22-May	
Harvesting date	20-Sep		14-Aug		11-Oct	

Table 2. Mature plant height (in centimetres) of European lines against CDC Bethune check.

Variety	Arborg	Melita	Roblin	Average	+/- Check
CDC Bethune	43.8	62.0	55.3	53.7	*0*
FX 204	35.7	51.7	55.7	47.7	-6
FX 305	37.8	51.7	46.0	45.2	-9
FX 406	39.7	53.3	48.0	47.0	-7
FX 511	36.8	49.3	45.7	43.9	-10
FX 608	36.2	50.0	46.3	44.2	-10
FX 707	41.3	46.0	45.3	44.2	-10

Table 3. Days to maturity of European lines against CDC Bethune check.

Variety	Arborg	Melita	Roblin	Average	+/- Check
CDC Bethune	95	84	82	87	0
FX 204	98	86	81	88	+1
FX 305	94	85	79	86	-1
FX 406	91	84	77	84	-3
FX 511	90	83	74	82	-5
FX 608	91	84	79	85	-2
FX 707	91	84	76	84	-3

Table 4. Length of flowering period (in days) in European flax cultivars.

Variety	Arborg	Melita	Roblin	Average	+/- Check
CDC Bethune	29	22	11	21	0
FX 204	31	25	11	22	+1
FX 305	20	15	10	15	-6
FX 406	13	22	11	15	-6
FX 511	16	17	11	15	-6
FX 608	16	22	12	17	-4
FX 707	16	12	13	14	-7

Background

With the declining popularity of flax as a rotational crop choice in Manitoba, farmers need incentive to grow a crop like flax. 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 crop rotation. With the closure of private breeding programs at Nutrien Ag Solutions, and the public breeding programs at Agriculture and Agri-Food Canada, only a single breeder of flax remains in Canada at the Crop Development Centre. With the introduction and evaluation of European lines, there may be the possibility of a higher yielding cultivar, or a cultivar with more desirable quality characteristics may be found to be well suited to Manitoba's agro-climate.

Currently, testing is underway at the University of Saskatchewan to determine oil content, fatty acid profile and other desirable characteristics. Further data will be communicated upon completion of this project.

Materials & Methods

Experimental Design – Randomized Complete Block Design

Treatments – Six Flax varieties of European origin along with a check variety, CDC Bethune grown in plots, all treated identically at a single site for fertility (values given on per acre basis), and weed control as per PRCO standards for Linseed Co-op testing.

- Arborg – 50lbs N, 20lbs P_2O_5
- Melita – 102lbs N, 35lbs P_2O_5, 24lbs K_2O, 9lbs S
- Roblin – 79lbs N, 10lbs P_2O_5

Varieties – CDC Bethune, FX204, FX305, FX406, FX511, FX608, FX707.

Seeding rate – 40lbs/acre, adjusted for individual variety germination percentage

Plot size -

- Arborg – 7.1m^2
- Melita – 12.27m^2
- Roblin – 5.98m^2

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

Agronomic information

Stubble, soil type –

- Arborg – fallow, heavy clay soil
- Melita – wheat, Waskada loam
- Roblin – oat/barley silage, Erickson clay loam

Evaluating Flax linseed lines from Saskatchewan

Project duration
2018-2020

Objectives
The purpose of this trial was to assess newly registered flax cultivars (SVPG entries) and experimental lines (FP entries) from the University of Saskatchewan (U of S) and Crop Development Centre (CDC) Flax Breeding Program in comparison to relevant reference flax cultivars under Manitoban conditions.

Collaborators
Helen Booker (University of Saskatchewan CDC)
Eric Fridfinnson (Manitoba Flax Growers Association)
Wayne Thompson (Sask Flax Dev. Comm.)
Dane Froese, Provincial Oilseeds Specialist, MB
WADO
PCDF
PESAI
Jeanette Gaultier, BASF

Results
The trial was established successfully at PESAI site, but deer caused extensive damage later during fall, resulted in yield variability. The yield results were not accepted.

Project findings
The test will be repeated in 2019 season.

Background
With the declining popularity of flax as a rotational crop choice in Manitoba, farmers need incentive to grow a crop like flax. The existing flax varieties are not keeping up with yield advances and farmers are switching to other more profitable crops.

University of Saskatchewan and Crop development Centre run flax breeding program and has developed experimental flax lines. These lines are still in evaluation phase. Some of these lines may have potential to have better yield output.

Material and methods
Experimental Design – Randomised block design with three replications
Treatments – 26 flax lines
Plot size – 7.1 m^2
Data collected – plant stand, plant height, lodging, days to maturity, yield

Agronomic info

Stubble, soil type – Fallow, heavy clay

Fertilizer applied – Soil nutrient levels (lbs/acre): N – 83, P – 34, K – 680
P – 20lbs/acre was applied at seeding.

Pesticides applied – Curtail @ 0.8L/acre on June 16
Basagran Forte @ 0.9L/acre on June 28

Seeding/harvesting date – May 26 / Oct 17

CORN Research Trials

Evaluating Silage corn varieties in Interlake region

Project duration
2018

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

Collaborators
Manitoba Corn Growers Association

Results
Silage corn varietal evaluations were done at Elm Creek, St. Pierre and Arborg sites during 2018 season. With the dry spring, both the Elm Creek and St. Pierre trials had variable emergence and early plant growth. High winds prior to harvesting caused some lodging at both the St. Pierre and Arborg sites. All three trials were taken to yield. Harvesting at Arborg was delayed by wet field conditions.

Silage corn varieties tested in the trial did differ in term of yield (Table 1). The yield ranged from 11.8 – 16.5 Mt/acre and variety PV61079 RIB produced higher yield. The trial CV was 7.1% showing that the results are presentable. Different corn varieties varied in the moisture level at harvest and it ranged from 46.7 -59.0%. Please see table on the page 21 for more detailed results.

Project Findings
These results are based on one year of testing. Please use caution while using these results. For more information, please contact Manitoba Corn Growers Association.

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 – 27 silage corn varieties (see table 1)
Plot size – 15m^2
Data collected – plant stand, plant height, yield

Agronomic info
Stubble, soil type – cereal, heavy clay
Fertilizer applied –N – 80, P – 40 lbs/acre were applied at seeding.
Pesticides applied – Glyphosate @ 0.67L/acre
Seeding/harvesting date – May 29 / Oct 18
During harvesting, 500 grams of silage sample were taken from each plot and were sent to laboratory for quality analysis. These samples were assessed for % TDN, ADF and NDF. Yield data were analyzed using ANOVA and the means were separated using least significant difference (LSD test) at $p = 0.05$.

SILAGE CORN 2018 - ARBORG

Comments:

The silage corn hybrid trial was tested and the data donated by the Manitoba Corn Committee.
The data presented is for one year only. Use with caution.
All hybrids were evaluated at a plant population of 32,000 plants per acre. Plots are planted at a higher rate and thinned to achieve the target population.
Yields are corrected to 65% moisture content.

				ARBORG										
CHU 1	Hybrid	Technology/Genetic Trait 2	Distributor	65% Yield (Mt/ac)	Moisture3 (%)	50% Silk	TDN (%)	ADF (%)	NDF (%)	Milk/Acre4 (lbs/ac)	Beef/Acre5 (lbs/ac)	NE/Gain Mcal/kg	NE/Lact Mcal/kg
2100	TH6875 VT2P	RR2/VT2PRIB	Thunder Seed	15.6	48.5	--	57.5	24.04	44.58	13814	1151	1.13	1.67
2100	E44H12 R	GENVT2P	Elite Seeds	14.2	52.2	--	58.2	32.14	54.74	12199	1062	0.89	1.46
2125	PS 2210VT2P RIB	GENVT2P	DLF Pickseed	15.0	51.9	--	60.9	29.32	52.26	14395	1174	0.97	1.53
2150	AS1017RR EDF	RR2	PRIDE Seeds	16.1	46.7	--	56.2	25.66	45.03	13412	1163	1.09	1.63
2150	A4414RR	RR2	PRIDE Seeds	13.8	51.7	--	63.3	32.57	56.26	14010	1119	0.87	1.45
2150	PV 60075 RIB	VTDpro,RR2	Proven Seed	14.8	51.2	--	63.6	31.29	54.16	15159	1206	0.91	1.48
2150	NSTRExp31086	GTCBLLBL	NorthStar Seed	13.6	50.9	--	60.8	29.57	52.55	12669	1060	0.97	1.53
2175	TH EXS1876	RR2	Thunder Seed	11.9	58.3	--	65.9	25.76	44.82	13406	1004	1.08	1.63
2200	PS 2320RR	RR2	DLF Pickseed	11.8	49.6	--	60.3	26.96	49.63	11174	914	1.05	1.59
2200	NSTRExp47068	GTCBLLBL	NorthStar Seed	15.5	51.4	--	58.2	31.23	55.31	13218	1160	0.92	1.48
2200	QS 1878 GT	GT	Quarry Seed	14.3	55.2	--	66.6	29.21	51.84	15526	1220	0.98	1.54
2225	LR 9474 VT2PRIB	VT2PRIB	Legend Seeds	16.0	47.9	--	51.4	30.32	53.52	10865	1053	0.94	1.51
2225	TH7578 VT2P	RR2/VT2PRIB	Thunder Seed	14.5	52.9	--	63.0	32.12	56.05	14430	1169	0.89	1.46
2250	TH4126 RR	RR2	Thunder Seed	13.4	52.2	--	58.9	27.76	50.07	12454	1013	1.02	1.57
2250	HZ 1885	Agrisure 3010	Horizon Seeds	13.7	55.7	--	60.4	27.27	49.91	12982	1064	1.04	1.59
2250	DALTON R	RR2	Elite Seeds	15.7	51.6	--	61.0	29.02	51.86	14797	1225	0.98	1.54
2250	PV 61079 RIB	VTDpro,RR2	Proven Seed	16.5	51.6	--	57.6	29.49	51.25	14240	1217	0.97	1.53
2250	PV 61180 RIB	VTDpro,RR2	Proven Seed	15.2	58.0	--	61.3	27.86	50.06	14723	1196	1.02	1.57
2275	PS 2333RR	RR2	DLF Pickseed	12.4	55.2	--	59.0	27.86	48.55	11286	939	1.02	1.57
2300	A4705HMRR	RR2	PRIDE Seeds	12.8	55.6	--	57.8	31.52	56.53	11026	948	0.91	1.47
2300	XP18078G2	VT2P	PRIDE Seeds	16.1	55.7	--	59.3	25.40	46.78	15217	1230	1.09	1.64
2300	NSTRExp13110	GTCBLLBL	NorthStar Seed	15.6	54.7	--	66.6	26.62	47.19	17480	1332	1.06	1.60
2310	LR 99S77RR	RR	Legend Seeds	13.7	56.1	--	60.8	28.82	50.13	12937	1066	0.99	1.55
2350	HZ 675	Agrisure 3010	Horizon Seeds	13.9	59.0	--	65.1	31.33	54.50	14794	1164	0.91	1.48
2350	PV 62282 RIB	VTDpro,RR2	Proven Seed	15.2	52.8	--	61.2	29.44	51.30	14645	1192	0.97	1.53
			Site Average	**14.3**	**52.8**								
			CV	**7.12**	**4.94**								
			Sign Diff	**Yes**	**Yes**								
			LSD	**1.7**	**4.3**								
			Planting Date						**May 29, 2018**				
			Harvest Date						**October 18, 2018**				

1 Each company assigns a corn heat unit (CHU) rating to each of their hybrids. The CHU rating is a measure of re ative maturity and is one criteria for choosing a hybrid which is suitable for your growing region.

2 The Canadian Seed Trade Association (CSTA) website provides a database for corn hybrids available in Canada, available at https://seedinnovation.ca/corn-hybrids-database. Information provided includes technology brand name and refuge requirements.

3 Moisture content at harvest.

4 Milk per Acre was calculated using Milk 2006, a model developed by the University of Wisconsin Extension Service.

5 Beef per acre was calculated on the assumption that one pound of beef is produced for every six pounds of TDN.

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), Craig Linde (CMCDC), Nirmal Hari (PESAI),
Scott Chalmers (WADO), Diversification Specialists, MB Ag

Project Findings

This was the first year of testing. More varietal evaluations are planned in 2019 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 is an evolving crisis that 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 – 7.6 m^2
Data collected – plant stand, disease incidence, grain yield, test weight
Agronomic info
Stubble, soil type – Fallow, heavy clay
Fertilizer applied – N – 80 lbs/acre and P – 30lbs/acre were applied at seeding.
Pesticides applied – Brotex @ 570 ml/acre on June 23
Seeding/harvesting date – May 28 / Nov 5

PULSE Research Trials

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). 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 will continue through 2019.

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

Results

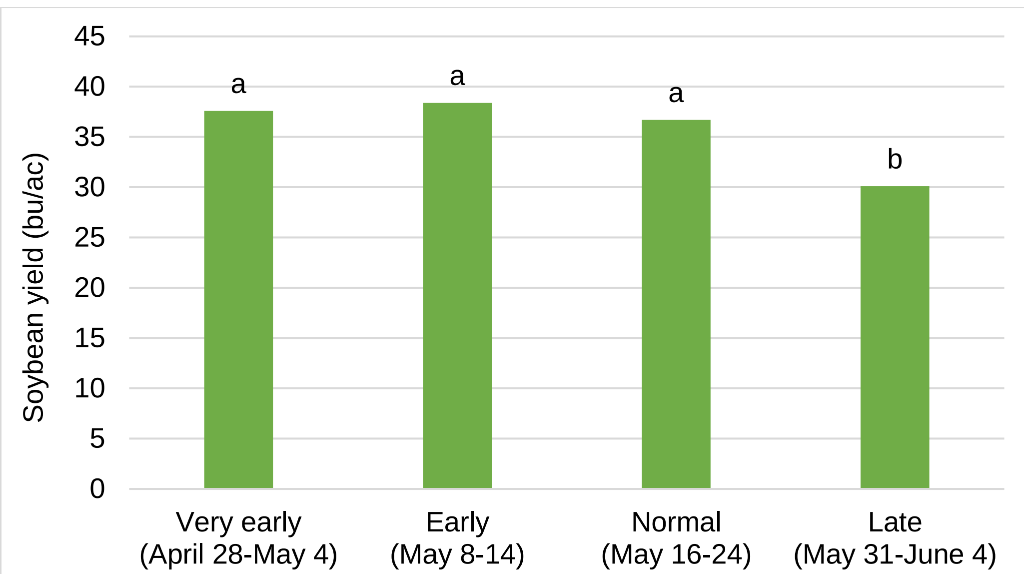


Figure 2. *Soybean yield by seeding window among 7 site-years in Manitoba from 2017-2018. Means followed by the same letter are not statistically different at P < 0.05.*

Project Findings

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 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 (Figure 1). 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 2). 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 2nd 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.

Figure 1. *Soybean seedlings in the first seeding window (April 28 to May 4) were emerging and exposed to the last spring frost in 2 out of 7 environments, making frost exposure an important risk with very early seeding.*

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). 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. 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).

Data collected- plant height, lodging, days to maturity, yield
Agronomic Info (Stubble, soil type) - N= 138 lb/Ac, P= 30 lb/Ac, K= 600 lb/Ac
Fertilizer Applied – P = 15 lbs/acre at seeding
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 Dates (PESAI Arborg)- May 4, May 14, May 23, May 31
Harvest Date- October 9

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 and 2018. 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

Results

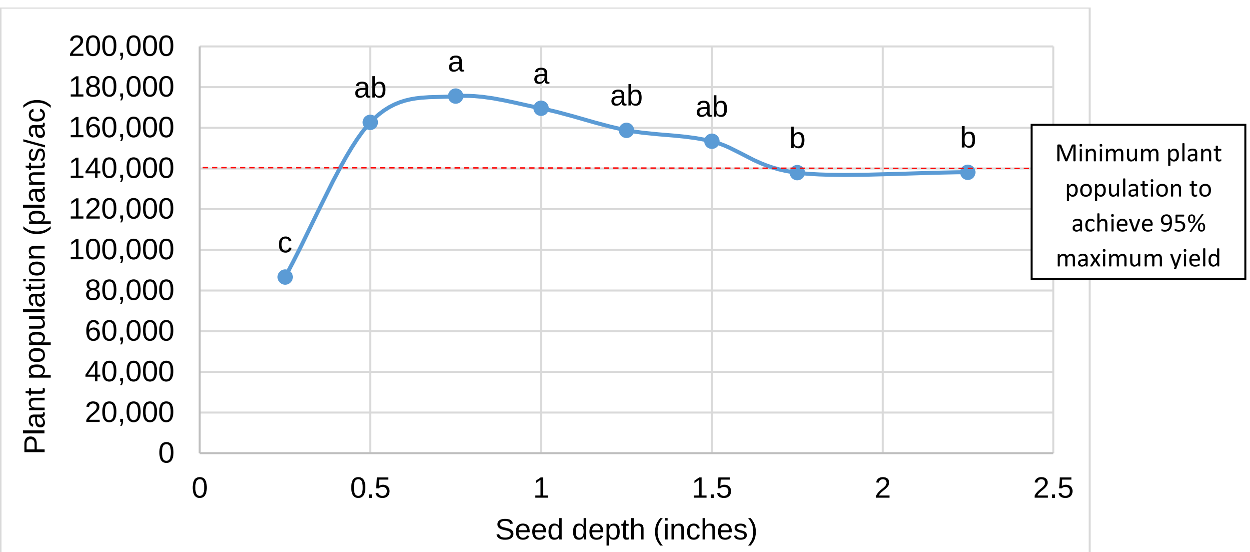


Figure 1. *Effect of seeding depth on established plant population among environments. Means that contain the same letter are not statistically different at* $P \leq 0.05$.

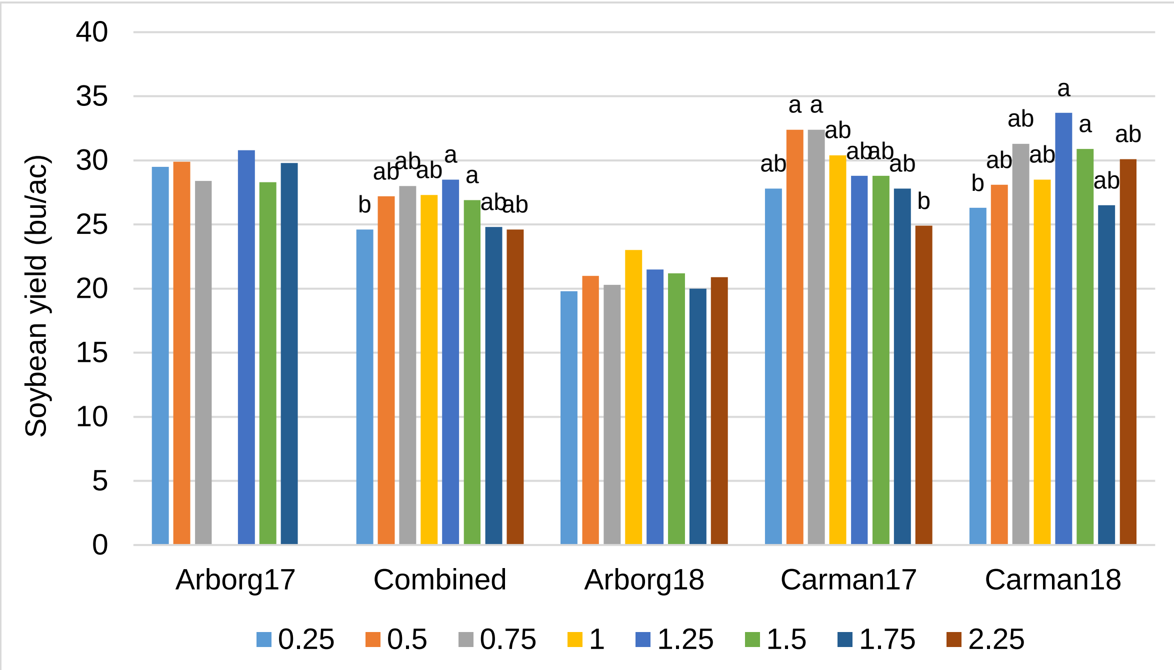


***Figure 2**. Effect of seed depth x environment and the overall effect of seeding depth ("combined", excluding Arborg17) on soybean yield.*

Project Findings

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). 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 (Figure 3). To identify other mechanisms potentially contributing to yield differences, we measured the effect of seed depth on pod height in 2018 and we plan to measure nodulation and root rot in 2019, which will be the last year of the study. In 2018, seed depth did not affect pod height.

Based on the first 2 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.

Figure 3. *Soybean seedlings emerging from 0.5 to 2.25" seed depth (L-R), 7 days after seeding on May 24, 2017. As depth increases, emergence is slower and vigour is reduced.*

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 ½" 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) and Carman (loam soil) in 2017 and 2018 in a randomized complete block design experiment.
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"), three replicates
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 16
Harvest Date: October 9

SPECIAL CROP / PROJECT Research Trials

Evaluating Hemp grain and fiber varieties for yield

Project Duration – 2018

Objective – Assessing different hemp varieties for grain / fiber yield potential.

Collaborators – James Frey PCDF Roblin, Craig Linde CMCDC Carberry, Scott Chalmers WADO Melita, Jeff Kostuik, Hemp Genetics International

Results

Grain yield results are available through the SEED Manitoba guide (2018). Hemp varieties differed in grain yield in Arborg (Table 1) and CRS-1 had the highest grain yield. This variety also had taller plants (at maturity) as compared to all other varieties tested. X59 took 100 days to mature and this maturity period was significantly higher than for Katani, CFX-2 and Grandi.

Table 1. Hemp growth and grain yield results from Arborg grain varieties trial.

Variety	Plant height (inches)	Days to Maturity	Grain yield (Kg/ha)
CRS-1	47.9b	97.3ab	1222.5b
Katani	39.7a	94.0a	1147.9ab
CFX-2	41.1a	94.8a	1166.9ab
X59	39.2a	99.8b	1087.5a
Grandi	41.5a	95.0a	1084.4a
LSD (p value)	3.3 (<0.001)	3.5 (0.019)	93.1 (0.04)
CV (%)	5.2	2.4	5.3

Hemp fiber varieties did not differ in plant height at maturity (Table 2). However, Silesia and Anka took significantly more number of days to mature, when compared with other varieties. The varieties Silesia, Anka and Altair produced less grain yield than varieties CRS-1, Joey and Canda did. However, Silesia produced significantly higher fiber yield.

Table 2. Hemp growth and grain/fiber yield results from Arborg grain/fiber varieties trial.

Variety	Plant height (inches)	Days to Maturity	Grain Yield (Kg/ha)	Fibre Yield (Kg/acre)
CRS-1	55.8a	96.3ab	1150.7d	1237a
Silesia	64.9a	101.3d	565.1a	1843b
Joey	59.6a	95.8a	1192.2d	1058a
Anka	61.1a	99.3c	845.2b	1262a
Canda	56.8a	96.5ab	1157.0d	1301a
Altair	59.3a	97.3ab	975.3bc	1236a
JOEY_FILL	56.7a	98.0bc	1074.5cd	1169a
LSD (p value)	(0.397)	1.93 (<0.001)	134.5 (<0.01)	370 (0.008)
CV (%)	10.1	1.35	9.1	19.3

Project Findings

Arborg site had seen differences in grain / fiber yield among hemp varieties tested. Grain yield ranged from 565 – 1222 kg/ha for different varieties tested in both trials.

Background

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.

There were a number of new developments in Canadian legislation in 2018 with a very direct affect on Canadian hemp growers. The CHTA website outlines these new developments, specifically the changes in Cannabis legislation as well as Health Canada's revision of Section 56 of the Controlled Drugs and Substances Act (CDSA). These changes now allow hemp farmers to immediately collect and store industrial hemp flower, bud and leaf material, a vital piece which was previously prohibited.

This current trial 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 – Five hemp varieties in grain trial and seven varieties in grain/fiber trial (See Tables 1 $ 2).
Plot size – 8.22m^2
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 – 28, K – 740
N – 25 lbs/acre and P – 20lbs/acre was applied at seeding.
Pesticides applied – Brotex 240 @ 0.5 L/acre on June 19
Seeding/harvesting date – May 22 / Aug 30

Evaluating different quinoa varieties under Interlake conditions

Project duration

2018

Objectives

Assessing different varieties of Quinoa for production.

Collaborators

Prairie Quinoa

Results

The test varieties did not differ in grain yield ($p = 0.207$) (Figure 1). Grain yield varied from 202 – 275 lbs / acre. Quinoa variety, PHX 16-02 had higher yield, although the results were not statistically significant.

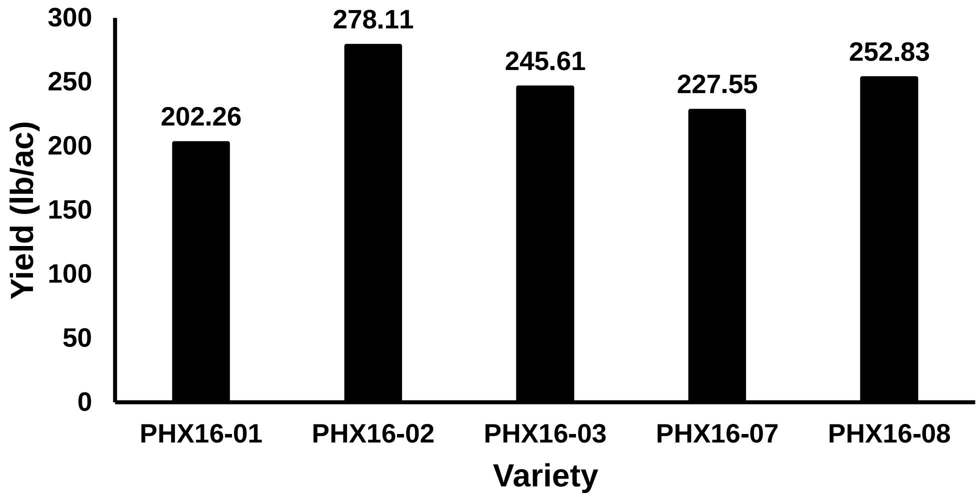


Figure 1. Yield performance of different quinoa varieties at Arborg site.

Project Findings

Grain yield was quite low for all the Quinoa varieties. As Arborg site experienced a relatively drier year, it might have affected yield potential of Quinoa varieties. The site got only 70 % of the normal rainfall during active growing period. The plots were infested with goosefoot groundling moth and bertha armyworm infestation and these infestations also impacted grain yield.

Background / Additional Resources / References

Quinoa is a cool season crop and it prefers short day length and cool temperatures for good growth. Fertility, seedbed preparation, seeding and harvesting parameters for quinoa are similar to canola. Quinoa requires good soil moisture to germinate but once it is established, quinoa prefers drier soils.

Various insect-pests infest Quinoa and Goosefoot groundling moth (*Scrobipalpa atriplicella*) is emerging as a serious pest in Canadian prairies (Boyd et al, 2017). Larvae of this pest can feed within the stem, on foliage, and directly on seed within the panicles, which can result in up to a 100% yield loss.

Quinoa has been traditionally grown in South America. In recent years, quinoa has been grown in Canadian Prairies to find its suitability for the region. In the current study, five varieties from Prairie Quinoa were evaluated for their yield potential.

Boyd A. Mori , Colin Dutcheshen and Tyler J. Wist (2017) *Scrobipalpa atriplicella* (Lepidoptera: Gelechiidae), an invasive insect attacking quinoa (Amaranthaceae) in North America. Canadian Entomologist 149(4): 534-39.

Materials & Methods

Experimental Design – Randomised block design with three replications
Treatments – Five Quinoa varieties (see Fig 1)
Plot size – 8.22m^2
Data collected – plant stand, yield

Agronomic info

Stubble, soil type – Canola, heavy clay
Fertilizer applied – Soil nutrient levels (lbs/acre): N – 77, P – 30, K – 600
N – 25lbs/acre and P – 20lbs/acre was applied at seeding.
Pesticides applied /*Weed control*– Hand weeding on June 23.
Decis @ 45 ml/acre on June 25 (for goosefoot groundling moth)
Decis @ 50 ml/acre on August 10 (for bertha armyworm)
Seeding/harvesting date – May 22 / Oct 19

Effect of tile drainage spacing on wheat production in heavy clay soils

Project Duration: 2018

Objectives

This study investigated the effects of three tile drainage configurations (15', 30' and 45' spacing) on the behaviour of the water table (WT), volume of drainage outflow, quality of drainage outflow and nutrient transport, as well as wheat growth and yield.

Collaborators: Agriculture and Agri-food Canada
Manitoba Ag Staff

Results

Throughout the season, the water table in the 15' plots on the tile and between the tiles was consistent, indicating that there is unlikely to be variation in the field due to an uneven water table. On the 45' plots, the water table between the tiles was up to 1/2' closer to the surface at specific times throughout the season compared to the water table at the tile, indicating that variation in the water table would exist in the field.

The water quality from the tile showed low concentrations of nutrients (total nitrogen or total phosphorus), indicating that nutrient transport is dependent of both the concentration of nutrients in the soil as well as on the total volume of water leaving the field from each treatment (Table 1). Due to very low precipitation, water outflow volumes were too low to measure over the season and additional data collection is necessary to draw specific conclusions about the effect of tile spacing on nutrient transport.

Plots with 45' tiles had higher salt levels in the soil and also higher salt concentrations in the drainage water (Table 1). This indicates that wider spacing may remove more salts than narrower spacing (dependent on volume outflow), or that greater salt concentration in the soil results in greater salt concentration in drainage water, or both.

Table 1. Comparison of 15 and 45 ft tile spacing on water quality based on soils test results.

Tile Spacing (ft)	Water Quality				Soils Test			
	pH	Specific Conductivity (uS)	TN (mg/L)	TP (ug/L)	pH	EC (dS/m)	TN (lb/ac)	TP (lb/ac)
15	8.9	3.2	4.5	151	8.3	0.8	87	36
45	9.1	6.3	4.5	183	8.2	1.7	127	42

Tile drainage had no effect on wheat yield across any treatments. The yield varied between 63.5 – 74.9 bushels/acre among different treatments (Table 2). This was expected during 2018, as excess moisture was not a limiting factor in growth during this season. Tile drainage also did not appear to affect overall plant growth expect head counts. Different tile treatments did not differ for plant stand, plant height and lodging (data not shown in the table).

Table 2. Wheat growth and yield as affected by different tile spacing treatments.

Treatment	Plant Stand (# of plants/m row length)@	Plant Height (inches)*	Head Counts (plants/ft2)#	Yield (bu/acre)^
15'-in between	50.00a	26.90a	50.60ab	63.50a
15'- on tile	53.20a	26.58a	52.80ab	67.30a
30'-in between	60.47a	28.56a	62.80c	67.70a
30'- on tile	65.10a	26.60a	57.40bc	65.43a
45'-in between	62.90a	26.83a	57.00bc	70.37a
45'- on tile	57.77a	26.58a	48.07a	70.10a
No Tile	49.30a	26.75a	48.70a	74.85a
P value	0.743	0.383	0.038	0.584
CV (%)	23.8	4.23	9.39	9.57

**Based on 10 randomly selected plants/plot*
#Based on five samples/plot
^Based on two 6m long combine passes/plot
@Average of 15 samples / plot

Project findings

Between May 15 – August 21, PESAI site got 157mm of rainfall which was 70% of the normal for this time of year. Excess moisture was not a limiting factor in wheat production this season, meaning that it was difficult to assess the effect of tile drainage on crop production. Yield was statistically not affected by any tile drainage spacing treatment.

Neither moisture stress nor drought stress were limiting factors in production this season, meaning that it was difficult to assess the effect of tile drainage on crop production. As well, all plots were seeded on the same day instead of seeding when the field was actually ready for planting. This was due to the fact that PESAI relied on custom seeding for this project.

In dry seasons, tile at 15' in this soil type will still lower the water table (WT) more effectively than surface drainage alone (45' will not). This may be a concern if the crop is not receiving enough water for production. However, this can also be alleviated with the use of control structures to prevent drainage when it is not desirable. Similarly, if the tile is between 2-3 feet from the surface, this rapid lowering of the WT in this space may not be a large concern, considering the tile drainage does not generally affect the groundwater below it.

It is recommended to repeat this study to collect data during a year when excess moisture stress affects plant growth.

Background / References

Manitoba receives significant amounts of snowfall and sub-zero temperatures during the period between November and March. This leads to accumulation of snow over the ground and frozen soils. As temperatures rise during the month of April, melting of snow and frozen soils can cause excessive moisture in agricultural fields. 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 a reduced yield.

The presence of heavy clay soils in the Interlake contributes to the presence of 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.

The Prairie East Sustainable Agricultural Initiative (PESAI) research site has various configurations of subsurface drainage installed and was used for this study. Soil at this site is classified in the Fyala (FYL) soil series as Class -3 agricultural capability due to limitations in high moisture conditions. Fyala soil is considered as poorly drained soil due to presence of clay particles throughout the profile. This site was chosen to investigate the effects of subsurface drainage in on water quality, yield, water table, and drainage volume outflow.

Materials and Methods

Three treatments were studied: 15’ tile spacing, 45’ tile spacing (4.6 m and 13.7 m spacing, respectively), and no tile spacing (check), and wheat was selected as the crop under study due to its prominence in Manitoba. The wheat yield of the 30’ tile spacing plots were also observed. Wheat was planted on May 15, 2018 at a 1.5” depth with a target seeding rate of 2.5 bushels/acre. Wheat variety AAC Brandon was planted in all the treatment plots.

Level logger sensors were placed in two monitoring wells for one replication on each treatment (except 30’spacing). On tiled treatments, one was placed directly over the tile, and one was placed at the halfway point between two tiles in order to understand the uniformity of the water table. On check treatments, monitoring wells were placed randomly. Level loggers were also used with a V-notch weir in drainage control structures to monitor the volume of drainage outflow from tiled treatments (there was no adequate location to measure surface run-off from any treatments). Water quality samples were taken from control structures on a weekly basis and sent away to a third-party lab for analysis of total nitrogen, total phosphorus, and specific conductivity (salt concentration).

The data on plant stand, plant height, head counts, lodging and yield were taken from different treatment plots. Harvest took place on August 21. For harvesting, two 6-metre long strips were combined from each plot either on the tile or in between the tiles. The data of different growth parameters and yield were analysed using MINITAB.

Assessing different seeding rates for Quinoa production

Project Duration – 2018

Objectives – To compare four different seeding rates to see their effect on quinoa productivity.

Collaborators – Northern Quinoa Production Corporation

Project Findings

This was the first year of testing. Dry soil conditions during seeding resulted in poor germination in some of the treatment plots and the trial was not well established. Data from this trial were not presentable during to high variation (CV).

Material and methods

Experimental Design – Randomised block design with four replications
Treatments – Four seeding rate treatments – 2.5 lbs/acre, 5.0 lbs/acre, 7.5 lbs/acre, 10.0 lbs/acre
Plot size – 8.22m^2
Data collected – plant stand, plant height, vigor, heading date, lodging, days to maturity, yield
Agronomic info
Stubble, soil type – Fallow, heavy clay
Fertilizer applied – Soil nutrient levels (lbs/acre): N – 129, P – 46, K – 780
N – 25lbs/acre; P – 20lbs/acre was applied at seeding.
Pesticides applied/Weed control – Manual weeding on June 23
Decis @ 45 ml/acre for insects on June 25
Manual weeding on July 11
Decis @ 50 ml/acre for insects on August 10
Seeding/harvesting date – May 22 / Oct 19

Irrigation effects on Canola production

Project Duration - 2018

Objectives

The current study was designed with the objective to determine if canola variety agronomic attributes (maturity and height) and seeding rate have any effect on canola yield and performance under excess moisture conditions. Three canola varieties and three seeding rate combinations were evaluated under irrigation and ideal growing (on tile drainage land) conditions.

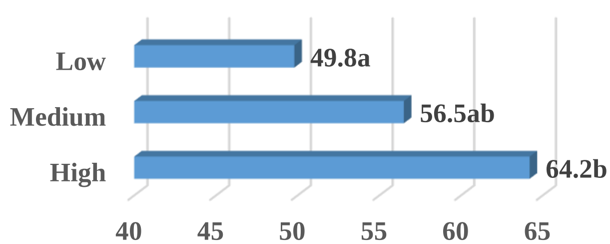
Collaborators

Bifrost Agricultural Sustainability Initiative Cooperative (BASIC)
Bayer Crop Science

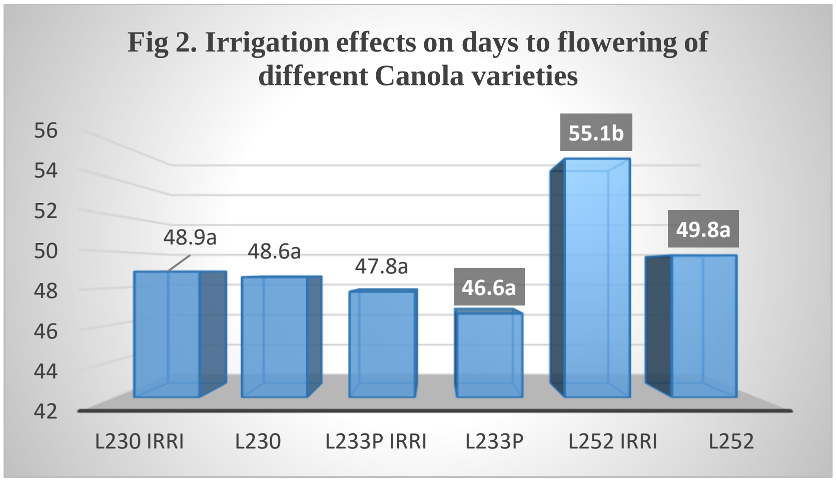
Results

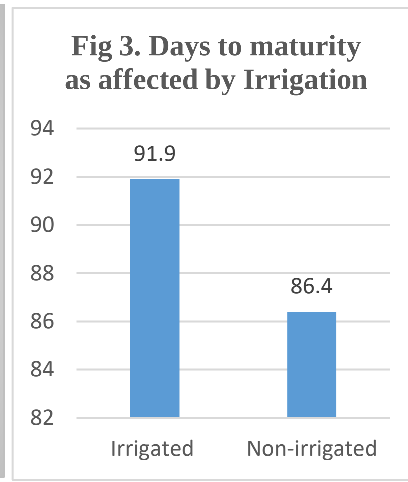
It was not possible to compare yield between irrigated and non-irrigated canola plots as a rainstorm towards end August resulted in huge shattering losses in non-irrigated canola plots. However, canola seeding rate had significant effect on yield (Figure 1) in irrigated canola plots and higher seeding rate resulted in greater yield as compared to low seeding rate (p=0.044). Canola varieties did not differ in yield.

Fig 1. Canola yield (bu/acre) as affected by different seeding rates

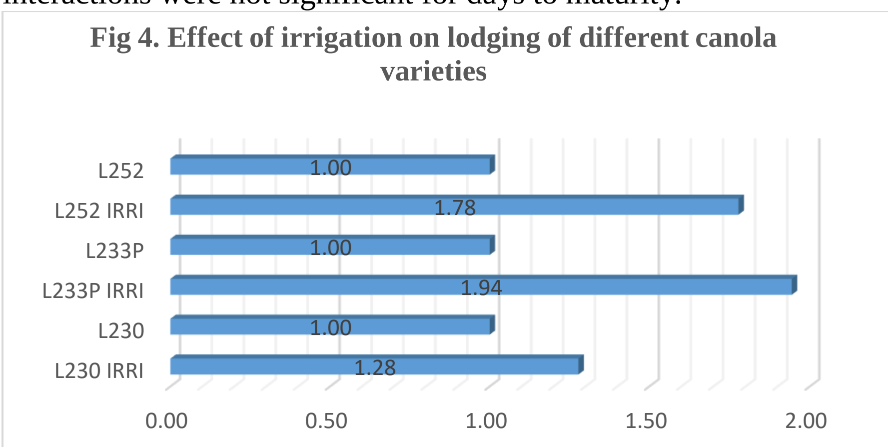


Irrigation had no effect on plant height at maturity when data were combined over varieties and seeding rates. Irrigation delayed days to flowering in canola variety L252 ($p<0.0001$, LSD – 2.36), when the data were pooled for seeding rates (Figure 2). This effect due to irrigation was not recorded in other two varieties.





Irrigation also increased number of days to maturity (p<0.0001, LSD – 2.76), when data were combined over varieties and seeding rates (Fig 3). Irrigation-variety or irrigation-seeding rate interactions were not significant for days to maturity.



Irrigation also exhibited significant effect on lodging of canola varieties L252 and L233P (Figure 4), although it did not affect variety L230 (p – 0.009, LSD – 0.52).

Project findings

Irrigation treatment had effects on canola growth, but its effect on yield was not determined because of rainstorm damage in non-irrigated plots.

The summer during 2018 was exceptionally drier at Arborg site and the site only got almost 70% of the normal rainfall during active canola growing period. A total of 16.5 inches of simulated rainfall (started at 3-4 leaf stage) did not show any adverse effect on canola productivity and the yield ranged from 34-76 bu/acre in different plots. Irrigated canola plots took greater number of days to mature, when compared with non-irrigated canola plots. Irrigation exhibited significant effect on lodging of canola varieties L252 and L233P.

It was not possible to simulate excess moisture conditions because of drier year. It is recommended to repeat this study to simulate excessive moisture stress.

Background/References/Additional Resources

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). 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 – Canola grown in Irrigated and Non-irrigated set ups. Irrigated plots got 16.5" simulated rainfall during June 14 – Aug 10 in addition to natural rainfall.
Varieties – L230, L 252, L233P
Seeding rate treatments -

a. Low seeding rate – target population 6 plants/ft^2 (75% survival)
b. Medium seeding rate – target population 9 plants/ft^2 (75% survival)
c. High seeding rate – target population 12 plants/ft^2 (75% survival)

Plot size – 7.1 m^2
Data collected – plant population, plant height at maturity, days to flower, days to maturity, lodging, yield

Agronomic information

Stubble, soil type – Fallow, Heavy clay
Fertilizer applied – P 25 lbs/acre at the time of seeding.
Pre-plant broadcasting of 100 lbs/acre of actual N
Pesticides applied – Sprayed Liberty @ 1 L/acre on June 4.
Decis @45 ml/acre on June 25 (for flea beetles)
Decis @45 ml/acre on August 19 (for flea beetles)
Seeding/Harvesting date – May 22/Sep 6

Irrigation effects on the production of different Pea varieties

Project duration
2018

Objectives
To find out how irrigation affects phenology and yield of different pea varieties.

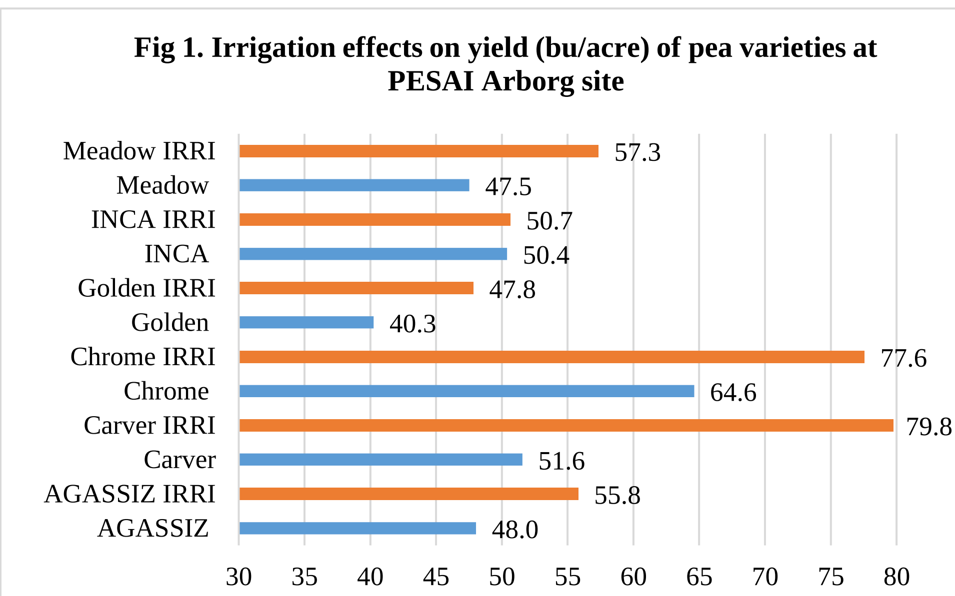
Collaborators
Dennis Lange, Provincial Pulse Specialist
Bifrost Agricultural Sustainability Initiative Cooperative (BASIC)

Results
Irrigation on the plots started when the peas were almost two weeks old. Although irrigation showed chlorosis in some varieties during early phase of growth, but it did not cause adverse effect on yield. Irrigated plots had significantly higher yield than non-irrigated pea plots (Table 1). Overall, pea varieties were taller and they matured two days earlier when grown with irrigation. Irrigation did not result in increased lodging in pea plots.

Table 1. Effect of irrigation on various growth parameters and yield of peas at Arborg site.

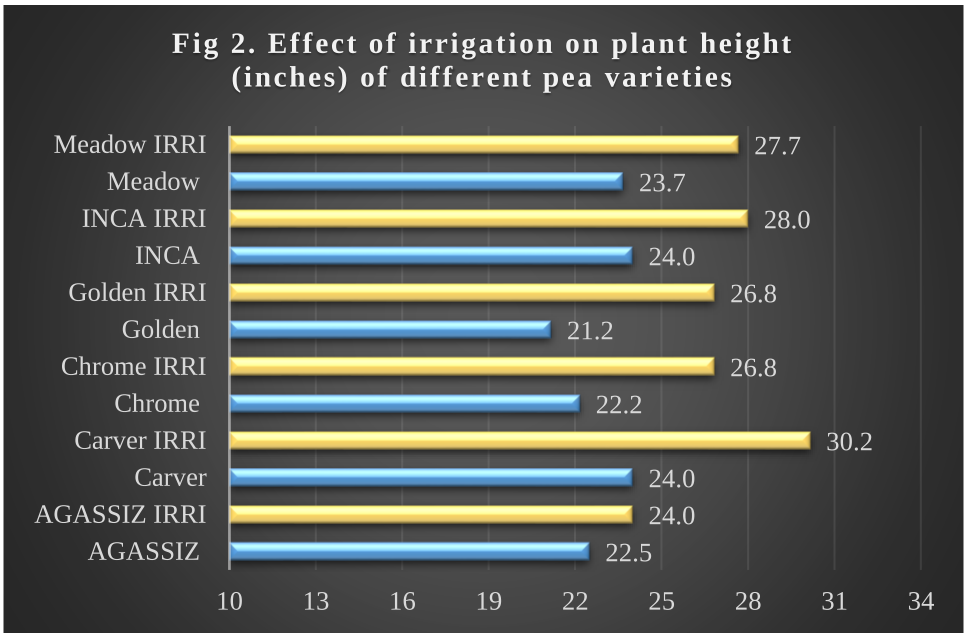
Treatment*	Plant stand (plants/ft^2)	Days to Maturity	Plant height (inches)	Lodging**	Yield (bu/acre)
Irrigated Peas	8.7	83.3	27.3	1.6	61.5
Non-irrigated Peas	9.6	85.3	22.9	1.5	50.4
Significant Difference	No	Yes	Yes	No	Yes
P value	0.187	0.005	<0.0001	0.144	<0.0001
CV (%)	20.1	2.37		14.2	12.9

*Mean of all six pea varieties tested.
**Lodging scale: 1-5; 1 = upright, 5 = flat



Irrigation-variety interaction was not significant for yield (Figure 1). Most pea varieties had higher yield when grown with irrigation. Pea variety Carver had the maximum yield benefit (35% more yield) with irrigation, whereas irrigation did not have any effect on yield of pea variety Inca.

Pea varieties differed in yield irrespective of whether they were grown under irrigated or non-irrigated field conditions. Both Carver and Chrome had significantly higher yield than all other pea varieties, when evaluated with irrigation. Chrome had the maximum yield in non-irrigated trial.



Irrigation – variety interactions were significant for plant height and all pea varieties had higher plant height when grown with irrigation (Figure 2).

Project Findings

The summer during 2018 was exceptionally drier at Arborg site. Pea varieties tested in these trials actively grew between June 1 – Aug 30 and Arborg got only 72 % of the normal rainfall during this period. On the other hand, this site received more heat than usual (Growing degree-days – 109% of the normal). Irrigation actually benefitted peas in terms of yield rather than causing any stress in such a dry and hot environment. A total of 14.5 inches of irrigation were applied over seven weeks and the maximum irrigation given per week was three inches. Deficit soil moisture and probably high evapotranspiration resulted in high water demand of the crop and irrigation applied at regular intervals helped in meeting this demand.

Pea varieties varied in their response to irrigation. Inca was the only variety, which did not show any response to irrigation applied. To create excess moisture conditions in a drier year, a more comprehensive irrigation plan is needed in future evaluations. Probably flooding peas continuously for few days will be a more realistic approach in a drier year.

Background/References/Additional Resources

Peas perform well in relatively dry soil conditions and are susceptible to diseases under excess moisture conditions. Under optimum soil moisture conditions, peas will use 12-15 inches of water (McKenzie and Woods, 2011). Cannel and Jackson (1981) reported that peas waterlogged for continuous five days at 4-5 leaf and pod-filling stage suffered most yield loss. However, when peas were grown under excess moisture for two days, they did not suffer any yield loss.

If soil is deficit in moisture, peas can be successfully grown under irrigation. Early maturing, short-vined varieties are best suited to this type of production. Yields can be much higher than dry land production. Pezeshkpour et al. (2008) reported that supplemental irrigation has increased the seed yield and the biological yield of peas.

In the current study, we evaluated six commonly grown pea varieties under irrigated and non-irrigated conditions to see their response.

McKenzie R and S Woods (2011) Crop water use and requirements. Government of Alberta, Agri-facts.

Cannell, RQ and Jackson MB (1981) Alleviating aeration stresses in modifying the root environment to reduce crop stress. GF Arkin and HM Taylor (Eds.) ASAE Monograph, Pp 141-192.

Pezeshkpour P, Mousavi SK, Shahabu SH, Kalhor M, Khourgami A (2008) Effects of supplemental irrigation and crop density on dryland pea (*Pisum sativum* L.) production in Hamadan province. Iranian J. Agric., 39(2): 389-397.

Materials & Methods

Experimental Design – Randomised block design with three replications
Treatments – Six pea varieties – Meadow, Inca, Carver, Agassiz, Golden, Chrome were evaluated under irrigated and non-irrigated conditions. A total of 14.5 inches of irrigation were applied to iritated plots between June 14-July 27 in addition to natural rainfall.
Plot size – 5.75m^2
Data collected – plant stand, plant height, lodging, days to maturity, yield

Agronomic info

Stubble, soil type – Fallow, heavy clay
Fertilizer applied – Soil nutrient levels (lbs/acre): N – 246, P – 36, K – 740
P – 20lbs/acre was applied at seeding.
Pesticides applied – Basagran Forte @ 0.9L/acre on June 18
Seeding/harvesting date – May 23 / Sep 4

Barley Water Stress Management Trial

Project duration – 2018

Objectives

The purpose of this project was to evaluate the tolerance and recovery of two-row barley cultivars to prolonged excess moisture environment, with the intention of identifying a barley variety with improved tolerance and recovery in waterlogging conditions. The response of yield to waterlogging under field conditions was evaluated at PESAI site in Arborg, MB in 2018 on a set of contrasting two-row barley cultivars to waterlogging stress.

Collaborators

Ana Borrego-Benjumea, Brandon Research and Development Centre, Agriculture and Agri-Food Canada

Ana Badea, Brandon Research and Development Centre, Agriculture and Agri-Food Canada

Results

ANOVA analysis showed that cultivar, treatment, and their interaction all significantly influenced grain yield, with the lowest value in control and the highest in the irrigated treatment for all the cultivars. Similarly, lodging was lower in the control than in the irrigated treatment. The plant height was significantly affected by cultivar and treatment, while the days to heading were significantly affected only by cultivar.

Contrary to what was expected, the data indicated that grain yield was significantly higher in plots with irrigated treatment than in the control for all the cultivars. Furthermore, plant height increased significantly in the irrigated treatment.

Project Findings

Despite of unexpected results, we can take some learning from 2018 (drier year) in order to improve the 2019 experiment. To do so, some steps are recommended to take, such as to modify the application of the treatment by increasing the amount of water and/or frequency of irrigation in order to induce considerable stress symptoms (around 70% leaf symptom yellowing) in the susceptible cultivars. Probably flooding plots continuously for few days will be a more realistic approach in a drier year.

Materials and Methods

Twelve two-row barley cultivars were evaluated for waterlogging tolerance in field conditions at Prairies East Sustainable Agriculture Initiative (PESAI) site in Arborg, MB in 2018. The experimental design used was a Randomized Complete Block Design with three replications and different randomization in irrigated and non-irrigated trials. The trial was seeded on May 16 and harvested on Aug 23. At the time of seeding, 75 lbs/acre of nitrogen and 25 lbs/acre of phosphorous were applied. On June 8, 0.8L/acre of Curtail herbicide was sprayed to control broadleaf weeds.

Waterlogging-tolerant cultivar Deder2 and waterlogging-sensitive cultivar Franklin were used as checks. The excess moisture treatment was imposed by applying a total of 14.5 inches of irrigation starting June 14 and ending on July 27.

Some of the traits evaluated included days to heading, days to maturity, plant height at maturity, lodging, and grain yield. Heading date was determined when 50% of the heads in each plot had fully emerged, maturity date was determined when 50% of the heads in each plot were ripe, and lodging was evaluated in a scale of 1-5 (1=fully erect, 5=fully flat).