Parkland Crop Diversification Foundation
2017 ANNUAL REPORT

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Introduction

PCDF received substantial funding from the Growing Forward 2 and Agriculture Sustainability Initiative (ASI) programs, as well as from trial cooperators, producers, and members of the local community.

PCDF is always open to project ideas and learning about the production concerns of local producers, so please feel free to contact us with any project proposals. For project submissions or additional information, please refer to the Contact info supplied on this website.

Extension Opportunities – 2017

Amazing Ag Adventure & Ag in the Classroom – Russell (April) and Kelburn Farms, Winnipeg (Sept)
Ag Days – Keystone Centre, Brandon (January)
CBC Manitoba, Quinoa – Online (April)
CKDM Radio, 2018 Pea Outlook – Dauphin (February)
Crop Connect (February)
Goose Lake High School – Roblin (April)
Organic Farm Club – Roblin (March)
PCDF Annual Field Day – Roblin (July)
PCDF Self-Guided Tour – Roblin (Field season)
University of Manitoba Agriculture Diploma Program (February)

PCDF Board of Directors 2017

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2017 Meteorological Data

Roblin 2017 Season Report by Month (based on 30-year average)

Month	Precipitation		Corn Heat Units		Growing Degree Days	
	Actual	Normal	Actual	Normal	Actual	Normal
April	12	24	81	33	30	7
May	42	45	320	321	175	172
June	39	73	282	530	172	314
July	38	71	650	645	403	392
August	36	56	587	587	364	354
September	25	53	244	292	216	163
October	14	26	128	42	59	11

From Manitoba Agriculture Growing Season Report;
http://tgs.gov.mb.ca/climate/SeasonalReport.aspx

Roblin 2017 Season Summary April 1 – October 31

	Actual	Normal	% of Normal
Number of Days	214	-	-
Growing Degree Days	1423	1415	101
Corn Heat Units	2394	2452	98
Total Precipitation	209	350	60

From Manitoba Agriculture Growing Season Report;
http://tgs.gov.mb.ca/climate/SeasonalReport.aspx

2017 PCDF Field trials

Plot information

At seeding: 7m by 1.2m
Trimmed: 5m by 1.2m
Plot Area: $6m^2$
Alleyways: 2m

Equipment

5-Row Fabro Disc Seeder
Plot Sprayer
Wintersteiger Plot Combine

Manitoba Crop Variety Evaluation Team (MCVET) Evaluation Trials

The Manitoba Crop Variety Evaluation Team (MCVET) facilitates variety evaluations of many different crop types in this province. PCDF's unique position on the Manitoba Saskatchewan border provides it with opportunities to work also with the Saskatchewan Variety Performance Group.
The purpose of the MCVET and SVPG 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 2017, PCDF did variety trials in Spring wheat, Fall Rye, Oats, Barley, Faba beans, Flax, Soybeans (both RoundUp Ready and conventional) and Peas. The Winter Wheat trial was discontinued due to spray drift damage, and one Spring Wheat trial was discontinued due to weed issues.
From each MCVET site across the province, yearly data is collected, combined, and summarized in the 'Seed Manitoba 2017' guide. Hard copies are available at most Manitoba Agriculture and Ag Industry Offices.

Table 1. Brief summary of MCVET trials conducted by PCDF during 2017

Crop type	Number of plots	Sites
Fall Rye	15	*Roblin*
Spring Wheat	84	*Roblin*
Barley	51	*Roblin*
Oats	48	*Roblin*
Peas	66	*Roblin*
Faba beans	90	*Roblin*
Soybeans	150	*Roblin*
Flax	42	*Roblin*
Total plots	**546**	

For MCVET trial results conducted by PCDF, please see *Seed Manitoba Guide* or visit websites *www.seedinteractive.ca* or *www.seedmb.ca*.

Table 2. Additional Trials

Crop Type	Collaborators	Purpose	Number of Entries
Alfalfa	Manitoba Agriculture Farm Production Extension	Evaluation of AC Yellowhead Alfalfa for winter hardiness and forage production	8
Barley	Field Crop Development Centre	Variety Trial	20
Barley	Agriculture Agri-Food Canada	Variety Trial (Grain and Forage)	14
6 Row Malt Barley	Agriculture Agri-Food Canada	Evaluation of 6-row malt barley lines for registrations	18
Barley	Manitoba Agriculture	Determination of optimum seeding rates for barley	10
Barley	Field Crop Development Centre	Variety Trial (Grain and Forage)	20
Barley	Agriculture Agri-Food Canada	Variety Trial	14
Fall Rye	FP Genetics	Seeding rates and Nitrogen Application for Hybrid Rye	12
Flax A	Flax Council of Canada	Seed Treatment and Fertilizer	6
Flax B	Flax Council of Canada	Seeding Date, Rate and Row Spacing	9
Flax C	Flax Council of Canada	Fungicide and Herbicide	6
Flax D	Flax Council of Canada	Effect of Crop Stubble on Yield	6
Hemp	Various	Variety Trial	13
Hemp	Parkland Industrial Hemp Growers, Hemp Genetics Intl., Manitoba Harvest	Nitrogen Application	9
Hemp	Parkland Industrial Hemp Growers,	Seeding Rate	6

	Hemp Genetics Intl., Manitoba Harvest		
Hemp	Parkland Industrial Hemp Growers, Hemp Genetics Intl., Manitoba Harvest	Seeding Date	3
Quinoa	Phillex Ltd	Variety Trial	5
Soybean	Agriculture and Agri-Food Canada	Effect of residue management on soybean growth, yield and quality	6
Agroforestry	PCDF		3
Fruit Demonstration	University of Saskatchewan	Sour Cherry and Haskap	10
Integrated Soil Management	PCDF		6

Table 3. 2017 PCDF Exclusive Trials

Crop Type	Collaborators	Purpose
Oats	Crop Development Centre	Variety Trial
Oats	Pepsi Quaker Oats	Variety Trial

Table 4. 2017 PCDF Discontinued Trials

Crop Type	Collaborators	Purpose	Number of Entries
Corn nursery	Agriculture Agri-Food Canada	Variety Trial	100
Corn	Agriculture Agri-Food Canada	Variety Trial	90
Sugar Corn	Agriculture Agri-Food Canada	Variety Trial	7
Corn	Pioneer	Demonstration	7
Hops	Manitoba Agriculture	Demonstration	9
Soybeans	AgQuest		14
Winter Wheat	MCVET		9

CEREALS

Determining Optimum Target Plant Stands for Spring Cereal Crops in Manitoba

Project duration – 2017-2018
Objectives – To determine optimum plant populations for spring wheat, oat, and barley, and will determine if optimum plant population differs for individual cultivars.

Collaborators – Anastasia Kubinec – Manager, Crop Industry Development, Manitoba Agriculture
Anne Kirk – Crop Industry Development, Manitoba Agriculture

Results

Mortality

- Seedling mortality averaged 21% across all crop types, locations, and seeding rates, but ranged from 0-51% (data not shown). In general, mortality was higher at higher seeding rates. Figure 2 shows actual plant stand for each crop and location.
- When calculating seeding rates for spring cereals 10-20% stand loss should be taken into account.

Tillering

- Cereals typically compensate for lower plant populations by increasing tillering. Varieties have differing abilities to tiller, but in this study no differences between the wheat and oat varieties were found at any location, only at the Melita site did the barley varieties differ in heads/plant (data not shown).
  While the general trend was for heads/plant to decrease as plant population increased (Table 1), statistically significant differences in heads/plant across plant populations were only seen in wheat at the Melita site and in oat at the Arborg site.

Table 1. Heads/plant for spring wheat, oat, and barley at five target plant populations averaged across locations.

Target Plant Population (plants/ft^2)	Heads/Plant		
	Wheat	Oat	Barley
15	2.8	2.0	3.3
21	2.4	1.8	3.0
27	2.2	1.5	2.3
33	2.2	1.8	2.2
39	2.1	1.5	2.3

Yield

- Both cultivars of each crop responded similarly to increasing plant stands; therefore, yield results are averaged over cultivars.
- Plant stand did not have a significant effect on barley yield at the Carberry and Melita locations, but at Arborg the trend was for yield to increase with higher plant stands (Figure 1A).
- Plant stand did not have a significant effect on oat yield at either location (Figure. 1B).

- For wheat, plant stand did not effect yield at the Carberry location but yield did significantly increase with increasing plant stands at Melita (Figure 1C).

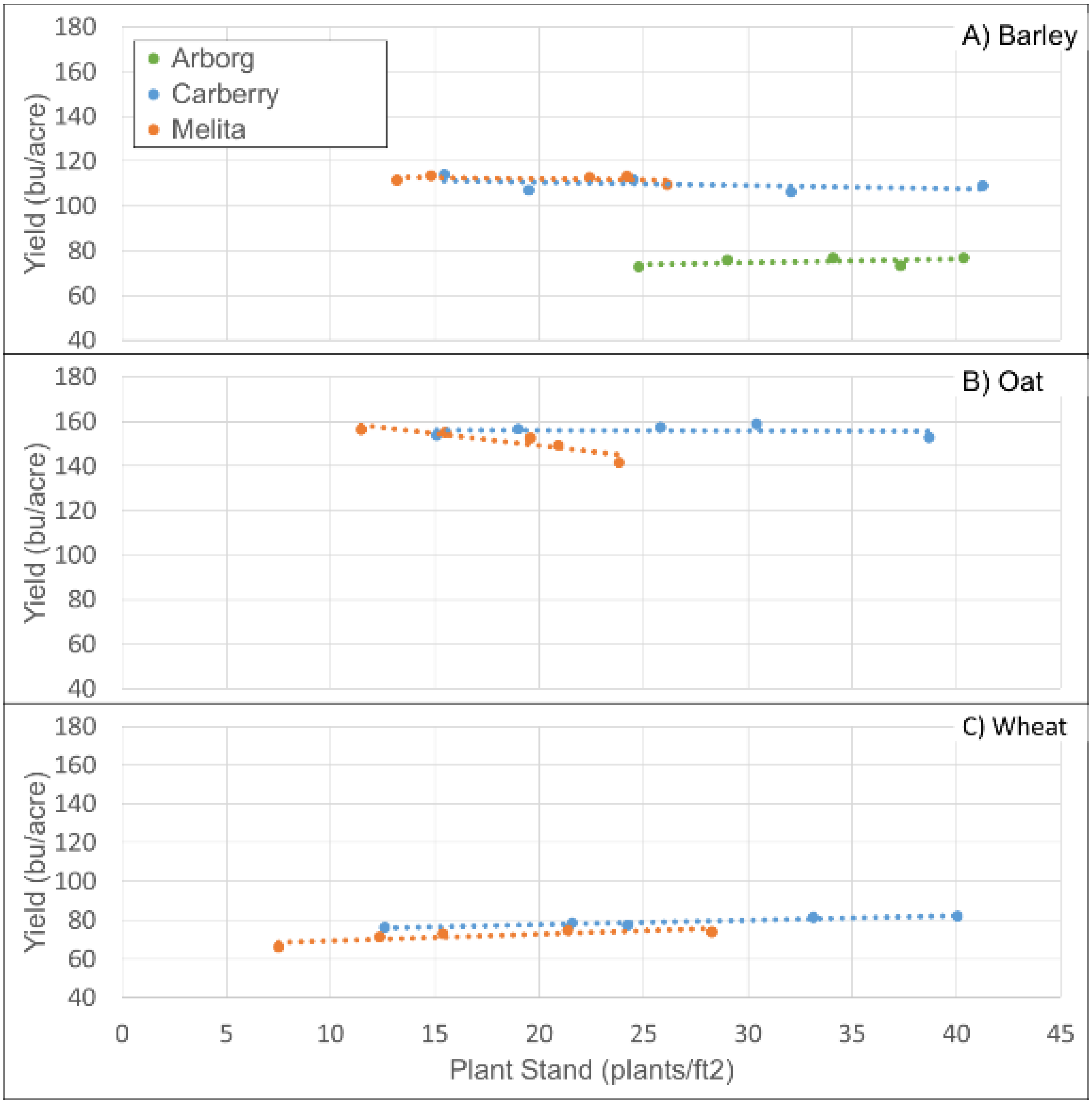

Figure 1. Yield (bu/acre) at five plant stands (plants/ft²) for barley (A), oat (B), and wheat (C), at Arborg (green, barley only), Carberry (blue), and Melita (orange). Yields are represented by circles, linear trend lines are dashed lines. Treatments within the same location with the same letter are not significantly different (P<0.05).

Project findings

Mortality, tillering, and yield are highly influenced by environment; more data is needed to make recommendations about optimal plant stand

Materials & Methods

Experimental Design:	Random Complete Block Design
Entries:	10 entries for each cereal
Seeding:	**Barley**: May 18; **Oats**: May 18; **Wheat**: May 17
Harvest:	**Barley**: Sept 1; **Oats** Sept 4; **Wheat**: Sept 1
Varieties:	**Barley**: AAC Synergy and CDC Austenson;
	Oat: Summit and CS Camden;
	Wheat: Brandon and Prosper

Two cultivars of spring wheat (AAC Brandon and Prosper), oat (CS Camden and Summit), and barley (AAC Synergy and CDC Austenson) were grown at the crop diversification centres in Arborg, Carberry, Melita and Roblin, at five seeding rates. Target plant stands were 15, 21, 27, 33, and 39 plants/ft^2. Data collected includes plant stand, mortality, heads/plant, and yield. Data from the Roblin location is not included in the results since a range of plant stands was not achieved. A late season hail storm damaged oat and wheat plots in Arborg, yield data from those trials is not included in the results. This project will take place over two growing seasons, data presented is preliminary and from 2017 only.

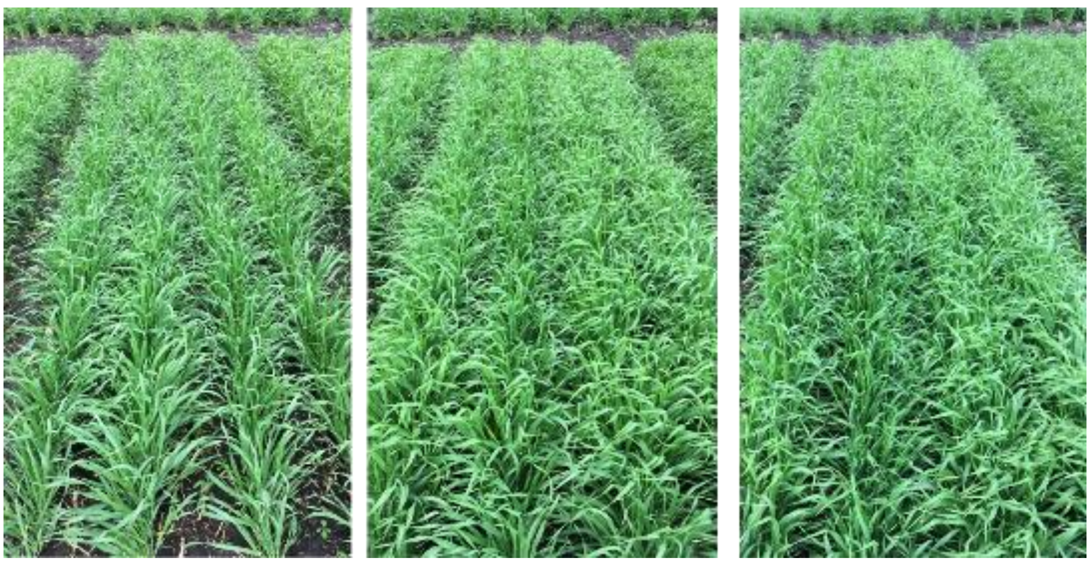

Figure 2. AAC Synergy barley planted at target plant stands of 15, 27, and 39 plants/ft^2 (left to right).

Table 1: Target Plant Population

(Plants/m^2)	15	21	27	33	39
Seeds/m^2 for target population (+15%)	186	260	334	408	483

Data collected and date collected

Emergence	**Barley:** May 27; **Oats:** May 27; **Wheat:** May 27
Emergence population	**Barley:** June 9; **Oats:** June 9; **Wheat:** June 9
% Seed mortality	**Barley:** June 9; **Oats:** June 9; **Wheat:** June 9
Heading (50%)	**Barley:** July 9; **Oats:** July 13; **Wheat:** July 9
Head counts	**Barley:** July 27; **Oats:** July 27; **Wheat:** July 27
Lodging	**Barley**: Sept 1; **Oats** Sept 4; **Wheat**: Sept 1

Agronomic info

Previous year's crop:	Oat barley silage
Soil Type:	Erickson Loam Clay
Landscape:	Rolling with trees to the east
Seedbed preparation:	Heavy harrowed twice

Table 2: Spring 2017 Soil Test

	Available
N	86 lb/ac
P	10 ppm
K	183 ppm
S	184 lb/ac

Table 3: Added N and P

	Blend	Blend (actual lbs/ac)	Actual lbs N	Actual lbs P
Barley	46-0-0	78.01	38	0
	11-52-0-0	19.23	2.12	10
	Total	-	40.12	10
Oats	46-0-0	28.01	15	1
	11-52-0-0	19.23	2.12	10
	Total	-	17.12	10
Spring Wheat	46-0-0	278.01	130	0
	11-52-0-0	19.23	2.12	10
	Total	-	132.12	10

N side-banded; P Banded with seed

Table 4: Pesticide Application

	Crop stage	Date	Product	Rate
Barley	Pre-emerge	May 18	RoundUp WeatherMax	0.51 L/ac
	In-crop	June 27	Prestige XCA	0.26 L/ac
	In-crop	June 27	Axial BIA	0.96 L/ac
	Desiccation	Aug 24	RoundUp	0.67 L/ac
Oats	Pre-emerge	May 18	RoundUp WeatherMax	0.51 L/ac
	In-crop	June 12	Prestige XCA	0.17 L/ac
	Desiccation	Aug 24	RoundUp	0.67 L/ac
Spring Wheat	Pre-emerge	May 18	RoundUp WeatherMax	0.51 L/ac
	In-crop	June 27	Prestige XCA	0.26 L/ac
	In-crop	June 27	Axial BIA	0.96 L/ac
	Desiccation	Aug 24	RoundUp	0.67 L/ac

Hybrid Fall Rye Fertility and Seed Rate

Project duration – September 2016 – August 2017
Objectives – To study different fertility and seed rates on varieties Brasetto and Bono
Collaborators – Denise Schmidt – National Sales Manager, FP Genetics

Results

The average grain yield by variety and the mean yield for all varieties are provided in Figure 1.

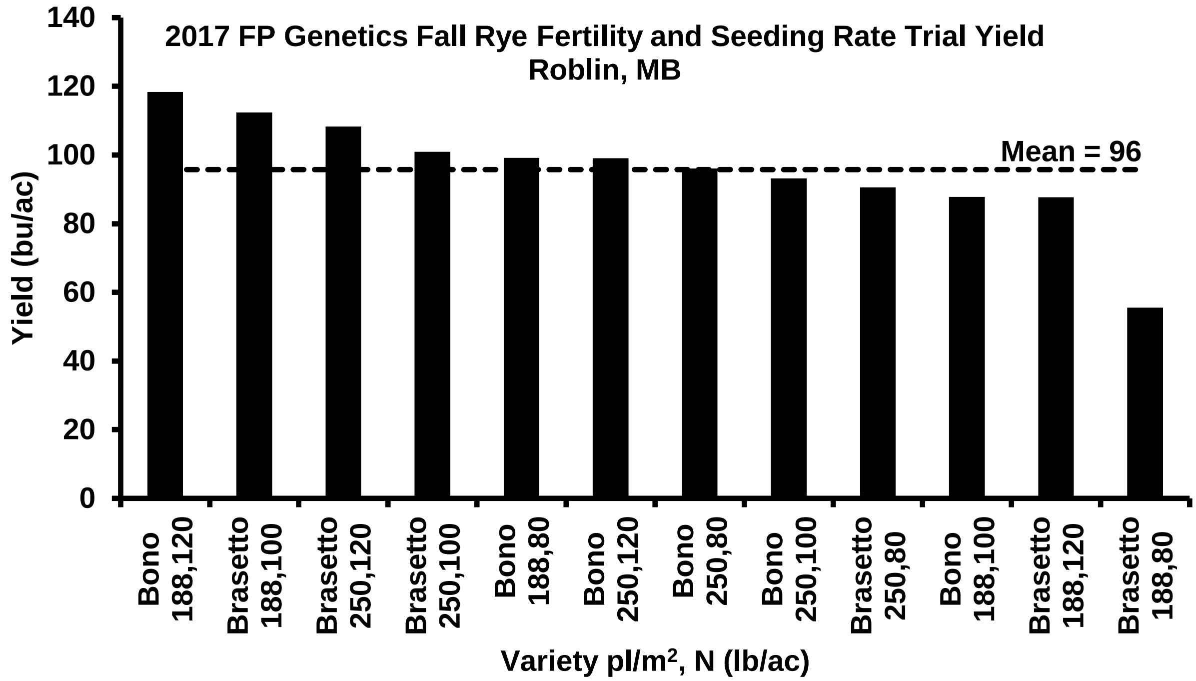

Figure 1. Average hybrid fall rye yield, Roblin, 2017

Project findings

Good soil moisture at seeding and a mild winter, as well as good early-season moisture in 2017, provided excellent growing conditions for fall rye. Dry growing conditions resulted in relatively low incidence of disease, and appeared to hasten maturity. Ripening was more uniform, as compared to open-pollinated (non-hybrid) varieties. The yield results for Roblin 2017 represent only one site year, and should not be used to draw broader conclusions.

Background/References/Additional Resources

The better lodging resistance and more even maturity and height of hybrid fall rye offers many benefits to growers as compared to open-pollinated varieties. This includes a ready market for the high quality bread flour it produces. An improved understanding of seeding and fertility rates will increase producers' ability to capitalize on fall rye production.

Brassetto Fact Sheet
http://fpgenetics.ca/quadrant/media/Fact%20Sheets/BRASETTO_2017.pdf
Bono Fact Sheet
http://fpgenetics.ca/quadrant/media/Fact%20Sheets/KWS_BONO_2017.pdf

Materials & Methods

Experimental Design: Split plot (see Table 1)
Treatments: 2 seeding rates x 2 varieties x 3 fertility rates
Seeding: September 19, 2016
Harvest: August 30, 2017

Table 1: Treatments

Variety	Bono						Brasetto					
Seeding Rate (pl/m2)	188			250			188			250		
Nitrogen Rate (lb/ac)	80	100	120	80	100	120	80	100	120	80	100	100

Data collected and date collected

Spring emergence: April 12
Spring plant counts: May 10
Days to maturity: 121 days
Height: August 25
Grain moisture:
Yield:

Agronomic info

Previous year's crop: Oat barley silage
Soil type: Erickson Loam Clay
Landscape: Rolling with trees to the east
Seedbed preparation: Heavy harrowed twice

Table 2: Fall 2016 Soil Test

	Available
N	42 lb/ac
P	26 ppm
K	302 ppm
S	46 lb/ac

Table 3: Added P and S

Blend	Blend (actual lbs/ac)	Actual lbs N	Actual lbs P	Actual lbs K	Actual lbs S
11-52-0-0	28.8	3.17	15	-	-
21-0-0-24	20.83	4.37	-	-	5
Total		7.54	15	0	5

Banded with seed

Table 4: Added N

Treatment	Target N	Available N lbs/ac	From other sources lbs/ac	Actual N lbs/ac	Blend 46-0-0 lbs/ac
1	100	42	7.54	30.46	66.22
2	120	42	7.54	50.46	109.70
3	120	42	7.54	70.25	153.17

Table 5: Pesticide Application

Stage	Date	Product	Rate
Pre-Emerge	September 12	Roundup WeatherMax	0.67 L/ac
In-crop	-	-	-
Desiccation	August 11	Roundup Transorb	0.67 L/ac

Organic Oats Variety Evaluation

Project duration - May 2017 – October 2017
Objective - To evaluate oat varieties for organic production.
Collaborators - Jennifer Mitchell-Fetch, AAFC Brandon

Results

The average grain yield by variety and the mean yield for all varieties are provided in Figure 1.

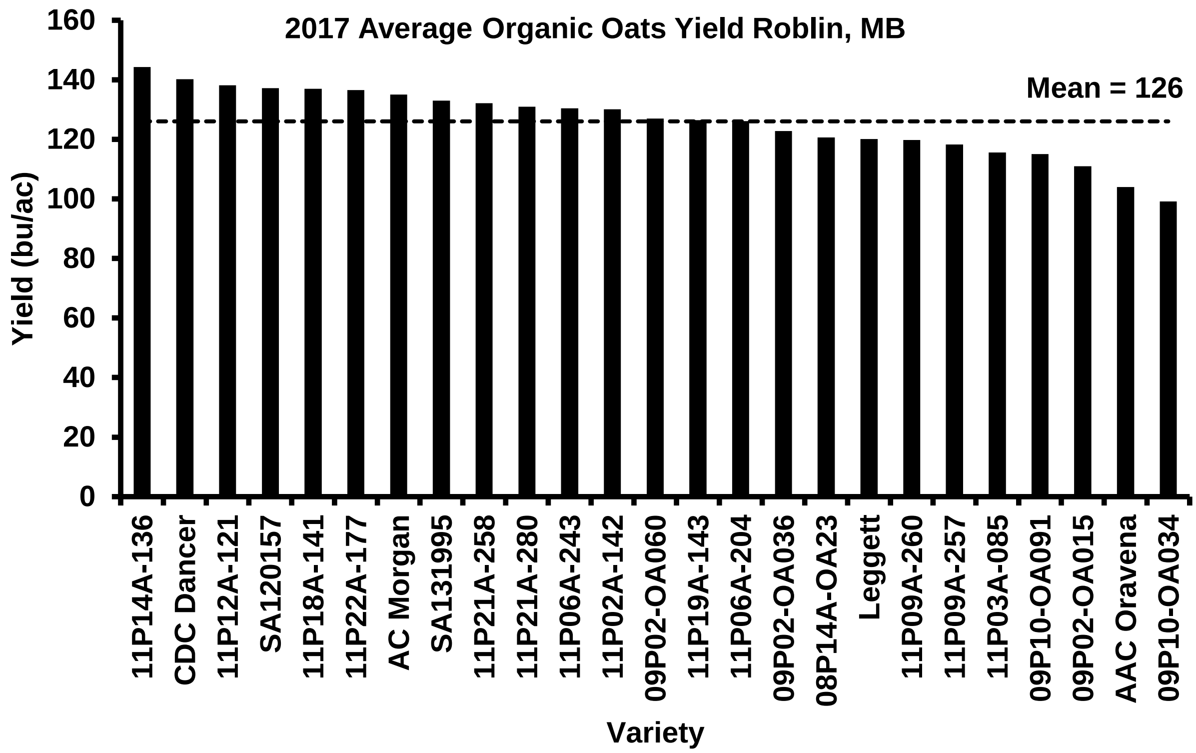

Figure 1. Average organic oats yield, Roblin, 2017

Project findings

Good early-season soil moisture provided excellent growing conditions for oats. Dry growing conditions resulted in relatively low incidence of disease, and appeared to hasten maturity. Dry conditions also appeared to suppress weed competition. The yield results for Roblin 2017 represent only one site year, and should not be used to draw broader conclusions. For more information, contact Jennifer Mitchell-Fetch at Agriculture and Agri-food Canada, Jennifer.Mitchellfetch[at]agr.gc.ca.

Background

Research suggests that selection of cereal crops specific to organic agriculture should be conducted on organically managed land [1,2]. Conventional management systems may mask or confound certain plant characteristics, resulting in selection of sub-optimal cultivars for organic production systems. Organic management conditions were used for the trial at PCDF, although the site was not certified organic.

Materials & Methods

Experimental Design: Random Complete Block Design
Entries: 25 varieties
Seeding: May 15
Harvest: September 8

Table 1: Varieties included at Roblin 2017

11P03A-085	CDC Dancer	11P14A-136	11P12A-121	AAC Oravena
11P22A-177	11P21A-280	09P10-OA034	SA131995	Leggett
11P06A-204	AC Morgan	11P21A-258	09P10-OA091	SA120157
09P02-OA015	11P18A-141	11P19A-143	08P14A-OA23	11P02A-142
09P02-OA036	11P09A-257	11P09A-260	11P06A-243	09P02-OA060

Data collected and date collected

Emergence date: May 21
Heading: July 9
Maturity: Sept 1
Vigour Rating: Aug 1
Disease Rating: Aug 1
Height: Aug 21
Yield:
Moisture:

Agronomic info

Previous year's crop: Oat barley silage
Soil Type: Erickson Loam Clay
Landscape: Rolling with trees to the east
Seedbed preparation: Heavy harrowed twice

Table 2: Spring 2017 Soil Test

	Available
N	86 lb/ac
P	10 ppm
K	183 ppm
S	184 lb/ac

References

[1] Reid, T., Yang, R.-C., Salmon, D. and Spaner, D. (2009). Should spring wheat breeding for organically managed systems be conducted on organically managed land? Euphytica 169:239-252.
[2] Dalhousie University, Organic Agriculture Centre of Canada. The crafting of organic oats. https://www.dal.ca/faculty/agriculture/oacc/en-home/about/about-oacc/documents/newpaper-articles/newsarticles-2012/newsarticles-2012-fetch.html

Parkland Coop Variety Evaluation

Project duration - May 2017 – October 2017
Objectives - To evaluate wheat varieties for the Parkland Coop
Collaborators - Dean Spanner – Coordinator, University of Alberta Research Station
Klaus Strenzke – Research Technician, University of Alberta Research Station

Results
The average grain yield by variety and the mean yield for all varieties are provided in Figure 1.

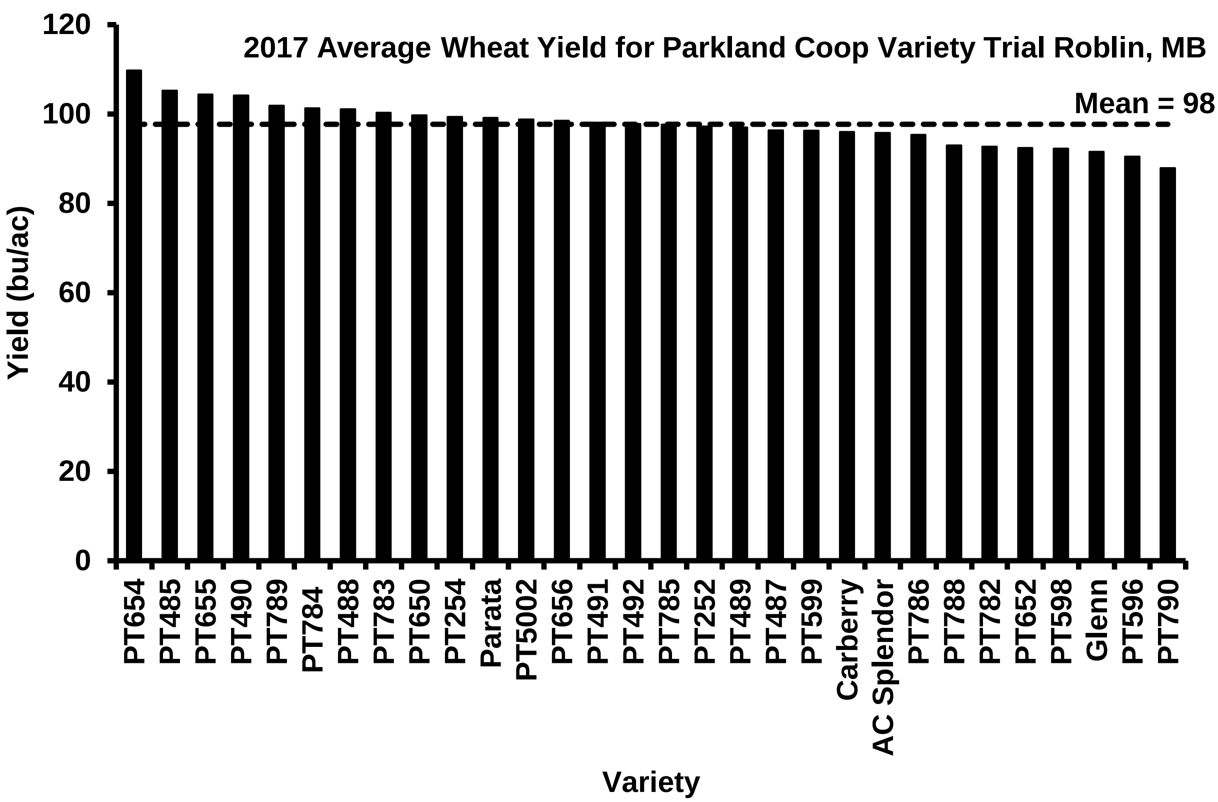

Figure 1. Average wheat yield for Parkland Coop variety trial, Roblin, 2017

Project findings
Good early-season soil moisture provided excellent growing conditions for wheat. Dry growing conditions resulted in relatively low incidence of disease, and appeared to hasten maturity. The yield results for Roblin 2017 represent only one site year, and should not be used to draw broader conclusions. For more information, contact Klause Strenzke, strenzke[at]ualberta.ca.

Background
The Parkland Cooperative wheat trial is conducted across the Prairies as a resource for wheat breeders to generate data in support of registration of new Canada Western Red Spring varieties.

Materials & Methods
Experimental Design: Rectangular Lattice

Entries: 30 varieties
Seeding: May 17
Harvest: September 4

Table 1: Varieties included in trial at Roblin, 2017

AC Splendor	Carberry	Glenn	Parata	PT485
PT596	PT650	PT782	PT783	PT784
PT785	PT252	PT487	PT488	PT489
PT598	PT599	PT652	PT786	PT254
PT490	PT491	PT492	PT5002	PT654
PT655	PT656	PT788	PT789	PT790

Data collected and date collected

Emergence date: May 26
Heading: July 13
Maturity: Aug 26
Height: Aug 21
Lodging: Sept 4
Yield
Moisture

Agronomic info

Previous year's crop: Oat barley silage
Soil Type: Erickson Loam Clay
Landscape: Rolling with trees to the east
Seedbed preparation: Heavy harrowed twice

Table 2: Spring 2017 Soil Test

	Available	Needed
N	86 lb/ac	216 lb/ac
P	10 ppm	10 lb/ac
K	183 ppm	0
S	184 lb/ac	0

Table 3: Added N and P

Blend	Blend (actual lbs/ac)	Actual lbs N	Actual lbs P
46-0-0	278.01	127.88	0
11-52-0-0	19.23	2.12	10
Total	-	130	

N side-banded; P seed placed

Table 4: Pesticide Application

Crop stage	Date	Product	Rate
Pre-emerge	May 18	RoundUp WeatherMax	0.51 L/ac
In-crop	June 27	Prestige XCA	0.26 L/ac

	June 27	Axial BIA	0.96 L/ac
Desiccation	Aug 24	RoundUp	0.67 L/ac

Manitoba Agriculture Wheat Fusarium Head Blight Risk Model

Project duration - May 2017 – October 2018
Objectives - To increase understanding of resulting Fusarium Head Blight (FHB) infection based on the current model.
Collaborators - Holly Derksen – Field Pathologist, Crop Industry Development
Anne Kirk – Cereal Specialist, Crop Industry Development
Rejean Picard and Earl Bargen – Farm Production Extension

Results

No significant yield difference was observed between treatments within a variety. Very few disease symptoms were observed in these trials, even in treatments that did not receive a fungicide application.

Background

Improved decision-making tools to assess the local risk of Fusarium Head Blight are needed in order to help farmers make good judgements on whether or not to use of fungicides and, if they are needed, how to time the application. Analysis of FDK and DON showed similar treatment differences, with more significant differences in the analysis of DON levels. Very little disease was present in the samples, with the only significant differences within a variety observed between treatments on Muchmore, the moderately susceptible variety (Figures 1 and 2).

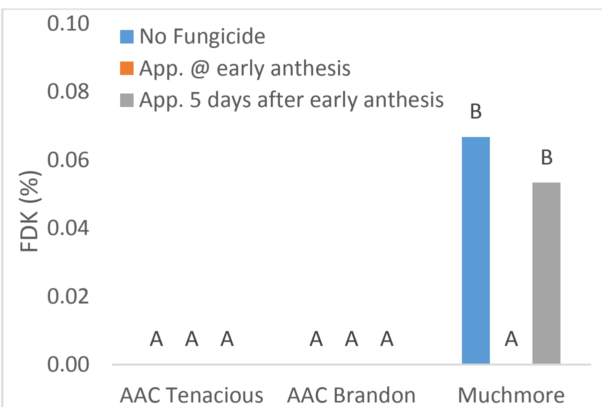

Figure 1. FDK levels of each treatment separated by variety at the Roblin location. Treatments with the same letter are not significantly different (P<0.05).

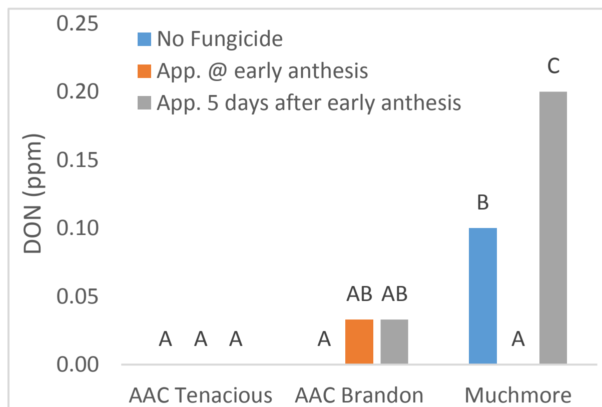

Figure 2. DON levels of each treatment separated by variety at the Roblin location. Treatments with the same letter are not significantly different (P<0.05).

Project findings

Dry conditions in 2017 were not conducive for infection by Fusarium head blight. Yield differences observed between varieties were as expected and influence from disease was minimal. Comparisons between varieties may also be made to consider whether growing a resistant variety and not applying a fungicide provides equal or better protection than growing a less resistant variety and applying a fungicide. When looking at disease levels (FHB Index, FDK, DON), the moderately resistant variety, AAC Brandon, sprayed with a fungicide resulted in comparable disease levels to the resistant variety (with or without a fungicide). In some cases, even using a moderately susceptible variety (Muchmore) and using a fungicide resulted in disease levels similar to that of the resistant variety (with or without a fungicide).

Background

Recent research has indicated that delaying a fungicide application for Fusarium head blight suppression in wheat might be as effective as or more effective than the recommended timing when conditions are not conducive for infection at the recommended timing. There were high levels of Fusarium head blight in 2016 across the Canadian prairies. In Manitoba, many fields received a fungicide application at the recommended timing of early anthesis, but Fusarium remained a major downgrading factor. It is hypothesized that some of these infections occurred later in anthesis and therefore may have caused an increase in DON content without a resulting increase in disease symptoms or fusarium damaged kernels (FDK).

Materials & Methods

Experimental Design:	Random Complete Block Design
Entries:	9 (3 varieties x 3 treatments)
Seeding:	May 17
Harvest:	September 5
Varieties:	AAC Tenacious (FHB resistant); AAC Brandon (Intermediate/Moderate FHB Resistance); and Muchmore (Moderately Susceptible/Susceptible)
Target plant population:	30 plants/ft^2, assuming 15% seedling mortality.
Treatments:	No fungicide Fungicide (Prosaro) at full head emergence/early anthesis Fungicide (Prosaro) five days after full head emergence/early anthesis

Data collected and date collected

Emergence	May 27
Anthesis	July 9
FHB rating	21 days after anthesis
Yield	
Moisture	
Analysis for fusarium damaged kernels	
Kernel accumulation of DON	

Agronomic info

Previous year's crop:	Oat barley silage
Soil Type:	Erickson Loam Clay
Landscape:	Rolling with trees to the east
Seedbed preparation:	Heavy harrowed twice

Table 1: Spring 2017 Soil Test

	Available	Needed
N	86 lb/ac	216 lb/ac
P	10 ppm	10 lb/ac
K	183 ppm	0 lb/ac
S	184 lb/ac	0 lb/ac

Table 2: Added Fertilizer

Blend	Blend (actual lbs/ac)	Actual lbs N	Actual lbs P
46-0-0	278.01	130	0
11-52-0-0	10	19.23	10
Total	-	149.23	10

N banded with seed; P side banded

Table 3: Pesticide Application

Crop stage	Date	Product	Rate
Pre-emerge	May 18	RoundUp WeatherMax	0.51 L/ac
In-crop	June 27	Prestige XCA	0.26 L/ac
In-crop	June 27	Axial BIA	0.96 L/ac
Desiccation	Aug 24	RoundUp	0.67 L/ac

Prosaro applied as a fungicide according to predetermined treatments described above at the rate of 0.33 L/ac

References

[1] Freije, A. & K.A. Wise. 2015. Impact of Fusarium graminearum inoculum availability and fungicide application timing on Fusarium head blight in wheat. Crop Protection 77:139-147.

6-Row Barley Test

Project duration - May 2017 – August 2017
Objectives - To evaluate different lines of six-row barley for malting and feed
Collaborators - Ana Badea – Barley Breeder, AAFC Brandon
Rudy Von Hertzberg – Research Technician, AAFC Brandon

Results

The average grain yield by variety and the mean yield for all varieties are provided in Figure 1.

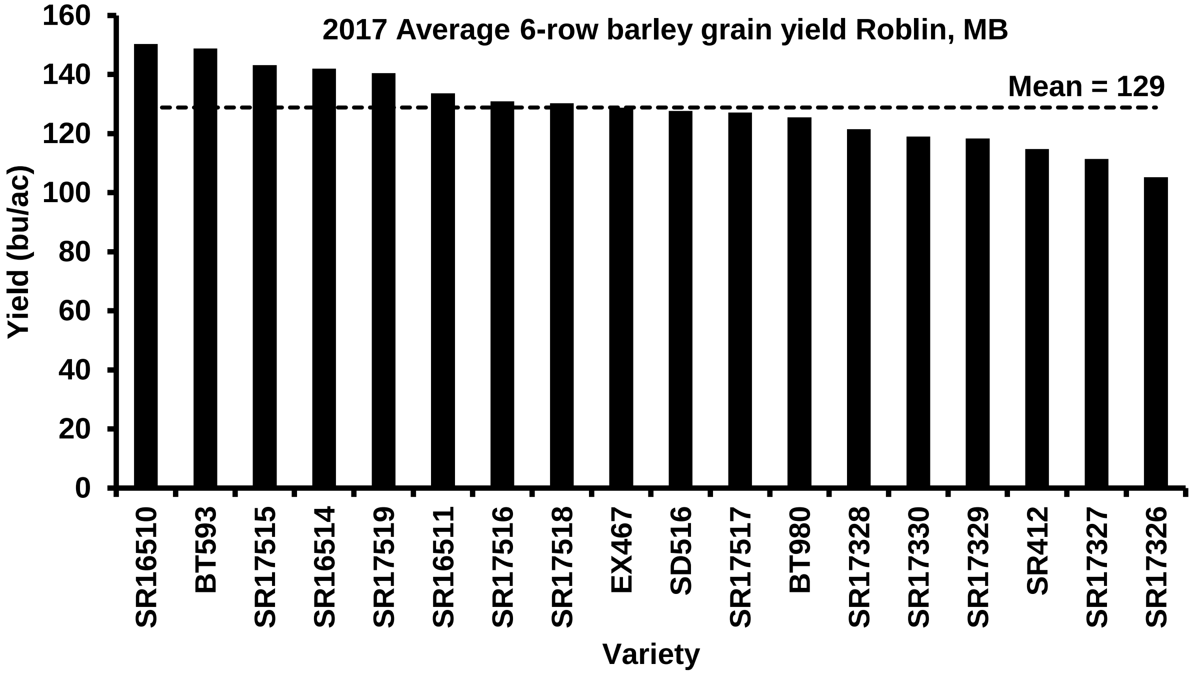

Figure 1. Average 6-row barley grain yield, Roblin, 2017

Project findings

Good early-season soil moisture provided excellent growing conditions for barley. Dry growing conditions resulted in relatively low incidence of disease, and appeared to hasten maturity. The yield results for Roblin 2017 represent only one site year, and should not be used to draw broader conclusions. For more information, contact Ana Badea at Agriculture and Agri-food Canada, Ana.Badea@agr.gc.ca.

Background

AAFC Brandon's barley breeding effort is aimed at developing new varieties of six-row malting barley with improved disease resistance and agronomic performance, combined with enhanced quality traits to expand market opportunities.

Materials & Methods

Experimental Design	Random Complete Block Design
Entries	18 entries
Seeding	May 30
Harvest	August 24

Table 1: Varieties included in trial at Roblin 2017

EX467(F)	SR16511(F)	SR17330(M)
SD516(F)	SR16514(F)	SR17515(F)
SR412(M)	SR17326(M)	SR17516(F)
BT980(M)	SR17327(M)	SR17517(F)
BT593(F)	SR17328(M)	SR17518(F)
SR16510(F)	SR17329(M)	SR17519(F)

Data collected and date collected

Heading	July 21
Height	August 25
Lodging	August 24
Wet weight	August 24
Dry weight	September 20

Agronomic info

Previous year's crop:	Oat barley silage
Soil type:	Erickson Loam Clay
Landscape:	Rolling with trees to the east
Seedbed preparation:	Heavy harrowed twice

Table 2: Spring 2017 Soil Test

	Available	Needed
N	86 lb/ac	124lb/ac
P	10 ppm	10 lb/ac
K	183 ppm	0
S	184 lb/ac	0

Table 3: Added N and P

Blend	Blend (actual lbs/ac)	Actual lbs N	Actual lbs P
46-0-0	78.01	35.89	0
11-52-0-0	19.23	2.12	10
Total		38	10

P banded with seed; N side-banded

Table 4: Pesticide Application

Stage	Date	Product	Rate
Pre-emerge	May 18	RoundUp WeatherMax	0.51 L/ac
In-crop	June 27	Axial BIA	0.96 L/ac
		Prestige XCA	0.26 L/ac
Desiccation	August 24	Roundup	0.67 L/ac

FORAGE CROPS

Advanced Forage Barley Line Evaluation

Project duration - May 2017 – August 2017
Objectives - To test the top barley forage lines from the barley breeding program at AAFC Brandon for grain yield and quality.

Collaborators - Ana Badea – Barley Breeder, AAFC Brandon
Rudy Von Hertzberg – Research Technician, AAFC Brandon

Results
The average grain yield by variety and the mean yield for all varieties are provided in Figure 1. The average forage yield by variety and the mean yield for all varieties are provided in Figure 2.

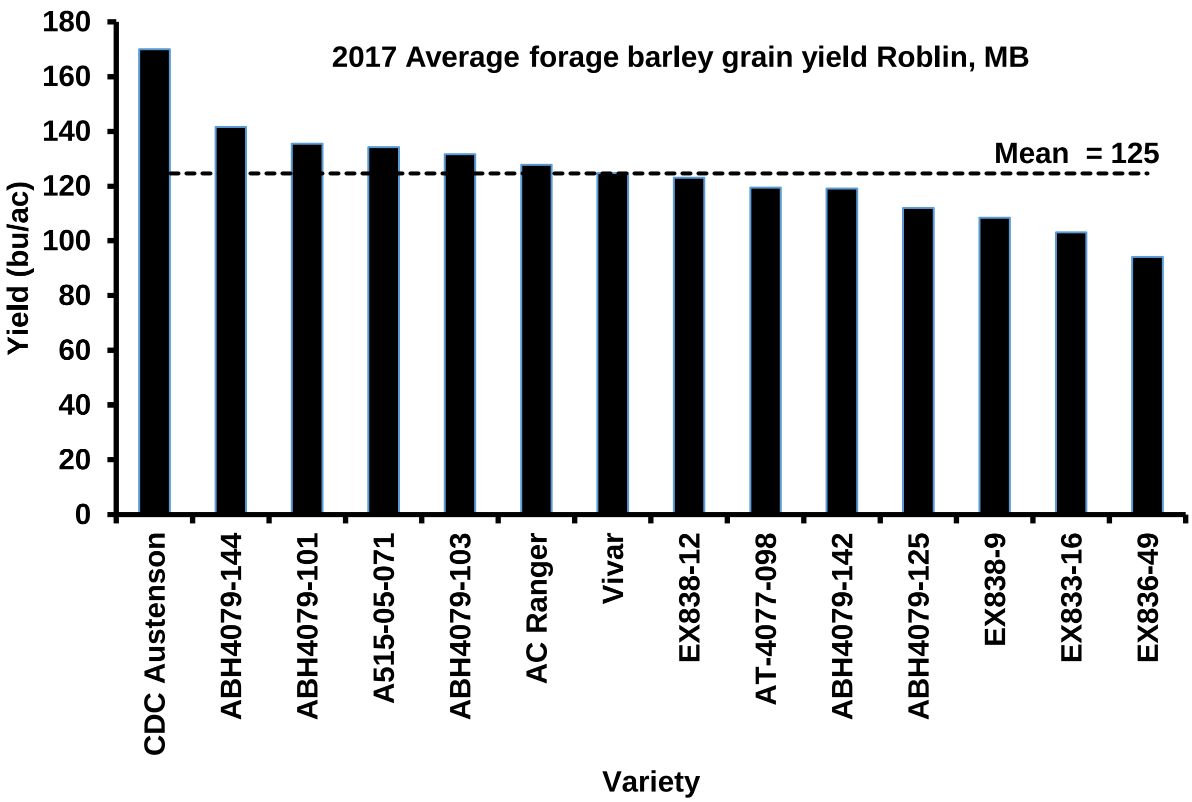

Figure 1. Average forage barley grain yield, Roblin, 2017

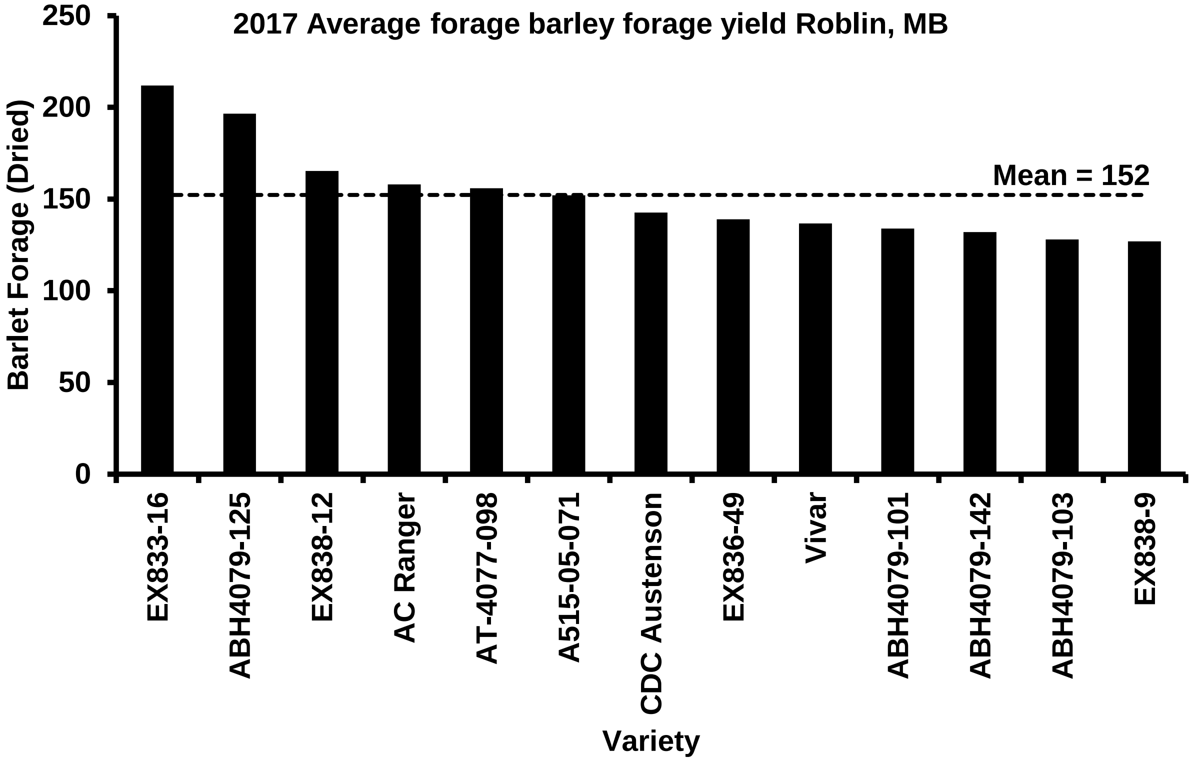

Figure 2. Average forage barley forage yield, Roblin, 2017

Project findings

Good early-season soil moisture provided excellent growing conditions for barley. Dry growing conditions resulted in relatively low incidence of disease, and appeared to hasten maturity for both grain and forage. The yield results for Roblin 2017 represent only one site year, and should not be used to draw broader conclusions. For more information, contact Ana Badea at Agriculture and Agri-food Canada, Ana.Badea[at]agr.gc.ca.

Background

Forage barley varieties produce high total biomass but usually have insufficient grain yield to compete with regular varieties when only grain production is desired. Thus, the barley breeding effort at AAFC Brandon aims to develop new varieties of dual forage-feed barley well-suited to Western Canada with improved disease resistance and agronomic performance, combined with enhanced quality. This report provides results for both grain and forage yields for these varieties.

Materials & Methods

Experimental Design:	Random Complete Block Design
Entries:	14* varieties X 4 replications
Seeding:	May 17
Harvest:	August 23

*Due to seeder error, not all entries were successfully grown or replicated. Only the entries that were successfully planted are included in Table 1.

Table 1: Varieties included in trial at Roblin, 2017

EX838-9 (2)	ABH4079-103 (2)	A515-05-071 (3)	AT-4077-098 (2)
ABH4079-125 (3)	CDC Austenson (3)	Vivar (1)	ABH4079-142 (2)
ABH4079-101 (2)	EX838-12 (3)	AC Ranger (2)	EX833-16 (1)
ABH4079-144 (0)	EX836-49 (2)		

Brackets indicate number of successful replications

Data collected and date collected

Height: Aug 18
Lodging: Aug 22
Forage wet weight: Aug 18
Forage dry weight: Sept 7

Agronomic info

Previous year's crop: Oat barley silage
Soil Type: Erickson Loam Clay
Landscape: Rolling with trees to the east
Seedbed preparation: Heavy harrowed twice

Table 2: Spring 2017 Soil Test

	Available	Added
N	86 lb/ac	124 lb/ac
P	10 ppm	10 ppm
K	183 ppm	0
S	184 lb/ac	0

Table 3: Added N and P

Blend	Blend (actual lbs/ac)	Actual lbs N	Actual lbs P
46-0-0	78.01	35.89	0
11-52-0-0	19.23	2.12	10
Total		38	10

N side-banded; P banded with seed

Table 4: Pesticide Application

Stage	Date	Product	Rate
Pre-emerge	May 25	RoundUp WeatherMax	0.94 L/ac
In-crop	June 27	Axial BIA	0.96 L/ac
	June 27	Prestige XCA	0.26 L/ac
Desiccation	August 24	Roundup	0.67 L/ac

Western Canada Forage Barley Coop Line Evaluation

Project duration - May 2017 – August 2017
Objectives - To evaluate different forage barley lines for grain quality characteristics for the purpose of evaluation and recommendation of lines for registration
Collaborators- Dr. Patricia Juskiw – Barley Breeder, Lacombe Field Crop Development Centre
Susan Lajeunesse – Research Technician, Lacombe Field Crop Development Centre

Project findings

The data were generated for the Prairie Recommending Committee for Oat and Barley; however, due to intellectual property issues pertaining to Plant Breeders' Rights, results for individual lines are not provided in this report. For more information on the Coop trial, contact Patricia Juskiw, Lacombe Field Crop Development Centre, Patricia.Juskiw@gov.ab.ca.

Background

The barley breeding effort at the Lacombe Crop Development Centre coordinates the generation of data for new 2 row and 6 row barley lines for both grain and forage purposes in order to to be evaluated for recommendation. This report concerns the forage outcomes of the trial.

Materials & Methods

Experimental Design: Random Complete Block Design
Entries: 20 total; 5 checks, 11 varieties in first round testing, 4 varieties in second round testing.
Seeding: May 30
Harvest: August 22

Table 1: Varieties included in trial at Roblin, 2017

AC Ranger	FB472	FB208	FB022
CDC Austenson	FB473	FB479	FB207
Gadsby	FB476	FB480	FB483
Vivar	FB023	FB481	FB484
CDC Cowboy	FB024	FB482	FB485

Data collected and date collected

Heading July 21
Height August 22
Lodging August 22
Forage wet weight August 22
Forage dry weight September 7

Agronomic info

Previous year's crop: Oat barley silage
Soil Type: Erickson Loam Clay
Landscape: Rolling with trees to the east
Seedbed preparation: Heavy harrowed twice

Table 2: Spring 2017 Soil Test

	Available	Needed
N	86 lb/ac	124lb/ac
P	10 ppm	10 ppm
K	183 ppm	0 ppm
S	184 lb/ac	0 lb/ac

Table 3: Added N and P

Blend	Blend (actual lbs/ac)	Actual lbs N	Actual lbs P
46-0-0	78.01	35.89	0
11-52-0-0	19.23	2.12	10
Total		38	10

N side banded; P banded with seed

Table 4: Pesticide Application

Stage	Date	Product	Rate
Pre-Emerge	May 18	RoundUp WeatherMax	0.94 L/ac
In crop	June 27	Axial BIA	0.96 L/ac
		Prestige XCA	0.26 L/ac
Desiccation	August 24	Roundup	0.67 L/ac

OILSEEDS

Effect of Soil Temperature at Different Planting Dates, and of Residue Management on Soybean

Project duration - 2014 – 2018

Objectives - A better understanding of the impact of management practices, including planting date and residue management practices, and of early-season soil temperatures, on soybean growth, yield and quality in Manitoba may help to refine management practices in order to reduce risks associated with cold temperatures and thereby to optimize soybean production. The objectives of this study were:

1. Experiment 1: to determine the effect of soil temperature at different planting dates on soybean growth, yield and quality
2. Experiment 2: to determine the effect of residue management on soybean growth, yield and quality

Collaborators - Manitoba Pule & Soybean Growers
Ramona Mohr – Research Scientist, AAFC
Craig Linde – Diversification Specialist, Manitoba Agriculture
James Frey – Diversification Specialist, Manitoba Agriculture

Results

Results of the current study suggest that delaying planting beyond the currently recommended planting window of May 15th to 25th has the potential to result in significant yield penalties and may present a significant production risk. Under the conditions of this study, delayed planting resulted in marked yield declines in most site-years at Brandon, Carberry and Portage (Figure 1). Delaying planting in this study, typically by 9 to 15 days (from the 3rd to 4th week of May into June), resulted in 40 to 80% the yield of the May planting dates depending upon the site-year. Further, at one of three years at Roblin, significant frost damage occurred with the later planting date resulting in negligible yields.

A strong and clear relationship between soil temperature at planting and soybean performance was not evident under the conditions of the current study. In Study 1, soil coverings installed in the field in early spring often produced a range of soil temperatures at planting, and for varying lengths of time thereafter, but differences in soil temperature at planting were not consistently associated with differences in soybean yield (Figure 1). This was the case although soil temperatures at planting were often below the 18 to 22 °C suggested as ideal based on current provincial recommendations, and occasionally <10 °C. Of five cases where yields were higher in "warm" treatments that had been covered by black plastic than in "cold" treatments covered by Styrofoam, warmer temperatures at planting were evident in the "warm" treatments in only three cases.

Similar general trends were evident in Study 2, which assessed the effect of residue management practices preceding soybean on soil temperature and its relationship to soybean performance. Although residue management frequently influenced early-season soil temperature and/or moisture, and occasionally affected the days to crop emergence, effects on soybean yield were limited (2 of 12 site-years) (Figure 2). In part, because soybeans had been planted within the recommended planting dates for Manitoba and when soil temperatures exceeded the critical 10 °C, the effects of residue management on growth and yield may have been less than under more marginal conditions.

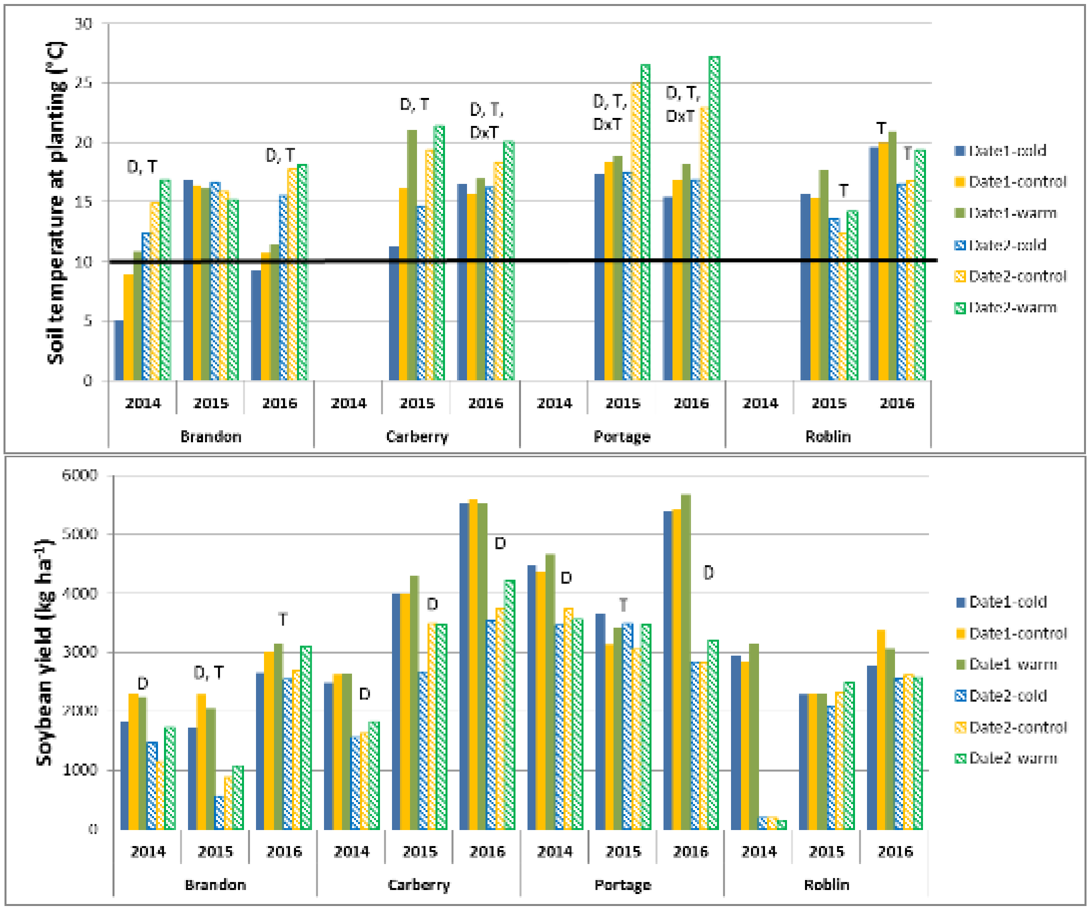

Figure 1. Effect of planting date and soil temperature treatment on soil temperature measured at time of planting and on soybean yield at Brandon, Carberry, Portage and Roblin (2014-16). (D, T and DxT indicate significant (P≤0.05) effects of planting date (D), temperature treatment (T), and DxT interactions based on analysis of variance.)

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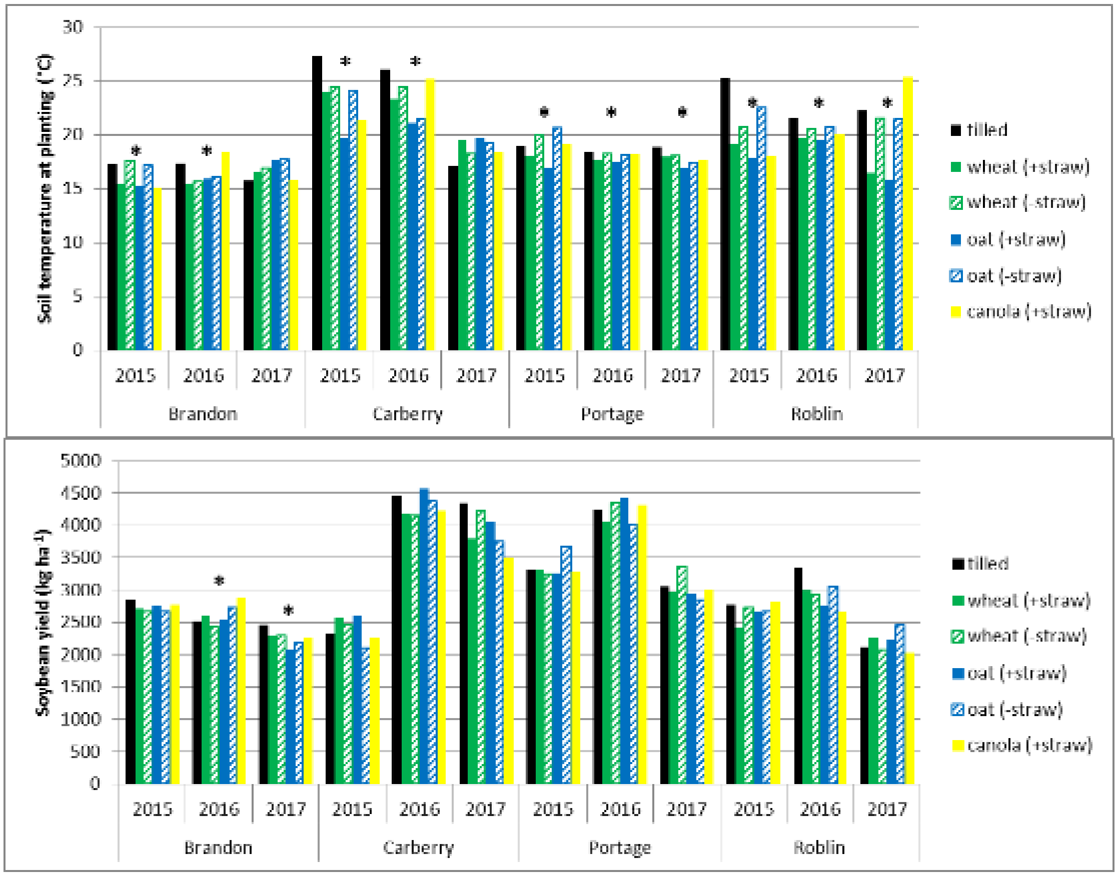

Figure 2. Effect of residue management practices on soil temperature measured at time of planting and on soybean yield at Brandon, Carberry, Portage and Roblin (2015-17). (indicates a significant (P≤0.05) effect of residue management treatment based on analysis of variance by site-year.)*

In conclusion, managing the risk of cold temperature damage in soybean crops grown in short-season areas can be most effectively addressed with an integrated approach. Selection of a well-adapted cultivar suited to local growing conditions is key, as are appropriate planting dates and soil temperature conditions. Current provincial recommendations suggest that soybean be planted from May 15th to May 25th, or when the average soil temperature has reached 10 °C, with 18 to 22 °C considered ideal (Manitoba Agriculture 2013). These research findings suggest that delaying planting beyond the recommended window may result in a significant yield penalty and may expose the crop to fall frost damage. The relationship between soil temperature at planting and soybean growth and yield appears to be more complex, however. The potentially damaging effects of chilling injury, which occurs when soybean seed imbibes water of <10 °C particularly during the first 24 hours after planting, is well-recognized, and underlies the recommendation to delay seeding until the average soil temperature has reached 10 °C. However, the current study did not identify a clear relationship between soil temperature at planting and soybean establishment or yield when soil temperatures were >10 °C. While the current research findings suggest that warmer temperatures at planting may occasionally enhance emergence and increase seed yield when soil temperatures at planting are >10 °C, warmer soil temperatures at planting did not consistently enhance crop emergence or translate into higher yields. When soybeans were planted within or near the recommended planting date window and soil temperatures at planting were above the critical 10 °C, residue management practices like tillage and straw removal that often increased soil temperature to varying degrees (<1 to 5 °C) rarely increased seed yield. In order to better understand the effects of residue management practices on soybean growth and yield under a broader range of conditions, a field study was initiated in fall 2017 which will look at the effect of a range of residue management practices including burning, tillage, stubble height and straw removal on soybean planted before and during the recommended planting date window

Background

The Canadian prairies represent the northern fringe of soybean production in North America. Growing soybean in this region was long considered unlikely because few areas had more than 120 consecutive frost-free days, and temperatures during the frost-free period were too cold for adequate crop development (Burnett et al. 1985).

With the introduction of early-maturing cultivars adapted to Manitoba conditions, the soybean industry in this province has grown rapidly over the past decade. Production has expanded from traditional areas in the Red River Valley to other regions, leading to a record soybean acreage of 2.3 million acres in 2017 (Statistics Canada 2017).

Despite ongoing improvements to soybean cultivars, the short growing season and climate in Manitoba can be a significant production risk for this long-season crop. Frost and near-freezing conditions in spring and fall can damage soybean. Early planting in cool and wet conditions can increase seedling disease and reduce plant stand (NDSU Extension Service 2010). Soil temperature at seeding, together with soil moisture conditions, may impact establishment (Helms et al. 1996a; Helms et al. 1996b; Wuebker et al. 2001).

Potential may exist to reduce the risks associated with cool temperatures, frost and/or near-freezing conditions through management. Selection of well-adapted cultivars suited to short-season areas is critical. However, proper choice of planting date, and management of preceding crop residue, may influence early-season temperatures and therefore crop growth.

A better understanding of the impact of these factors on soybean growth, yield and quality in various regions within Manitoba may help to refine management practices in order to reduce production risk and optimize soybean production.

Planting date: Manitoba recommendations indicate that soybean should be planted from May 15th to May 25th, or when the average soil temperature has reached 10°C, with 18 to 22°C considered ideal (Manitoba Agriculture 2013). North Dakota recommendations suggest that soybeans not be planted earlier than five days before the average date for the last killing frost in order to reduce the risk of spring frost damage (NDSU Extension Service 2010).

Manitoba production data indicates that soybean yield generally decreases with delayed seeding (Manitoba Agricultural Services Corporation 2013), although research suggests this effect may vary among regions in Manitoba. In seeding date trials in the Morden/Carman area conducted from 2006 through 2008, yield was similar for May planting dates but declined with mid-June planting dates (Manitoba Agriculture 2011). At Arborg, yield declined when planting was delayed until late May and declined further when planting was delayed until mid-June. Soil temperature at planting may have influenced the results obtained. As well, because a killing frost did not occur until late September in these studies, yield differences among planting dates were likely smaller than if an early fall frost had occurred.

In studies conducted in North Dakota, early planting of late-maturing cultivars (Maturity Group I and II) did not increase yield, but early planting of early-maturing cultivars (Maturity Group 0) that were adapted to the region increased yield when an early fall frost occurred (Halvorson et al. 1995). Although early planting increased the risk of spring frost damage, this approach allowed the option of re-planting.

Effect of residue management: Soybean may be grown under a range of cultural practices, from conventional to reduced tillage systems (NDSU Extension Service 2010). Residue management practices may influence the micro-environment the crop is exposed to, both above and below the soil surface. In field studies near Brandon, MB, the effect of wheat residue management (short stubble, tall stubble, cultivated) on canola, pea and wheat was assessed from 2000-02 (Volkmar and Irvine 2003). In this study, stubble delayed day-time soil warming and night-time cooling at the soil surface and at a depth of 7.5 cm, and generally increased day-time and decreased night-time air temperature compared to the cultivated treatment. Stubble treatments also typically had higher soil moisture levels than the cultivated soil. Although these micro-environment effects contributed to increased emergence and vegetative growth, especially for tall stubble, there was minimal effect on crop yield. Little information is available regarding the effect of stubble management on soybean in Manitoba.

Another aspect of residue management that could potentially affect crop growth relates to the type of residue. Anecdotal information suggest that, in the case of canola, direct seeding into oat stubble may sometimes slow emergence and increase the risk of frost damage compared to other cereal stubble types. This effect has been attributed to the "brightness" of the oat straw relative to other cereals, which may reflect more incident light and result in cooler soil and air temperatures near the soil surface. This effect has not been documented in Manitoba however.

Materials & Methods

A series of field studies were conducted at each of Brandon, Carberry, Portage and Roblin during the period 2014 through 2017 as outlined below. Two experiments were conducted at each site over three field seasons: Experiment 1: Effect of soil temperature at different planting dates on soybean growth, yield and quality (2014-16) and Experiment 2: Effect of residue management on soybean growth, yield and quality (2015-17).

Experimental design and management

Experiment 1. Effect of soil temperature at different planting dates on soybean growth, yield and quality

Small plot field experiments were conducted at four Manitoba sites (Brandon, Carberry, Portage, Roblin) in each of 2014 through 2016. Details regarding the experimental sites are summarized in Table 1. A randomized complete block design (RCBD) with four replicates was established, with treatments arranged in a split plot design consisting of two planting dates (main plots) and three soil temperature treatments (subplots). At Roblin only, main plots were not randomized due to logistical factors; therefore early and late planting dates were considered as two separate studies for the purpose of analysis.

Planting dates consisted of an earlier and later planting date, with the earlier planting date typically occurring from mid- to late May, and the later planting date typically 9 to 15 days later. Three soil temperature treatments, designated as "cold", "control" and "warm" depending upon the soil coverings applied, were established as subplots. To produce soil temperature treatments, plots were covered in early spring with: 1) styrofoam and/or reflective material to insulate the soil ("cold"); 2) black plastic to warm the soil ("warm"); and 3) white+clear plastic to reflect the sun ("control") (Figure 1).

Soil coverings were typically removed shortly before seeding to allow some drying of the soil surface prior to seeding, while maintaining soil temperature differences. Soybean (RR2, Maturity grouping 00.1, short-season zone) commercially treated with seed treatment and Rhizobium was solid-seeded directly into untilled soil at a rate of 50 pure live seeds per m2. The germination rate of the seed lots used ranged among years from 97 to 100%. Soybeans were grown using generally-accepted agronomic practices with respect to seeding, fertilizer, weed, and harvest management.

Experiment 2. Effect of residue management on soybean growth, yield and quality

Small plot field studies were initiated at four Manitoba sites (Brandon, Carberry, Portage, Roblin) in 2014. Residue management treatments were imposed at each site in 2014, 2015 and 2016, with soybean established into these treatments in each of 2015, 2016 and 2017. A randomized complete block design (RCBD) with four replicates was established, comprised of six residue management treatments: control (wheat residue, fall tilled), wheat with straw chopped and retained (standing stubble), wheat with straw removed (standing stubble), oat with straw chopped and retained (standing stubble), oat with straw removed (standing stubble), and canola with straw chopped and retained (standing stubble).

During the year of stubble establishment, hard red spring wheat, oat, and hybrid canola were established at each site using the same seed lot, with seeding rates adjusted to achieve 250, 300 and 120 plant m-2, respectively. Generally-accepted agronomic practices with respect to seeding, fertilizer, weed, and harvest management were applied. In most site-years, residue management treatments were imposed in the fall prior to soybean as per treatment. Exceptions were Roblin where tillage treatments were conducted in the spring prior to soybean establishment, and Brandon in 2014 where the fall tillage treatment was delayed until spring.

Soybean (RR2, Maturity grouping 00.1, short-season zone) commercially treated with seed treatment and Rhizobium was solid-seeded at a rate adjusted to achieve 40 plants per m^2. The same cultivar and seed lots were used in Experiments 1 and 2. Soybeans were grown using generally-accepted agronomic practices with respect to seeding, fertilizer, weed, and harvest management.

Data collection and analysis (Experiments 1 and 2)

Similar datasets were collected from Experiments 1 and 2. Soil temperatures were recorded hourly using self-logging sensors (Model DS1922L, iButton Temperature Logger, Maxim Integrated) installed at a 5 cm depth in each plot following planting at two sites in 2014 (Brandon and Carberry) and all four sites in 2015 and 2016 for Experiment 1. In Experiment 2, two iButton loggers were installed in each plot at a 5 cm depth. One logger was installed at the front and back of each plot, approximately 1 m from the plot edge.

In both experiments, soil temperature and moisture were also measured at seeding depth at time of planting using a manual digital thermometer (Key-Chain Thermometer, Fisher Scientific) and soil moisture probe (ML3 ThetaProbe, Delta-T Devices). Plant counts were conducted periodically for several weeks after planting, from the first evidence of crop emergence until no further change in plant stand was detected. At crop maturity, plots were harvested by plot combine and cleaned yields determined. Test weight, % oil and % protein of seed was determined using an Infratec™ 1241 Grain Analyzer (Foss North America Inc., Eden Prairie, MN), and thousand seed weight determined using a mechanized seed counter. Date of emergence and crop growth stage were determined based on periodic visual assessment of the field experiments.

Both early-season biomass and Greenseeker measurements were collected in an effort to quantify early-season growth, in addition to the repeated plant counts conducted. Early-season biomass was determined by hand-harvesting 2-1 m lengths of row several weeks after planting and determining dry weight. Preliminary analysis of the early-season biomass data demonstrated a high degree of variability in most site-years which limited the value of this measurement for identifying treatment effects; therefore, these data have not been included in the current report. Greenseeker measurements were collected using a handheld Greenseeker device periodically during the early part of the growing season; however, the presence of volunteers and/or weeds in some site-years influenced the readings obtained and therefore these data have not been included in the current report.

For the purpose of this report, data from each experiment were analyzed by site-year. For Experiment 1, data were analyzed as a split plot using Proc Mixed in SAS, with treatments considered fixed effects and replicates considered random effects. Data collected at Roblin were analyzed as a randomized complete block design separately for each planting date because planting date treatments had not randomized at this site for logistical reasons. For Experiment 2, data were analyzed as a randomized complete block design using Proc Mixed in SAS, with treatments and replicates considered fixed and random effects, respectively. A combination of Tukey's test and contrast analysis were used to identify treatment effects of interest. A P-value ≤ 0.05 was considered significant.

Sub-daily soil temperature (TSOIL) treatment means were calculated from the self-logging sensor data based on the 3-hour average values for each plot (i.e. n = 8 for TSOIL for every plot each day). Only those site-years where the sensors were installed the same day as planting and where data was retrievable from at least 3 out of 4 treatment replications were retained for further analyses from each experiment. Cumulative soil degree hours less than 10°C (∑SDH < 10°C) were calculated as the summation of negative values of TSOIL-10°C, and cumulative soil degree hours greater than 10°C (∑SDH > 10°C) were calculated as the summation of positive values of TSOIL-10°C . Preliminary statistical analyses of the TSOIL data indicated several interactions between year and site (Experiment 1 and Experiment 2), as well as site and planting dates within years (Experiment 1), so analyses focused in on each planting date separately for individual site-years to evaluate the significance of the temperature (Experiment 1) and residue (Experiment 2) treatments imposed for the studies. Sub-daily TSOIL data were analyzed for Experiment 1 for each site-year planting date with a univariate repeated-measures analysis of variance (ANOVA) model where plot (i.e. replicate) was considered a random effect, and treatment, days after planting (DAP) and the interaction term (treatment x DAP) were considered fixed effects using JMP software (version 13, SAS Institute, Inc.). The significance of the temperature (Experiment 1) and residue (Experiment 2) treatments imposed on ∑SDH < 10°C for 20 DAP and ∑SDH > 10°C for 30 DAP were tested using one-way ANOVA in SigmaPlot (version 13, Systat Software, Inc.). Where data did not meet the assumptions for parametric ANOVA (i.e. distribution not normal and/or unequal variances), the equivalent non-parametric statistical test was used (i.e. Kruskal-Wallis one-way ANOVA on ranks).

Impact of seeding rate, seeding date, and nutrient management on flax agronomy

Project duration - May 2017 – October 2017
Objective - To provide data on the validity and priority of select BMPs and to illustrate these BMPs to growers. Demonstrate and quantify yield differences from varying fertilizer management practices.
Collaborators - Flax Council of Canada

Results

For results and project findings, please see Flax Council of Canada Agronomy Trials - 2017 Final Report

Background

Flax is an important crop for improving or maintaining on-farm diversity and sustainability in Manitoba. It has scientifically proven value as a rotational crop providing a break for disease, insect and weed populations. It is relatively lower input cost crop making it a competitive alternative oilseed crop on a net return basis. However, flax has not kept pace with yield improvements of most major crops in western Canada. Commercial flax yields have increased 0.5% per year for the last 30 years, compared to canola (1.7%/year), corn (2.4%/year) and soy (2.5%/year). Flax yields in Manitoba have increased the least (0.38% yield increase/year) compared to Saskatchewan (0.53%/year) and Alberta (2.27%/year). The genetic potential for flax yield is much higher than the average commercial yields (21 bushels/acre). For example, Seed Manitoba 2014 yield comparison table for flax states that the highest yielding flax cultivar at Rosebank was 76 bushels/acre equivalent. This is corroborated by the 2013 Annual Report of the Parkland Crop Diversification Foundation (Roblin) where the overall average yield of flax in field trials was 61 bushels/acre with the range being 41 to 73 bushels/acre. However, average flax yield for the five year period from 2008-2012 was 23.5 bushels/acre- Manitoba, 23.3 bushels/acre-Saskatchewan and 34.3 bushels/acre-Alberta.
It is critical to identify the factors that have caused Manitoba producers to dramatically reduce their flax production, identify current production tools available that can lead to a resurgence of flax acreage, communicate those best management practices (BMP's) to new and existing growers, and identify the gaps that exist in current agronomic research.

Materials & Methods

This project has been broken down into four trials:

A. Fertilizer and seed treatment
B. Seeding rate, date, depth and row spacing
C. Herbicide and fungicide
D. Crop rotation

Each demo project includes an “ideal plot” treatment, which incorporates an optimal combination of agronomic inputs and management practices. The other treatments in each project will have one factor removed from the ideal plot combination, to measure the yield impact of each individual BMP.

The factors associated with the “ideal” plot are as follows:

1. Choose well drained soil with very little salt
2. Soil tested for macro and micro nutrients
3. Sown on pulse or cereal stubble

4. Pre-plant glyphosate/Authority® (Authority – 118 ml/acre, glyphosate – recommended rate for corresponding formulation)
5. 9.6” row spacing or similar ‘regular’ commercial row spacing
6. Seed treatment - Insure Pulse® (300 ml per 100 kg of seed)
7. Fertilizer target of 45 bushels/acre
8. Optimum start-up fertilizer (seed placed - 15 lbs/acre actual phosphate as MAP 11-52-0 or 12-51-0). Side-band or mid band the rest of the fertilizer if possible
9. Optimum seeding date target May 15th
10. Seeding rate 45 pounds/acre
11. Seeding depth < 1 “
12. High yielding variety: CDC Glas
13. Priaxor® (Headline EC® + Xemium) (120 ml/acre) for pasmo control
14. All recommended herbicides as required (regardless of cost)
15. Desiccate at maturity with glyphosate (360 grams active ingredient per acre) or Reglone®

SPECIAL CROPS

Quinoa Variety Evaluation

Project duration - May 2017 – October 2017
Objectives - Evaluation of quinoa varieties
Collaborators - Percy Phillips, Phillex Ltd
All Manitoba Diversification Centres

Results

The average grain yield by variety and the mean yield for all varieties are provided in Figure 1.

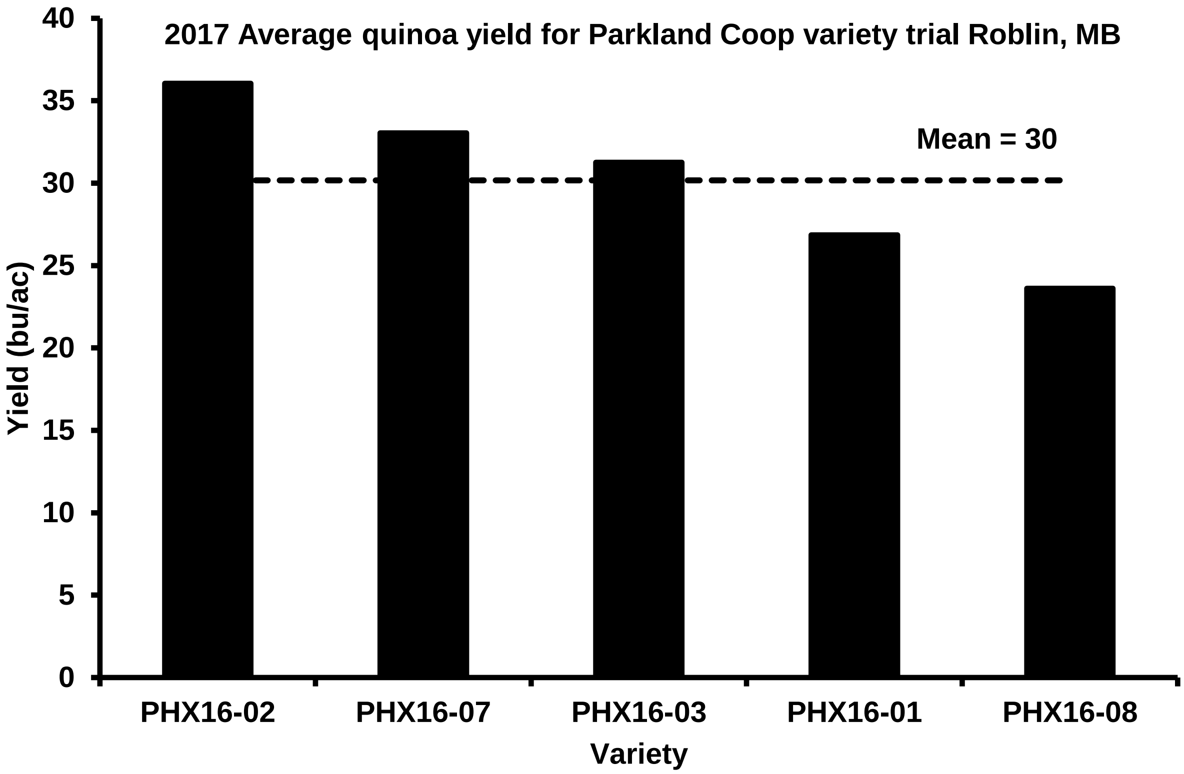

Figure 1. Average quinoa yield for Parkland Coop variety trial, Roblin, 2017

Project findings

Good early-season soil moisture provided excellent growing conditions for quinoa. The yield results represent only one site year, and should not be used to draw broader conclusions. For more information, contact Percy Phillips, p300953[at]mymts.net.

Background

Quinoa is a broadleaf annual plant that producers small, round seeds with excellent nutritional qualities [1,2]. The crop can be grown in all agricultural regions of Manitoba. Phillex Ltd, based in Portage la Prairie, participated with all four Manitoba Diversification Centres to conduct the quinoa variety trial.

Materials & Methods

Experimental Design:	Random Complete Block Design
Entries:	5 varieties
Seeding:	May 10
Harvest:	October 13

Table 1: Varieties included in the quinoa variety trial, 2017

PHX16-03	PHX16-08	PHX16-01	PHX16-07	PHX16-02

Data collected and date collected

Emergence date:	May 23
Plant Counts:	June 12
Vigour Rating:	Aug 1
Disease Rating:	Aug 1
Flowering Date:	Aug 7
Height:	Aug 21
Maturity:	Oct 1
Lodging:	Oct 13
Yield	
Moisture	

Agronomic info

Previous year's crop:	Oat barley silage
Soil Type:	Erickson Loam Clay
Landscape:	Rolling with trees to the east
Seedbed preparation:	Heavy harrowed twice

Table 2: Spring 2017 Soil Test

	Available	Needed
N	86 lb/ac	54 lb/ac
P	10 ppm	10 lb/ac
K	183 ppm	0 lb/ac
S	184 lb/ac	0 lb/ac

Table 3: Added fertilizer

Blend	Blend (actual lbs/ac)	Actual lbs N	Actual lbs P
46-0-0	112.8	51.88	0
11-52-0-0	19.23	2.12	10
Total	-	54	

N side-banded; P seed placed

Table 4: Pesticide Application

Crop stage	Date	Product	Rate
Pre-emerge	May 18	RoundUp WeatherMax	0.51 L/ac

Industrial Hemp Variety Evaluation

Project duration - May 2017 – October 2017
Objectives - To estimate varietal differences in grain and fibre yield for industrial hemp in Manitoba.
Collaborators - Craig Linde – Diversification Specialist, Manitoba Agriculture
James Frey – Diversification Specialist, Manitoba Agriculture

Results

The average grain and fibre yields by variety are provided in Figures 1 and 2, respectively. Least significant differences for grain yield were 290lbs/ac and 190lbs/ac for Carberry and Melita, respectively. Least significant differences for fibre yield were 0.5, 0.6 & 0.3 tons/ac for Arborg, Carberry and Melita, respectively. Percent cannabidiol results are provided in Table 1. Due to high coefficients of variability, some results for Arborg are not included, and no results for Roblin are included.

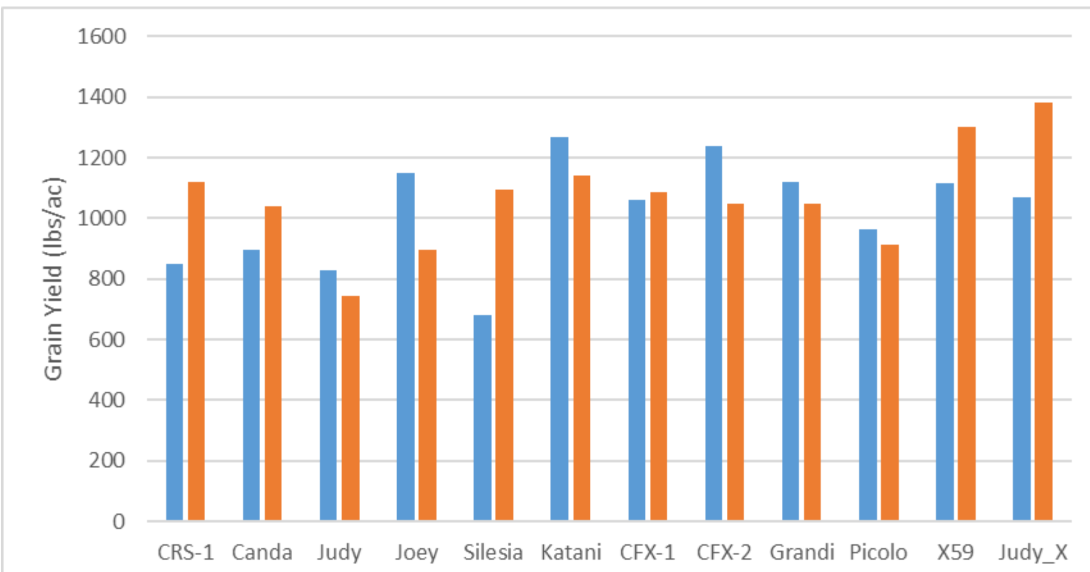

Figure 1. Hemp grain yield (lbs/ac) 2017

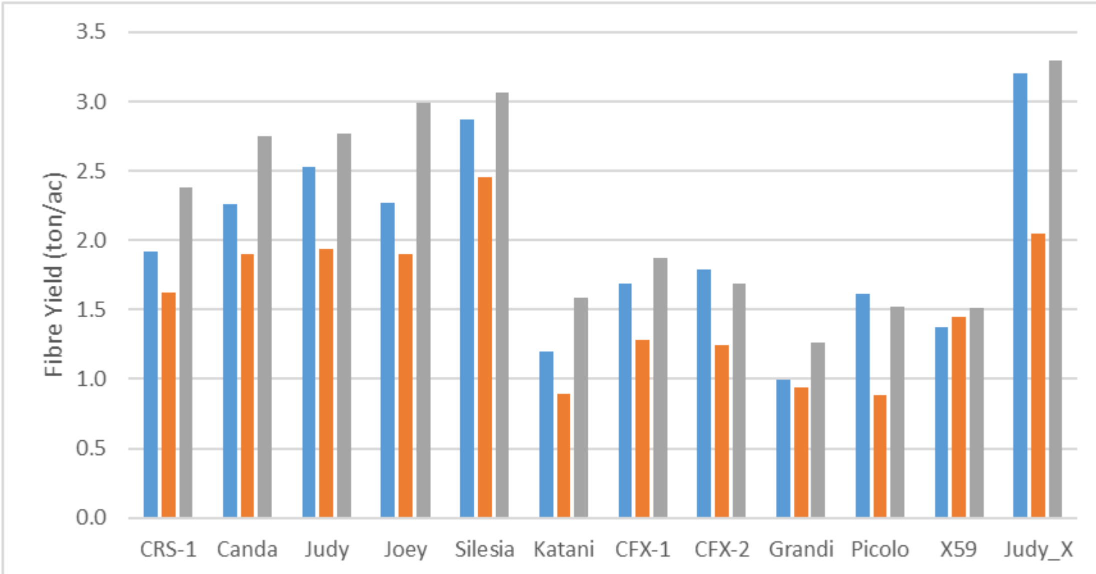

Figure 2. Hemp fibre yield (ton/ac) 2017

Table 1: Total cannabidiol (CBD) content (%) of upper stem leaf material removed at grain harvest (chaff)

Average of Total CBD	Location			
Variety Name	**Arborg**	**Carberry**	**Melita**	**Average**
Canda	0.39	0.48	0.70	0.52
CFX-1	1.89	0.94	1.81	1.55
CFX-2	1.07	0.72	1.70	1.16
CRS-1	0.98	0.85	1.78	1.20
Grandi	0.67	0.78	1.48	0.90
Joey	1.84	0.63	1.25	1.24
Judy	1.23	0.82	1.46	1.17
Judy X	1.14	0.34	1.35	1.04
Katani	0.96	0.89	1.53	1.13
Picolo	0.99	0.62	1.53	1.17
Silesia	0.25	0.30	0.66	0.40
X59	0.87	0.58	1.65	1.03
Average	**1.00**	**0.66**	**1.41**	**1.04**

Project findings
Grain yield results are available through the SEED Manitoba guide (2017).

Background
The Manitoba Diversification Centres participated in a hemp variety trial, in partnership with private industry and the Canadian Hemp Trade Alliance.

Materials & Methods
Experimental Design: Randomized complete block design
Entries: 12 varieties

Table 2: Varieties included in variety trial, 2017

Canda	CRS-1	Judy	Picolo
CFX-1	Grandi	Judy X	Silesia
CFX-2	Joey	Katani	X59

Table 2: Agronomic info for all sites

Item	Melita	Carberry	Roblin	Arborg
Legal Location	NE 27-3-27W1	SW 8-11-14W	NE 20-25-28 W1	RL 37-22-2 E
Soil Series	Waskada Loam	Wellwood Loam	Erikson Clay Loam	Heavy Clay
Soil Test (0-24")				
N - lbs/ac	7.2	33	60	138
P- ppm	11	12	11	15
K - ppm	260.8	250	194	300
S - lbs/ac	219.8	22	64	1634
Burnoff Date	May 23		June 3	
Product	Glyphosate/Liberty		RoundUp Transorb	
Seed Date	May 23	May 15	June 2	May 23
Seed Depth	0.75”	1”	0.75”	0.75”
Spring Fertilizer Application - lbs/ac				
N	120	110	75	25
P	35	0	10	25
K	25	0	0	0
S	10	0	0	0
Spring Fertilizer Date	SB at seeding	Side-banded at seeding	Side-banded at seeding	Side-banded at seeding
In-crop Herbicides Date	June 16	N/A	N/A	June 19
Product	Koril/Arrow	N/A	N/A	Brotex 240 @0.5L/ac
Fibre Harvest Date	August 11	Aug 17	Aug 18	Aug 10
Grain Harvest Date	September 6	Aug 25	Sept 11	Sep 14

The Effect of Seeding Date on Three Varieties of Industrial Hemp in Manitoba

Project duration - May 2017 – September 2017
Objectives - To understand the effect of seeding date by variety on industrial hemp grain yields.
Collaborators - Hemp Genetics, Parkland Industrial Hemp Growers, Manitoba Harvest

Results

- The greatest mortality was observed for Seeding Date 3 which followed a series of large rain events, affecting all varieties (Figure 1). Overall, variety was significant for seedling mortality with CRS-1 having the greatest mortality at 73%, followed by CanMa at 60% and Finola at 47%.
- Overall average grain yield for the trial was 871 kg/ha and ranged from 313-1427 kg/ha (Figure 2)
- The earliest seeding date in Melita resulted in the greatest grain yield.
- Seeding between May 31 and June 16 did not significantly increase grain yield.
- Seeding at June 23 significantly reduced grain yield.
- Overall height was negatively impacted by seeding date with the exception of Date 3.
- There was a significant interaction between test weight and variety with longer season varieties showing a negative relationship between seeding date and test weight (figure). Test weight Finola (early season) was not affected by seeding date while both CRS1 (mid season) and CanMa (late season) were affected.

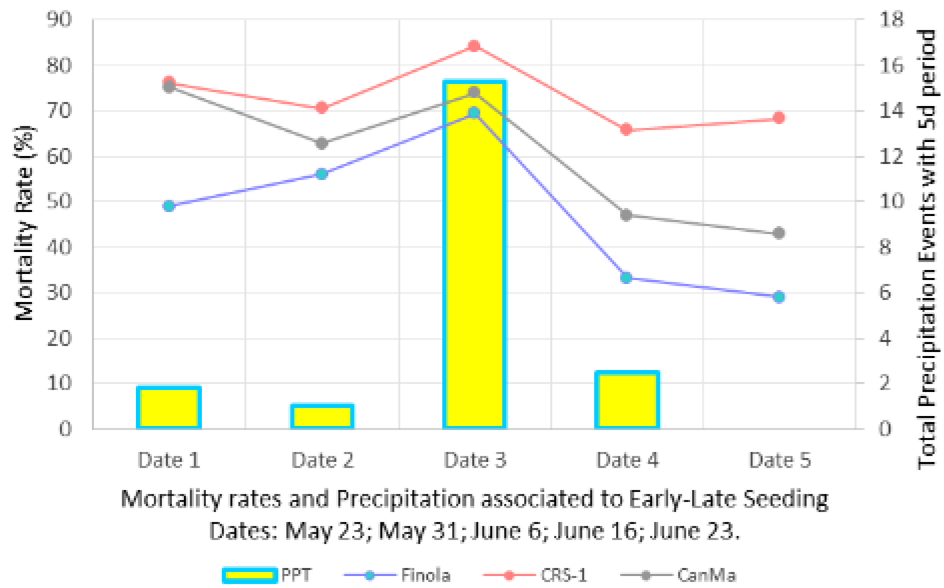

Figure 1. Mortality levels associated to seeding date and total precipitation events (within 5d period of seeding date)

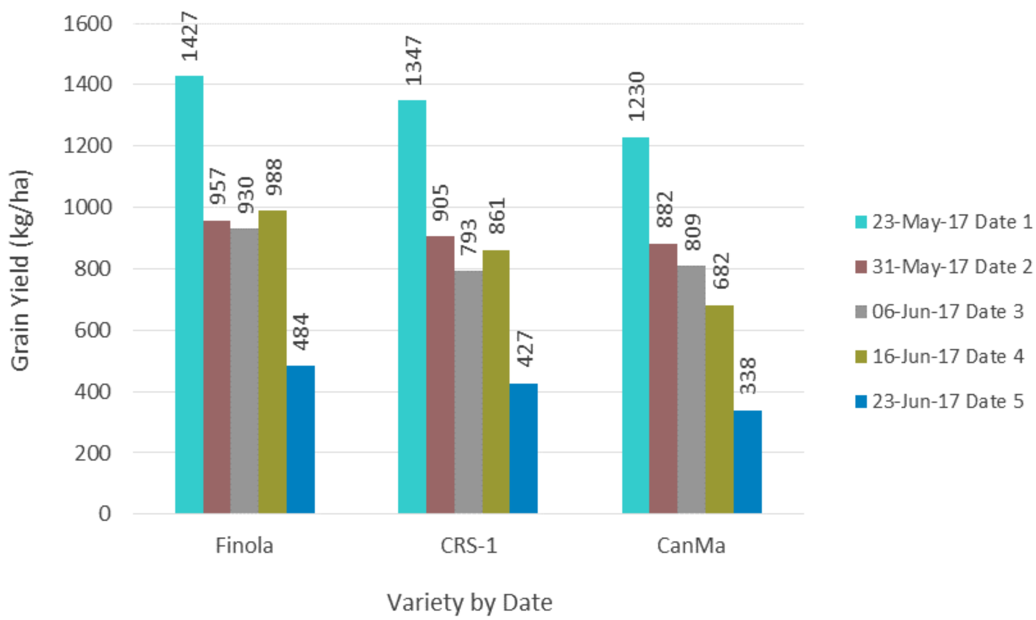

Figure 2. Effect of seeding date by variety on grain yield (kg/ha) for hemp planted at Melita Manitoba, 2017.

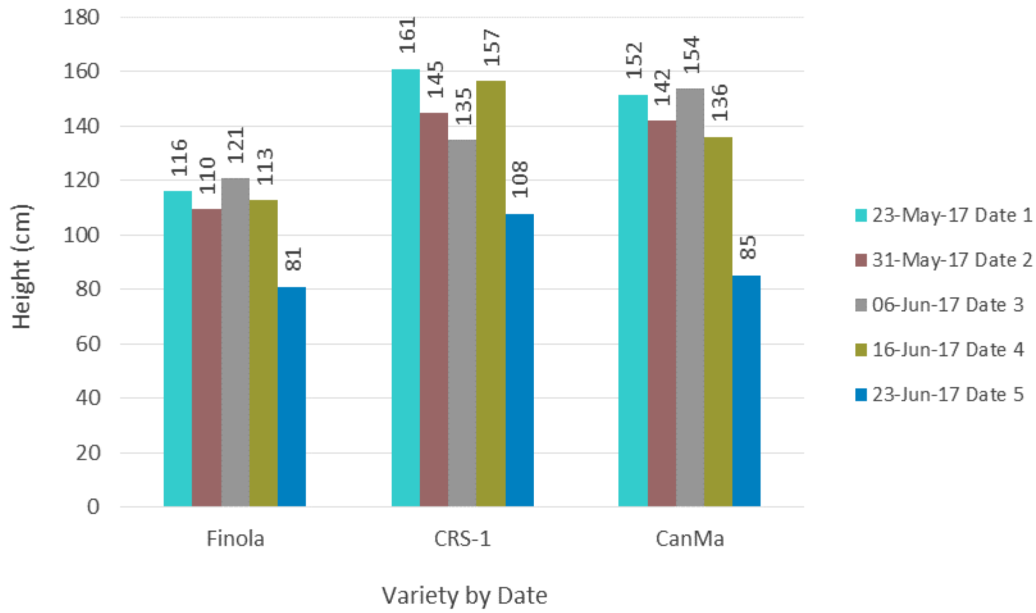

Figure 3. Effect of seeding date by variety on plant height (cm) for hemp planted at Melita Manitoba, 2017.

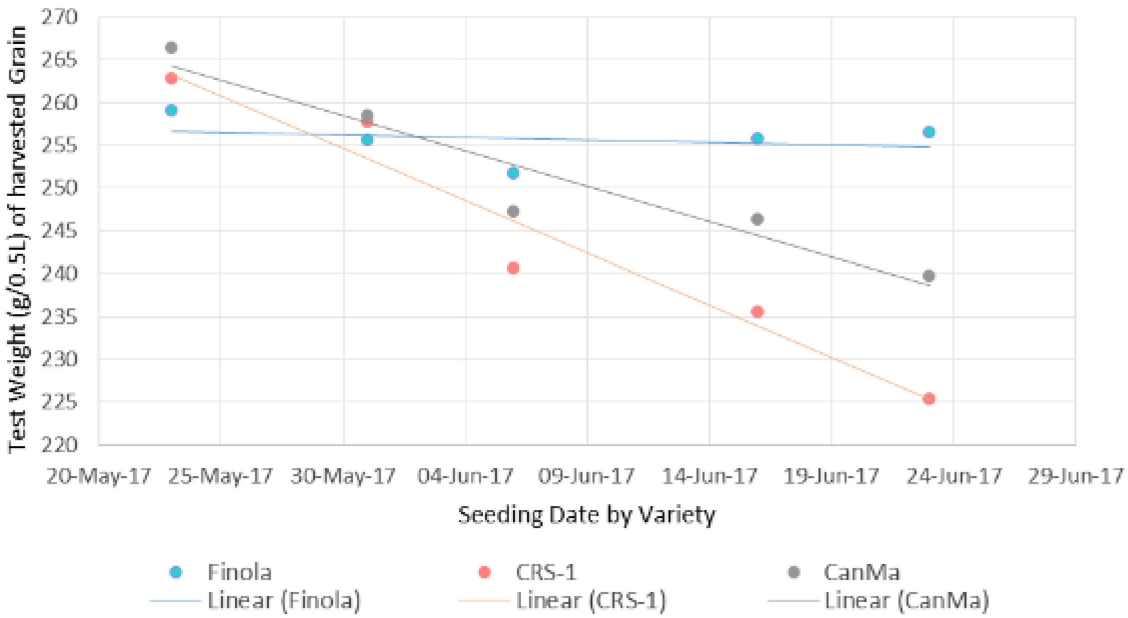

Figure 4. Effect of seeding date by variety on test weight (g/0.5L) for hemp planted at Melita Manitoba, 2017.

Project findings

- There was not a significant effect of seeding date on seedling mortality although there was a general trend of greater mortality for the earlier seeding dates. Despite the mortality levels seed densities were still sufficient, with Finola and CanMa averaging 79 and 59 plants/m2, respectively. The exception may have been CRS-1 which averaged 41 plants/m2. Previous work done by the Diversification Centres (2011-2012) demonstrated that grain yield is typically not affected until densities drop below 40 plants/m2. CRS-1 therefore would have had densities right around the threshold where yield may have been impacted.
- The effect of seeding date appears to be variety dependent. All varieties showed a general reduction in both height and grain yield with no interaction between variety and seeding date. However, there was no statistical advantage or penalty detected for seeding until mid June. These results suggest that early seeding, if establishment risk factors (cold, wet soil conditions) are perceived low and the added height at harvest is not an issue can result in greater yield.
- Quality may also be of concern when choosing to seed late, especially for mid and long season varieties such as CRS-1 and CanMa. In this study both varieties expressed decreasing test weights as seeding date was delayed with CanMa being affected the most. Although there was a decrease in yield for Finola when seeded at the end of June, test weight was not effected by seeding date. CRS-1, and especially CanMa had both lower yield and decreasing test weights as seeding was delayed.

Background

Earlier seeding dates (before May 15) for industrial hemp may result in high plant mortality rates, as well as taller, thicker stems [1]. Limited research is available on the effect of seeding date in Western Canada.

Materials & Methods

Locations:	Melita (Roblin results not included due to high %CV)
Experimental Design:	3 varieties with 5 seeding dates
Main plot:	CanMa (tall, dual purpose-type) CRS-1 (medium, dual purpose-type) Finola (short, grain-type)
Data collected:	Seeding date Emergence date Plants/m^2 Mortality Vigor (1 low, 9 high) Height (cm) % Moisture Yield (kg/ha)

Table 1: Agronomic info for all sites

Item	Melita	Roblin
Legal Location	NE 27-3-27W1	NE 20-25-28 W1
Soil Series	Waskada Loam	Erikson Clay Loam
Soil Test (0-24")		
N - lbs/ac	7.2	86
P- ppm	11	10
K - ppm	260.8	183
S - lbs/ac	219.8	184
Burnoff Date	May 23	May 25
Product	Glyphosate/Liberty	RoundUp Transorb
Seed Date	Date 1-May 23 Date 2- May 31 Date 3- June 6 Date 4-June 16 Date 5- June 23	Date 1 – May 24 Date 2 – June 2 Date 3 – June 9 Date 4 – June 28 Date 5 – June 28
Seed Depth	0.75”	0.75”
Spring Fertilizer Application - lbs/ac		

N	120	49
P	35	10
K	25	0
S	10	0
Spring Fertilizer Dates	SB at Seeding	Side-banded at seeding
In-crop Herbicides Date	July 11 for Seed Date 2 - 5	N/A
Product	Koril/Arrow	N/A
Fibre Harvest Date	N/A	Aug 28
Grain Harvest Date	September 7	Sept 27

References

Canadian Hemp Trade Alliance: Production, Seeding Date. http://www.hemptrade.ca/eguide/production/seeding

The Effect of Split Nitrogen Application Rate on Three Varieties of Industrial Hemp in Manitoba

Project duration - May 2017 – September 2017
Objectives - To understand the effect of split verses banding nitrogen fertilizer to optimize industrial hemp grain yields.
Collaborators - Hemp Genetics, Parkland Industrial Hemp Growers, Manitoba Harvest

Results

- Overall, despite the split nitrogen application averaging 13% greater grain yield, overall there was no statistically significant difference in grain yield when applying nitrogen in one application at seeding verses 70% at seeding and 30% at stem elongation.
- At Melita there was a significant effect on grain yield when nitrogen was divided into split applications. At Carberry, although split application resulted in greater yield it was not statistically different do to overall higher variability in the trial.
- There was no significant difference in height between a split application or single application of nitrogen.
- Further study is required to better understand and confirm any positive effect of split verses banding all nitrogen at time of seeding on grain yield.

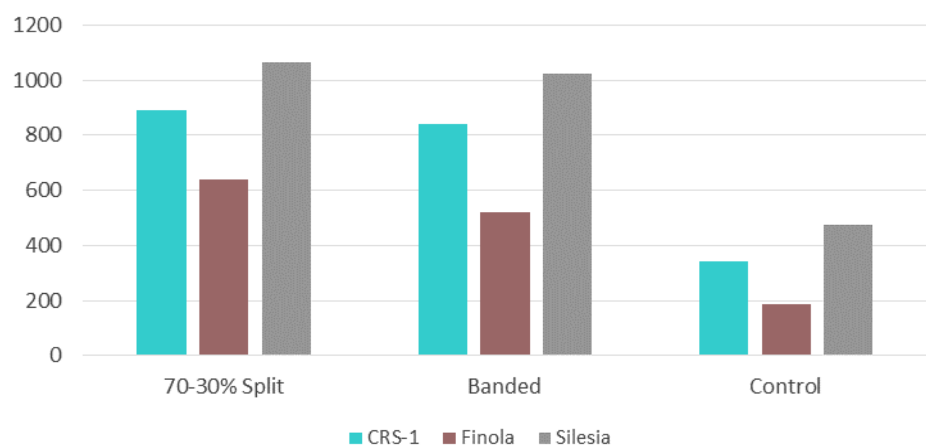

Figure 1. Effect of split nitrogen application on industrial hemp grain yield (kg/ha) combined over two Manitoba locations

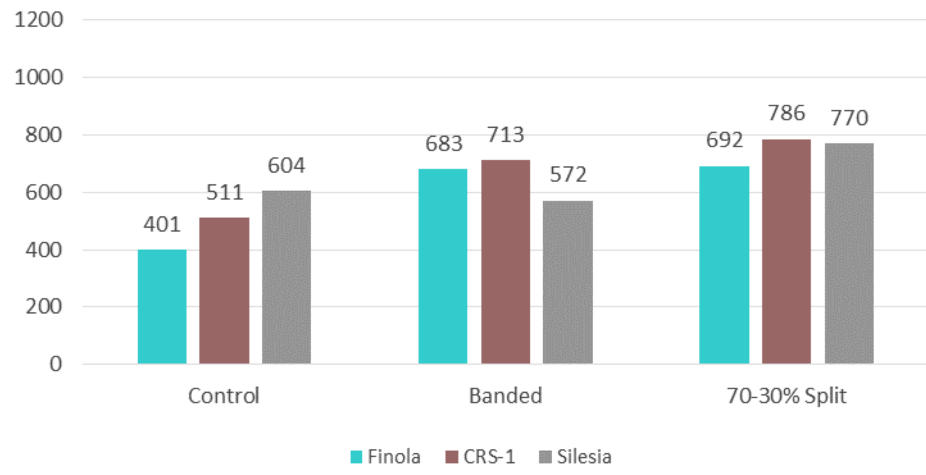

Figure 2. Effect of split nitrogen application on industrial hemp grain yield (kg/ha) at Carberry, Manitoba

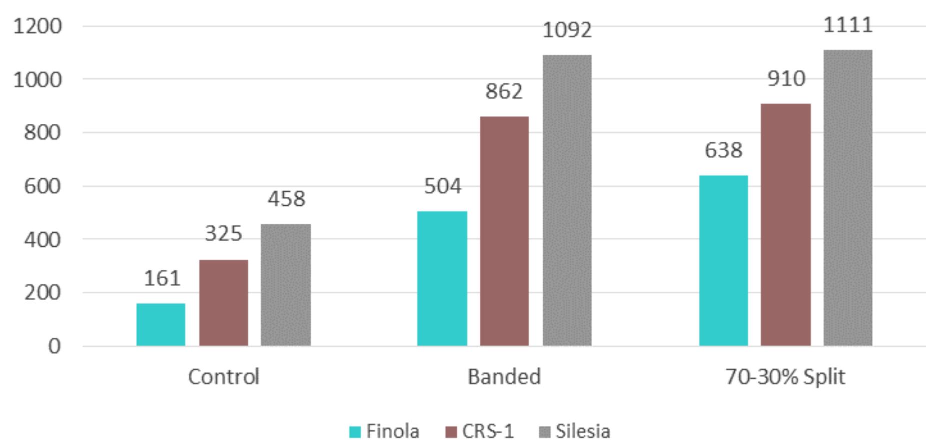

Figure 3. Effect of split nitrogen application on industrial hemp grain yield (kg/ha) at Melita, Manitoba

Project findings

- Applying nitrogen at both sites resulted in a significant increase in grain yield.
- Applying nitrogen in a split format verses applying all at seeding increased grain yield at both sites; however, the increase was only significant at the Melita location.
- Lower yields at the Carberry site was most likely a result of below average rainfall, not allowing plants to fully utilize available nutrients.
- Further study is required to understand the potential benefit of split nitrogen application in industrial hemp.

Background

Current nitrogen recommendations for nitrogen are 80-120 lb/ac, with some suggesting higher rates, depending on variety and growing conditions. However, the economic risk of applying all nitrogen at planting can be high, especially if prolonged stress restricts the plants' utilization of the added nutrients. Additionally, in many cases it is not logistically possible to apply all the nutrient requirements at seeding. Split nitrogen applications have the potential to increase seeding efficiencies and allow growers to adjust rates of application according to growing conditions.

http://www.hemptrade.ca/eguide/production/nutrient-use

Materials & Methods

Locations:	Carberry, Melita (Roblin results not included due to high %CV)
Experimental Design:	Split plot design with four replications
Main plot:	Silesia (tall, fibre-type) CRS-1 (medium, dual purpose-type) Finola (short, grain-type)
Split plot:	Control – no nitrogen added Banded – nitrogen side-banded at seeding Split application – 70% nitrogen side-banded at seeding, 30% broadcast at canopy closure
Data collected:	Seeding date Emergence date Plants/m^2 Mortality Vigor (1 low, 9 high) Height (cm) % Moisture Yield (kg/ha)

Table 2: Agronomic info for all sites

Item	Melita	Carberry	Roblin
Legal Location	NE 27-3-27W1		NE 20-25-28 W1
Soil Series	Waskada Loam	Wellwood Loam	Erikson Clay Loam
Soil Test (0-24")			
N - lbs/ac	7.2	33	86
P- ppm	11	64	10
K - ppm	260.8	673	183
S - lbs/ac	219.8	22	184
Burnoff Date	May 23	n/a	May 25
Product	Glyphosate/Liberty	n/a	RoundUp Transorb
Seed Date	May 24	May 19	May 24
Seed Depth	0.5”	1”	0.75”
Spring Fertilizer Application - lbs/ac	Variable N + Blend	46-0-0	
N	120/84+36	100/70+30	49
P	35	0	10
K	25	0	0
S	10	0	0
Spring Fertilizer Date	SB at Seeding + broadcast	SB at Seeding + broadcast	SB at Seeding + broadcast
In-crop Herbicides Date	June 16	N/A	N/A
Product	Koril/Arrow	N/A	N/A
Fibre Harvest Date	N/A	N/A	Aug 28
Grain Harvest Date	September 7		Sept 26

The Effect of Seeding Rate on Industrial Hemp Fibre Yield and Mortality in Manitoba

Project duration - May 2017 – October 2017
Objectives - To understand the effect of seeding rate on plant/seed mortality and final fibre yield of industrial hemp.
Collaborators - Parkland Industrial Hemp Growers

Results

- Seedling mortality was constant at both the Melita and Carberry locations (Figure 1).
- At the Roblin site mortality increased with seeding rate.
- Increasing seeding rate resulted in a decrease in height.
- There as no significant difference in total fibre yield at Carberry or Roblin, only at Melita.
- In general, fibre yield reached a maximum at a target rate of 250 plants/m2, however the recommended target rate of 150 plants was not significantly different from higher rates at all sites.

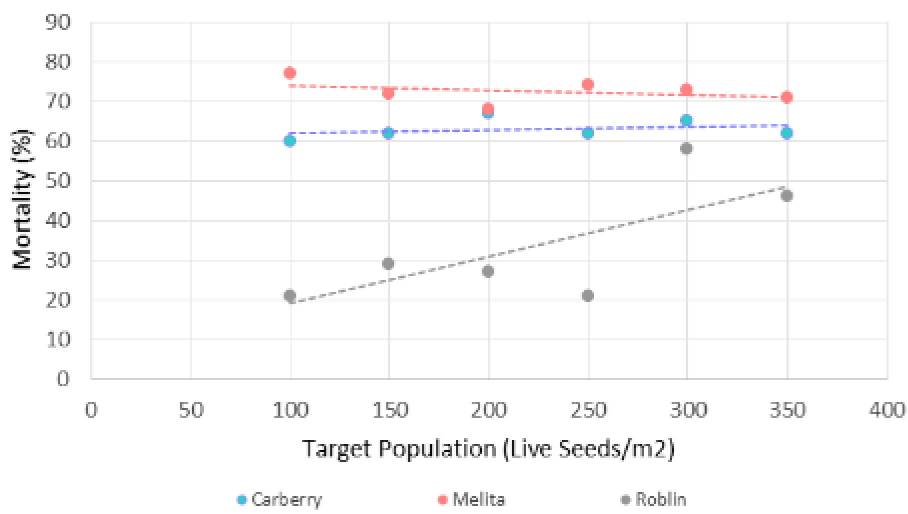

Figure 1. Seedling mortality rates relative to target planting populations at Melita, Carberry & Roblin, 2017.

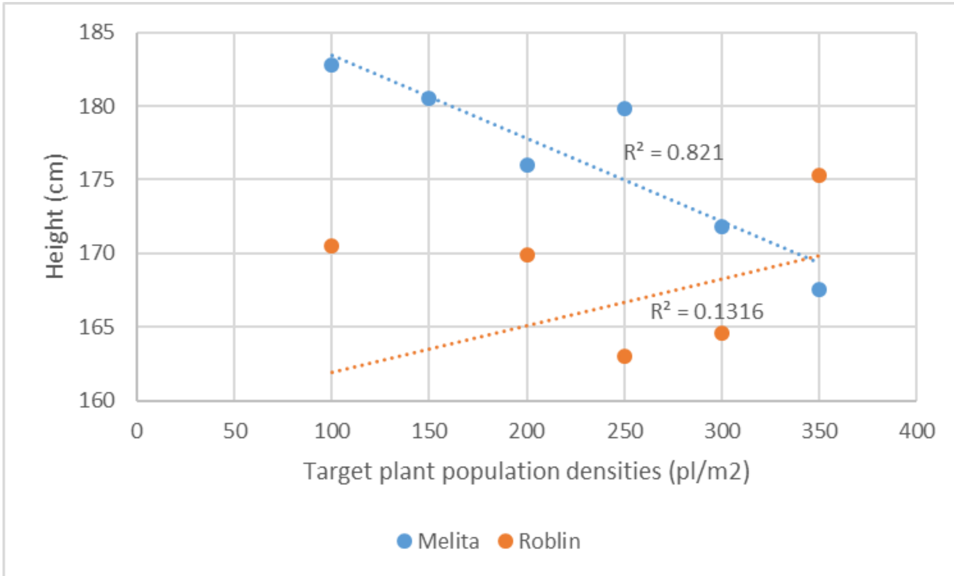

Figure 2. Effect of target population density on plant height in hemp at Melita and Roblin, Manitoba, 2017.

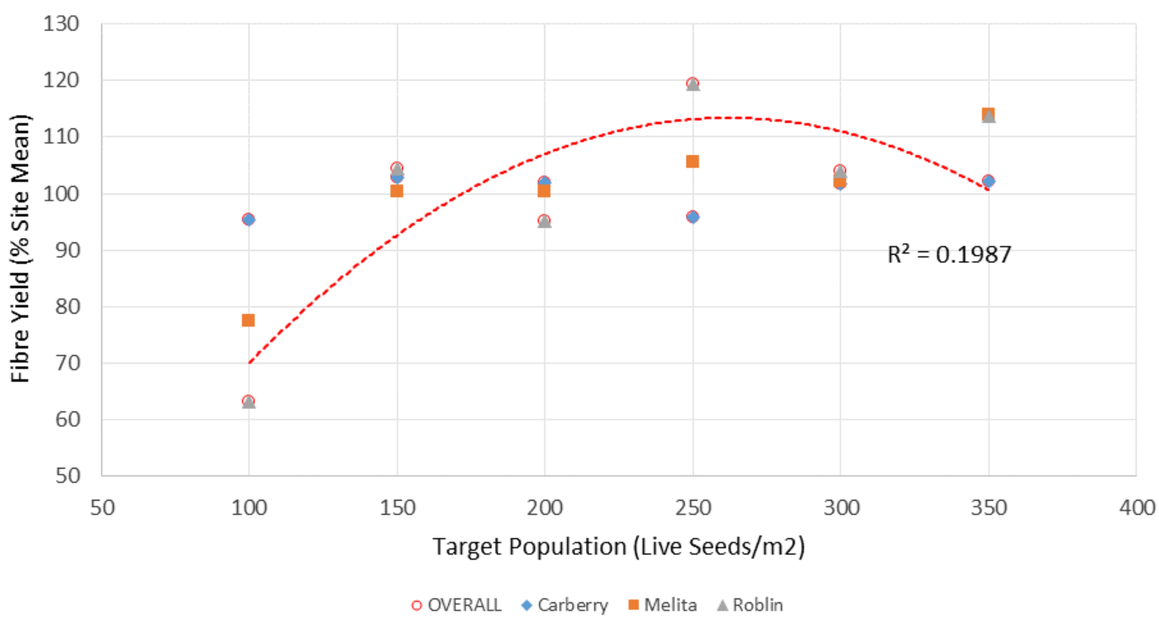

Figure 3. Effect of target population on hemp fibre yield at Carberry, Melita, and Robin Manitoba, 2017.

Project findings

This work supports previous work by the Diversification Centres focusing more specifically on grain varieties where mortality rates were constant and within a similar rage regardless of the target plant population.

Roblin in 2017 was a bit of an anomaly with regard to mortality rates changing with increased population targets. This needs to be investigated further to better understand the mechanisms behind the different mortality rates.

Unfortunately weather data is missing for the Roblin site between June 2 and June 16 however, comparisons between sites from May 10th to June 10 (Figure 4).

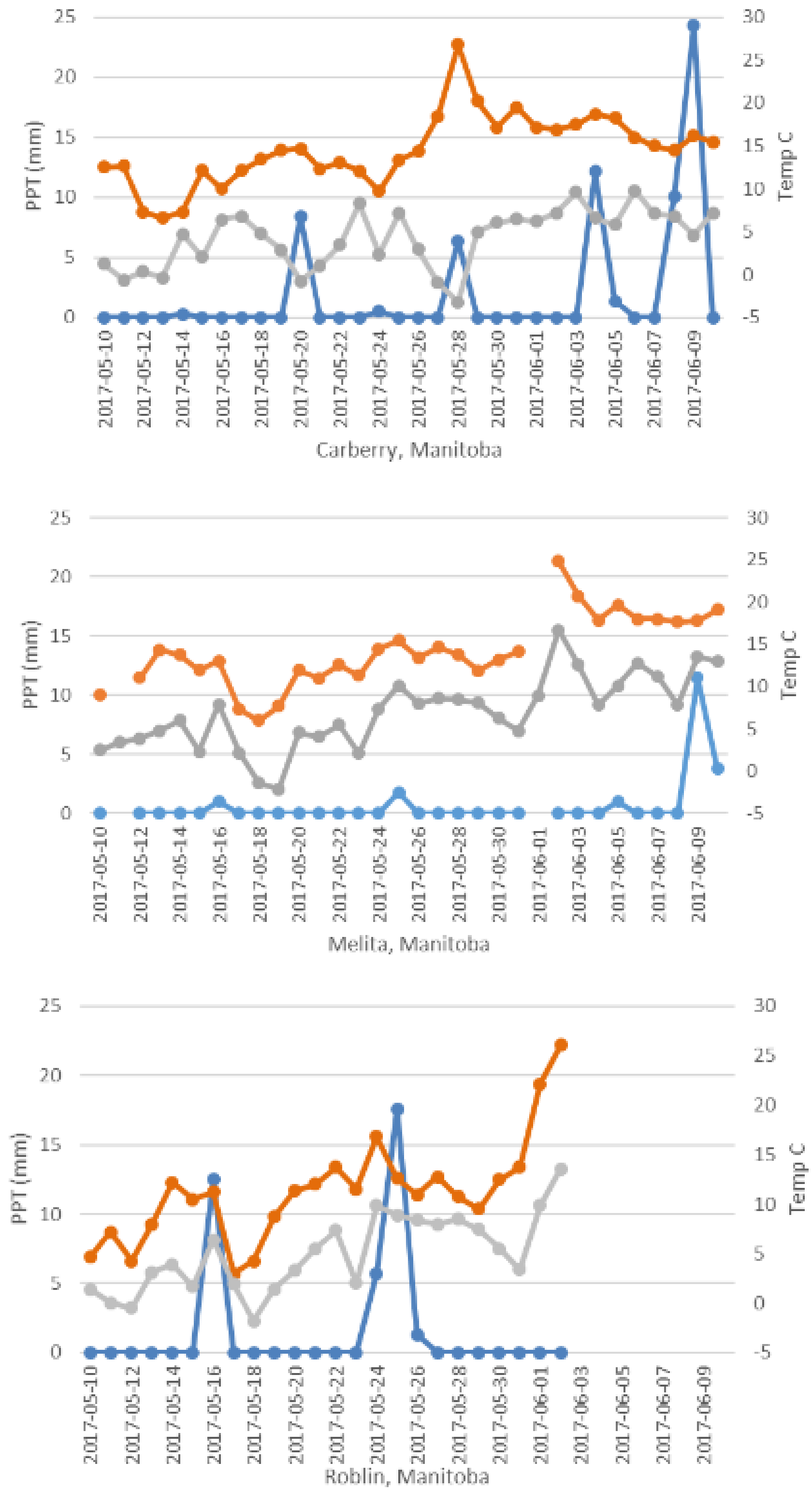

Figure 4. Weather data comparison

Overall, all sites had a moisture deficit relative to historical averages with Carberry, Melita and Roblin receiving 43%, 8% and 84% of 10yr average rainfall in May and the April prior was only at 63%, 80%, & 37% of normal, respectively. Moisture conditions at seeding for all sites was rated satisfactory. Both Melita and Carberry were similar with small rain events occurring around seeding but otherwise relatively fair to dry conditions with moderate temperatures. The Roblin site however, had a large rain event following seeding and cool temperatures. Given these differences however it would be expected that Roblin should have seen the largest levels of mortality and equal mortality across all plant populations which did not occur.

Future Work must focus more on environmental conditions during early stages of establishment, specifically soil conditions and the rate of emergence and seedling recruitment/death. The reasons why low stress weather conditions at both Carberry and Melita resulted in similar with mortality across all population levels verses the excess moisture and cooler temperatures at the Roblin site that resulted in different mortality rates across target populations needs to be explored in more detail.

Background

Mortality rates for industrial hemp can vary from 10-70% [1]. Nevertheless, the crop demonstrates the ability to adapt to different plant densities by altering its architecture (e.g. tall and thin vs. shorter and branched). Consequently, plant density has an impact on stem length and thickness. Higher seeding rates are used when targeting a hemp fibre crop. Varieties suited to fibre production typically have long, "pencil-thin" stems, sometimes exceeding two metres in height. Stem thickness affects the ratio of bast (long, outer fibres) and hurd (short, inner fibres), with thicker stems producing more hurd. This in turn affects the industrial application of the fibres.

http://www.hemptrade.ca/eguide/production/seeding
http://www.hemptrade.ca/eguide/fibre-production/selecting-hemp-varieties-for-fibre-only-applications

Materials & Methods

Experimental Design: Randomized complete block design
Entries: 5 (1 variety, 5 seeding rates)

Table 2: Treatments included in hemp fibre seeding rate trial, 2017

Variety	Seeding Rate (pl/m^2)
Canda	100
	200
	250
	300
	350

Table 2: Agronomic info for all sites

Item	Melita	Carberry	Roblin
Legal Location	NE 27-3-27W1		NE 20-25-28 W1
Soil Series	Waskada Loam	Wellwood Loam	Erikson Clay Loam
Soil Test (0-24")			
N - lbs/ac	7.2	33	86
P- ppm	11	32	10
K - ppm	260.8	673	183
S - lbs/ac	219.8	22	184
Burnoff Date	May 23	N/A	May 25
Product	Glyphosate/Liberty	N/A	RoundUp Transorb
Seed Date	May 24	May 18	May 24
Seed Depth	0.5”	1”	0.75”
Spring Fertilizer Application - lbs/ac			
N	120	100	49
P	35	0	10
K	25	0	0
S	10	0	0
Spring Fertilizer Date	SB at Seeding	SB at Seeding	Side-banded at seeding
In-crop Herbicides Date	June 16	N/A	N/A
Product	Koril/Arrow	N/A	N/A
Fibre Harvest Date	August 10		Aug 18
Grain Harvest Date	August 31	N/A	Sept 4

References

Canadian Hemp Trade Alliance: Production, Seeding Rate. http://www.hemptrade.ca/eguide/production/seeding

PCDF
Parkland Crop Diversification Foundation

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Canada

Manitoba