CMCDC

2018 ANNUAL REPORT

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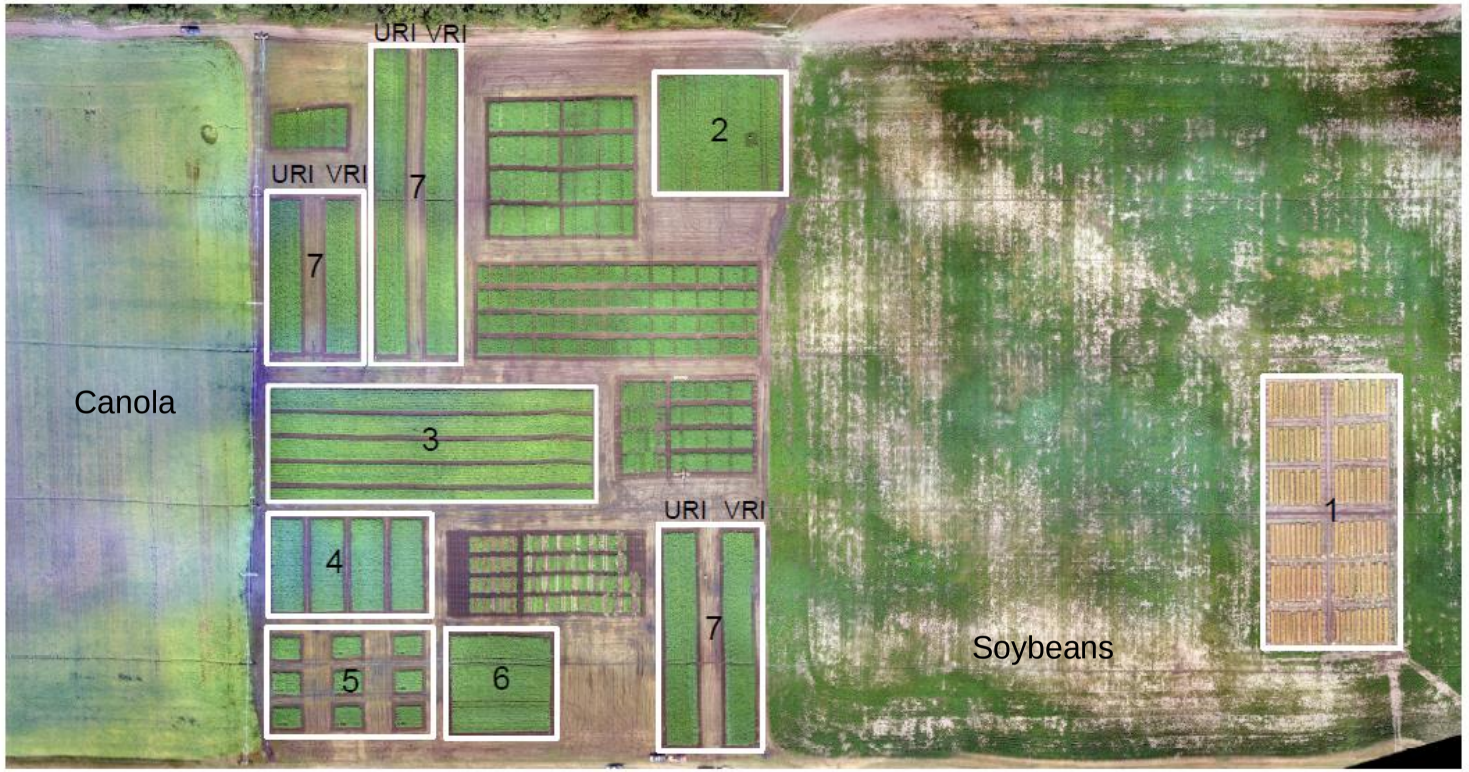
CMCDC-Carberry Sites – Aerial Photos and Trial Locations

CMCDC Carberry Site 2018 – On Site

1 – Linseed Flax Variety Evaluation
2 – MCVET Flax Variety Trial
3 – Quinoa Seed Treatment
4 – Quinoa Minor Use
5 – Quinoa Variety Trial
6 – Quinoa Minor Use
7 – Hemp Variety Trial
8 – Hemp CBD Agronomy
9 – Soybean Residue Management
10 – Soybean Demo
11 – WC CN Soybean Variety Trial
12 – MCVET Pea Variety Trial
13 – Edible Bean Variety Trial
14 – WC RR Soybean Variety Trial
15 – MCVET Fall Rye Variety Trial
16 – MCGA Corn Variety Trial
17 – MCGA Corn Nurseries
18 – Buckwheat
19 – High Yield Wheat Demo
20 – FHB Wheat Model Verification
21 – Soybeans
22 – Oat Seeding Rate by Variety
23 – Wheat Seeding Rate by Variety
24 – Corn Demonstration
25 – Soybean Demonstration
26 – FHB Barley Model Verification (Irrigated)
27 – FHB Wheat Model Verification (Irrigated)
28 – FHB Barley Model Verification
29 – Barley Seeding Rate by Variety
30 – Food Barley Variety Evaluation
31 – Hop Demonstration
32 – CCC Canola Seeding Speed Evaluation

CMCDC Carberry Offsite 2018



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1. Potato N Rotation; Final year of project, planted to wheat
2. Moisture Monitoring Plots
3. Nitrogen Variability Study (MHPEC)
4. Seed Age; Final year of project
5. Moisture Stress Plots; Final year of project
6. Extra Off
7. VRI vs. URI Plots

Source: CMCDC Aerial Photograph

August 2018

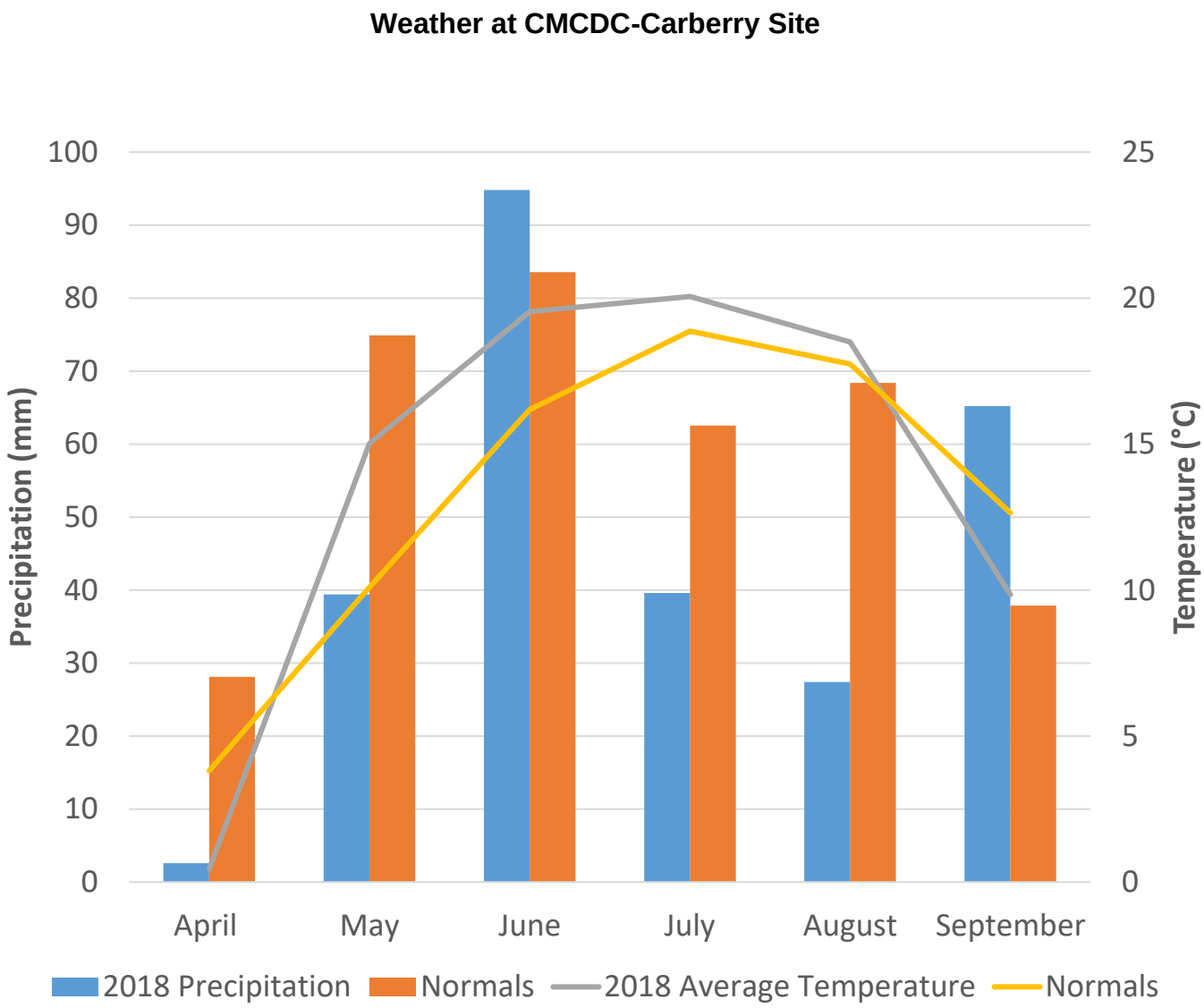


Figure 1. 2018 growing season precipitation and monthly temperatures at CMCDC-Carberry.

Staff at CMCDC Carberry 2018

Full time staff	Supporting CMCDC Partner	Position
Lindsey Andronak	AAFC	Research Technician
Brian Baron	AAFC	Site Supervisor
Zachary Frederick	MHPEC	Potato Research Agronomist
Craig Linde	Manitoba Agriculture	Diversification Specialist
Alison Nelson*	AAFC	Agronomist (Winnipeg)
Sherree Strain	AAFC	Office Administrator

Seasonal/Term staff		
Eric Claeys	AAFC	Senior Field Operations Worker
Jane Klippenstein	MHPEC	Research Technician
Alan Manns	Manitoba Agriculture	Field Operations Worker
Colter McPhail	AAFC	Research Technician
Beverley Mitchell	MHPEC/Manitoba Agriculture	Summer Research Assistant

Summer students/Casual staff		
Ashley Blackshaw	AAFC	Summer Research Assistant
Olivia Gessner	AAFC	Summer Research Assistant
Haley Lobreau	MHPEC	Summer Research Assistant
Christine McGorman	Manitoba Agriculture	Summer Research Assistant
Shukurat Raji	AAFC	Summer Research Assistant
Scott Price	AAFC	Field Operations Worker
Carmen Stewart	Manitoba Agriculture	Summer Research Assistant
Rylee White	MHPEC	Technician

*on assignment to the Science Policy and Partnerships Division from January 29, 2018

2018 CMCDC Carberry Field Day

Our annual field day was held August 14, 2018 with over 35 people in attendance.
Both speakers and participants were well represented from both private and public industry, along with producers. This year we hosted a half day program at the offsite, focusing on potato production and irrigation. After the presentations, everyone returned to the onsite station for a free BBQ lunch which of course included French fries!

Dan Sawatsky with the Keystone Potato Producers welcomed everyone to CMCDC with opening remarks to start the day.

Demonstration of new Variable Rate Irrigation technology; Smartdrop Pivot-Mounted Radiometers, which measure and map soil water content in the root zone.

Dr. Zachary Frederick (MHPEC) discussed his Nitrogen Variability study and let participants observe the visual effects of different rates and types of nitrogen fertilizer.

Dr. Vikram Bisht (Manitoba Agriculture) provided participants with a comprehensive growing season update on pests, disease and current research across the province and provided some impromptu Verticillium wilt identification.

Brian Baron (AAFC) dug a soil pit that allowed participants access to a soil profile adjacent to a potato crop. Marla Riekman and John Heard (both Manitoba Agriculture) were on-hand to demonstrate soil properties including soil moisture, colour, texture and rooting depth.

Lindsey Andronak (AAFC) presented initial results from the Seed Age and Moisture Stress studies, including differences in emergence timing.

Darin Gibson (Gaia Consulting) had some new potato varieties on display that were grown at CMCDC.

Thanks to everyone who presented and attended our annual field day. We'd also like to thank all the staff who helped out with set up and take down. Your support and interest is greatly appreciated!

Potato Projects

Seed Physiological Age of Russet Burbank Potatoes

Principal Investigators: Dr. Alison Nelson, AAFC-Carberry (on assignment 2018)
Manitoba Potato Research Committee

Co-Investigators: Lindsey Andronak, AAFC-Carberry
Steve Sager, AAFC – Morden (interim support 2018)

Scientific Support: CMCDC

Progress: Year 4 of 4

Objectives:
- Determine the impact of seeding date, harvest date and soil moisture regime of a potato seed crop, and seed storage regime on physiological seed age and subsequent field performance of a Russet Burbank processing crop.
- Establish base seed performance values and physiological measures for future seed physiological age studies in Manitoba

Key 2018 Message:
- None of the treatments had any effect on yield.
- The potato seed held at a constant temperature until a week before planting had more large tubers

Contact Information: lindsey.andronak@canada.ca

Project Report

Growing and storage conditions of a potato seed crop are known to affect the seed physiological age, and the performance of the seed in the following production crop. The purpose of this study is to assess the effects and interactions of various potato seed crop management practices on the physiological age and subsequent performance of a processing potato crop.

Treatments are applied to non-replicated seed plots in year 1. The impact of the seed treatments are observed in the randomized, replicated test plots in year 2.

In 2015, 2016 and 2017, non-replicated plots of E3 Russet Burbank seed were planted at CMCDC-Carberry Onsite to obtain all combinations of:

Early and late planting dates (2-3 weeks apart)
Early and late termination and harvest dates (2 weeks apart)
Irrigated and dryland seed production
Constant and ramp-up storage temperature regimes

A total of 16 seed crop treatments were obtained (Table 1) – the treatments are all applied to the seed crop plots (year 1). The seed crop treatment impacts on subsequent (year 2) crop

performance were tested in a randomized complete block design trial, at CMCDC-Carberry Offsite in 2016, 2017 and 2018. The test plots in year 2 are all treated the same to determine the impact of seed crop management on processing crop stand, emergence, yield and quality.

Table 1. Treatment listing for the potato seed physiological age trial. All treatments are applied in the seed crop year (year 1), with the test plots (year 2) being treated equally across all plots.

Treatment	Seed Crop Planting	Seed Crop Harvest	Seed Crop Moisture	Seed Storage Temperature
1	Early	Early	Irrigated	Constant
2	Early	Late	Irrigated	Constant
3	Early	Early	Dryland	Constant
4	Early	Late	Dryland	Constant
5	Early	Early	Irrigated	Ramp up
6	Early	Late	Irrigated	Ramp up
7	Early	Early	Dryland	Ramp up
8	Early	Late	Dryland	Ramp up
9	Late	Early	Irrigated	Constant
10	Late	Late	Irrigated	Constant
11	Late	Early	Dryland	Constant
12	Late	Late	Dryland	Constant
13	Late	Early	Irrigated	Ramp up
14	Late	Late	Irrigated	Ramp up
15	Late	Early	Dryland	Ramp up
16	Late	Late	Dryland	Ramp up

Seed Crop Treatments

The year 1 seed plot treatment details are outlined in Table 2. Planting and harvest dates differed by approximately two weeks. The tubers were dug approximately two weeks after vine kill, when field conditions were suitable for harvest. Tubers sized 3-8 oz. were stored for year 2 testing.

Table 2. Details of differences in year 1 seed crop treatment details.

Main Treatment	Treatment Details	
Planting Date	Early – before May 1	Late – mid-May
Harvest Date	Early - Terminated mid-Aug	Late - Terminated late Aug
Seed Crop Moisture	Irrigated – 4-5" added water	Rainfed – no added water
Seed Storage	Ramp up – in late March, start warming seed 0.5°C/day. Hold at 10°C until planting.	Constant – seed warmed by 0.5°C/day for approximately 1 week before planting

The length of the sprouts on the Ramp Up treatments required all seed pieces to be de-sprouted during handling, cutting and seed treatments (Figure 1). All seed pieces (3-8oz when

put into storage) had a single cut made by hand, to make relatively uniform seed pieces with the same cut profile.

Figure 1. Sprouting on Ramp Up tubers (right) compared to Constant tubers (left)

Year 2 Test Plot Results and Discussion

For emergence percentages, the 2018 test plots had a shorter time to emergence when compared with the 2016 and 2017 plots (Figure 2). This is likely due to the later planting date (May 16, 2018 compared with May 10, 2016 and 2017). Due to differences among years, emergence data for the three years were not combined. For the 2016 and 2017 plots, early seed crop planting and warming the seed before planting in year 2 increased the speed of emergence (Figure 2). There was also slightly lower total emergence (approximately 4% difference) from dryland seed compared to irrigated seed. For the 2018 test plots, storage regime did not affect total emergence, but dryland seed had a slightly higher total emergence (approximately 3.3%) compared to irrigated seed.

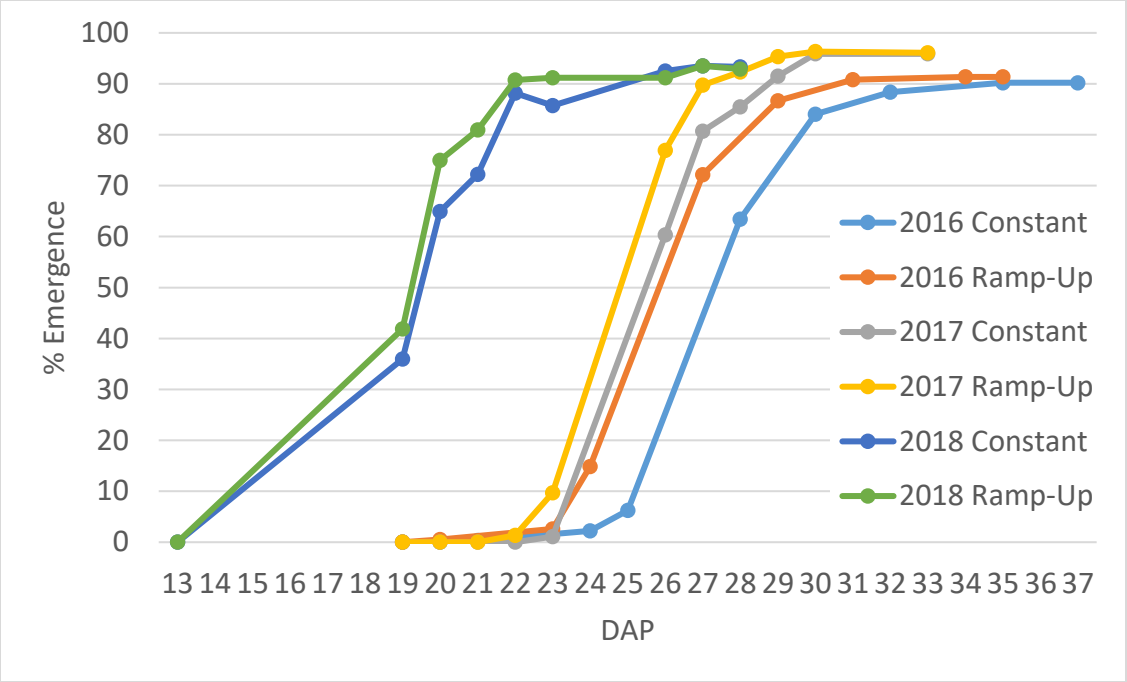


Figure 2. Effect of storage temperature on timing and percentage of emergence.

None of the factors or any of the interactions among the factors had any significant effect on gross or marketable yield.

Both planting and harvest dates had no significant effect on any of the variables observed. Irrigated seed had more tubers per acre, a higher percentage of total defects and a lower percentage of oversized tubers (Table 3). Irrigated plots tended to have higher amounts of rot when compared with dryland plots. However, the trend towards higher levels of rot in irrigated plots was not consistent for all three study years and was most prevalent in 2016. Dryland plots tended to have higher percentages of hollow heart, but again this trend was not consistent for all three study years and was most prevalent in 2018.

Storage regime had the strongest impact on processing crop growth, and the characteristics of the tuber yield. The ramp up treatment had more tubers per acre and more stems per plant compared to the constant treatment (Table 3).

While storage regime did not have a significant impact on gross or marketable yield, it did have a significant impact on the tuber size profile (Table 3, Figure 3). All categories of size profile were impacted by the spring storage regime. The seed held at a constant temperature until a week before planting had more large tubers. The constant storage seed had more yield in the 6-10 oz, 10-12 oz and greater than 12 oz size categories, compared to the ramp-up storage seed. The seed that was ramped up and held at 10°C for a number of weeks before planting had more small tubers. The ramp up treatment had just under 10% more yield in tubers sized less than six oz (Table 3, Figure 3).

Specific gravity was significantly affected (P<0.05) by the interactions between planting and harvest dates (Figure 4) and planting date and moisture regime (data not shown). The late planting date – late harvest date treatment and late planting date - irrigated had higher specific gravities compared to other treatment combinations.

Table 3. Main factor effects on tuber number, stems per plant, defects and yields. Study years 2016, 2017 and 2018 are combined in this table.

	Tuber Number	Stems/Plant	Total Defects	<3 oz	3-6 oz	6-10 oz	10-12 oz	>12 oz
	(#000/ac)		(%)	(%)				
Planting								
Early								
Late								
Harvest								
Early								
Late								
Moisture	**		*		*			**
Dryland	154		3		31.4			13.9
Irrigated	160		5		33.3			11.3
Storage	***	***		***	***	***	***	***
Constant	147	3.6		7.2	28.8	39.0	10.7	14.2
Ramp up	167	4.0		9.5	35.9	35.4	8.2	11.0

, **, * indicate a significant effect of the main factor at P<0.1, P<0.05, P<0.01, respectively. Increasing number of stars indicate greater level of statistical significance of the effect. Blank squares indicate that the mean values are not significantly different from one another.*

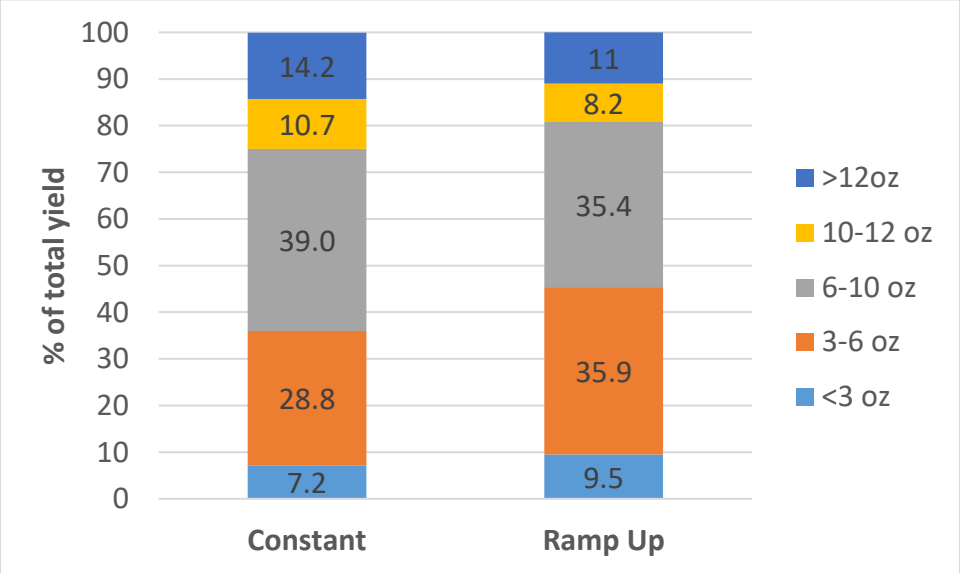


Figure 3. Processing crop (year 2) tuber size profile from the two seed crop storage regimes over 3 years of data collection.

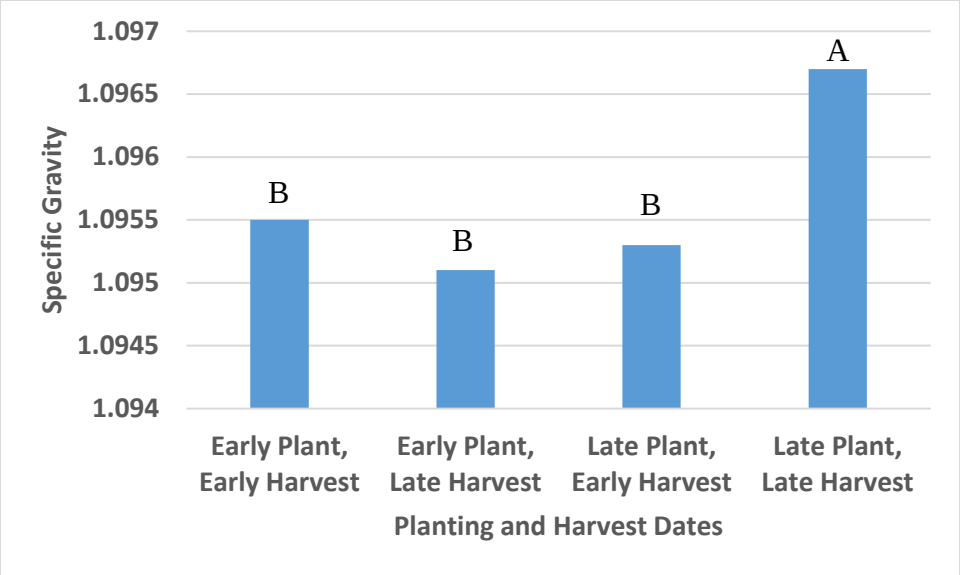


Figure 4. Interaction effect of planting and harvest dates on specific gravity. Different letters signify differences at $p<0.05$.

Variable Rate Irrigation as a Technology to Improve Potato Yield and Quality

Principal Investigator: Dr. Alison Nelson, AAFC – Carberry *(on assignment 2018)*

Co-Investigators: Dr. Bernie Zebarth, AAFC – Fredericton, NB *(retired 2019)*
Lindsey Andronak, AAFC – Carberry
Steve Sager, AAFC – Morden (interim support 2018)

Support: Agri-Innovation Program, AAFC
MHPEC, Inc.

Progress: Year 3 of 3

Objectives: - Evaluate current VRI management techniques for their effectiveness in improving yield and quality of tubers across areas of soil moisture variability

Key 2018 Message: - Drier conditions during the growing season decrease the effectiveness of VRI.

Contact Information: lindsey.andronak@canada.ca

Project Report

Three years of Variable Rate Irrigation (VRI) vs. Uniform Rate Irrigation (URI) study were completed by the end of 2018. Based on the topography, soil test and remote sensing data, a VRI prescription zone map was developed at the CMCDC-Carberry research facility offsite (Figure 1). In all years, following the development of the prescription maps, replicated, paired comparison plots were identified within the study areas to test VRI management against Uniform Rate Irrigation (URI). The plots were located to capture yield and crop data across different irrigation management zones from the VRI prescription maps.

Continuous soil moisture monitoring was carried out in selected plots and zones at the study sites using Decagon field dataloggers and EC-5 and 5TM soil moisture sensors installed within potato rows at multiple depths (Figure 2). Tuber yield and quality and post-harvest soil sampling were carried out for site characterization.

For the 2018 yield data, there was no difference in total yield between VRI and URI management. However, URI plots had a significantly higher marketable yield than the VRI plots (500 vs. 456 cwt/ac) (Figure 3). URI plots also had significantly less total tuber defects (1.5% vs. 6.1%), which is likely due to the higher amount of tuber rot in the VRI plots (Figure 4).

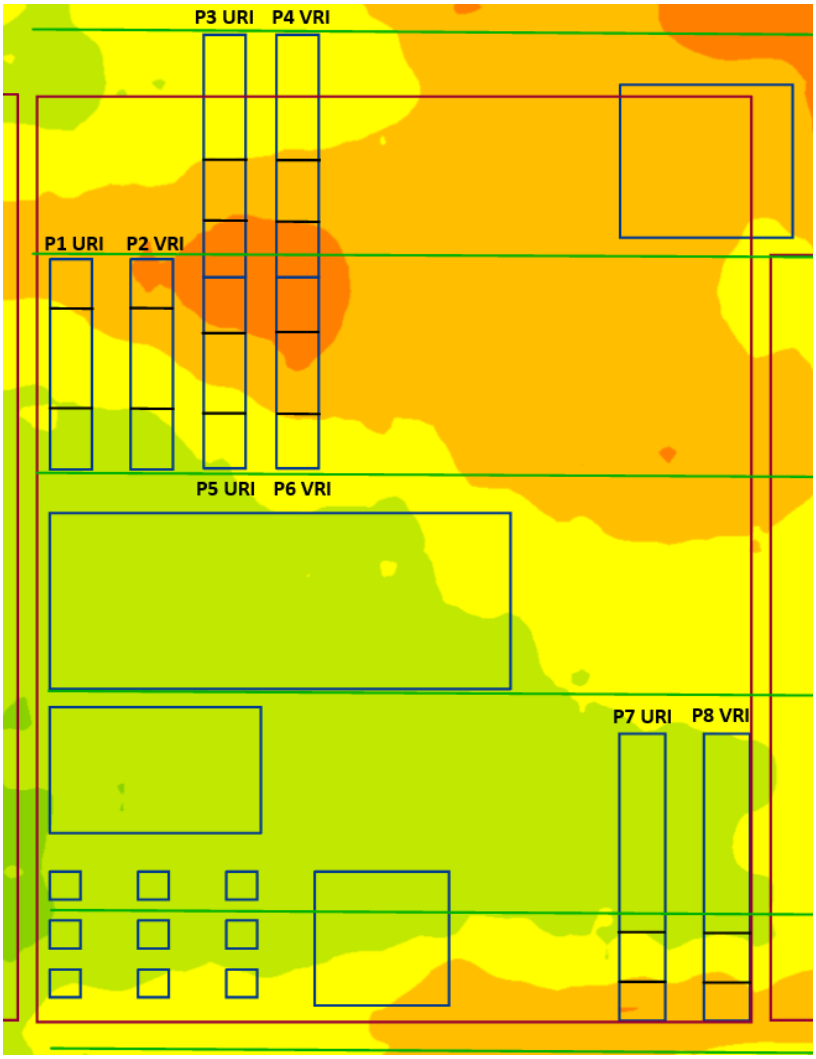


Figure 1. VRI prescription map and paired VRI/URI plot locations for the CMCDC field.

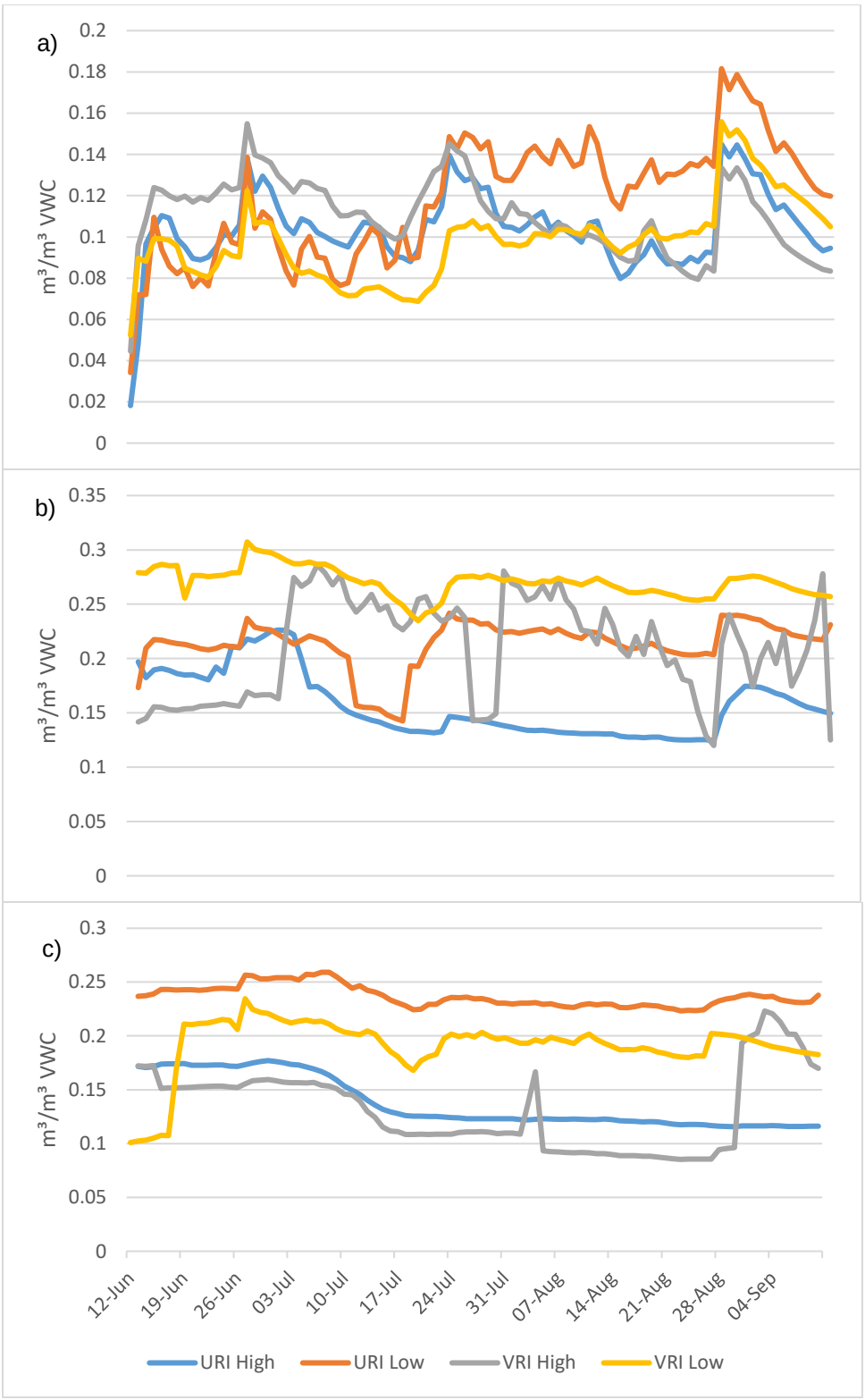


Figure 2. Average volumetric water content over the growing season at a) seed piece height and depths of b) 30 cm and c) 60 cm.

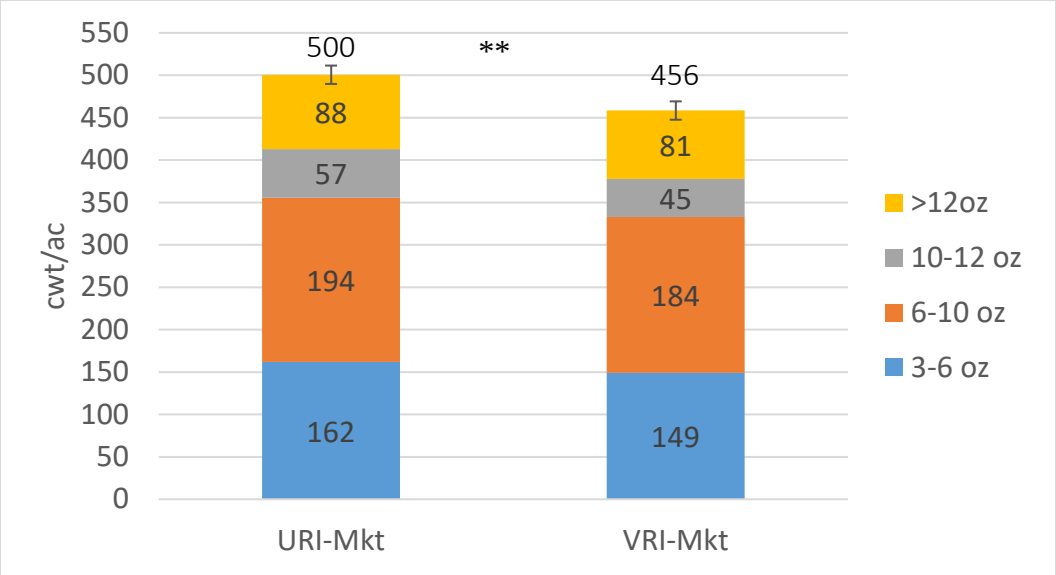


Figure 3. Comparison of URI and VRI marketable yields and size profiles in 2018.

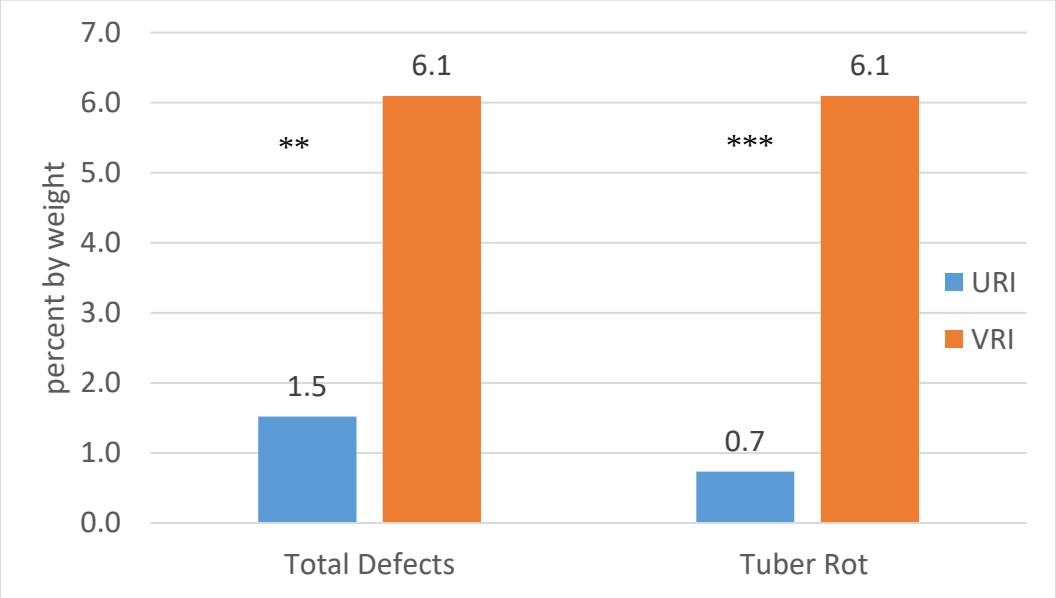


Figure 4. Comparison of URI and VRI percent total defects and tuber rot in 2018.

Testing the Use of a Proximal Sensor for Measuring Soil Moisture Changes In-Season

Principal Investigator: Dr. Alison Nelson, AAFC – Carberry (on assignment 2018)

Co-Investigators: Steve Sager, AAFC – Morden (interim support 2018)
Lindsey Andronak, AAFC - Carberry
John Fitzmaurice, AAFC - Winnipeg

Support: AAFC

Progress: Year 3 of 3

Objectives: **Test the concept and field logistics of using an Em38 sensor for measuring in-season soil moisture changes over time.**

Key 2018 Message: The dry growing season in 2018 led to issues with reaching some of the desired moisture contents of the treatments, particularly the 80 PAW treatment. In a wetter year, differences among treatments may be more pronounced.

Contact Information: lindsey.andronak@canada.ca

Project Report

Using already established water stress/heat stress trial protocol, a secondary study tested the concept of using an Em38 sensor to measure in-season changes in soil moisture. We are testing to see if an individual on a quad scouting a production-scale potato field could pull an Em38 sensor through an adjacent potato furrow to collect soil moisture data at the time of scouting. The Em38 is pulled across the soil surface, or slightly above the soil surface, causing little soil disturbance. The sensor has the potential to rapidly collect long transects of soil moisture data to depths of interest.

The plots used for this project were at the CMCDC-Carberry offsite location. The studies had a randomized complete block design, testing three different moisture regime treatments. The three moisture treatments of 40, 60 and 80 % plant available soil water were created using the lateral irrigation system and regular Watermark readings to maintain target soil moisture levels.

Soil testing was done to characterize the soil's properties at the study locations. EM-38 sensor readings were collected in each plot every two weeks during the growing season. After planting, locally calibrated Decagon soil moisture sensors (measuring dielectric constant) were installed in each plot to continuously monitor the soil moisture levels at three soil depths. The dry growing season in 2018 led to issues with reaching some of the desired moisture contents of the treatments, particularly the 80 PAW treatment. In a wetter year, differences among treatments may be more pronounced.

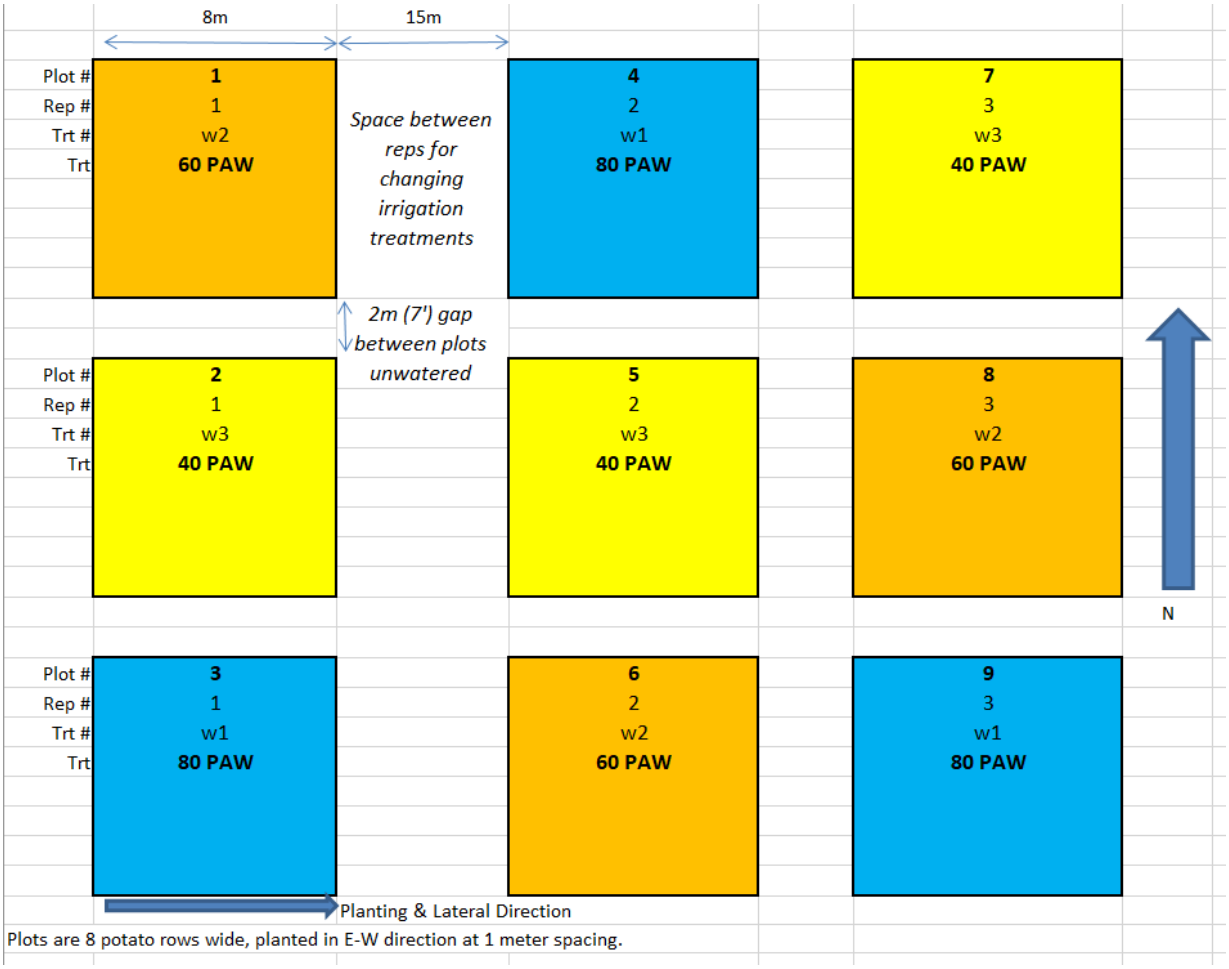


Figure 1. 2018 Water use plot layout.

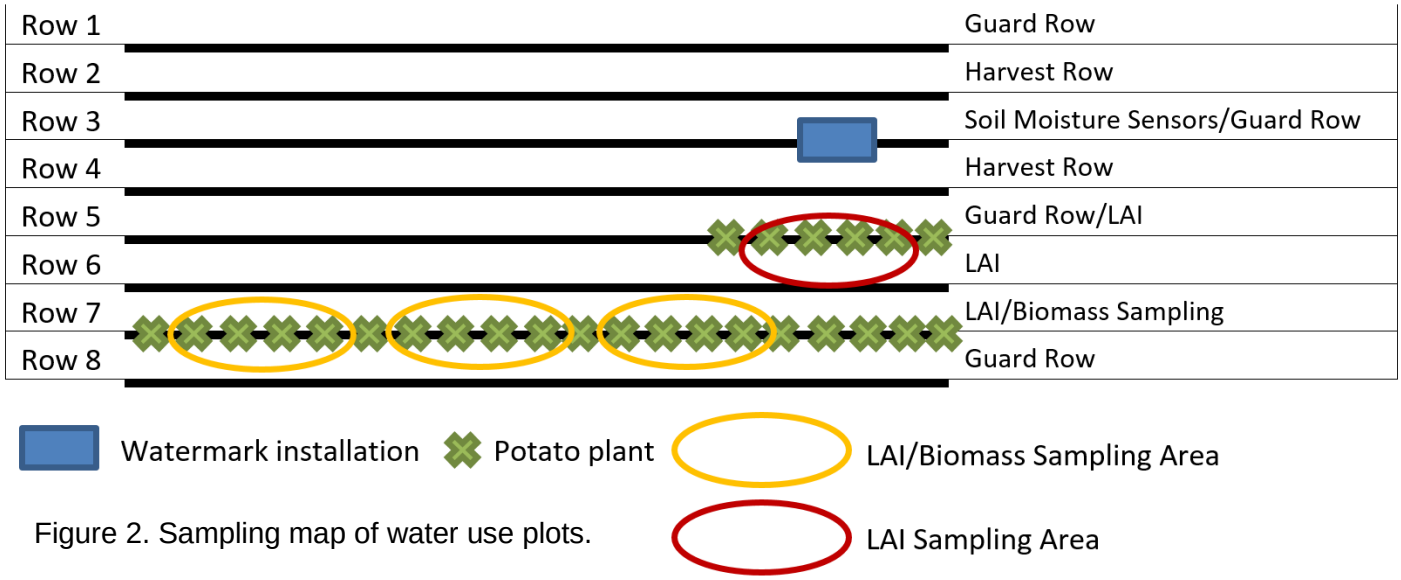
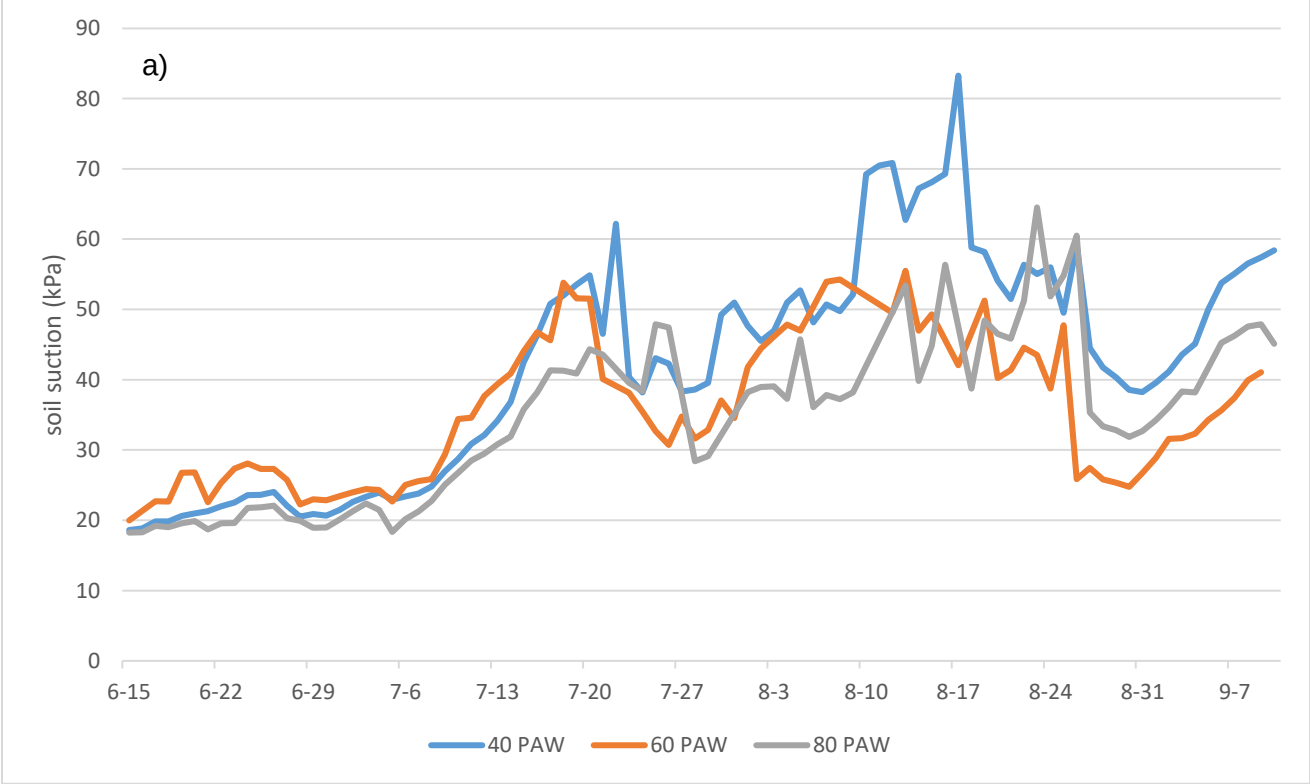


Figure 2. Sampling map of water use plots.



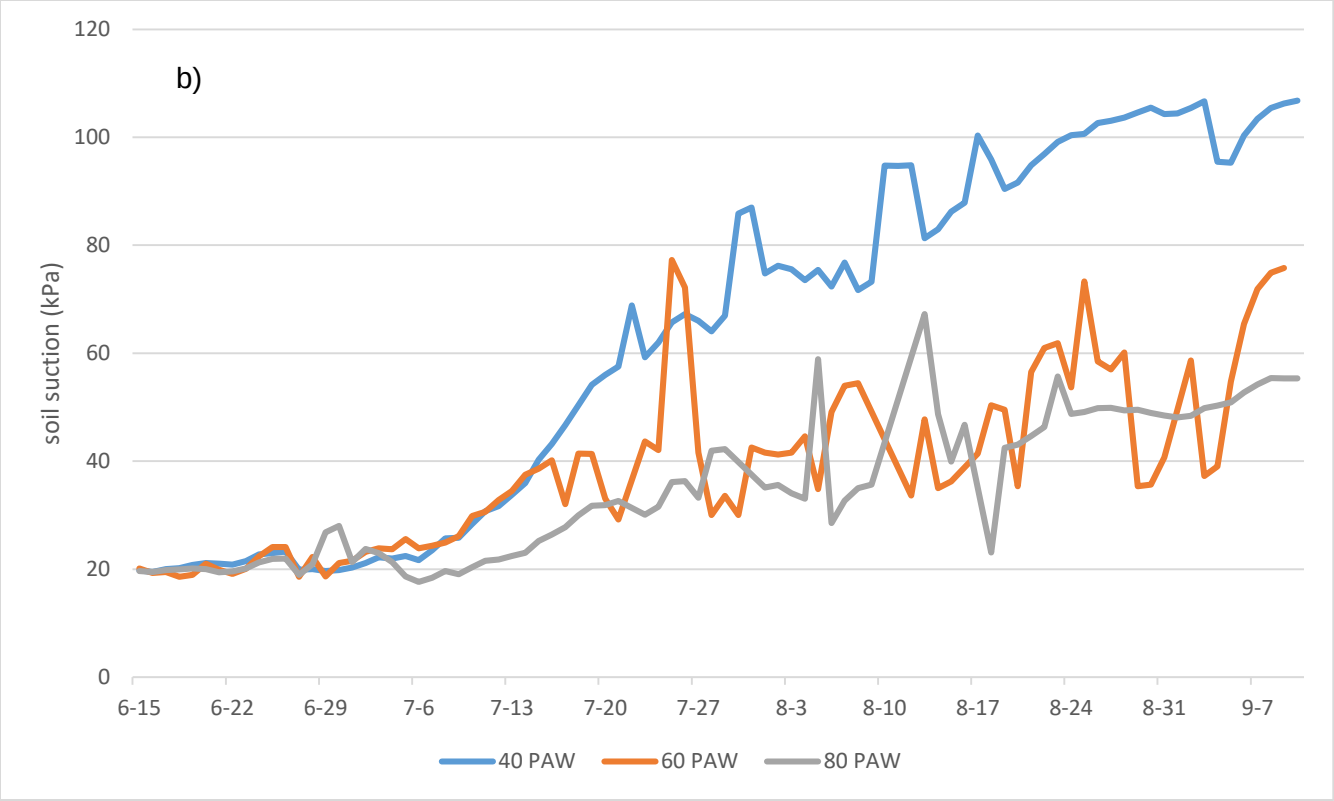


Figure 3. Soil moisture contents during the growing season at a) 30 cm and b) 60 cm. Note that higher soil suction values indicate lower plant available water.

Potato Cropping Sequence

Principal Investigators: Dr. Jazeem Wahab, AAFC – Saskatoon, SK
Dr. Reynald Lemke, AAFC – Saskatoon, SK
Dr. Alison Nelson, AAFC – Carberry, MB

Scientific Support: AAFC

Progress: Year 3 of 3

Objectives:
- Evaluate the effects of previous crop residue and nitrogen fertilizer on soil properties and the growth and quality of potatoes.
- Evaluate the agronomic and economic efficiencies and environmental impact of nitrogen

Key 2018 Message:
- Original rotation crop had no effect on wheat yield or 1000 seed weight.
- Higher wheat yields obtained when grown on potato plots that received N fertilizer.
- Fertilized wheat crop produced higher yield than the unfertilized wheat crop and the response was marked when grown on potato plots that received 0 or 75 kg N/ha compared to 150 and 225 kg N/ha.

Contact Information: jazeem.wahab@canada.ca

Nitrogen (N) is one of the most limiting nutrients for potato and both previous crop and fertilizer rate have an effect on total soil nitrogen availability. Crop residues with a high carbon to nitrogen ratio can immobilize nitrogen when incorporated, making it unavailable to the next crop. Conversely, crop residues with a low carbon to nitrogen ratio can release nitrogen into the soil, leading to an excess of nitrogen.

A split-split plot design was used for this experiment. In year 1 (crop residue treatment), plots were either planted to wheat, canola or fababean. In year 2 (potato nitrogen treatment), all plots were seeded to potato with 4 different nitrogen treatments (0, 75, 150 or 225 kg N/ha).In year 3 (2018), wheat (cv. Brandon) was planted to all plots. Plots either received no nitrogen or 140 kg N/ha. All plots were fertilized with phosphorus.

Table 1. Spring soil analysis: Soil N influenced by crop residue, potato N, and depth

Rotation crop	Soil N (ppm)	Potato N	Soil N (ppm)	Soil depth	Soil N (ppm)
Wheat	13.7 a	0	11.3 c	0-15 cm	21.3 a
Canola	12.6 a	75 kg N/ha	12.1 bc	15-30 cm	11.0 b
Fababean	12.5 a	150 kg N/ha	13.2 b	30-60 cm	10.0 bc
		225 kg N/ha	15.1 a	60-90 cm	9.4 c

ANOVA	
Source	Significance
Rotation crop (R)	ns
Potato nitrogen (N)	***
Soil depth (D)	***
R x N	ns
R x D	**
N x D	ns
R x N x D	ns

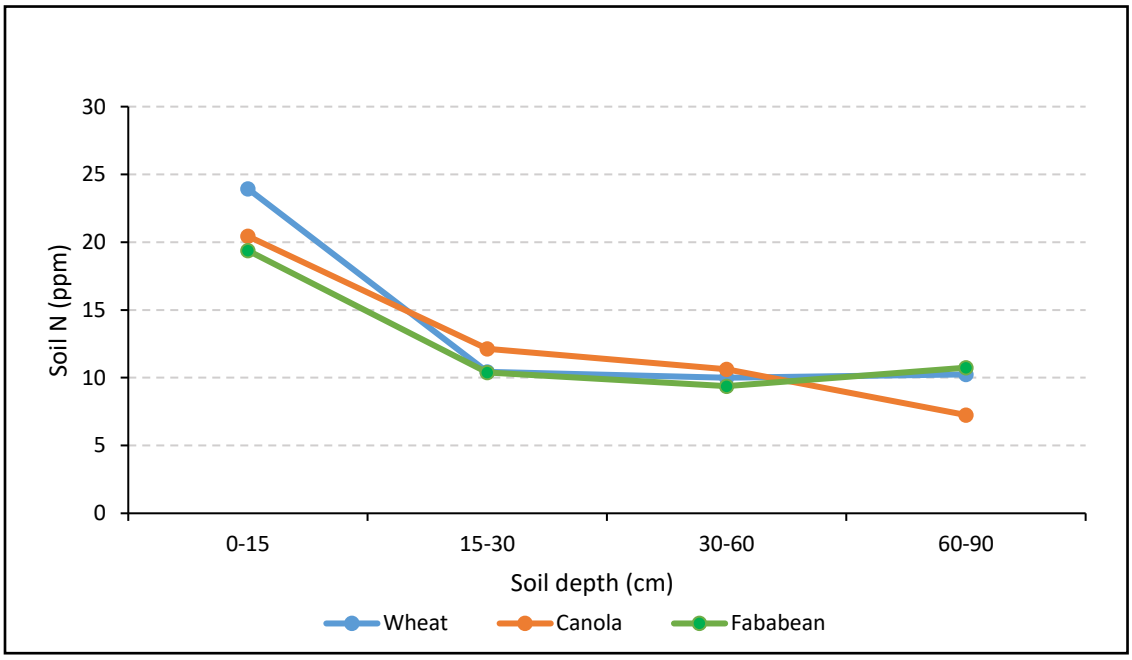


Figure 1. The interaction of crop residue type and soil depth on 2018 spring soil nitrogen levels.

Table 2. Yield, 1000-seed weight, and seed protein for Brandon wheat in response to rotation crop, potato residual N and wheat fertilizer application

Treatment	Yield (t/ha)	1000-Seed weight (g)	Protein (%)
Rotation crop:			
Wheat	5506 a	38.7 a	14.4 b
Canola	5119 a	39.0 a	14.9 a
Fababean	5534 a	38.7 a	14.3 b
Potato nitrogen:			
0 N	5305 b	38.7 a	14.0 d
75 N	5369 ab	38.7 a	14.3 c
150 N	5387 ab	39.0 a	14.7 b
225 N	5484 a	39.0 a	15.1 a
Wheat fertilizer:			
0	5116 b	38.4 a	13.5 b
140 kg N/ha	5657 a	38.2 b	15.5 a
Source	Yield	1000 Seed wt.	Protein %
Rotation Crop (R)	ns	ns	ns
Potato nitrogen (N)	ns	ns	***
Wheat fertilizer (F)	***	***	***
R x N	ns	ns	ns
R x F	ns	ns	*
N x F	*	*	ns
R x N x F	ns	ns	ns
C.V. (%)	7.1	2.1	2.7

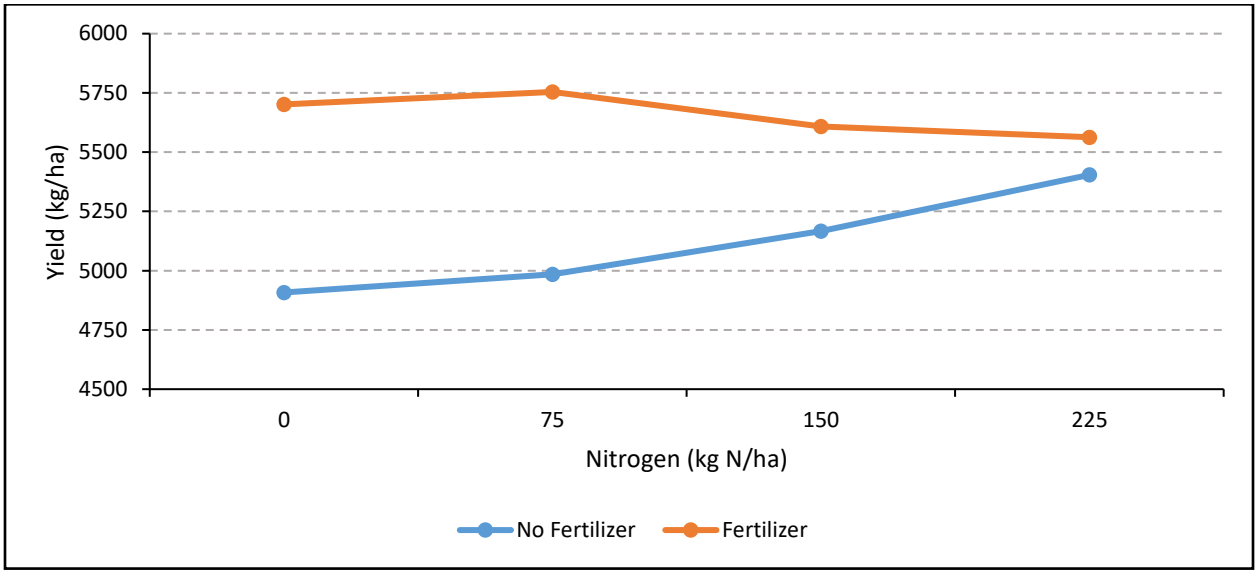


Figure 2. The interaction of potato residual nitrogen and fertilizer application on 2018 wheat yields.

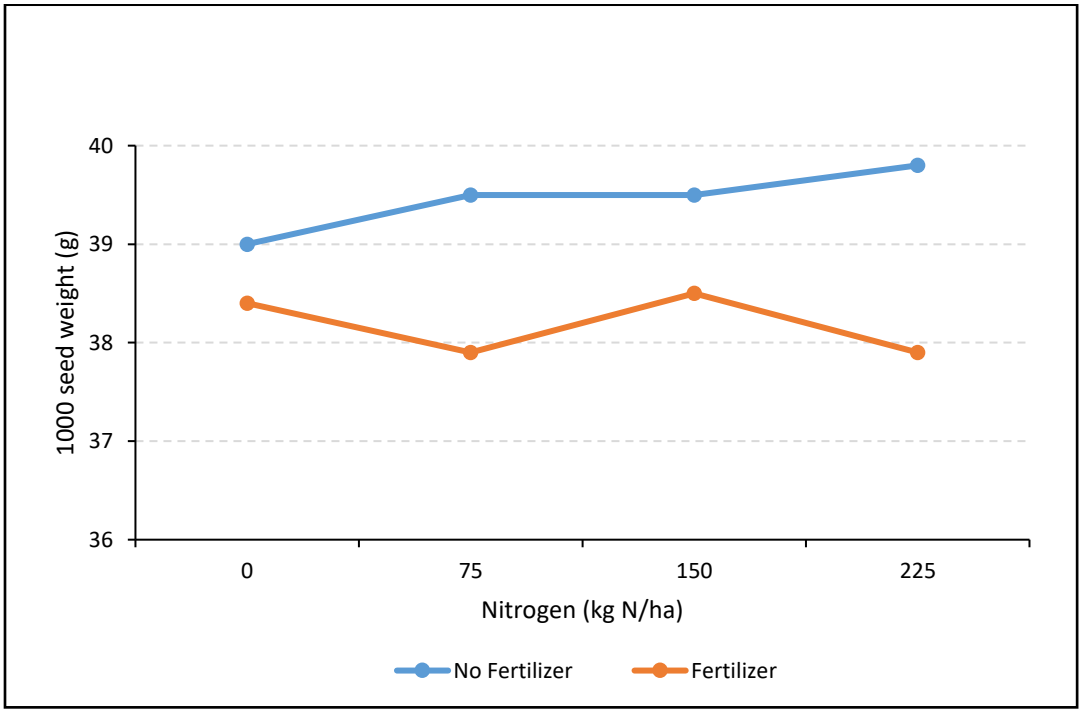


Figure 3. The interaction of potato residual nitrogen and fertilizer application on 2018 1000-seed weight.

Summary - Increasing the Competitiveness of Manitoba's Potato Industry

Principal Investigator: Dr. Zachary Frederick, MHPEC Inc

Scientific Support: Jane Giesbrecht, Rylee White, Haley Lobreau

Progress: Year 1 of 5 Strategic Initiative, Year 1 of 3 Canadian Agricultural Partnership, Year 4 of chronological study regardless of funding source

Objectives:
- Characterize the variables responsible for variable 'Russet Burbank' yield in MB
- Experimentally confirm ideal range of a variable that is currently yield-limiting (i.e. if low soil sulfur is a problem, what rate of sulfur is necessary to eliminate the problem)
- Evaluate treatment on field-scale for variables identified in objective 1, evaluate treatment cost-effectiveness

Key 2018 Message:
- Lower petiole nitrate at row closure are associated with total yield negatively (i.e. lower petiole nitrate at row closure is associated with the lowest yielding sampling points).
- Soil sulfur at all growth stages are associated positively with total yield and virtually all the size categories. The most benefit to sulfur was when more soil sulfur was available at row closure.
- Increasing numbers of Verticillium propagules were the single largest negative contribution to 10-12 oz yield

Note: a complete version of this research is available at mbpotatoresearch.ca under the research reports tab as of March 31 2019. This is an interim report for 2018-19, implying the project not complete yet.

Problem: Manitoba potato growers must generate an increased yield of a high-quality crop grown in a sustainable, cost effective manner to improve market competitiveness in response to changes in the local and global supply and demand of processed potato products, as well as the volatility in the exchange rate between Canada and the United States.

Why conduct this study in Manitoba? Yield increases must be achieved through regional research, development, and evaluation of crop management strategies because the long-distance importation of research results from other areas risks overlooking regionally significant yield-limiting factors.

Methods: The independent variables (what we measured) were approximately 98 soil, plant, and environmental factors from 2015-2018 for 19 fields planted to 'Russet Burbank'.

The dependent variables (what we are associating our independent variables to) were the total yield, value (in dollars), specific gravity, and percentage of each tuber size profile of < 3 oz, 3-6 oz, 6-10 oz, 10-12 oz, and > 12 oz.

In the case of each dependent variable, such as total yield, a model was created (partial least squares regression) which listed the major contributing variables and denotes if the association was positive or negative.

Conclusions: Approximately 50 independent variables have been associated with yield variability, and the effect of each variable has been ranked in order of significance. Consultations with growers on the project have identified three variables of the top ten that are economically feasible to manage and have the support to study improvements on their farms.

The Future of the Project

Objective	2015	2016	2017	2018	2019	2020	2021	2022
1.Characterize yield variability factors	Complete in 2019							
2. Establish target rates/methods of applying				Anticipated completion in 2020				
3. Field scale test/cost effectiveness								

Future projects to address the three main takeaways

1. Lower petiole nitrate at row closure are associated with total yield negatively (i.e. lower petiole nitrate at row closure is associated with the lowest yielding sampling points).
   - A nitrogen study was begun in 2018 to begin to address objective 2 – establish the rates and method of applying nitrogen to decrease yield variability.
   - This was a 1-acre, randomized complete block design experiment with 5 replicates and consisted of plots at the CMCDC offsite (lighter texture). Planting date 10 May, hilling 4 June, row closure samples 28 June.
   - The treatments were based on inferences from the first objective for ESN and urea. Treatments were a no-nitrogen treatment, goal to achieve soil tests of 40, 130, 180, and 280 lbs/acre **by row closure**. All treatments received the equivalent of 60 lbs N/acre via UAN fertigation in July as needed, with applications occurring as petiole and soil tests were deemed necessary.
   - There was a nearly significant (P = 0.07) treatment effect with one year of data, two years of data required to report results.
   - Rates and products will have to evaluated in-field for nitrogen remediation, with the benefit determined compared to the cost.

2. Soil sulfur at all growth stages are associated positively with total yield and virtually all the size categories. The most benefit to sulfur was when more soil sulfur was available at row closure.
   - A sulfur study will begin in 2019 to address objective 2 – establish rates of sulfur to decrease yield variability.
   - This will be a 1-acre, randomized complete block design experiment with 5 replicates and consisted of plots at the CMCDC offsite (lighter texture).
   - The treatments were based on inferences from the first objective, and will be set to achieve soil tests of 20, 60, and 100 lbs/acre
   - Products that are planned to be included are Tiger sulfur XP, Bio Sul, magnesium sulfate, and ammonium sulfate ($(NH_4)_2SO_4$ soil amendment) and ammonium thiosulfate ($(NH_4)_2S_2O_3$, ATS) fertigation

Crop Diversification Projects

Barley Variety Evaluation for Food Uses

Project duration May 2018 to Aug 2018
Objectives Evaluate barley variety performance & adaptation to the Carberry and Portage la Prairie regions of the Central plains.
Collaborators Ana Badea – Barley Breeder, AAFC Brandon

Results 2018

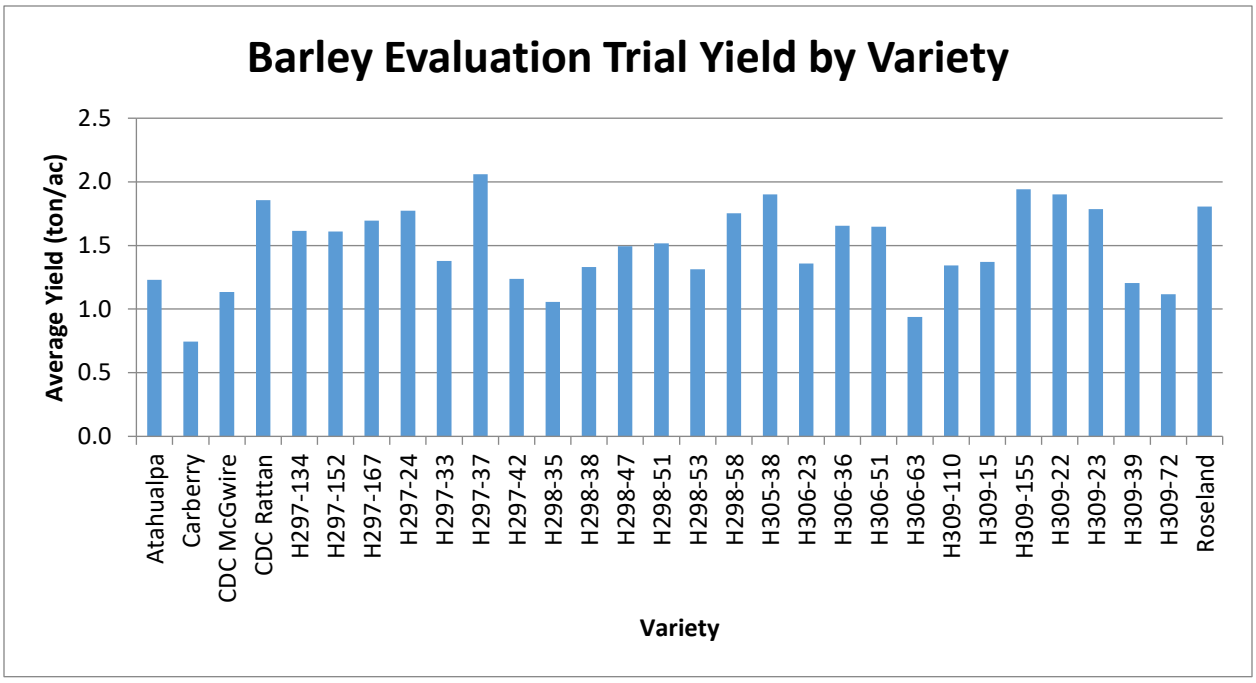


Figure 1. RoundUp Ready soybean varieties and yield performance at Carberry in 2018.

Materials & Methods

Experimental Design	Randomized complete block design with 3 replicates
Seeding Date	May 28, 2018
Harvest Date	August 30, 2018
Fertility	91 lb/ac actual N (46-0-0); 30lb/ac actual Phos (11-52-0)
In Crop Weed Control	Tundra applied June 6, 2018 Achieve applied June 19, 2018
Fungicide	No fungicide applied

Determining Optimum Target Plant Stands for Barley in Manitoba

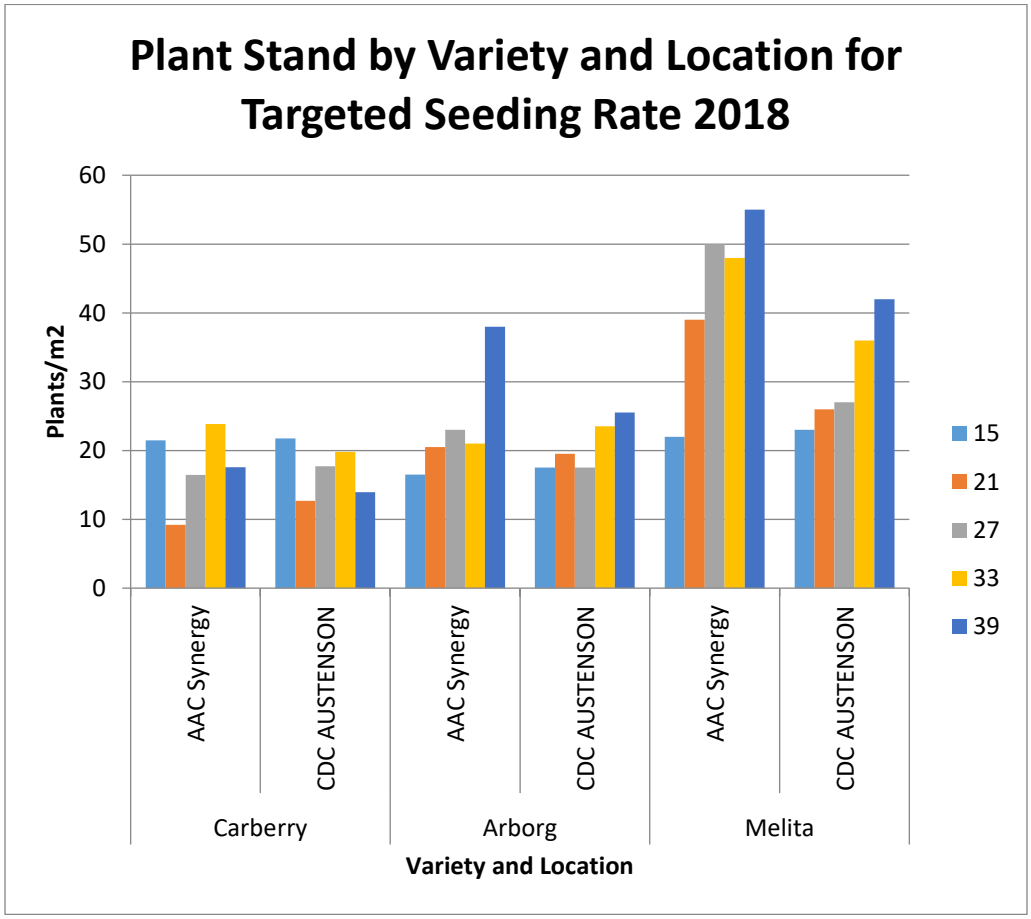
Project duration May 2017 – August 2018

Objectives To determine if optimum seeding rates differ by crop type and for individual varieties and to assist producers with the annual question of what target plant stands and seeding rates to aim for regarding newer spring cereal varieties. This project was conducted at four Manitoba Agriculture diversification centres in Manitoba including at Carberry, Arborg, Roblin and Melita.

Collaborators Anastasia Kubinec – Manager, Crop Industry Development, Manitoba Agriculture
Anne Kirk – Crop Industry Development, Manitoba Agriculture
Rejean Picard and Earl Bargen – Farm Production Extension

Results

The cumulative results of the two years for this project will be available at a later date. This report concerns only the structure of the trial for 2018.



Note: Roblin data excluded from plant stand due to error in plant counting

Figure 1. Diversification Centres comparative oats plant stand by variety and by seeding rate in 2018

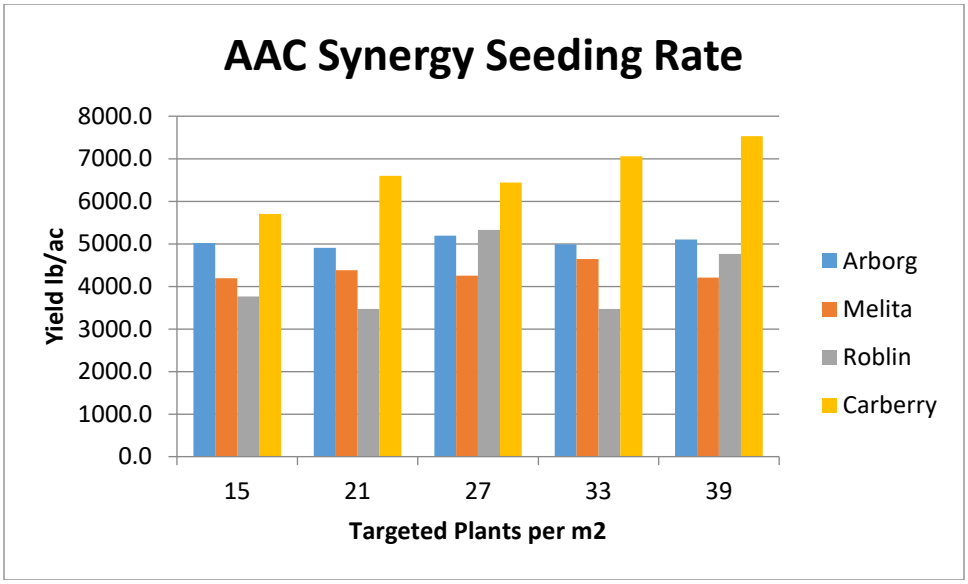


Figure 2. Yield demonstrated for variety AAC Synergy by seeding rate in 2018

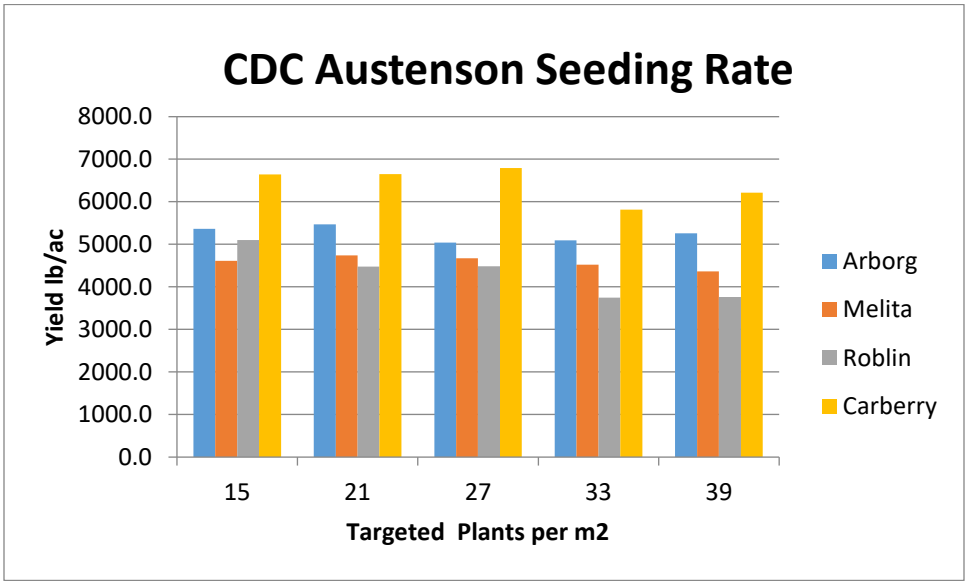


Figure 3. Yield demonstrated for variety CDC Austenson by seeding rate in 2018

Background
This project was developed and implemented by Manitoba Agriculture.

Carberry Materials & Methods

Experimental Design	Random Complete Block Design
Entries	5 seeding rates x 2 varieties
Seeding	May 9
Harvest	Aug 21

(Carberry specific)

Data collected	**Date collected**
Emergence population	May 31
% Seed mortality	May 31
Head counts	Jul 10
Lodging	Aug 21
Yield and Moisture	Aug 21

Table 1. Carberry Spring 2018 Soil Test

	Available
N	18 lb/ac
P	20 ppm
K	257 ppm
S	24 lb/ac

Materials & Methods

Experimental Design	Randomized complete block design with 3 replicates
Seeding Date	May 28, 2018
Harvest Date	August 30, 2018
Fertility	91 lb/ac actual N (46-0-0); 10lb/ac actual Phos (11-52-0)
In Crop Weed Control	Tundra applied May 29, 2018
Fungicide	No fungicide applied

Determining Optimum Target Plant Stands for Oats in Manitoba

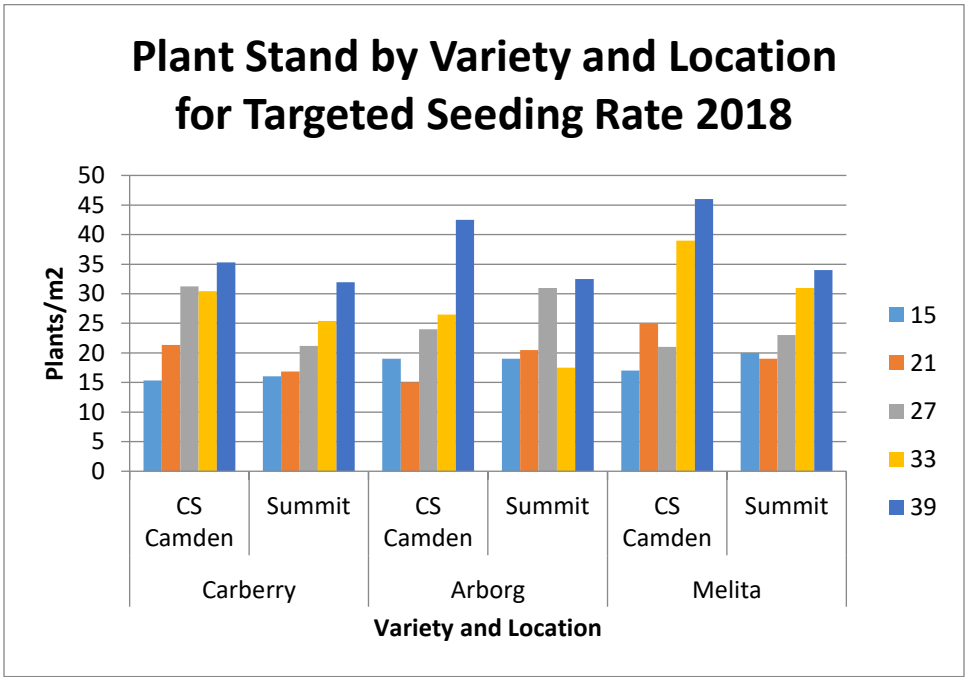
Project duration May 2017 – August 2018

Objectives To determine if optimum seeding rates differ by crop type and for individual varieties and to assist producers with the annual question of what target plant stands and seeding rates to aim for regarding newer spring cereal varieties. This project was conducted at four Manitoba Agriculture diversification centres in Manitoba including at Carberry, Arborg, Roblin and Melita.

Collaborators: Anastasia Kubinec – Manager, Crop Industry Development, Manitoba Agriculture
Anne Kirk – Crop Industry Development, Manitoba Agriculture
Rejean Picard and Earl Bargen – Farm Production Extension

Results

The cumulative results of the two years for this project will be available at a later date. This report concerns only the structure of the trial for 2018, but results are illustrated across the four Diversification Centres in Roblin, Carberry, Melita and Arborg.



Note: Roblin data excluded from plant stand due to error in plant counting

Figure 1. Diversification Centres comparative oats plant stand by variety and by seeding rate in 2018

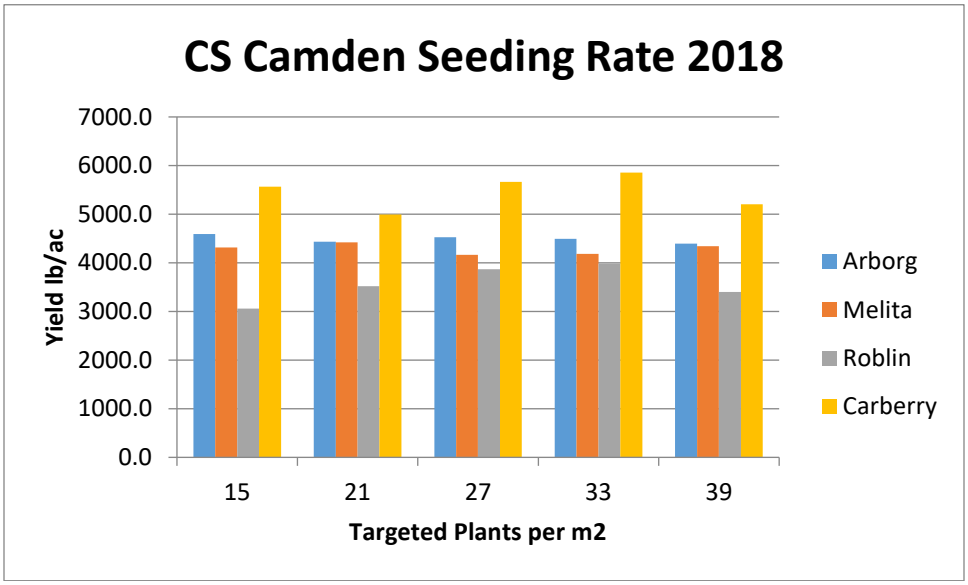


Figure 2. Yield demonstrated for variety CS Camden by seeding rate in 2018

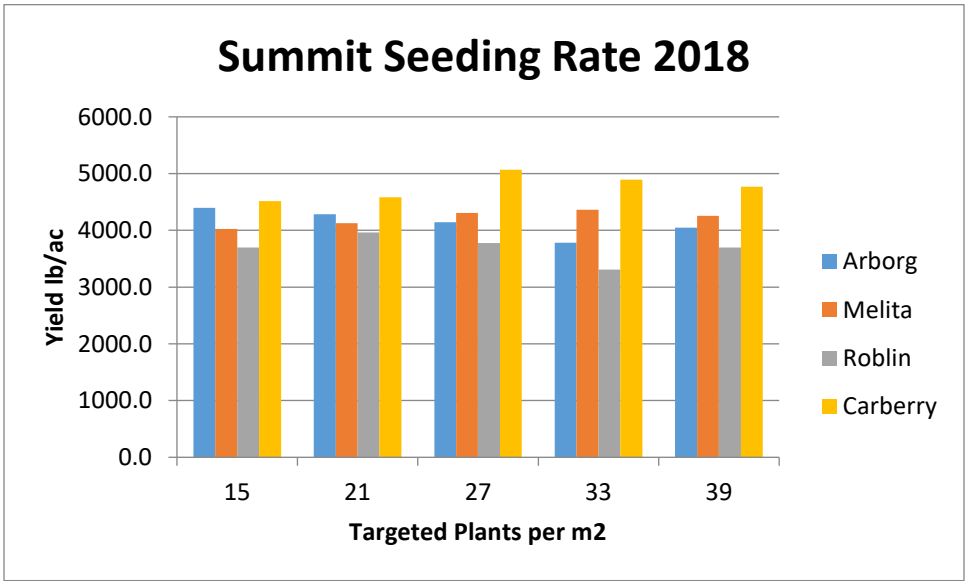


Figure 3. Yield demonstrated for variety Summit by Seeding Rate in 2018

Background

This project was developed and implemented by Manitoba Agriculture.

Carberry Materials & Methods

Fertility	91 lb/ac actual N (46-0-0); 10lb/ac actual Phos (11-52-0)
In Crop Weed Control	Buctril M applied May 29, 2018
	Reglone Applied August, 2018
Fungicide	No fungicide applied
Experimental Design	Random Complete Block Design
Entries	10 entries for each cereal
Seeding	May 9
Harvest	Aug 21

Data collected	**Date collected**
Emergence	May 9
% Seed mortality	May 31
Head counts	Jul 12
Lodging	Aug 21
Yield	Aug 21
Moisture	Aug 21

Table 1. Carberry Spring 2018 Soil Test

	Available
N	18 lb/ac
P	20 ppm
K	257 ppm
S	24 lb/ac

Determining Optimum Target Plant Stands for Spring Wheat in Manitoba

Project duration May 2017 – August 2018

Objectives To determine if optimum seeding rates differ by crop type and for individual varieties and to assist producers with the annual question of what target plant stands and seeding rates to aim for regarding newer spring cereal varieties. This project was conducted at four Manitoba Agriculture diversification centres in Manitoba including at Carberry, Arborg, Roblin and Melita.

Collaborators Anastasia Kubinec – Manager, Crop Industry Development, Manitoba Agriculture
Anne Kirk – Crop Industry Development, Manitoba Agriculture
Rejean Picard and Earl Bargen – Farm Production Extension

Results

The cumulative results of the two years for this project will be available at a later date. This report concerns only the structure of the trial for 2018.

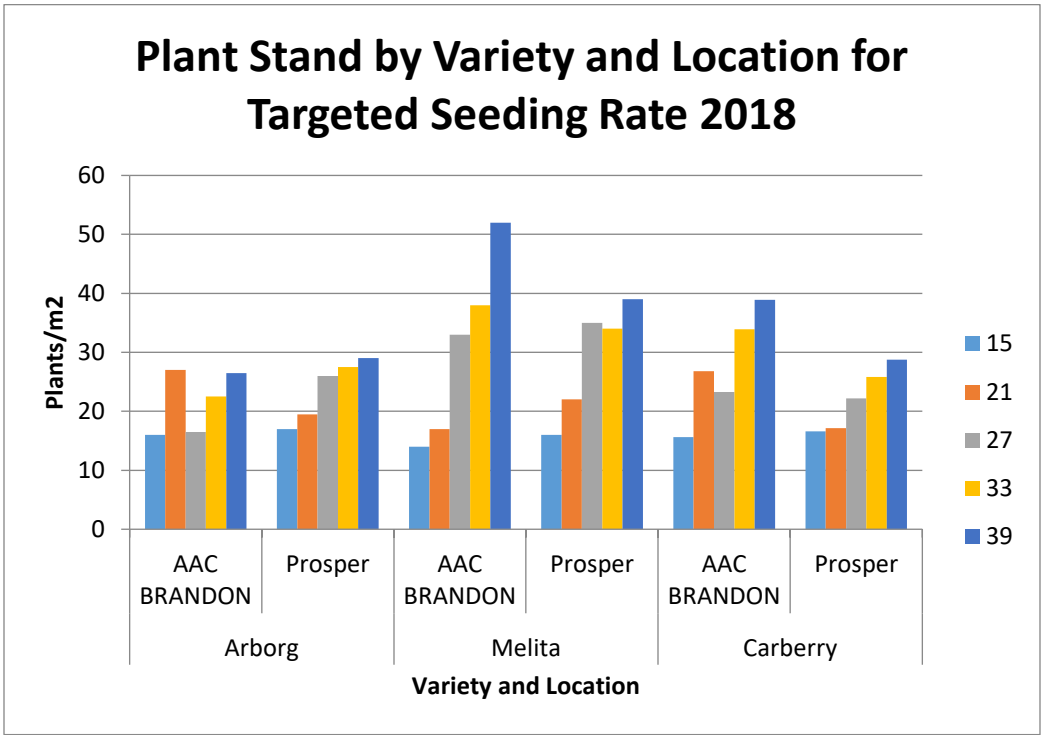


Figure 1. Diversification Centres comparative barley plant stand by variety and by seeding rate in 2018

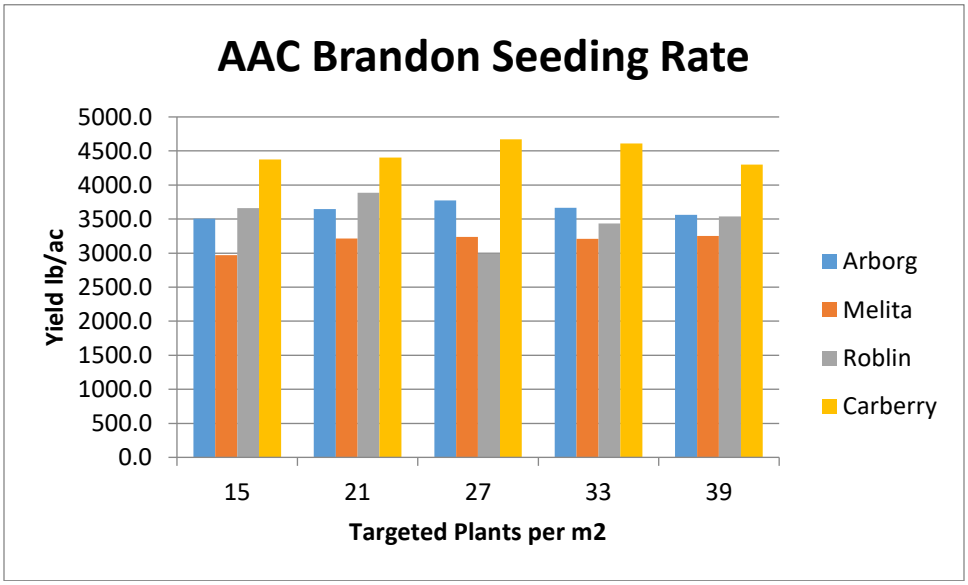


Figure 2. Yield demonstrated for variety AAC Brandon by seeding rate in 2018

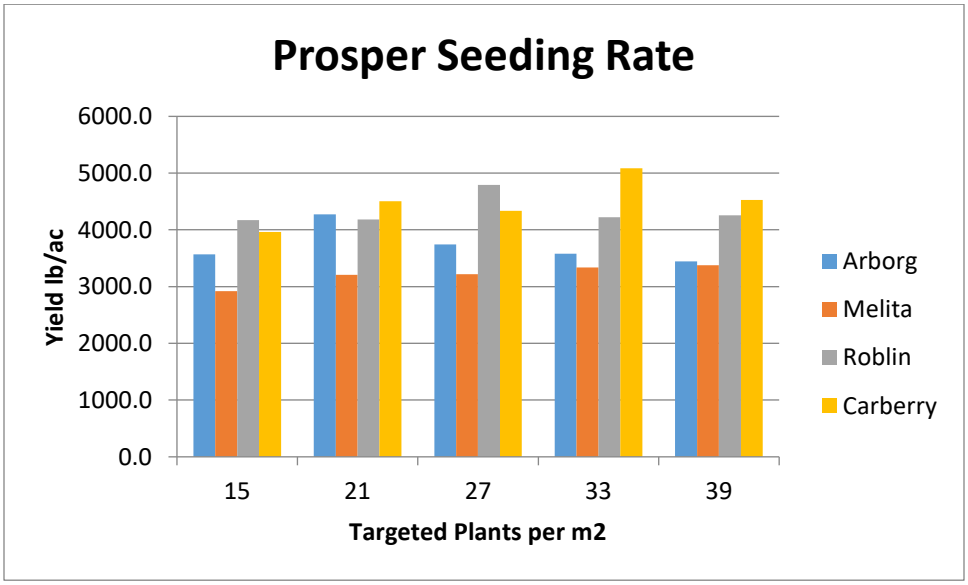


Figure 3. Yield demonstrated for variety Prosper by seeding rate in 2018

Background

This project was developed and implemented by Manitoba Agriculture.

Carberry Materials & Methods

Experimental Design	Random Complete Block Design
Entries	2 varieties x 5 seeding rates
Seeding	May 9
Harvest	Aug 21
Fertility	132 lb/ac actual N (46-0-0)
In Crop Weed Control	Tundra applied May 29, 2018
	Achieve applied June 19, 2018
	Reglone Applied August, 2018

Data collected	**Date collected**
Emergence population	May 31
% Seed mortality	May 31
Head counts	July 11
Lodging	Aug 21
Yield and Moisture	Aug 21

Table 1. Carberry Spring 2018 Soil Test

	Available
N	18 lb/ac
P	20 ppm
K	257 ppm
S	24 lb/ac

Manitoba Agriculture Wheat Fusarium Head Blight Risk Model

Project duration May 2018 – August 2018
Objectives To increase understanding of resulting Fusarium Head Blight (FHB) infection for wheat and barley 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
Grain samples were sent away for Fusarium specific analysis, but no report for these results has yet been generated. PCDF will post a link when this report is available. Other collected data and yield results for the Carberry site are included below.

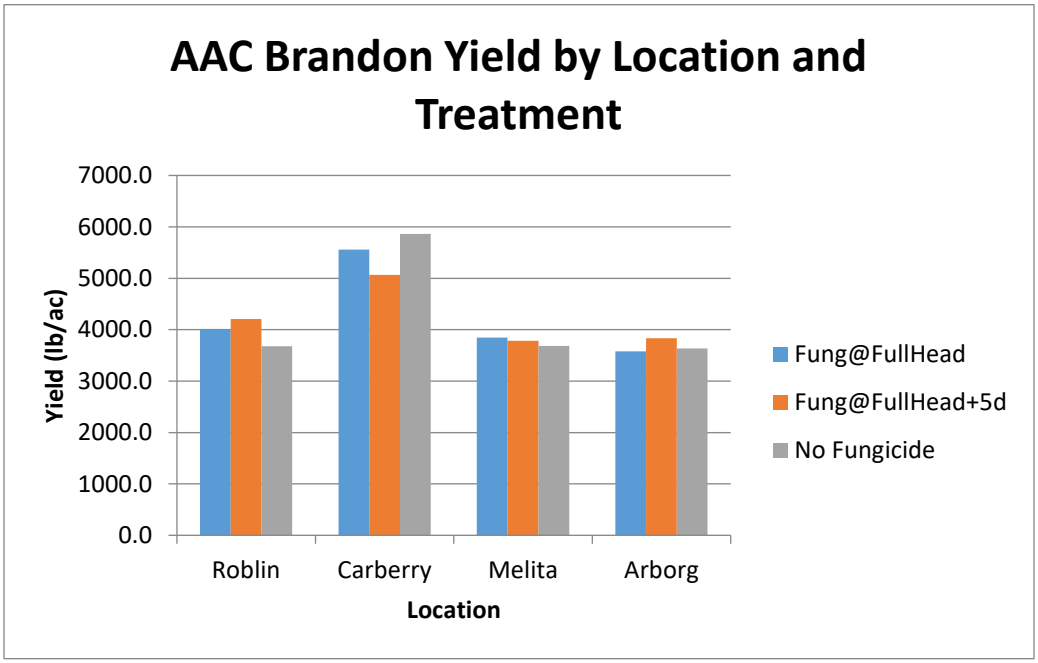


Figure 1. Yield by location and timing of fungicide application for AAC Brandon

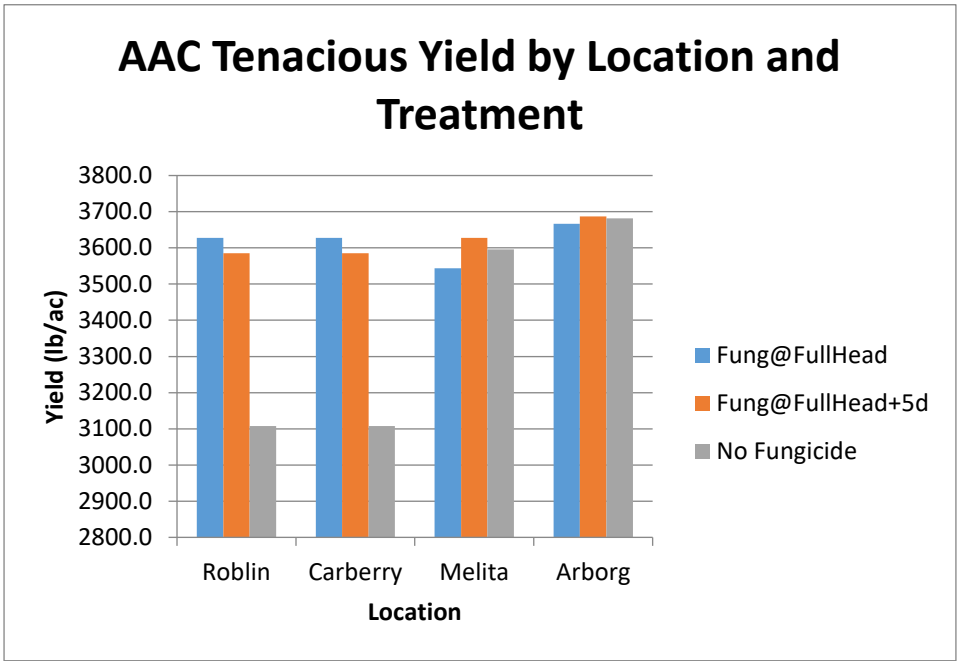


Figure 2. Yield by location and timing of fungicide application for AAC Tenacious

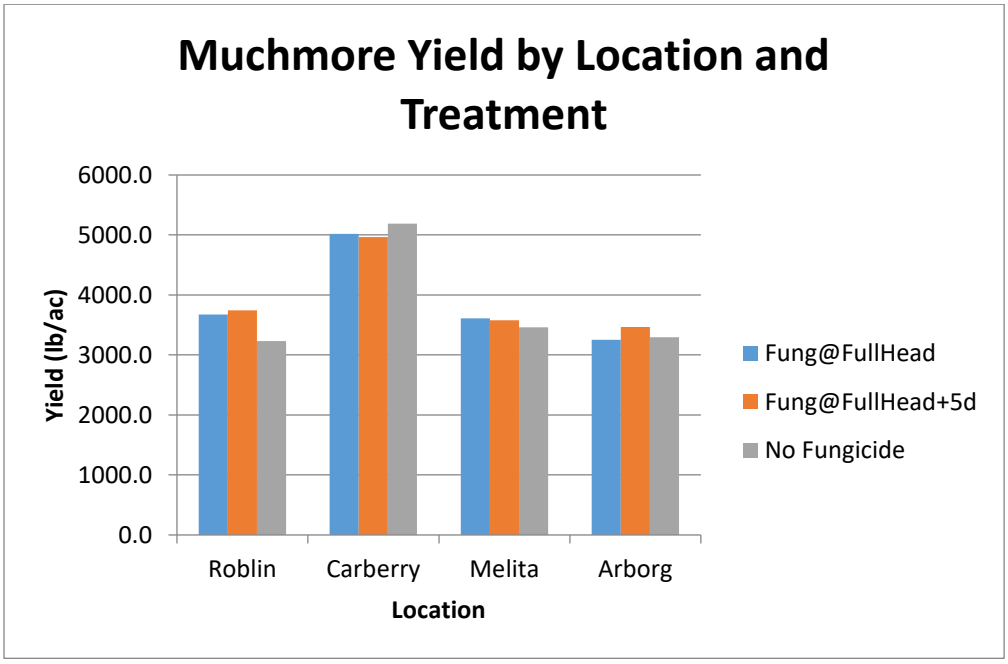


Figure 3. Yield by location and timing of fungicide application for Muchmore

Background

Farmers need improved decision-making tools in order to assess the local risk of Fusarium Head Blight (FHB). Better tools would improve judgement on whether or not to use fungicide and how to time application. The project recognizes that the current model for predicting the presence of FHB is insufficient and is gathering data across the province for different treatment plans using known fusarium resistant or fusarium susceptible varieties.

Carberry Materials & Methods

Experimental Design	Random Complete Block Design
Entries	9 (3 varieties x 3 treatments)
Seeding	May 15
Harvest	Aug 30
Varieties	AAC Tenacious AAC Brandon Muchmore
Fertility:	132 lb/ac actual N (46-0-0)
In Crop Weed Control:	Tundra applied May 29, 2018 Achieve applied June 19, 2018 Roundup Applied August, 2018
Fungicide	Prosaro applied according to treatments
Target population	30 plants/ft2 assuming 15% seedling mortality
Treatments	No fungicide Fungicide at full head emergence/early anthesis Fungicide five days after full head emergence/early anthesis

Data collected	**Date collected**
Emergence	Jun 5
Yield	Sept 17
Moisture	Sept 17

Samples sent away to analyze for fusarium damaged kernels and kernel accumulation of DON

Table 1. Carberry Spring 2018 Soil Test

	Available	Needed for Wheat
N	18 lb/ac	150 lb/ac
P	10 ppm	20 lb/ac
K	257 ppm	0 lb/ac
S	24 lb/ac	0 lb/ac

Manitoba Agriculture Barley Fusarium Head Blight Risk Model

Project duration May 2018 – August 2018
Objectives To increase understanding of resulting Fusarium Head Blight (FHB) infection for wheat and barley 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
Grain samples were sent away for Fusarium specific analysis, but no report for these results has yet been generated. PCDF will post a link when this report is available. Other collected data and yield results for the Roblin site are included below.

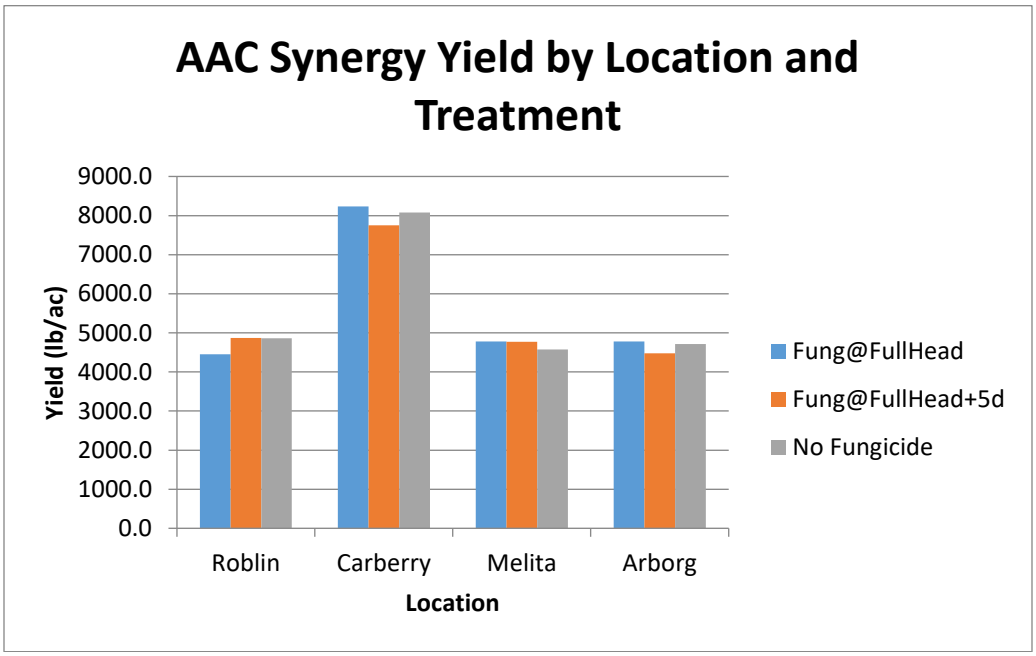


Figure 1. Yield by location and timing of fungicide application for AAC Synergy

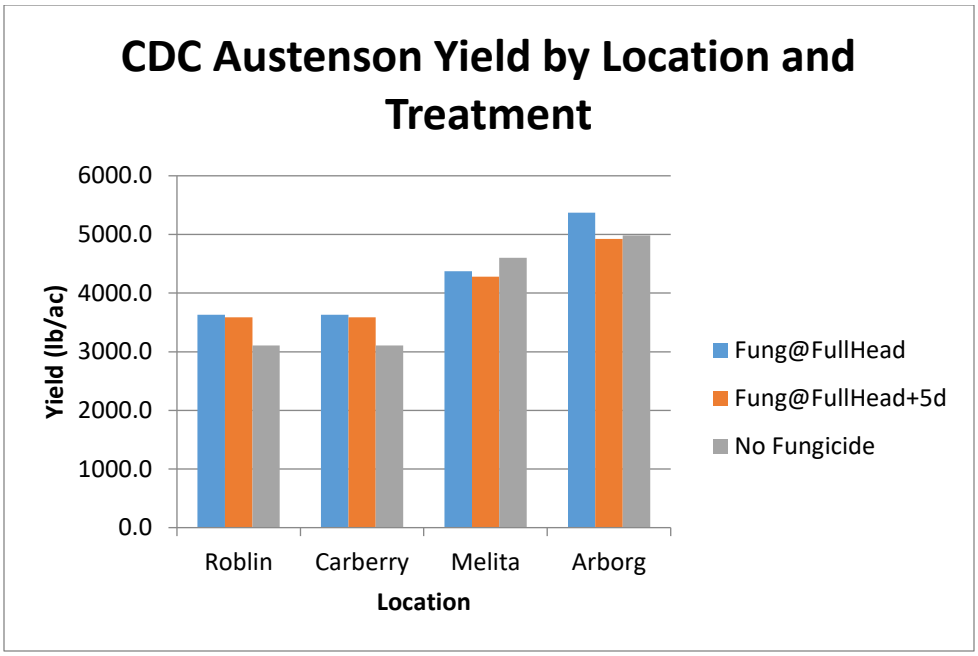


Figure 2. Yield by location and timing of fungicide application for CDC Austenson

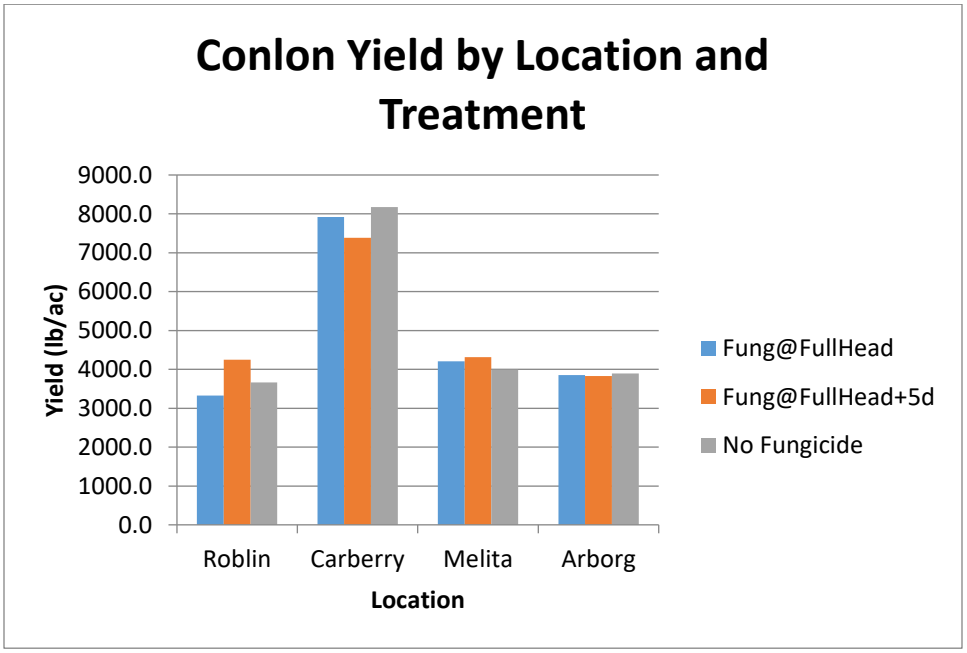


Figure 3. Yield by location and timing of fungicide application for Conlon

Background

Farmers need improved decision-making tools in order to assess the local risk of Fusarium Head Blight (FHB). Better tools would improve judgement on whether or not to use fungicide and how to time application. The project recognizes that the current model for predicting the presence of FHB is insufficient and is gathering data across the province for different treatment plans using known fusarium resistant or fusarium susceptible varieties.

Carberry Materials & Methods

Experimental Design	Random Complete Block Design
Entries	9 (3 varieties x 3 treatments)
Seeding	May 14
Harvest	Aug 15
Varieties	CDC Austenson
	Conlon
	AAC Synergy
Target population	30 plants/ft2 assuming 15% seedling mortality
Fertility	91 lb/ac actual N (46-0-0); 30lb/ac actual Phos (11-52-0)
In Crop Weed Control:	Tundra applied May 29, 2018
	Achieve applied June 19, 2018
Fungicide	Prosaro applied according to treatments
Treatments	No fungicide
	Fungicide at full head emergence/early anthesis
	Fungicide five days after full head emergence/early anthesis

Data collected	**Date collected**
Yield	Aug 15
Moisture	Aug 15

Samples sent away to analyze for fusarium damaged kernels and kernel accumulation of DON

Table 1. Carberry Spring 2018 Soil Test

	Available	Needed for Barley
N	29 lb/ac	120 lb/ac
P	10 ppm	40 lb/ac
K	222 ppm	
S	118 lb/ac	

Management Practices for High Yielding Spring Wheat

Project duration May 2018 – August 2018

Objectives The objective of project is to quantify the yield benefit of intensive management practices in spring wheat, and to determine if these management practices provide the same benefit to a variety of cultivars.

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

Results

The result on the protein analysis will be available at a later date. For yield results by treatment please see Figure 1 – Figure 5. For treatment outline please see Table 1.

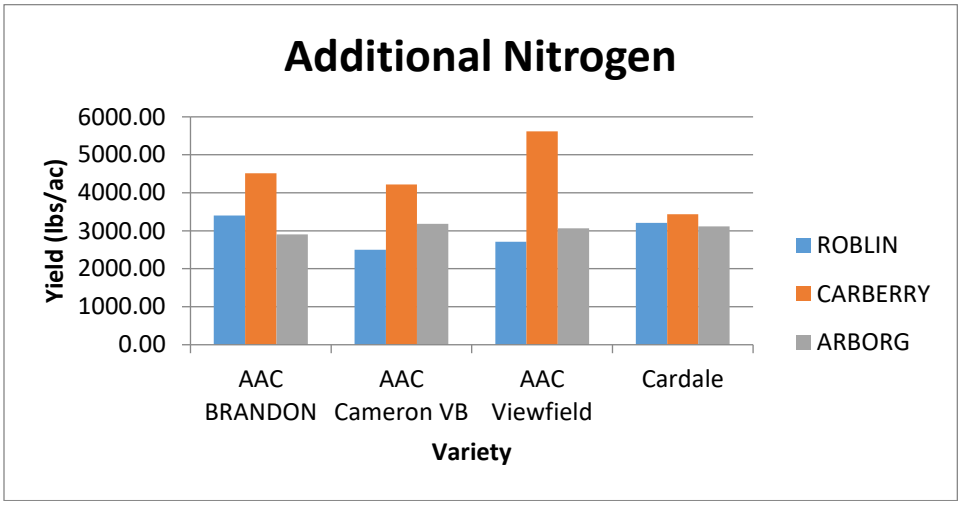


Figure 1. Yield results by location and variety for Treatment 1

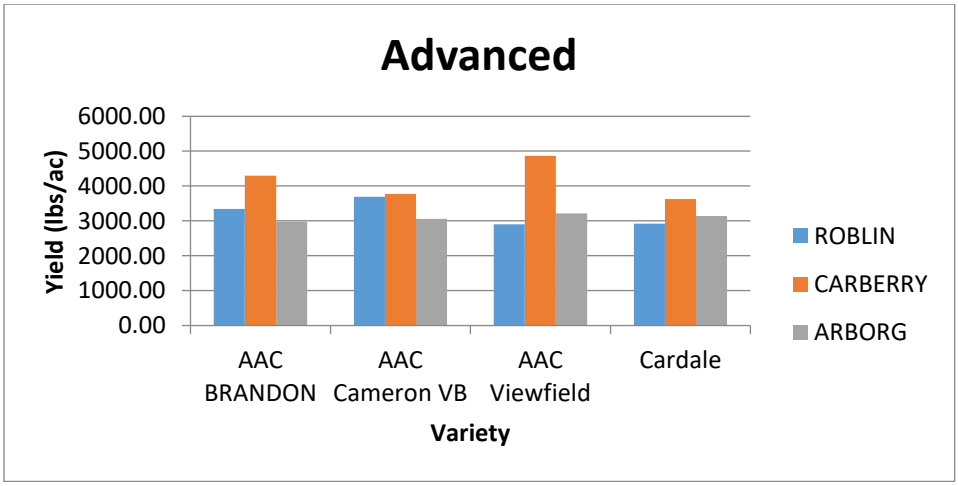


Figure 2. Yield results by location and variety for Treatment 2

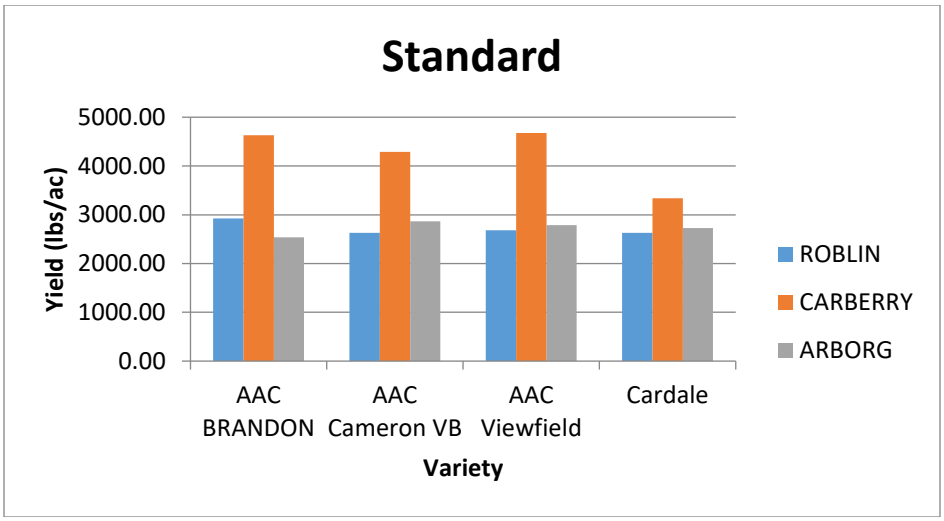


Figure 3. Yield results by location and variety for Treatment 3

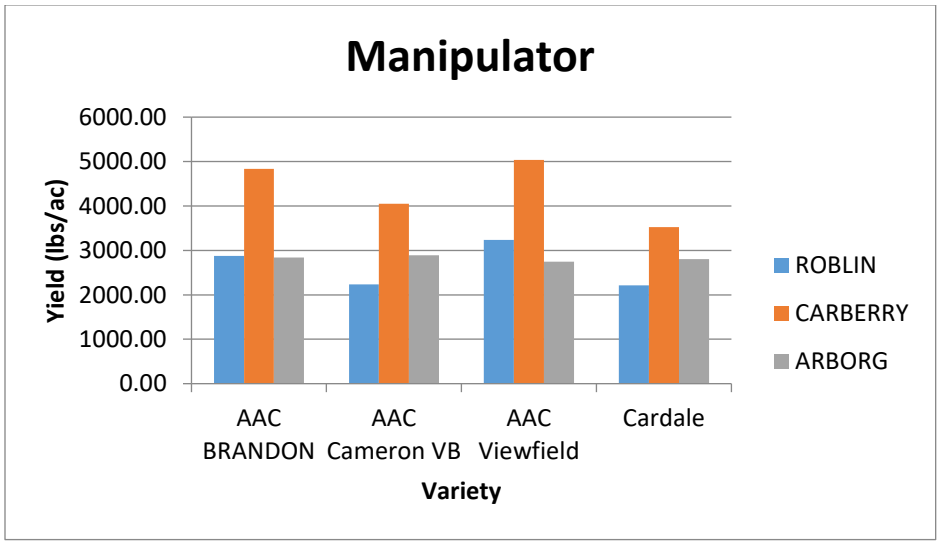


Figure 4. Yield results by location and variety for Treatment 4

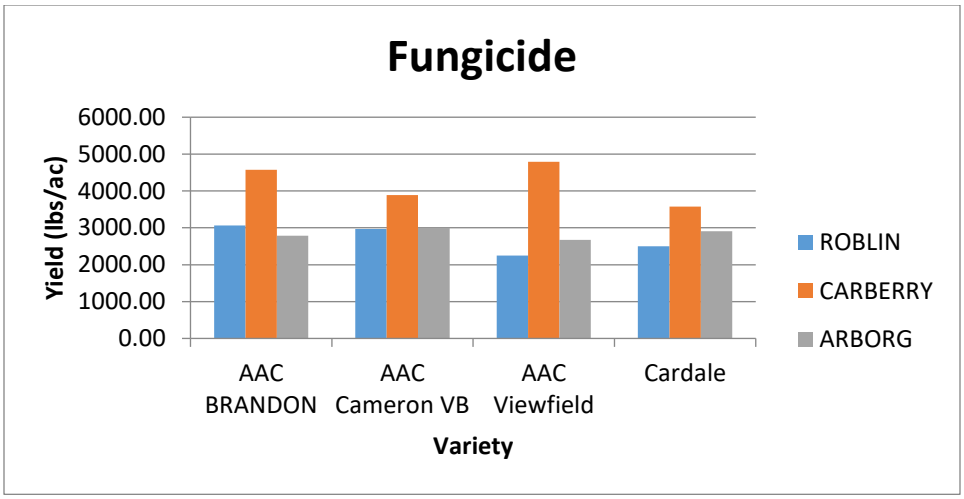


Figure 5. Yield results by location and variety for Treatment 5

Background
The focus of this project is on plant growth regulators (PGRs), fungicides, and higher nitrogen rates.

Targeting higher yields often means increasing nitrogen rates, which brings with it the increased risk of lodging. PGRs are used to improve crop standability, and may be a good fit for a management system with increased nitrogen rates. The PGR "Manipulator" (chlormequat chloride) is registered for use in Canada, but uptake has been limited due to the previous absence of an established maximum residue limit (MRL) for the USA. This limit was set in April of 2018, marking a change in the management practices that are open to Manitoban wheat growers.

Fungicides to control fusarium head blight (FHB) and leaf diseases are commonly used on spring wheat in Manitoba. Previous research has found some evidence of PGRs reducing protein content in spring wheat, but this is potentially not the case when PGRs are applied with fungicides.

The objective of this project is to quantify the yield benefit of intensive management practices in spring wheat, and to determine if these management practices provide the same benefit to a variety of cultivars. This information will help producers make decisions on where to focus their input dollars, and will provide an opportunity to highlight the effects of PGR's in spring wheat production.

Carberry Materials & Methods

Experimental Design	Random Complete Block Design
Entries	20 – 4 varieties x 5 treatments *(see Table 1)*
Varieties	AAC Brandon; AAC Viewfield; Cardale; AAC Cameron VB
Seeding	May 15
Harvest	Aug 30
Fertility	See Table 1
In Crop Weed Control	Tundra applied May 29, 2018 Achieve applied June 19, 2018 Roundup applied August, 2018
Plant Growth Regulator	Manipulator
Fungicide	Prosaro applied according to treatments

Table 1. Treatments for Management of High Intensity Spring Wheat

Treatment	N application	Fungicide *(Acapella)*	PGR *(Manipulator)*
1	100 lbs/ac	None	None
2	150 lbs/ac	None	None
3	100 lbs/ac	None	Applied at flag leaf
4	100 lbs/ac	At flag leaf and anthesis	None
5	150 lbs/ac	At flag leaf and anthesis	Applied

N banded with seed according to treatments set out in Table 1; P side-banded to 10lb/ac

As demonstrated in Table 1, the treatments involved different combinations of fertilizer rates, with or without fungicide and with or without a PGR.

- Treatment 1 represented a very standard treatment with regards to fertility and no fungicide or PGR.
- Treatments 3 and 4 used the same baseline fertility, however Treatment 3 incorporated PGR (no fungicide) and Treatment 4 incorporated Fungicide (no PGR).
- Treatments 2 and 5 increased the fertility by 50%. Treatment 2 did not incorporate any PGR or Fungicide. Treatment 5, called “Advanced” incorporated all elements of the trial, using increased fertility, and applying both PGR and Fungicide.

Data collected	**Date collected**
Height	Aug 2
Lodging	Sept 17
Yield	Sept 17
Moisture	Sept 17

Table 2. Carberry Spring 2018 Soil Test

	Available	Needed
N	54 lb/ac	According to treatments
P	14 ppm	20 lb/ac
K	296 ppm	0 lb/ac
S	42 lb/ac	0 lb/ac

RR Soybean Adaptation Trials

Project duration May 2018 to September 2018
Objectives Evaluate soybean variety performance & adaptation to the Carberry and Portage la Prairie regions of the Central plains.
Collaborators Manitoba Pulse & Soybean Growers (MPSG)
Manitoba Crop Variety Evaluation Team (MCVET)

Results 2018

As new varieties are added each year, assuming they are superior to previous lines is not always valid; especially if the said lines have not been tested intensively within the region of interest. Furthermore, even if a variety has been previously tested at the location of interest, that testing will always be limited to the environmental (growing conditions) parameters of that period, which can be much different from the future testing period. Therefore, the best estimate of future performance is the examination of performance over as many years of data as possible (or even adjacent locations). This permits an understanding of sustained performance. Varieties that are consistently among the top performers across multiple years will most likely remain top performers in the near future, with the duration depending on the actual annual yield increase due to genetic improvement. For example, two varieties that appear to be stable performers from the short season category in Carberry include PS 0035 NR2 & 23-60RY with Lono R2 demonstrating consistent performance for the mid-season varieties.

For more custom comparisons of soybeans and other crops in Manitoba visit www.seedinteractive.ca.

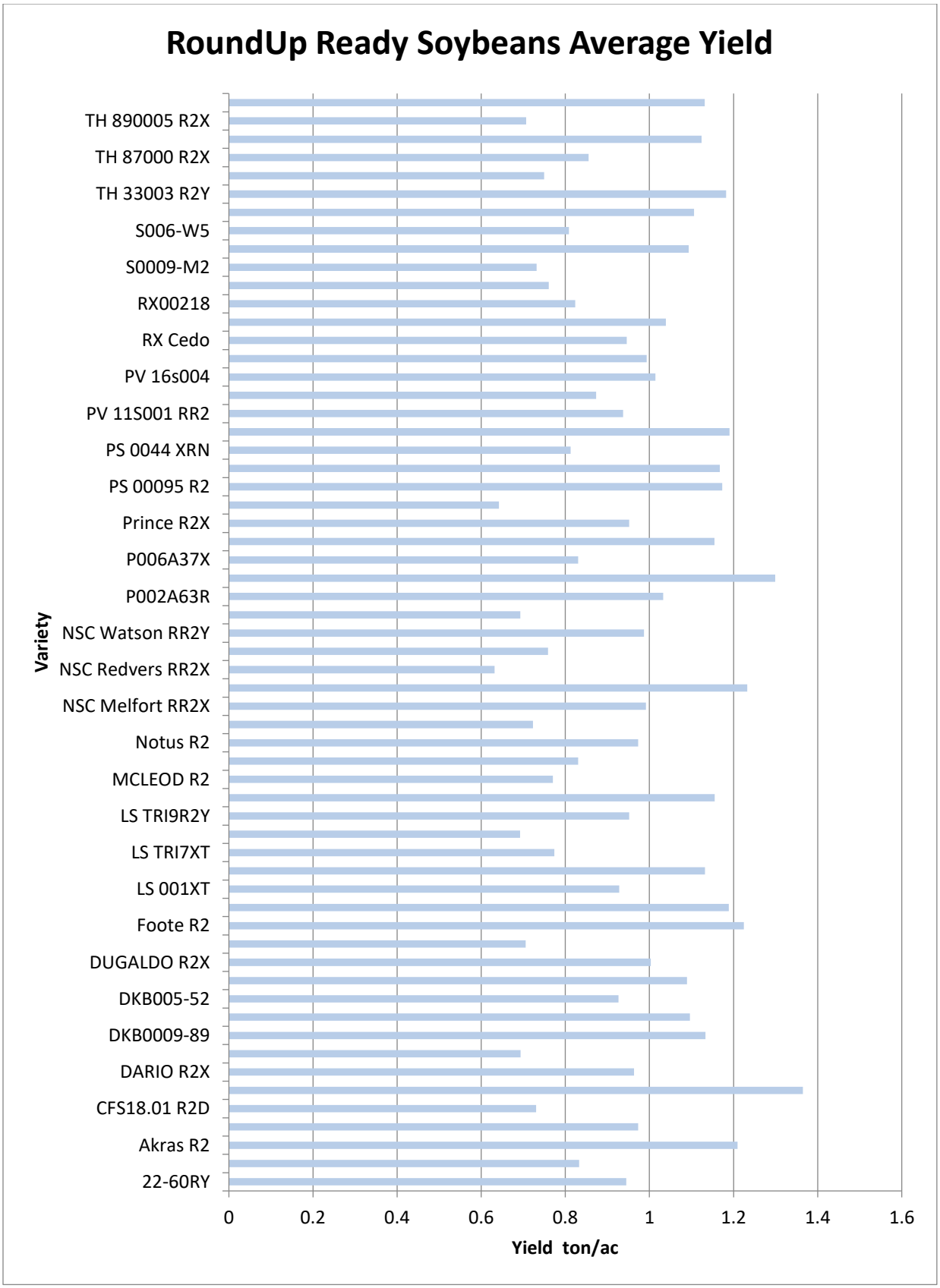


Figure 1. RoundUp Ready soybean varieties and yield performance at Carberry in 2018.

Background
Variety trials for all of Manitoba's major crops are conducted across the crop growing regions of Manitoba every year by the Manitoba Crop Variety Evaluation Team (MCVET). This performance data, along with variety characteristic information, is summarized in “SEED MANITOBA” and online at www.seedinteractive.ca. Both formats provide long term yield data as well as annual yield comparisons at various locations.

Carberry Materials & Methods

Experimental Design	Randomized complete block design with 3 replicates
Seeding Date	May 22, 2018
Harvest Date	October 11, 2018
Fertility	40lbs/ac actual Phos (11-52-0); 120 ppm K; 20 lb/ac actual Sulfur 20-0-0-24
In Crop Weed Control	Roundup Applied June 13, 2018
Fungicide	None applied

Conventional Soybean Adaptation Evaluation

Project duration May 2018 to September 2018

Objectives Evaluate newly registered Conventional Soybean varieties for adaptation and yield performance in the Central Plains region of Manitoba.

Collaborators Manitoba Pulse & Soybean Growers (MPSG)
Manitoba Crop Variety Evaluation Team (MCVET)

Results

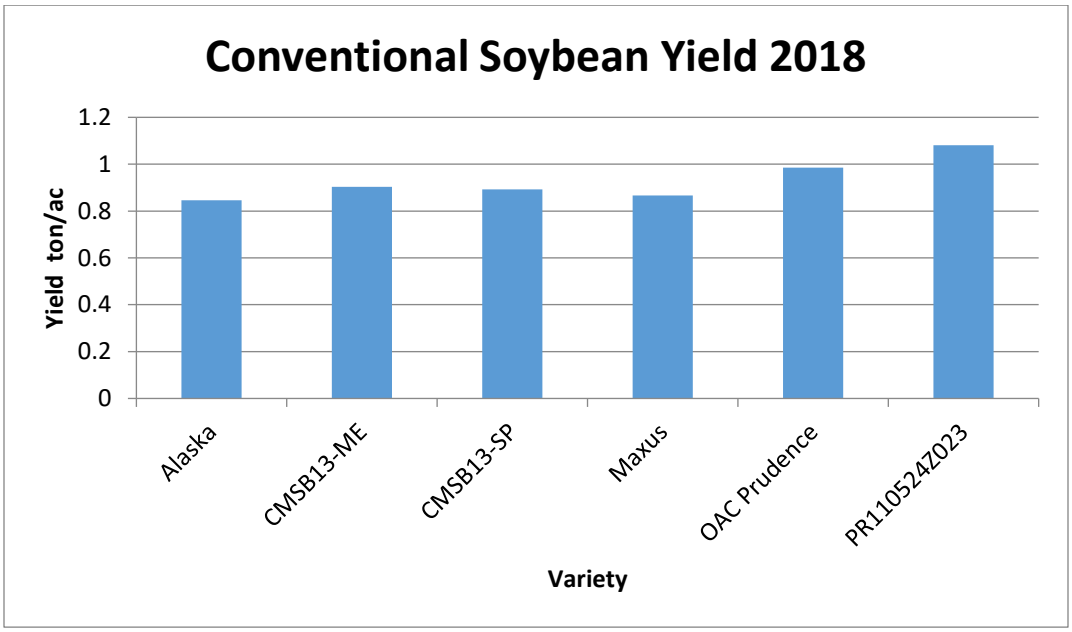


Figure 1. Conventional soybean varieties and yield performance at Carberry in 2018.

Background

Variety trials for all of Manitoba's major crops are conducted across the crop growing regions of Manitoba every year by the Manitoba Crop Variety Evaluation Team (MCVET). This performance data, along with variety characteristic information, is summarized in "SEED MANITOBA" and online at www.seedinteractive.ca. Both formats provide long term yield data as well as annual yield comparisons at various locations.

Materials & Methods

Experimental Design	Randomized complete block design with 3 replicates
Seeding Date	May 22, 2018
Harvest Date	September 12, 2018
Fertility	40lbs/ac actual Phos (11-52-0); 120 ppm K; 20 lb/ac actual S (20-0-0-24)
In Crop Weed Control	Roundup applied June 13, 2018
Fungicide	None applied

Pea Adaptation Evaluation

Project duration May 2018 to September 2018
Objectives Evaluate newly registered pea varieties for adaptation and yield performance in the Central Plains region of Manitoba.
Collaborators - Manitoba Crop Variety Evaluation Team (MCVET)

Results
For more custom comparisons of Pea varieties and other crops in Manitoba visit www.seedinteractive.ca.

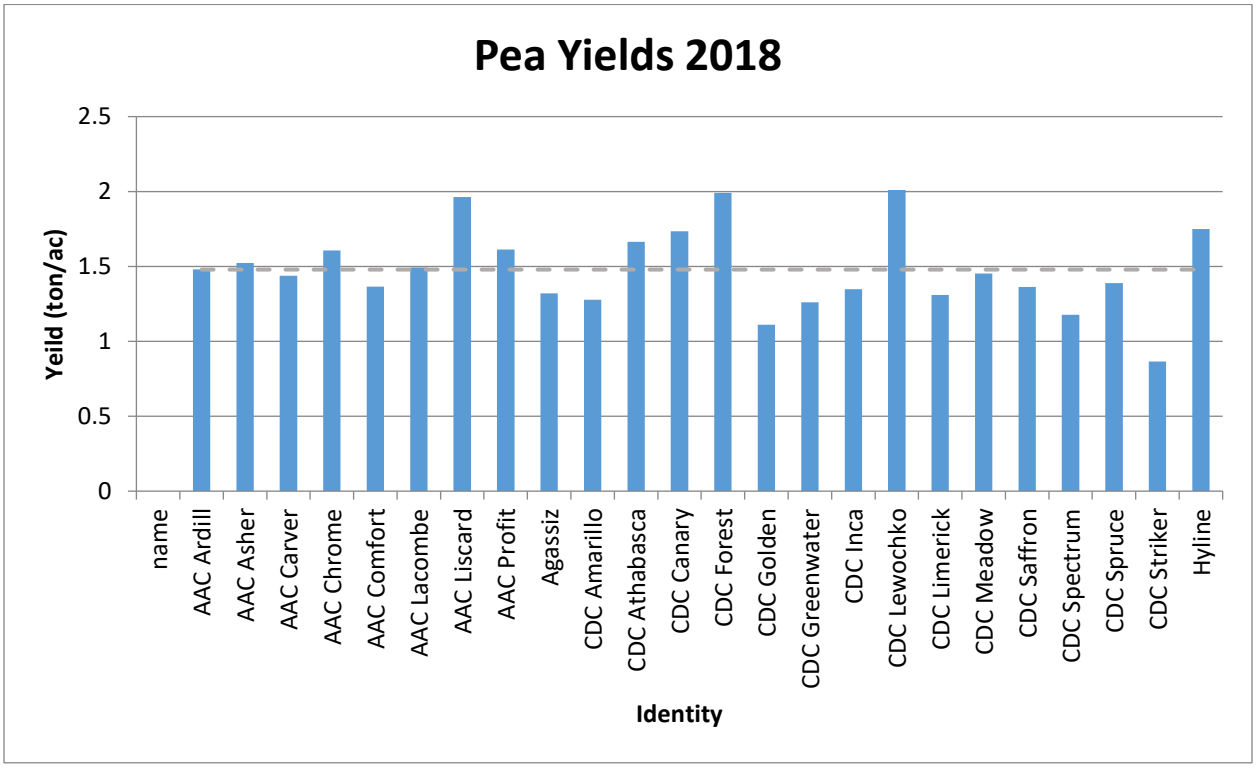


Figure 1. Pea varieties and yield performance at Carberry in 2018.

Background
Variety trials for all of Manitoba's major crops are conducted across the crop growing regions of Manitoba every year by the Manitoba Crop Variety Evaluation Team (MCVET). This performance data, along with variety characteristic information, is summarized in “SEED MANITOBA” and online at www.seedinteractive.ca. Both formats provide long term yield data as well as annual yield comparisons at various locations.

Carberry Materials & Methods

Experimental Design	Randomized complete block design with 3 replicates
Seeding Date	May 11, 2018
Harvest Date	August 31, 2018
Fertility	26lb/ac actual Phos (11-52-0); 4lb/ac actual Sulfur 20-0-0-24
In Crop Weed Control	Poast Ultra applied applied May 31, 2018 Basagran applied June 13, 2018 Reglone applied August 2018
Fungicide	None applied

Sunflower Adaptation Evaluation

Project duration May 2018 to September 2018

Objectives Evaluate newly registered oil and confection type sunflower varieties for adaptation and yield performance in the Central Plains region of Manitoba. In 2018 CMCDC did not grow any confectionary sunflowers.

Collaborators National Sunflower Association of Canada (NSAC)
Manitoba Crop Variety Evaluation Team (MCVET)

Results

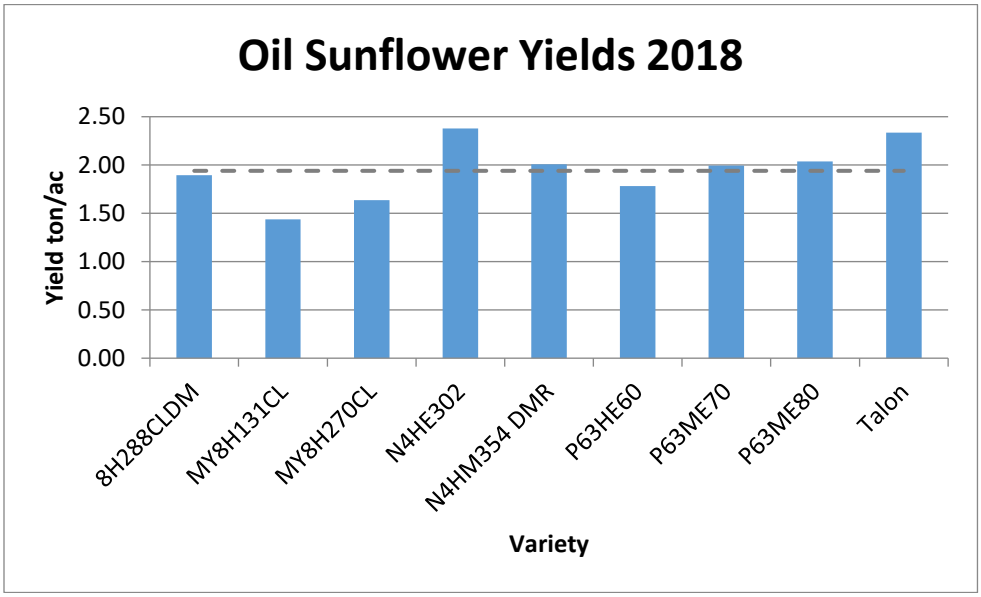


Figure 1. Oil Sunflower yield performance at Carberry 2018

Background

Variety trials for all of Manitoba's major crops are conducted across the crop growing regions of Manitoba every year by the Manitoba Crop Variety Evaluation Team (MCVET). This performance data, along with variety characteristic information, is summarized in "SEED MANITOBA" and online at www.seedinteractive.ca. Both formats provide long term yield data as well as annual yield comparisons at various locations.

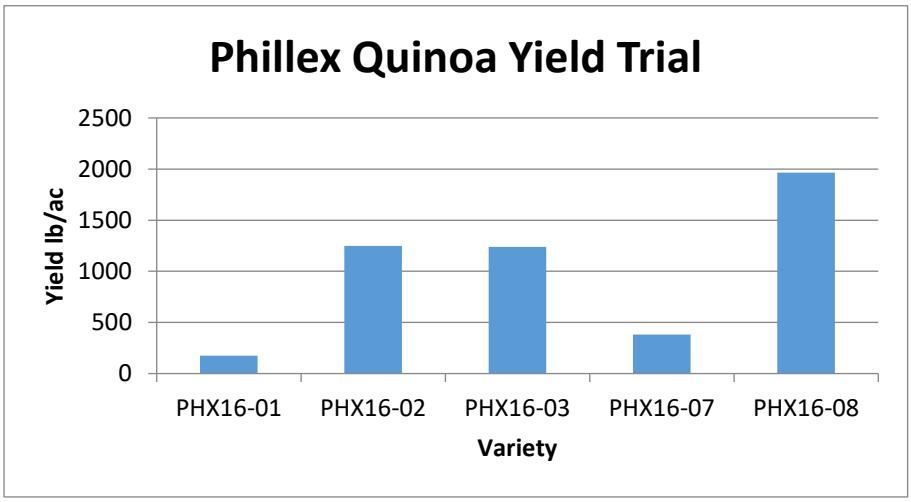
Carberry Materials & Methods

Experimental Design	Randomized complete block design with 3 replicates
Seeding Date	May 10, 2018
Harvest Date	Sept 24, 2018
Weed Control	Corogen applied July 20, 2018
	Avian Control applied Sept 5, 2018
	Avian Control applied Sept 14, 2018

Quinoa Adaptation Evaluation

Project duration May 2018 to September 2018
Objectives Evaluate quinoa lines/varieties for adaptation and yield performance in the Central Plains region of Manitoba.
Collaborators Phillex Inc.

Results
Figure 1: Quinoa lines and yield performance at Carberry in 2018



Background
Quinoa is a broadleaf annual plant that produces 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.

Carberry Materials & Methods

Experimental Design	Randomized complete block design with 3 replicates
Seeding	May 11
Harvest	Sep 10
Fertility	120lb/ac actual N (46-0-0); 26lb/ac actual Phos (11-52-0); 4lb/ac actual Sulfur (20-0-024)
In Crop Weed Control	May 31 Poast Ultra Assure II applied June13, 2018 Cygon applied July 6, 2018 Matador applied July 28, 2018
Fungicide	None Registered

Data collected	**Date collected**
Emergence Population	June 4
Yield	Oct 17
Moisture	Oct 17

National Industrial Hemp Fibre and Grain Variety Evaluation

Project duration May 2018 to September 2018
Objectives To evaluate hemp grain and fibre varieties for the Canadian Hemp Trade Alliance
Collaborators Canadian Hemp Trade Alliance

Results Grain yield results are available through the SEED Manitoba guide (2018). Graphical yield results for each of the four Manitoba research sites are displayed below according to grain and fibre yields.

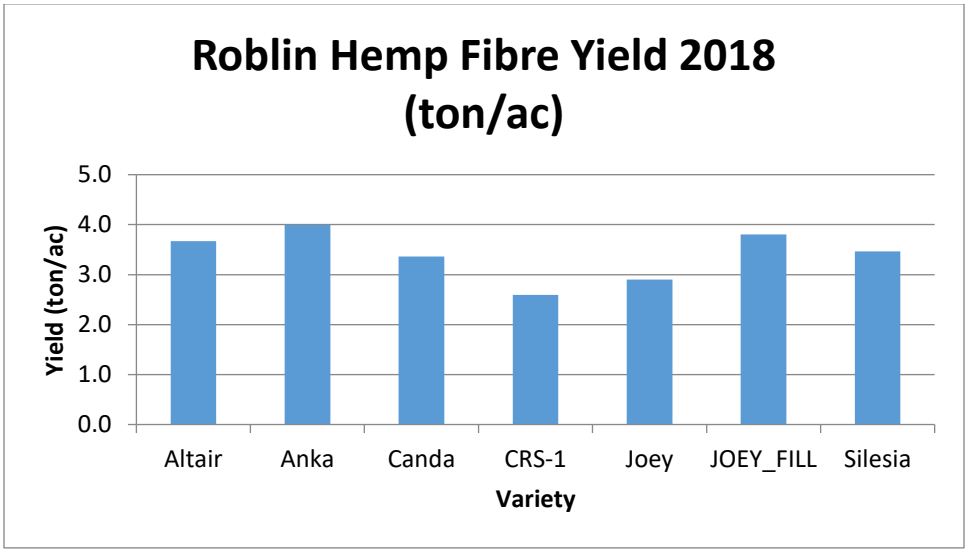


Figure 1. 2018 Hemp fibre yield results at Roblin, 2018

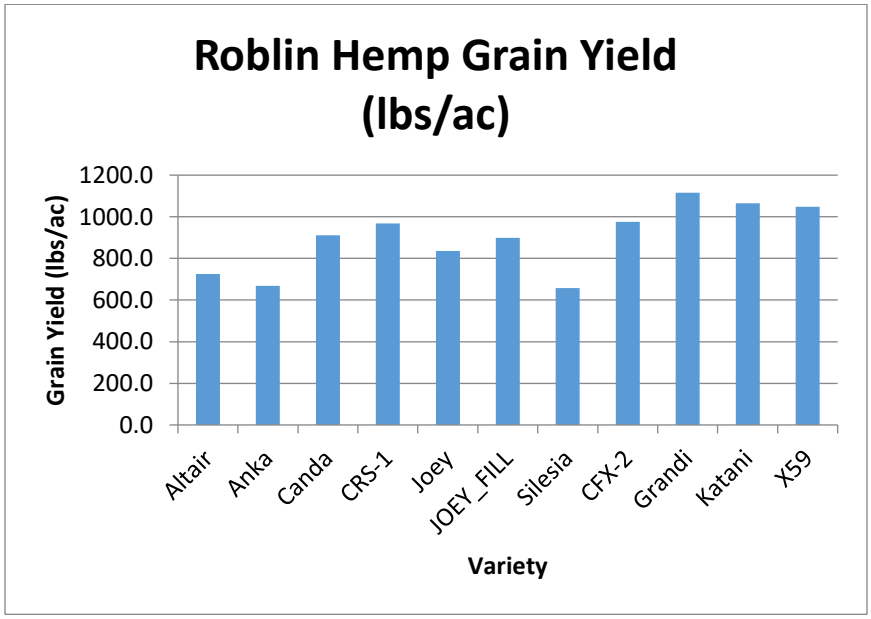


Figure 2. 2018 Hemp grain yield results at Roblin, 2018

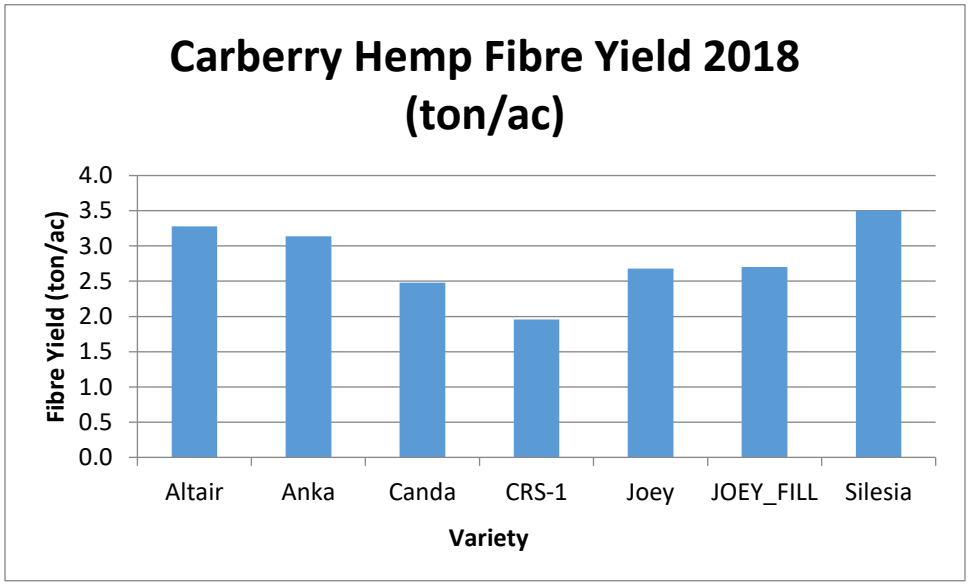


Figure 3. Hemp fibre yield results at Carberry, 2018

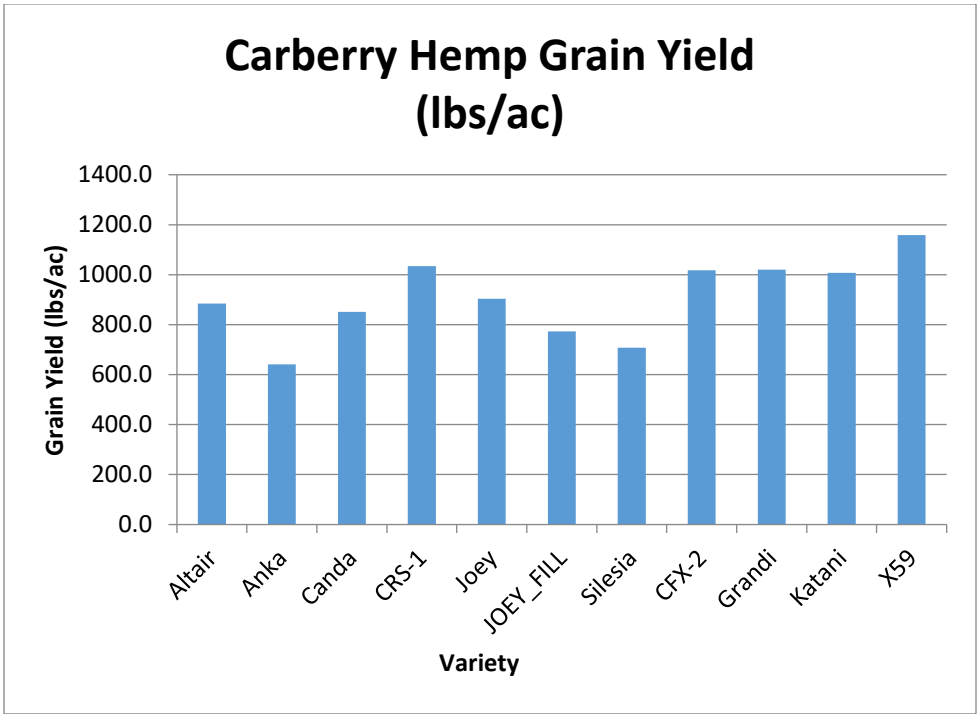


Figure 4. Hemp grain yield results at Carberry, 2018

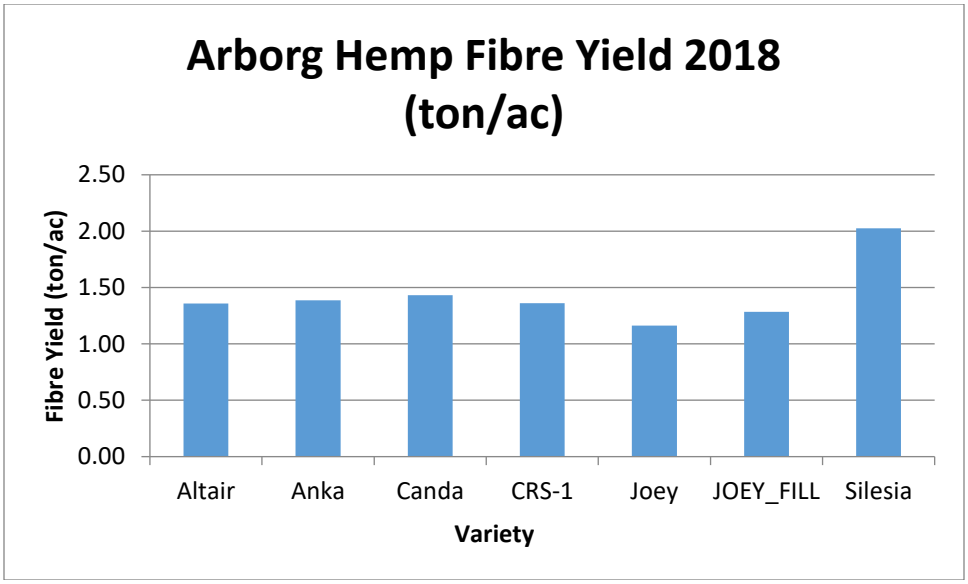


Figure 5. Hemp fibre yield results at Arborg, 2018

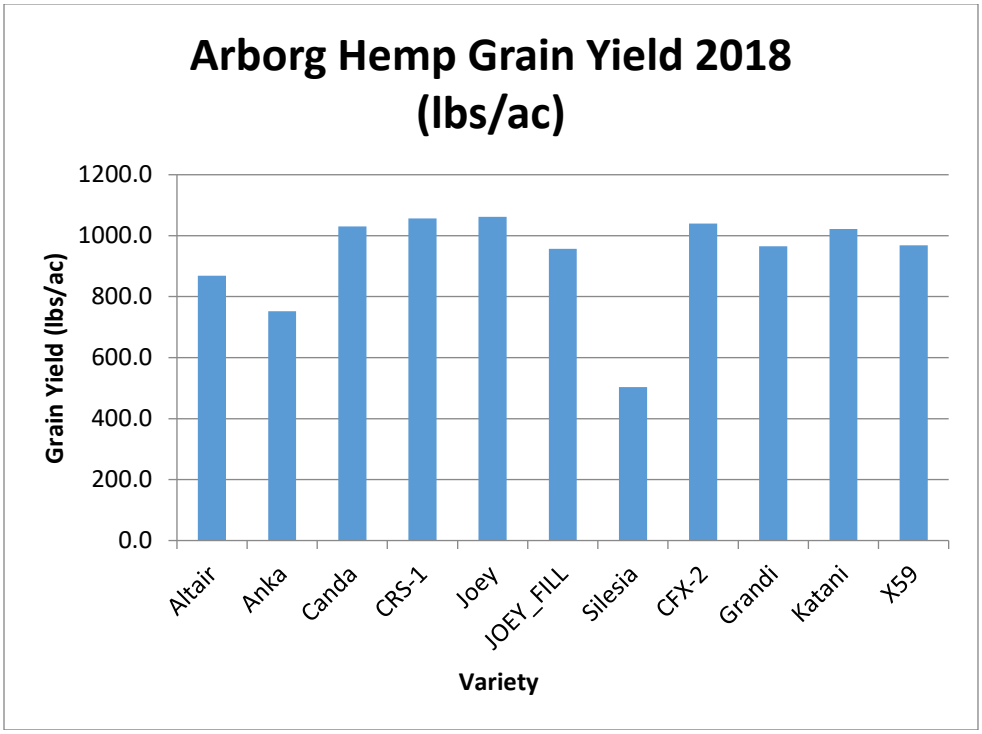


Figure 6. Hemp grain yield results at Arborg, 2018

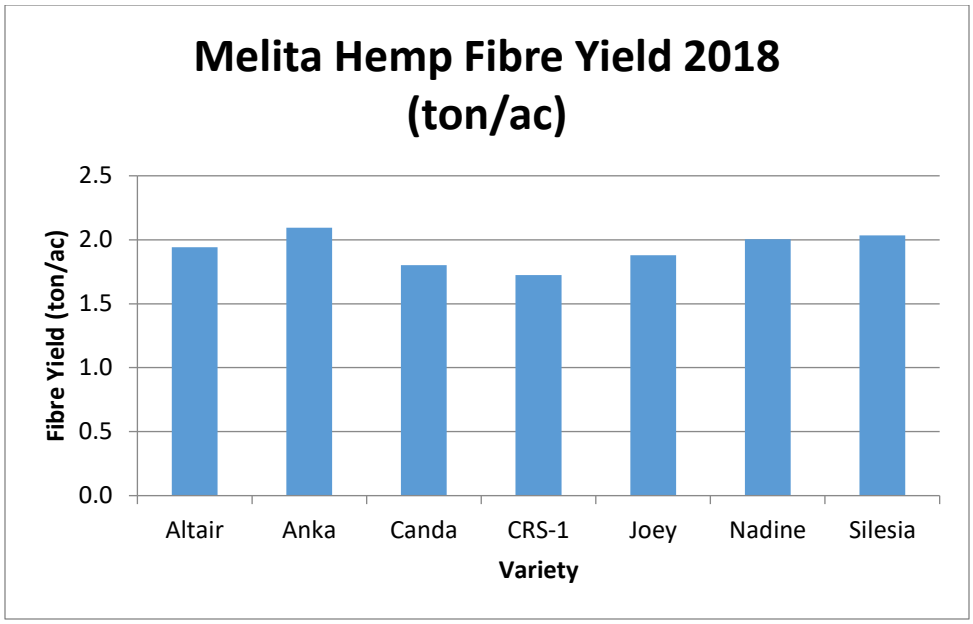


Figure 7. Hemp fibre yield results at Melita, 2018

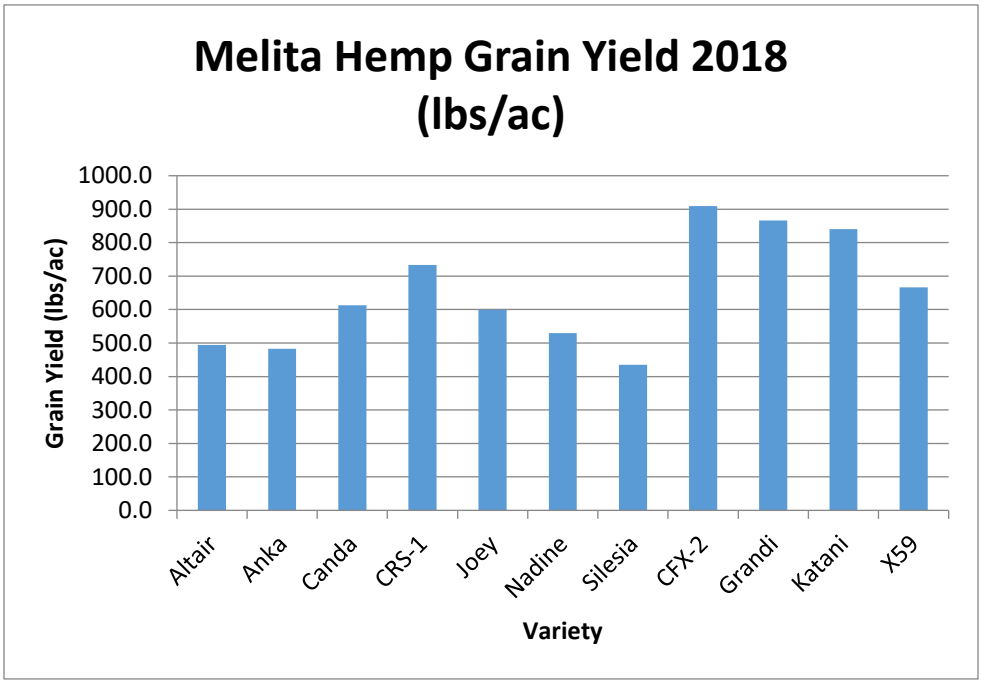


Figure 8. Hemp grain yield results at Melita, 2018

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 which very directly affects 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.

Jason Green, Head of Agriculture with Canopy Hemp and Director of the CHTA explains that this new permission allows hemp growers to learn more about the harvesting, drying and storing of their harvest materials, a key component in then bringing their product to market.

This trial looked at separate grain and fibre varieties of hemp.

Carberry Materials & Methods

Experimental Design	Randomized complete block design with 4 replicates
Seeding	May 17
Harvest	Aug 31
Fertility	130lb/ac actual N (46-0-0); 6lb/ac actual Phos (11-52-0)
In Crop Weed Control	May 31 Poast Ultra
	Assure II applied June13, 2018
Fungicide	None applied

Data collected	**Date collected**
Emergence Population	June 11
Vigor	June 19
Male/Female ratio	Aug 3
Height	Aug 3
Grain Yield	Aug 31
Stem Yield	Sept 28
Moisture	Aug 31

Table 1. Spring 2018 Soil Test

	Available	Needed
N	20 lb/ac	130 lb/ac
P	14 ppm	6 lb/ac
K	396 ppm	0 lb/ac
S	22 lb/ac	0 lb/ac

Project findings
Grain yield results are available through the SEED Manitoba guide (2018).

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

Project duration May 2017 – September 2018
Objectives To understand the effect of seeding date by variety on industrial hemp grain yields.
Collaborators Hemp Genetics, Parkland Industrial Hemp Growers, Manitoba Harvest

Adjusting Agronomic Practices in Industrial Hemp to Maximize CBD production

Project duration – 2018
Objectives – Gain a better understanding on the most economical way to produce CBD under field conditions in Manitoba.

- Identification of stable, high CBD varieties adapted to Manitoba conditions.
- Identify optimal harvest timing for CBD production/extraction & yield.
- Quantify relationship between plant population and CBD content related to Genetics and Environment in Manitoba.

Collaborators – Green Sky Labs, Canadian Isolates, HGI

Results

Seeding Rate

- Targeted planting densities were achieved for each variety.
- X59 was significantly taller than Katani.
- There was a reduction in canopy height as seeding rate increased although this was not significant.
- Average inflorescence length significantly decreased as seeding rate increased.

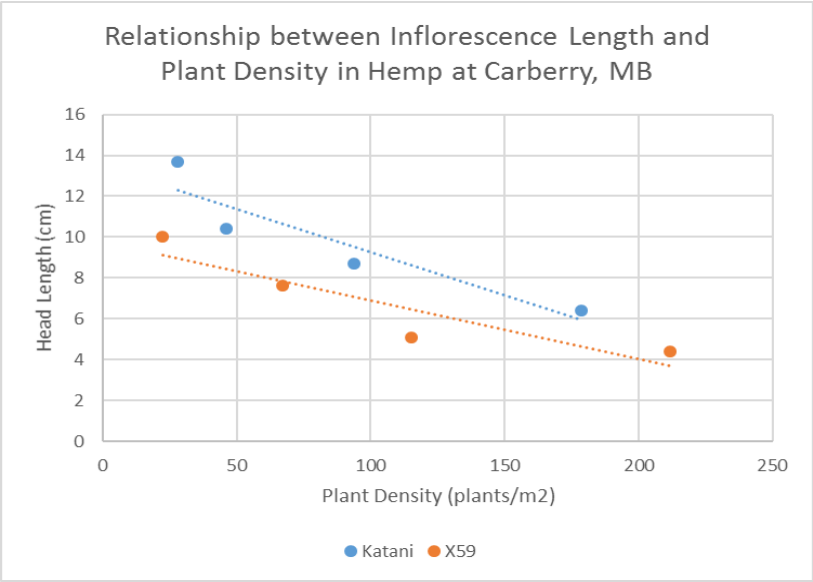


Figure 1. Relationship between inflorescence, length and plant density

The highest CBD contents were observed in the greatest seeding rates; however, levels also decreased for the highest seeding rate earlier in the fall than lower seeding rates. This is possibly due to slightly earlier or more consistent dry down.

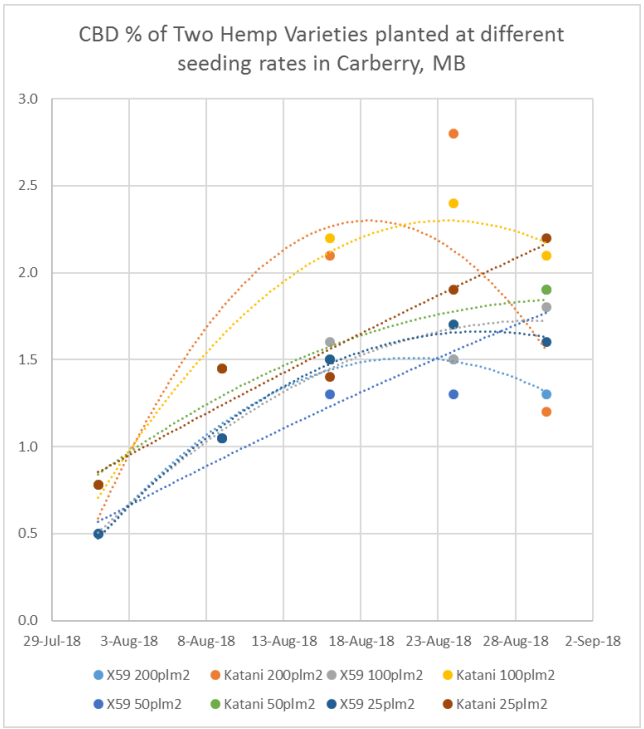


Figure 2. Relationship between CBD content, variety and seeding rate

Arborg was different from Carberry with only the lowest seeding rate at the August 15 sampling date having a greater content than all other sample dates.

Table 1. CBD levels sampled from increasing plant densities at Arborg, 2018

Katani	02-Aug	15-Aug
Average	1.11%	1.22%
Plant Density (pl/m2)		
25	0.93%	1.83%
50	1.02%	1.07%
100	1.37%	1.03%
200	1.08%	1.11%

When adjusted for moisture and plant density, the two highest seeding rates still resulted in the greatest amount of CBD on a kg/ha basis.

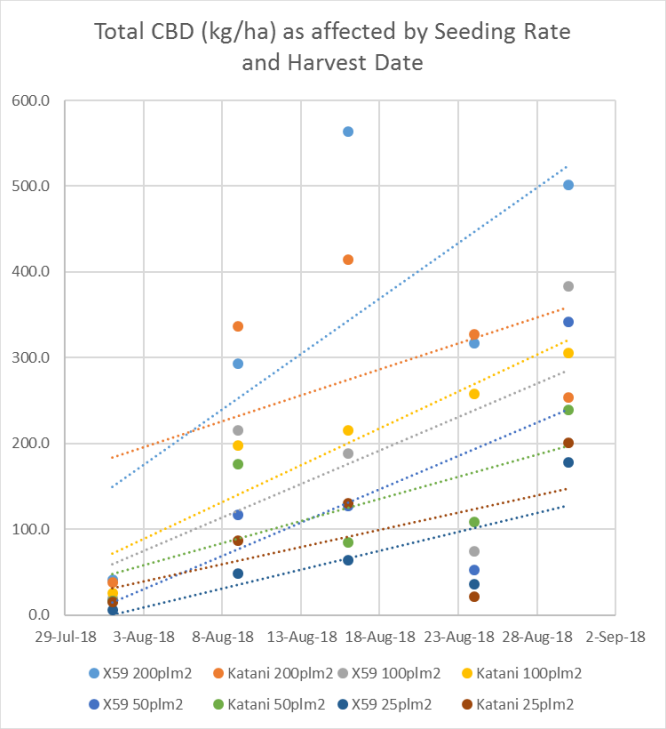


Figure 3. Variety Seeding Rates' and Dates' effect on CBD

Later season harvest would increase harvest efficiency with regard to biomass hauling/handling due to lower moisture content. There would also at this time be an opportunity to recover a percentage of grain.

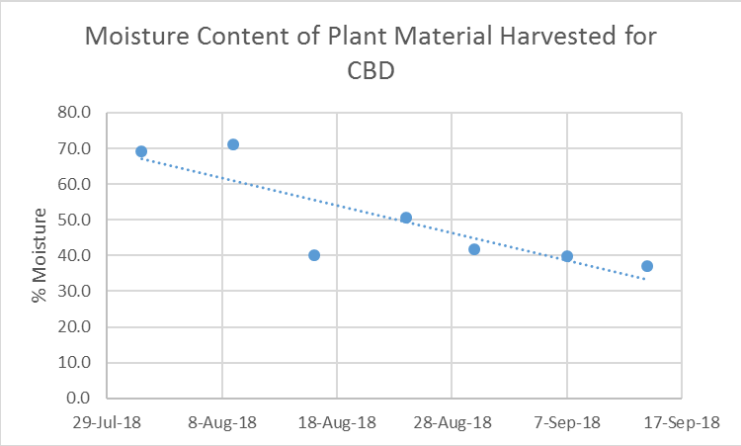


Figure 4. Relationship between moisture content and CBD

At the August 16th sampling date some additional plants were harvested. Additional testing (lowest seeding rate – large inflorescence) was performed on the inflorescence partitioning it into 1/3s. The top 1/3 of the plant had the highest CBD content (2.5%); followed by the mid 1/3 at 1.4% and the lower third at (0.89%) – overall average 1.6%.

Seeding Date

- Seedling recruitment (final plants/m2) was greater for the earliest seeding dates and declined slightly from seeding date 3 – date 5 (not significant); however, plant density was still in acceptable range (average 110 plants/m2).
- Mid June and late June seeding dates were also shorter by 10cm (p 0.1).
- Total CBD was the lowest for all studies at early August; increasing until grain harvest in early September; although there was evidence of a small peak the final week of August. The seeding date trial showed a shift in peak CBD content with later seeding dates further supporting the tie to physiological maturity; however, due to the lower biomass production maximum yield was still the lowest for the later seeding dates.

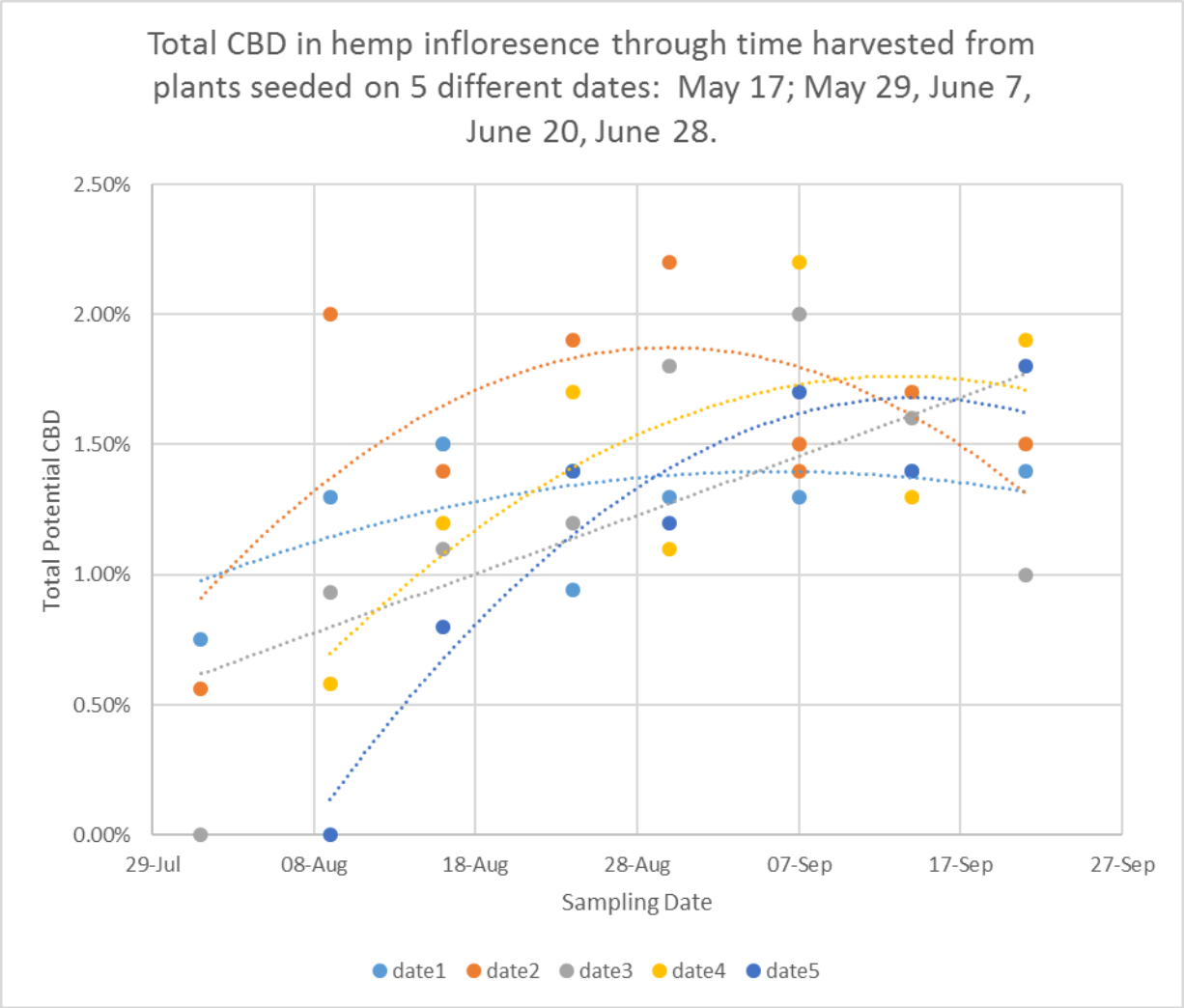


Figure 5. Relationship between CBD content in hemp inforesence and and harvest dates

Potassium

- Additional potassium had no effect on height (Katani – 131cm; X59 – 138cm) or plants/m2 (average 160 pl/m2).
- Additional potassium at seeding had no effect on total CBD levels until the last sampling date (August 30). At this date the highest 80K rate had the lowest CBD content overall. This may suggest there is an upper limit for which additional K may have a negative effect or alternatively, some additional potassium may extend the maximum CBD content period later into the fall; more research is required, especially under potassium deficient conditions. The Carberry site typically tests high for K; the hemp site was no exception testing 396ppm.

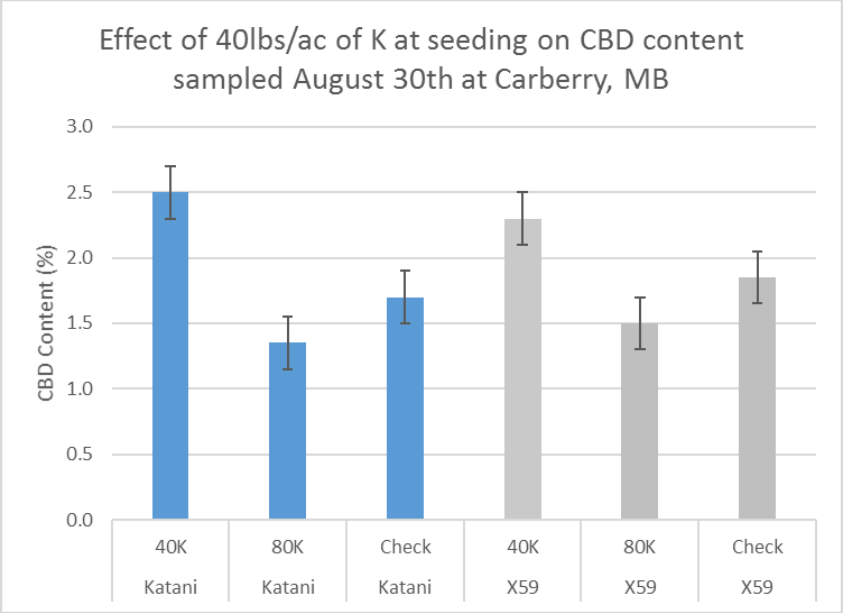


Figure 6. Relationship between K application at seeding and CBD content

Project findings:

- Katani out performed X59 in most situations with regard to overall CBD content; however, X59 produced more biomass. Variety selection would therefore depend on extraction efficiencies.
- Maximum CBD content related directly to the level of maturity of the plant.
- CBD concentration increases as you move from bottom to the top of the inflorescence.
- CBD concentration seems to reach a maximum faster in higher seeding rates possibly due to a more rapid and even maturity.
- Greater seeding rate result in small heads but more of them (greater density/m2) resulting in the greatest amount of CBD harvested per hectare.
- Optimal harvest timing for CBD content is during last week of August, but may be extended into early September, especially for late seeded crops. The lower biomass associated with later seeding negates any content gains; however, later seeding may slightly extend harvest window to spread logistical risk.
- Additional Potassium did not impact CBD levels.
- More research is required.

Background/References/Additional Resources

With the October 17th legalization of recreational marijuana and deregulation of industrial hemp, CBD, a cannabinoid found in both marijuana and hemp has become a sought after agriculture commodity. This is mainly due to the perception that CBD can be more economically produced in the field while, for various quality control (hemp and marijuana) and security reasons, high THC marijuana varieties are currently best grown indoors. At present, CBD levels in the industrial hemp varieties commercially available range from 0.5-2%. Understanding how to maximize CBD production has not been a focus until now; preliminary information suggests large environmental and genetic variability exists.

Materials & Methods:

Experimental Design: RCBD

Treatments:

Seeding Date Trial: 5 Seeding Dates - May 17, May 29, June 7, June 19, June 28
Plant Density Trial: Target population - 25pl/m2, 50pl/m2, 100pl/m2, 200pl/m2
Added Potassium Trial: Actual K added at Seeding: 0, 40 & 80lbs/ac

Data collected and date collected:

Plant Density
Height
CBD – content
10 heads from each plot were cut weighed, leaves and stems separated, leaves/flowers air dried at less than 35C to 10% moisture then homogenized using a food processor and refrigerated at 8C. Samples were evaluated on an Orange Photonics light analyzer using a custom method consisting of 200mg sub-samples, 10ml of solvent.

Sample Dates for CBD:

Arborg Plant Population: August 1, 15
Carberry Plant Population: August 1, August 9, August 16, August 24, August 30
Carberry Potassium Rate: August 1, August 9, August 16, August 24, August 30
Carberry Seeding Date: August 1, August 9, August 16, August 24, August 30, Sept 7, Sept 14, Sept 21.

Agronomic info

Carberry/Arborg were both seeded into Wheat Stubble
Fertilizer applied:
Nitrogen and Phosphorus Fertility: for all trials a baseline of 130lbs/ac of Nitrogen was side banded with 30lbs of seed placed Phosphorus at seeding. For potassium trial, K was banded just prior to seeding.
Pesticides applied
Edge was applied at label rate on May 6th at the Carberry site.
Assure II was applied at label rate.

Agriculture & Agri-Food Canada Corn Variety Evaluation

Project duration May 2018 – November 2018
Objectives To develop and release early maturing cold tolerant corn inbreds with emphasis on the 1800-2000 CHU market.
Collaborators Lana Reid Ph.D – AAFC Research Scientist Ottawa Research and Development Centre
Manitoba Corn Growers Association

Results
This project is part of a long-term, multi-site study led by Lana Reid. Research findings will be made available by Lana Reid and team.

Background
The objective will be achieved using conventional corn breeding methodology enhanced by double haploid inbred production and specialized screening techniques for cold tolerance and disease resistance. The trial is being conducted at sites across five Canadian provinces. The anticipated impact of developing earlier maturing, cold tolerant corn will expand the acreage of corn production in Canada.

Project findings
These data were generated for AAFC; 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 this variety trial please contact Lana Reid.

Materials & Methods

Experimental Design	Random Complete Block Design
Entries	30 varieties
Seeding	May 25
Harvest	Nov 15
Fertility	163lb/ac actual N (46-0-0); 50lb/ac actual Phos (11-52-0); 20lb/ac actual Sulfur
In Crop Weed Control	Roundup applied May 29 Option 2.25 applied June 8, 2018
Fungicide:	None applied

Data collected	**Date collected**
Stalk Lodging	-
Root Lodging	-
Yield	Nov 7
Moisture	Nov 7

Table 1. Spring 2018 Soil Test

	Available	Needed
N	20 lb/ac	200 lb/ac
P	24 ppm	50 ppm
K	-	-
S	14lb/ac	50lb/ac

Other Trials

Demonstrations
Brett Young
Canola Speed Trial

Terminated Trials
MCVET Winter Cereals
Ducks WW
Linseed Flax
Edible Beans
Goss's Corn Nursery
Quinoa Minor Use