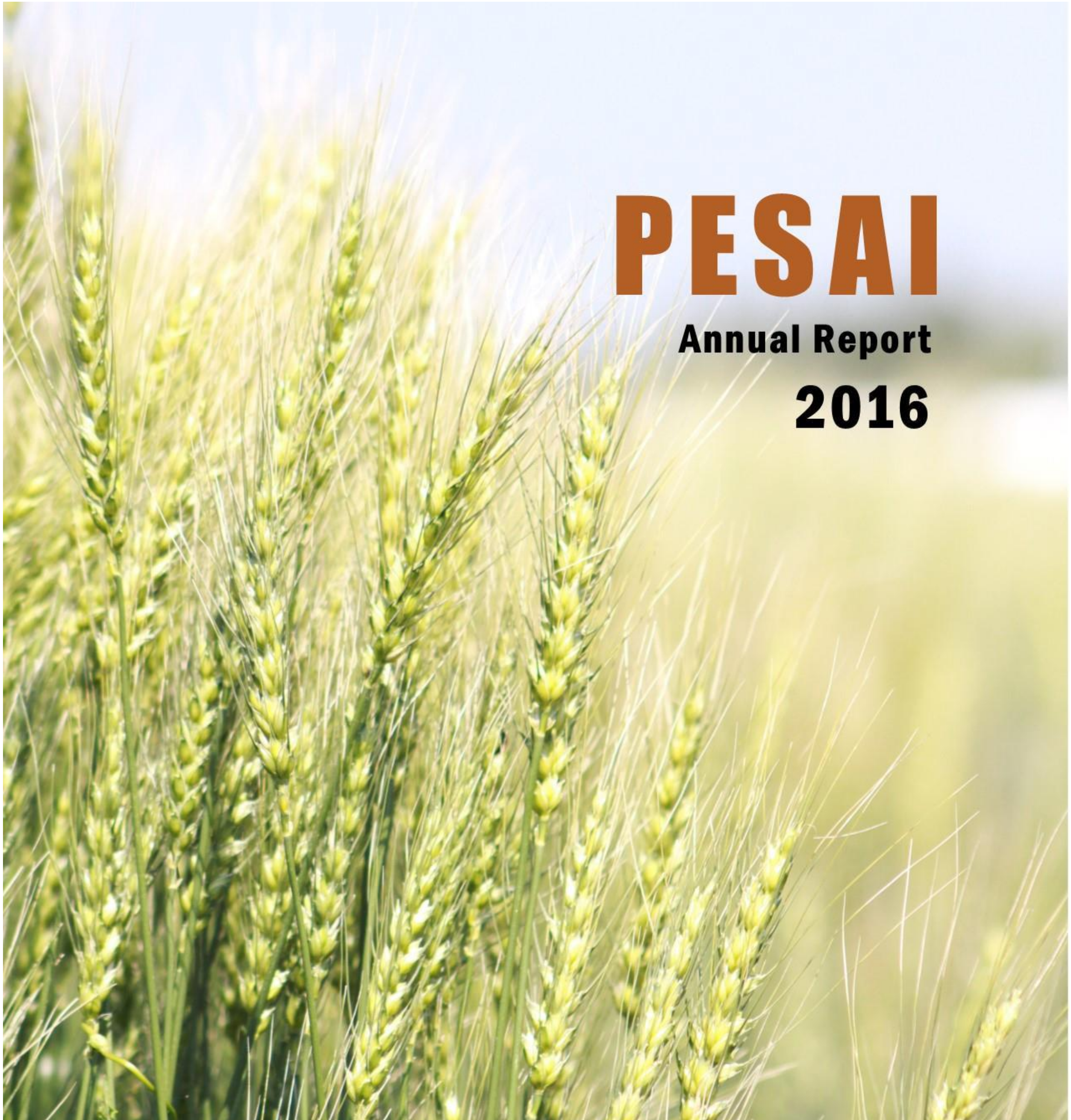
PESAI

Annual Report

2016



PESAI

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Introduction

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

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

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

A wide range of rentable plot equipment for research projects, including an RFID panel reader set, a portable handling facility and cattle scale are available to local producers and producer groups. The PESAI Board is also open to research and project submissions from individuals and producer groups.

PESAI/Manitoba Agriculture Staff (2016-17)

Diversification Specialist	*Nirmal Hari*	*Manitoba Agriculture*
Diversification Technician	*Roger Burak*	*Manitoba Agriculture*
Diversification Technician	*James Lindal*	*Manitoba Agriculture*
Diversification Technician	*Jordan Pawluk*	*PESAI*
Summer Research Assistant	*Eugene Delorme*	*PESAI*
Summer Research Assistant	*Rebecca Maynard*	*PESAI*
Agriculture Extension Coordinator	*Diljeet Brar*	*Manitoba Agriculture*

PESAI Financials (2016-17)

In 2016/17, PESAI was allotted $150,000 funding from Manitoba Agriculture. PESAI allocated $9800 funding to six partner-led projects, $115,000 was kept to conduct PESAI field trials/demonstrations, and a total of $11,564 was kept for PESAI promotions.

BOARD OF DIRECTORS (2016-17)

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

Table 1. PESAI board during 2016-17.

Chair	***Adrien Grenier***	***Woodridge***	***204-429-2058***
Vice Chair	*Danny Johnson*	*Beausejour*	*204-268-4695*
Treasurer	*Shannon Pyziak*	*Fisher Branch*	*204-372-6690*
Secretary	*Wayne Foubert*	*St. Anne*	*204-232-5069*
Director	*Hans Pausenwein*	*Whitemouth*	*204-348-7040*
Director	*Tim Shumilak*	*East Selkirk*	*204-482-5166*
Director	*Linda Loewen*	*Riverton*	*204-378-2771*
Director	*David King*	*Arborg*	*204-642-2695*
Director	*Andy Buehlmann*	*Arborg*	*204-376-2809*

Got an Idea?

PESAI continually looks for applied research and value-added ideas, and producer production concerns. Share your expertise and voice, and be a part of the latest developments in agriculture, by becoming a Member of PESAI. Membership to PESAI is free and open to individuals and corporations that are interested in the development of the Prairies East Region of Manitoba and whose applications for membership have been approved by the Board of Directors.

PESAI Members will receive copies of the PESAI annual report. Via email, members will be informed of upcoming PESAI-sponsored workshops or events, including the summer research tour and winter meeting. Contact PESAI to become a member.

Prairies East Sustainable Agriculture Initiative Inc. (PESAI)
c/o Nirmal Singh Hari
Box 2000, 317 River Road West
Arborg MB R0C 0A0
Hwy 68 & Rd 8E
Phone: 204.376.5917(Office), 204-391-3623(Cell)
Fax: 204.376.3311
Email: prairies.east@gmail.com

Partner Project Submissions

The Board of PESAI focuses on applied research, innovation, diversification, value-added, advanced technology, market development and sustainability initiatives that directly benefit local area producers. They look to grassroots organizations and producers for project ideas that fall within their mandate. If you have an idea you'd like to share, fill out PESAI's Project Submission Form. Please send your request for Project Submission Form at prairies.east@gmail.com.

Partner Projects

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

Workshop on "Using Social Media to Market Your Products"

Lead Partner: Jayne Kjaldgaard, Manitoba Agriculture
Allotted Funding from PESAI: $2000.0
PESAI Funding Spent: $1751.4

Background/Objectives

Social media plays an important role in today's agriculture and certainly it has a role in marketing food products. Jayne Kjaldgaard (Manitoba Ag, Teulon office) collaborated with PESAI to raise awareness among local food producers about use of social media. She organised a workshop and invited experts to share their experience with the participants.

Project activities

This workshop was organised on February 1, 2017 at Oak Hammock Marsh Interpretive Centre, Stonewall. This workshop attracted a total of 32 local clients. Susie E. Parker from Sparker Strategy Group was the keynote speaker, she discussed the different forms of social media. She highlighted the benefits of social media and elaborated how target markets are using different forms of social media. She showed several examples how these tools are best used. She talked about the trends with using social media and what businesses need to consider when using any of these platforms.

Two local entrepreneurs, Jen Morin, Director of First Impressions & Marketing who works with GORP from Niverville and Rudy Reimer from Water Song Farms in Warren also shared their experiences using social media in promoting their businesses.

During this workshop, speakers provided interactive examples to the audience using social media sites like Facebook and Instagram.

Results/Observations

Evaluations were very positive for the workshop (see below the summary).

Indicate your impression of the items listed below (1 = not very favorable, 5 = highly favorable)

A. *How do you rate the overall workshop*	***1-1***	***2-1***	***3-1***	***4-7***	***5-13***
B. The workshop met my expectations	***1-1***	***2-2***	***3-2***	***4-6***	***5-12***
C. The content was organized and easy to follow	***1-1***	***2-0***	***3-2***	***4-7***	***5-14***
D. The visual aids were appropriate and useful	***1-1***	***2-1***	***3-0***	***4-7***	***5-15***
E. I will be able to apply the knowledge I learned	***1-1***	***2-2***	***3-4***	***4-8***	***5-9***
F. The time held worked well for my schedule	***1-1***	***2-0***	***3-2***	***4-8***	***5-13***

Project findings

Participants liked this initiative and they expressed their motivation and knowledge gain with this effort. They provided suggestions for future topics to be covered. Jayne is planning to organize another workshop next year with a different food commercialization topic.

Agriculture Awareness School Tour

Lead Partner: Gringo Hogs & Moonshadow Holsteins
Allotted Funding from PESAI: $2000.0
PESAI Funding Spent: $1917.3
Contributors: Manitoba Pork

Background/Objectives

Gringo Hogs and Moonshadow Holsteins are agricultural operations in the Eastman region of Manitoba. Since 2009, they have partnered with local schools, PESAI, Manitoba Pork and others to increase students' agricultural knowledge through on-farm tours.

Project Activities

Gringo Hogs and Moonshadow Holsteins hosted and toured two groups of students through their operations in June. One tour was for students and staff from École Lagimodiere (Lorette) and a second tour was for students from École Precieux-Sang (Winnipeg). Both groups consisted of about 110 students, accompanying staff and parents.

The tour started at the dairy barn where the visitors were able to see where their milk comes from, and experienced the size and functionality of the operation. Although the dairy farm is a large operation, the students realized the importance of cow-comfort. The students especially enjoyed bottle-feeding the young calves and the drone demonstration from Roger Burak (PESAI).

Over lunch (pork loin supplied by Manitoba Pork), students were given a chance to investigate the inside of farm machinery. Next the students visited the hog barn site where they were explained the value of manure as a fertilizer, and the different crops grown on the farm.

Results/Observations

The tours were a wonderful success. Both groups had a great time and went back home with more knowledge and a better understanding of the farming industry.

In order to assess the value of the tours, students were asked to fill a short questionnaire. Overall, the comments were positive. It seems that the tour was enjoyed by both students and adults and most of them would recommend the tour to others.

Project findings

These tours provided the opportunity to promote agriculture and help people experience, if only for a short time, how things are done at the farm level, and see firsthand where some of the foods they eat originate. Gringo Hogs and Moonshadow Holsteins are planning to host the tours again next year.

Determining effects of Plant Growth Regulators in Forage Seed Crops

Lead Partner: Manitoba Forage Seed Association (MFSA)
Allotted Funding from PESAI: $4000.0
PESAI Funding Spent: $4000.0
Total Project Cost: $8617.0
Contributors: producer-cooperators

Background/Objectives

Plant growth regulators (PGR) are valuable tools in a grower's tool box as it can decrease plant height and lodging and increase pollination, plant tillering and seed yield. Most plant growth regulators work by affecting the Gibberellin Synthesis pathway that is responsible for stem elongation. Trinexapac Ethyl, Metconazole and Chlormequat chloride are Gibberellin Pathway inhibitors. Ethephon on the other hand is a maturity enhancer that releases the hormone ethylene and inhibits Auxin hormone production that is also responsible for stem elongation.

Project activities

In 2016, MFSA conducted small plot research exploring the potential of four plant growth regulators (Trinexapac Ethyl, Metconazole, Chlormequat chloride and Ethephon) in Hybrid Brome, Timothy, Tall Fescue, Perennial Ryegrass and Alfalfa. Three application rates of each PGR (Table 1) were compared with untreated control for their effect on plant height, lodging, thousand kernel weight (TKW) and yield in each crop type. Each trial had four replications and the trials were conducted at different locations in a randomised complete block (RCB) design. Application timing was completed at GS32 or 2nd node stage.

Table 1: PGR rates (L/acre) and approximate costs ($/acre) shown in brackets

PGR	***Rate 1***	***Rate 2***	***Rate 3***
Ethephon	*0.30 (11.8)*	*0.51 (19.7)*	*0.61 (23.7)*
Chlormequat Chloride	*0.40 (11.2)*	*0.57 (14.4)*	*0.73 (17.8)*
Trinexapac Ethyl	*0.70 (32.0)*	*1.00 (46.0)*	*1.40 (65.0)*
Metconazole	*0.57 (23.8)*	*0.73 (31.0)*	*0.89 (37.8)*

Results/ Observations

Timothy – Dugald, MB: Metconazole had no significant effect upon seed yield. Chlormequat chloride caused a decrease in seed yield as the treatment rate increased. Ethephon did not cause a decrease in plant height or lodging, but did increase the seed yield by 8.07%, 29.93% and 63.91 % above check (Table 2). The 0.61 L/ac rate of Ethephon resulted in the highest yield.

A decrease in lodging was observed with Trinexapac ethyl treatments and a yield increase of 42.61%, 61.27% and 20.15% was evident with the increasing application rates of this PGR (Table 3). The 1.0 L/ac rate of Trinexapac ethyl resulted in the highest yield.

Table 2: Ethephon in Timothy

Treatment	***Height (cm)***	***Lodging***	***TKW (g)***	***Yield (% Check)***	***Net return (% Check)***
Check	*127.50*	*5.00*	*0.42*	*100.00*	*100.00*
0.3 L/ac	*129.50*	*4.00*	*0.36*	*108.07*	*105.57*
0.51 L/ac	*130.00*	*4.00*	*0.38*	*129.93*	*125.75*
0.61 L/ac	*129.00*	*4.00*	*0.35*	*163.91*	*158.87*

Table 3: Trinexapac Ethyl in Timothy

Treatment	***Height (cm)***	***Lodging***	***TKW (g)***	***Yield (% Check)***	***Net return (% Check)***
Check	*122.13*	*5.25*	*0.39*	*100.00*	*100.00*
0.7 L/ac	*128.63*	*2.25*	*0.41*	*142.61*	*135.05*
1.0 L/ac	*130.00*	*1.00*	*0.41*	*161.27*	*150.47*
1.4 L/ac	*124.25*	*1.75*	*0.43*	*120.15*	*105.03*

Perennial Ryegrass – Calrin, MB: Metconazole, Chlormequat chloride and Ethephon were tested on perennial Ryegrass. Ethephon and Metconazole resulted in decreased seed yield as compared to check and did not decrease lodging or plant height. Chlormequat chloride, however, resulted in an increase in seed yield of 20.66 %, 16.46% and 13.07% with the increasing application rates (Table 4). There was no observable decrease in lodging at maturity, but there were minor decreases in plant height. The 0.4L/ac rate of Chlormequat chloride resulted in the highest yield.

Table 4: Chlormequat chloride in Perennial Ryegrass

Treatment	***Height (cm)***	***Lodging***	***TKW (g)***	***Yield (% Check)***	***Net return (% Check)***
Check	*79.00*	*8.00*	*1.96*	*100.00*	*100.00*
0.4 L/ac	*78.88*	*9.00*	*1.92*	*120.66*	*119.58*
0.57 L/ac	*77.25*	*8.00*	*1.92*	*116.46*	*115.06*
0.73 L/ac	*75.13*	*8.00*	*1.95*	*113.07*	*111.34*

Tall Fescue – Carman & Teulon, MB: PGR testing on Tall Fescue was done at Teulon and Carman sites in 2016. Growing conditions were very different at both sites. There were higher amounts of rain during June in Teulon compared to Carman and significant lodging was noticed in Teulon than in Carman. Both sites had different varieties of Tall Fescue.

Table 5: Ethephon in Tall Fescue (Carman)

Treatment	***Height (cm)***	***Lodging***	***TKW (g)***	***Yield (% Check)***	***Net return (% Check)***
Check	*92.75*	*4.25*	*1.84*	*100.00*	*100.00*
0.3 L/ac	*91.12*	*3.50*	*1.99*	*110.12*	*109.24*
0.51 L/ac	*92.50*	*2.50*	*1.88*	*112.59*	*111.13*
0.61 L/ac	*92.00*	*4.00*	*2.00*	*122.24*	*120.47*

Table 6: Trinexapac Ethyl in Tall Fescue (Teulon)

Treatment	***Height (cm)***	***Lodging***	***TKW (g)***	***Yield (% Check)***	***Net return (% Check)***
Check	*110.17*	*3.33*	*2.30*	*100.00*	*100.00*
0.7 L/ac	*102.13*	*2.75*	*2.17*	*130.48*	*128.05*
1.0 L/ac	*97.00*	*1.33*	*2.26*	*137.30*	*133.82*
1.4 L/ac	*96.83*	*1.67*	*2.22*	*128.95*	*124.09*

In Carman, Ethephon resulted in an increase in seed yield of 10.12%, 12.59% and 22.24% over check (Table 5). But in Teulon a decrease in seed yield was observed as compared to check with the application of Ethephon. Similarly with Trinexapac Ethyl, seed yield increased by 30.48%, 37.30% and 28.95% in Teulon, when compared with control treatment (Table 6). While in Carman there was a decrease in seed yield as compared to check. Chlormequat chloride produced a marginal increase in seed yield of 3.75%, 2.29% and 6.93% above check (Table 7). Environmental conditions, soil type and varietal differences might have contributed towards unpredictable response of PGRs at both locations. Studies will be carried out in 2017 to get a better idea of which PGR is best in Tall Fescue.

Table 7: Chlormequat chloride in Tall Fescue (Carman)

Treatment	***Height (cm)***	***Lodging***	***TKW (g)***	***Yield (% Check)***	***Net return (% Check)***
Check	*85.00*	*3.33*	*2.05*	*100.00*	*100.00*
0.4 L/ac	*90.67*	*3.33*	*2.04*	*103.75*	*102.88*
0.57 L/ac	*86.88*	*3.00*	*2.04*	*102.29*	*101.17*
0.73 L/ac	*88.88*	*3.00*	*2.08*	*106.93*	*105.54*

Hybrid Brome – Teulon, MB: At the hybrid brome field, there was some field variability caused by excess moisture and the Ethephon and Trinexapac ethyl trials were the only statistically valid trials. With the Ethephon treatments it was observed that there was a 5.94%, 27.86% and 65.39%

increase in seed yield (Table 8). The 0.61 L/ac treatment resulted in the highest seed yield. Trinexapac ethyl resulted in an increase in seed yield of 15.86% and 11.18%. Highest rate (1.4 L/ac) of Trinexapac ethyl resulted in malformation of the seed head and this caused decrease in seed yields (6.64%) as compared to check.

Table 8: Ethephon in Hybrid Brome

Treatment	***Height (cm)***	***Lodging***	***TKW (g)***	***Yield (% Check)***	***Net return (% Check)***
Check	*131.50*	*5.67*	*4.76*	*100.00*	*100.00*
0.3 L/ac	*131.33*	*4.67*	*4.63*	*105.94*	*98.67*
0.51 L/ac	*137.33*	*3.33*	*4.92*	*127.86*	*115.71*
0.61 L/ac	*129.38*	*3.50*	*4.44*	*165.39*	*150.74*

Table 9: Trinexapac Ethyl in Hybrid Brome

Treatment	***Height (cm)***	***Lodging***	***TKW (g)***	***Yield (% Check)***	***Net return (% Check)***
Check	*133.63*	*6.50*	*4.55*	*100.00*	*100.00*
0.7 L/ac	*134.50*	*3.00*	*4.50*	*115.86*	*104.76*
1.0 L/ac	*135.75*	*1.50*	*5.22*	*111.18*	*95.32*
1.4 L/ac	*128.25*	*1.00*	*4.85*	*93.36*	*71.16*

Alfalfa – Okno & Starbuck, MB: No significant differences were observed for alfalfa seed yield with any of the PGRs applied. Early on just after application there was a decrease in plant height, however approximately a month after application there was no significant difference observed in plant height or lodging as compared to the check. Exploring tank mixtures of the PGRs at a later growth stage might have influence in decreasing lodging and plant height.

Project Findings

There are differences in how the various grass species react to the application of PGRs. There is a fairly significant difference in the cost/acre for the different PGRs so determining which PGR has the best net return for the grower is necessary. Further research will be needed to confirm the preliminary results observed during the 2016 season and to determine which rates work best. Field scale medium size plot trials will be done in 2017 season for the following PGR / crop combinations at three locations each.

Ethephon: Timothy, Hybrid Brome, Tall Fescue

Trinexapac Ethyl: Timothy, Hybrid Brome, Tall Fescue

Chlormequat chloride: Perennial Ryegrass, Tall Fescue

For more information, please contact MFSA - http://www.forageseed.net/.

10th Annual Biomass Workshop and Tour

Lead Partner:	Manitoba's Bioenergy and Bioproducts Team
Allotted Funding from PESAI:	$1000.0
PESAI Funding Spent:	$1000.0
Contributors:	PAMI, Life Science Association of Manitoba, Manitoba Hydro, the Province of Manitoba, and the Government of Canada.

Background/Objectives

Manitoba has an abundance of under-utilized biomass that can be put to use for a variety of purposes. Usage of this resource requires knowledge of processing, supply and available technologies for use. The Biomass Workshop was intended to create awareness of regional biomass opportunities and development across the province. The workshop's goal is to: educate on various uses of biomass; promote innovative biomass technologies; help diversify the local rural economy; and add value to under-utilized agricultural residues, forest wastes and native grasses.

Project Activities

This workshop was organised at Carberry on March 10, 2017 and a total of 134 participants attended this workshop. Honourable Agricultural Minister Ralph Eichler made the opening remarks at the workshop. The 1st plenary session was chaired by Harvey Chorney of Prairie Agricultural Machinery Institute and included presentations by Juliane Schaible from the Department of Sustainable Development, Matthew Bock from Natural Resource Canada, and Heather Campbell from the Sustainable Development Technology Canada.

The 2nd plenary session was chaired by Sam Arkia of MB Hydro and included the following speakers: Geoff Gunn & Jeff Diamond from International Institute of Sustainable Development, Darcy Wood from Aki Energy; Freddy Bosum from Cree Community of Ouje-Bougoumou; and Harvey Chorney from PAMI.

Several companies also provided table top displays: Triple Green Energy, Erosion Control Blankets, SIM Enterprises, Firewood Manitoba, ManSEA, and MEIA.

A portable biomass boiler was available outside for attendees to view. Attendees had the opportunity to tour both the biomass heating plants at both Treesbank Colony and Acadia Colony.

Project findings

This workshop provided a good opportunity to network with others businesses who are active in the biomass field. This will facilitate creating new partnerships that can foster other new, innovative products or processes. Attendees were able to see how companies like Erosion Control Blanket are able to utilize biomass in an innovative way to create a biomass solid fuel product with local market uptake. This type of business can be created for other biomass types and products.

PESAI Extension Activities

Background/Objectives

PESAI does extension events every year with the objectives -

(1) To raise awareness about PESAI in the Eastern and Interlake areas of Manitoba, including its mandate, capabilities, resources, partnership opportunities, and projects; and

(2) To increase the PESAI membership

Project Activities

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

- PESAI organized Winter wheat and PESAI Crop Tours in July, 2016. During these tours, Manitoba Agriculture and industry experts spoke on various production issues. Various research topics like use of plant growth regulators in winter and spring wheat, tile drainage in heavy clay soils, late seeding of soybeans, hemp varieties etc., were covered during these extension events. A total of 50 producers and industry people benefitted from these tours.
- Soybean research tour was organized at PESAI plot site in Beausejour. Speakers from Manitoba Agriculture and Manitoba Pulse and Soybean Growers delivered lectures on soybean production issues. About 45 producers / industry people attended this tour.
- A crop tour was organized by South Interlake Crop Testing Committee at PESAI field site in Stonewall. Speakers discussed about varieties of different crop types.
- PESAI manned a booth entitled "Manitoba's Diversification Centres" at Ag Days 2017, with its counter-parts from other areas of the province: Parkland Crop Diversification Foundation (PCDF) – Parkland Region, Westman Agriculture Diversification Organization (WADO) – Southwest Region and Canada-Manitoba Crop Diversification Centre (CMCDC) – Central Region. Ag Days 2017 was a success for PESAI and the other Diversification Centres. Many people stopped by the Diversification Centre booth where we featured a display banner for each group (PESAI, WADO, PCDF, CMCDC), alternative crop seed samples and pamphlets, hemp products, and various other display material.
- An announcement of PESAI's project submission deadline and AGM were advertised in Eastern and Interlake areas.
- Annual General Meeting was held on April 26 in Steinbach. About 35 members attended the meeting. PESAI financials and research work were discussed. A tour of WS steel plant was organized.
- PESAI's 2016-17 Annual Report was compiled by Manitoba Ag support staff and distributed to PESAI Directors, members, project partners and Manitoba Agriculture extension staff.

Conclusions

PESAI's extension events have proven successful with positive attendance at PESAI events and the increase in membership. This promotion and awareness campaign will continue in 2017-18.

A glimpse from Soybean Research Tour organised at Beausejour site

PESAI
Field Trials

Allotted funding from PESAI: **$115,000**
PESAI Funding spent: **$115,000**

Contributors

Amy Mangin, University of Manitoba
Agassiz Soil and Crop Improvement Association
Bifrost Agricultural Sustainability Initiative Cooperative
Canola Council of Canada
Crop Production Services
Dr Ana Badea, AAFC Brandon
Dr Malcolm Morrison, AAFC Ottawa
Dr Yvonne Lawley, U of M
Ducks Unlimited
Flax Council of Canada
Manitoba Ag Support Staff
Manitoba Corn Growers Association
Manitoba Crop Variety Evaluation Trials (MCVET)
Manitoba Forage Seed Association
Manitoba Pulse and Soybean Growers
Manitoba Sunflower Association
Mazer Group Arborg
Parkland Industrial Hemp Growers
Quarry Seeds
South Interlake Crop Testing Committee

Meteorological Information – 2016

Looking back on the 2016 growing season, overall temperatures were above normal and the moisture conditions were adequate. October was really wet and posed problems in the harvesting of trials.

The beginning of May saw warm temperatures and the first seeding began on May 3, 2016 at Stonewall site. Seeding at Arborg site started on May 9 where as PESAI started seeding operations at Beausejour on May 18. Arborg site got almost two inches of rain towards end May and that halted seeding operations for a while.

Arborg got almost three inches of rainfall both in May and June, two inches in July and four inches in August. Overall the growing season was good and Arborg experienced first significant frost (-4.3C) in first week of October.

Table 1. Seasonal weather summary at Arborg site from May 1 – September 30, 2016

	Actual	*Normal*	*% of Normal*
Growing degree days	*1715*	*1572*	*109*
Crop heat Units	*2858*	*2675*	*107*
Total precipitation	*351*	*349*	*100*

Table 2. Diversification Centre's weather summary (% of normal) from May 1 – September 30, 2016

	Arborg	*Roblin*	*Carberry*	*Melita*
Growing degree days	*109*	*111*	*112*	*111*
Crop heat Units	*107*	*110*	*110*	*110*
Total precipitation	*100*	*115*	*103*	*104*

Overall Arborg had higher number of degree days and crop heat units (than normal) in 2016. Roblin had higher amount of rainfall during May – September growing period as compared to all other diversification centres. The rainfall amount at Arborg site between May - September was normal.

All the three sites (Arborg, Beausejour and Stonewall) got greater than normal rainfall during October month and that delayed harvesting significantly. Soybean trials were harvested during mid October, where as corn trials were combined in the first week of November. Although Arborg got 167% of the normal rainfall in October but still it was better than other diversification centres (WADO – 265%, CMCDC – 425%, PCDF – 447%).

Understanding Plot Statistics

There are two types of plots at PESAI sites.

The first type is ***demonstration plots***. Demonstration plots are non-replicated plots and they are not used to determine statistical differences between data. They are typically used for demonstration and observation purposes.

PESAI has second type of plots known as ***replicated trials***. These trials are scientific experiments in which various treatments (e.g. varieties, seeding rates etc.) are subject to a replicated assessment to determine if there are differences are real. Many designs of replicated trials include randomized complete block designs (most common), split plot design, split-split plot design and lattice designs. Since these types of trials are replicated, statistical differences can be derived from the data using statistical analysis tools.

The analysis of variance (ANOVA) is the most common statistical tool used to find out the difference among trial treatments. From statistical analysis, several important numbers such as coefficient of variation (CV) and least significant difference (LSD) will determine the trial outcome. CV indicates how well the trial was carried out in the field and it indicates the variability in the trial. Typically, CV greater than 15% is an indication of poor data in which a trial is usually rejected from further use. LSD is a measure of significant differences between any two treatments.

For example in a replicated trial, two Flax varieties A and B were compared for yield. The first variety A has a mean yield of 24 bushels/acre. The variety B has a yield of 39 bushels/acre. The LSD was found to be 8 bushels/acre. The yield difference between varieties is 15 bushels/acre. Since the difference was greater than the LSD value of 8 bushels/acre, these varieties are significantly different from each other. In other words, you can expect that variety B will consistently produce yields higher than variety A in field conditions. If "means" (averages) do not fall within this minimal difference, they are considered not significantly different from each other. Sometimes letters of the alphabet are used to distinguish similarity (same letter in common) between varieties or differences between them (when letters are different representing them).

Grand mean is the average of the entire data set. Quite often, it helps gauge the overall yield of a site or trial location.

Sometimes ‘checks’ are used to reference a familiar variety to new varieties and may be highlighted in grey or simply referred to as ‘check’ in the results table or summary for the readers convenience.

Data from all replicated trials at PESAI has been analyzed using statistical software Agrobase Gen II. Coefficient of variation and least significant difference at the 0.05 level of significance was used to determine trial variation and mean differences respectively. At this level of significance, there is less than 5% chance that this data is a fluke when considered significant. For differences among treatments to be significant, the p-value must be less than 0.05. A p-value of 0.01 would be considered highly significant.

Manitoba Crop Variety Evaluation Trials (MCVET)

Manitoba Crop Variety Evaluation Trials (MCVET) facilitate variety evaluations of many different crop types in this province. PESAI managed three MCVET sites (Arborg, Beausejour and Stonewall) during 2016-17 season.

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

During 2016-17, PESAI did variety trials in Winter Wheat, Spring Wheat, Fall Rye, Oats, Barley, and Soybean (both Roundup Ready and Conventional) at all the three sites. Grain corn and flax variety testing were done at Stonewall site, whereas Fababeans, Peas, Silage corn and Canola variety evaluation were conducted only at Arborg site (See Table 1).

From each MCVET site across the province, yearly data is created, 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 PESAI at different sites during 2016-17.

Crop type	***No of plots***	***Sites***
Winter wheat	63	*Arborg, Beausejour, Stonewall*
Fall Rye	45	*Arborg, Beausejour, Stonewall*
Spring Wheat	264	*Arborg, Beausejour, Stonewall*
Barley	78	*Arborg, Beausejour, Stonewall*
Oats	66	*Arborg, Beausejour, Stonewall*
Peas	48	*Arborg*
Faba beans	126	*Arborg*
Conventional Soybeans	126	*Arborg, Beausejour, Stonewall*
Roundup Ready Soybeans	423	*Arborg, Beausejour, Stonewall*
Dry bean	72	*Stonewall*
Canola	276	*Arborg, Beausejour*
Silage Corn	48	*Arborg*
Grain Corn	180	*Beausejour, Stonewall*
Flax	78	*Arborg, Stonewall*
Total plots	1893	

Seed Manitoba guide and the websites www.seedinteractive.ca and www.seedmb.ca, provides valuable variety performance information for Manitoba farmers.

Pulses

Late planting of early-maturing soybeans in Manitoba (2015-2017)

Nirmal Hari, Roger Burak, James Lindal

Cooperators

Kristen Podolsky MacMillan, University of Manitoba

Background and Objectives

Soybean varieties currently available in Manitoba range in maturity from 107-123 days. The relatively recent availability of very early maturing soybeans could allow farmers to plant beyond current seeding deadlines. The objective of this study is to evaluate the potential for planting soybeans beyond current seeding deadlines. Three soybean varieties of varying maturity (very early, early and mid) were evaluated within three seeding windows (normal, late and very late) in each of the three crop insurance test areas of Manitoba.

Materials and methods

Design – Split plot design

Replications – Three

Plot size – 8.22 m^2

Treatments

Factor 1 – Seeding date – June 6, June 13, June 20

Factor 2: Variety

a. P002T04R (108 DTM, 2300 CHU, 00.2) – very early
b. NSC Reston (112 DTM, 2325 CHU, 00.1) – early
c. 24-10RY (117 DTM, 2425 CHU, 00.5) – mid-season

Weed control – Round up (1L/Acre) pre-plant on May 16

Fertilizer – 27 lbs of actual P at the time of seeding

Harvesting – October 12

Table 1. Seeding dates for 2016 late planting trials at Morden, Portage and Arborg

Seeding window	***Area 1 - Morden***		***Area 2 - Portage***		***Area 3 - Arborg***	
	Target	***Actual***	***Target***	***Actual***	***Target***	***Actual***
Normal	*May 31-June 6*	*June 8*	*May 24-30*	*May 19*	*May 24-30*	*June 6*
Late	*June 7-11*	*June 14*	*May 31-June 4*	*June 7*	*May 31-June 4*	*June 13*
Very Late	*June 12-18*	*June 20*	*June 5-10*	*June 16*	*June 5-10*	*June 20*

Preliminary Results

The second year of this 3-year study was successfully established in all three sites as proposed (Table 1). The Portage site received hail on August 15 and had to be terminated. The Arborg site was delayed due to rain, resulting in all seeding dates being 7-10 days behind the target. Arborg and Morden were very successful sites and data on plant population, plant productivity, and detailed staging and maturity ratings were successfully collected. As of October 6, there had been no killing frost at Arborg or Morden allowing all varieties and seeding dates to reach maturity, which is well outside the normal expected fall frost date for both sites. Yields for all treatments were very good at Arborg (42-60 bu/ac) and markedly better than 2015. Due to varying maturity, harvest moisture varied by treatment and seed quality analysis is being planned.

In terms of maturity and potential for extending seeding deadlines, only the varieties planted at the *normal* planting date and the *very early* variety planted *late* reached physiological maturity within 5 days of the normal frost date. The *early* and *mid* variety planted *late* and all varieties planted *very late* reached maturity 5-15 days after the normal frost date, which indicates high risk. This is what would be expected in crop insurance test area 3 which has a shorter growing season than area 1 and 2. Statistical analysis has not been conducted yet.

Figure 1. *Maturity of three soybean varieties (very early, early, mid) at three seeding dates from left to right (normal, late and very late) in Arborg on September 19, the normal date of first fall frost (0 ℃).*

Project findings

Another year of study is planned for 2017 and detailed reported will be prepared by Manitoba Soybean and Pulse Growers based on three year data.

Evaluation of different Inoculants on the Soybean Productivity

Nirmal Hari, Roger Burak, James Lindal

Cooperators

Laryssa Grenkow, Manitoba Pulse and Soybean Growers

Background and Objectives

Soybeans grown in Manitoba are usually inoculated with *Bradyrhizobium japonicum* to ensure adequate bacteria populations are present to maximize nodulation and nitrogen fixation. Soybean farmers in Manitoba have a variety of inoculant choices available. The effectiveness of different inoculant types, however, is not fully understood in the various soybean-growing regions in Manitoba.

The current study is planned to determine if there is any additional yield benefit to:

1. Using in-furrow granular inoculant (instead of seed-applied liquid)
2. Double inoculating (seed-applied liquid + granular in-furrow) (compared to seed-applied liquid only)
3. Increasing the rate of inoculant (from 1x to 2x)
4. Using "enhanced" inoculant products

Materials and Methods

Design – Randomized block design
Replications – Three
Plot size – 7.1 m^2
Seeding date – June 7
Treatments – 13 inoculant treatments (see Table 1)
Variety – NSC Reston
Weed control – Round up (0.5L/Acre) on June 16
Fertilizer – 27 lbs of actual P at the time of seeding
Harvesting – October 14

At R-4 crop stage, 10 randomly selected plants per plot were dig up gently and submerged in water to wash away dirt. Afterwards, nodules were counted on individual plant and average number of nodules per plant were determined from each plot. At the same crop stage, all above ground biomass was harvested from two 1m rows selected at random per plot and dried to record dry weight. Plots were harvested using Wintersteiger plot combine. Data were statistically analysed using ANONA and the means were separated using LSD at $p = 0.05$.

Results

Table 1. Effect of different inoculant treatments on soybean growth and yield at Beausejour site.

Treatment	*Yield (bu/acre)*	*Biomass (kg/ha)*	*Number of Nodules/plant*
Nodulator G 2X	*46.7*	*3494*	*75.3*
Cell-Tech L 2X	*46.4*	*4318*	*86.8*
Nodulator L+G	*45.5*	*3666*	*68.0*
Cell-Tech L + JmpS	*45.0*	*3338*	*83.8*
Cell-Tech + Optimize	*44.4*	*3289*	*88.8*
Nodulator G	*44.1*	*3716*	*87.8*
Nodulator L 2X	*43.7*	*2986*	*80.9*
Cell-Tech L	*43.6*	*3305*	*87.1*
Nodulator L	*43.1*	*3568*	*70.9*
Cell-Tech L + JmpS	*42.3*	*3621*	*80.3*
Cell-Tech G 2X	*42.3*	*3798*	*69.6*
Cell-Tech L+G	*42.3*	*4072*	*77.1*
TagTeam + P	*41.6*	*3232*	*74.7*
Control	*41.2*	*3117*	*87.8*
P	*0.5*	*0.25*	*0.26*
CV (%)	*7.3*	*18.7*	*15.5*

Yield varied from 41.2 to 46.7 bushels/acre among different treatments although the differences were not statistically significant. Similarly, different inoculant treatments did not differ for biomass and number of nodules/plant.

Project Findings

Current study revealed that use of any kind or rate of inoculant did not result in greater soybean yield. Inoculant, even when applied at double dose, did not increase soybean yield. Manitoba Pulse and Soybean Growers are conducting this trial over many sites in Manitoba and it will be interesting to see how the overall results look like. Field history was not known in the present study conducted at Beausejour site. This field might have soybean grown in the past few years resulting in inoculant establishment in the soil.

Variation in Soybean seed quality parameters: The Manitoba Advantage

Malcolm Morrison, Roger Burak, Nirmal Hari, James Lindal

Collaborators

Elroy Cober, Judith Fregeau-Reid, Ottawa RDC, AAFC
Anfu Hou, Morden RDC, AAFC
Philippe Seguin, Ste. Anne de Bellevue, McGill Uni.
Jeff Kostuik, PCDF Roblin, Manitoba Agriculture
Brian Beres, Lethbridge RDC, AAFC
Yvonne Lawley, Carman, Kelburn, University of Manitoba
Scott Chalmers, WADO Melita, Manitoba Agriculture
Josh Price, Brandon RDC, AAFC
Lorna Woodrow, Harrow RDC, AAFC

Background and Objectives

While Manitoba now grows primarily industrial soybean for crushing and meal, in the future farmers may want to take advantage of the lucrative food-type export market valued at nearly one billion dollars annually. Canadian food-type soybean for export are usually from non-GM varieties. Seeds that are bright yellow in colour, large and round are preferred. When seeds are dark in colour or stained they are not purchased at a premium price. Seed protein concentration should be at least 42 % while there are not criteria yet for oil concentration and the oil quality profile. Minerals such as iron and cadmium may also influence buyer preference. Seed components that can be considered beneficial for human health, such as isoflavones, lutein, and tocopherols, may receive a premium in the near future.

The objective of the project was to characterize the quality of food-type soybean grown in Manitoba to determine the potential to develop a food-type soybean export market in Manitoba. Seed quality characteristics were compared to the same varieties grown in Ottawa, an active food-type soybean producer. These results may show that there are specific qualities of Manitoba-grown soybean that will promote the Manitoba food-type soybean export market. They may also help plant breeders to improve characteristics that may be lacking from Manitoba varieties.

Materials and Methods

Six varieties of soybean were grown at several locations in Manitoba in 2015 and 2016. In addition, the test was grown in Eastern Ontario and Western Quebec in both years. Soil was sampled, and at harvest seed samples were taken to determine seed quality characteristics.

Six soybean varieties with appropriate maturity for Manitoba were grown in a randomized complete block design with four replications. Each location managed planting, land preparation, and weed control according to their established methods, and seeded at 65 seeds per

square meter. There were four locations in Manitoba in 2015 and six in 2016. Notes on phenological development (seeding, vegetative, flowering, and maturity stages) were taken. Plant height was measured before harvest. At maturity seeds were combine-harvested and a sample was sent to Ottawa for quality analysis. Grain moisture was determined at harvest.
The seed was examined for:

- Appearance: size, roundness, and brightness.
- Minerals: iron, zinc, sulfur, and cadmium concentration.
- Protein, oil and sugar concentration, and oil component profile.
- Seed human health components: isoflavones, lutein, and vitamin E (α-tocopherol). Lutein and vitamin E were only analysed in 2015 due to equipment failure.

Data was analysed using the Proc GLM model in SAS. Within each year, location data was combined and analyzed to examine the statistical differences among locations, with the error term being replication within location. Data was also analysed by location to examine the response of variety within each location. In order to determine the suitability of a location for producing food-type soybean, the Manitoba locations were compared to Ottawa by calculating a Dunnett's t-test to calculate the minimum significant difference (MSD) value. There were only three locations in Manitoba; Arborg, Morden, and Portage, and two in eastern Canada; Ottawa and Ste. Anne that repeated the experiment in 2015 and 2016.

Results

2015: Six short-season soybean varieties were grown at Roblin, Portage la Prairie, Morden, and Arborg in MB; Ottawa in ON; and Ste. Anne de Bellevue in QC. Seed was harvested and analysed for quality characteristics. Seed yield in Portage and Morden was similar to Ottawa and Ste. Anne (Table 1).

Seed from the east had higher protein. Manitoba seed had greater sugar concentration and, were rounder, smaller, and darker. Seeds from Morden did not differ from those grown in eastern Canada in yield, seed colour or shape. There was generally higher linolenic acid and linoleic acid, and lower oleic acid and palmitic acid in seed produced in Manitoba than Ottawa, although there was considerable variation across locations. Morden had the highest seed cadmium concentration of any location in the test, exceeding the 200 ppb export limitation. Portage and Ste. Anne had similar cadmium concentrations (~100 ppb) while Arborg, Roblin, and Ottawa were below 50 ppb. All locations had similar iron concentrations, while Manitoba seed was higher in zinc than eastern Canada seed. Earlier varieties are needed for Roblin because the selected varieties did not mature on time. Manitoba generally had higher total isoflavone concentration than in eastern Canada.

Table 1. Soybean varieties performance at different test sites during 2015.

	Roblin	Portage	Morden	Arborg	Ste Anne	Ottawa	LSD†	MSDƗ
Yield (kg ha^{-1})	1641	3467	3481	1424	3497	3415	196	249
Days to Maturity	142	121	100	127	115	103	1	0.6
Protein (%)	37	43	39	40	43	43	0.8	1
Oil (%)	19	18	22	21	20	20	0.2	0.2
Sugar (%)	15	14	13	13	12	12	0.3	0.3
Linolenic acid (%)	13	9	8	9	7	8	0.4	0.4
Linoleic acid (%)	56	60	57	60	53	58	Ns	1.5
Oleic acid (%)	12	5	7	8	9	8	0.8	0.8
Palmitic acid (%)	15	24	26	19	28	24	ns	1
Stearic acid (%)	5	3	4	4	4	4	ns	0.3
Seed area (mm^2)	26	33	31	31	33	34	0.9	1.2
Seed roundness (%)	75	82	79	79	80	77	1	1
Seed brightness	58	60	62	59	59	61	1	0.9
Seed colour diff.	5	4	1	3	3	1	0.7	0.2
Seed cadmium (ppb)	48	90	353	25	78	22	19	0
Seed iron (ppm)	69	70	78	61	74	74	3.2	3.3
Seed sulfur (ppm)	2933	3356	3401	3360	2593	2739	112	58.3
Seed zinc (ppm)	38	33	46	43	32	28	3	1
Total isoflavone (µg g^{-1})	2982	2373	2121	2989	2252	1918	69	130
Vitamin E (µg g^{-1})	13	17	24	25	31	24	1.6	1.7
Lutein (µg g^{-1})	9	7	10	11	8	8	0.5	0.7

2016: The same six short-season soybean varieties were grown at Portage la Prairie, Morden, Arborg, Carman, Melita, and Kelburn in MN; Ottawa in ON, and Ste. Anne de Bellevue in QC. Seed was harvested and analysed for quality characteristics.

Compared to Ottawa, Morden and Arborg produced greater average seed yield while Portage and Carman produced similar yield, and Kelburn, Ste. Anne, and Melita lower yield (Table 2). Seed sugar concentration was significantly greater in seed produced at Manitoba locations than at Ottawa. Protein concentration was greater at Carman and Kelburn, similar at Morden, and lower at Portage, Arborg, and Melita than at Ottawa. Seed oil concentration was greater at Arborg and Melita than at Ottawa, but it was lower at the other Manitoba locations. Generally, Manitoba soybean seed was significantly greater in polyunsaturated (linoleic and linolenic) fatty acids, and significantly lower in unsaturated (oleic and palmitic) fatty acids. Seed cadmium was greater at the Manitoba locations that it was at Ottawa. At Morden, seed cadmium levels exceeded the 200 ppb export limitation.

Arborg results

The results from Arborg site are given in Table 3. During 2015, Soybean varieties Edward, Mandor and Prudence took less number of days to mature than other three varieties. In 2016, although Edward had less number of days to mature, but in comparison Mandor took more number of days to mature. Yield did not differ among soybean varieties in 2015. In 2016, soybean varieties Mandor, Jari and DH 863 produced significantly higher yield than all other varieties.

Table 1. Soybean varieties performance at different test sites during 2016.

	Portage	Morden	Arborg	Melita	Carman	Kelburn	Ste.Anne	Ottawa	LSDł	MSDł
Yield (kg ha^{-1})	2981	4619	4049	1717	2731	2346	2119	2789	177	237
Days to Maturity	117	115	131	115	--	--	122	100	1	2
Protein (%)	38	41	37	30	44	44	41	42	1	2
Oil (%)	19	19	21	25	18	17	22	21	0.5	0.6
Sugar (%)	15	13	14	16	14	13	13	11	0.4	0.4
Linoleic (%)	59	59	54	56	57	61	57	51	1.5	0.4
Linolenic (%)	12	9	14	10	11	11	6	9	0.6	1.5
Oleic acid (%)	16	20	18	19	18	16	25	25	1.3	0.8
Palmitic acid (%)	8	7	12	12	9	7	9	13	1.2	1
Stearic acid (%)	4	3	4	5	4	3	4	4	0.3	0.3
Seed area (mm^2)	37	37	38	31	35	34	37	39	1	1
Seed roundness	84	86	84	85	85	85	80	80	2	2
Seed brightness	61	61	61	60	58	59	61	62	0.4	0.7
Seed colour diff.	4.7	3.5	2.8	3.5	5.8	6	3	2.3	0.5	0.7
Seed cadmium (ppb)	76	363	49	77	114	137	112	27	14	2.7
Seed iron (ppm)	71	78	69	104	80	74	80	71	2.3	5.9
Seed sulfur (ppm)	3278	3458	3122	3226	3435	3410	3112	3129	66	200
Seed zinc (ppm)	29	42	31	39	40	37	42	41	1.2	3.2
Total isoflavone (µg g^{-1})	3081	2862	2947	3069	2832	2707	1751	1352	135	154

Table 3. Performance of different soybean varieties at Arborg site during 2015 and 2016.

Variety	2015			2016		
	Days to Maturity	Yield (Kg/ha)	Protein (%)	Days to Maturity	Yield (Kg/ha)	Protein (%)
Edward	122	1398	38	128	3756	34
Mandor	125	1566	39	136	4408	36
Prudence	124	1544	41	133	3849	37
OT1103	129	1413	37	129	3711	35
Jari	130	1245	41	129	4292	40
DH863	130	1381	42	134	4285	41
Mean	127	1424	40	131	4050	37
LSD[†]	2	ns	0.9	5	406	1.4

Project findings

- Seed yields are sufficiently high in Manitoba to support a thriving food-type soybean industry.
- Producers should be encouraged to grow varieties recommended for their Crop Heat Unit region. Pre-harvest desiccation alters the protein and oil concentration in the seed and should be discouraged.
- Seed protein concentration is sufficiently high at some locations in Manitoba (42 % target) but overall is too low for export. There are differences among varieties for protein

concentration and plant breeding effort should concentrate on developing high protein lines. Additional research should resolve the climatic factors resulting in low protein concentration.

- Long days in spring and cool nights during seed development result in a longer time to maturity. Photoperiod sensitivity should be an area of future plant breeding emphasis in order to increase the time for seed development.
- Cool night temperatures (<15ºC) during seed development increase the seed coat discoloration resulting in a darker appearance. Soybean for food-type market should be grey pubescence in colour, which has less of a tendency to darken with cool night temperatures.
- Manitoba seed was smaller in size. Future plant breeding and agronomy research may need to focus on methods to improve seed size.
- Natto soybean, which requires a smaller seed size may be another potential target market for Manitoba soybean as the export target demands higher sugar concentration, higher linolenic acid concentration and smaller, rounder seed. Natto seed production may be a very good fit for Manitoba food-type soybean. A new research project should investigate the potential for establishing a small and medium-small seeded market for export.
- Seeds from Manitoba are rounder in shape, which is an export advantage.
- The higher concentration of polyunsaturated fats (Omega-3 linolenic acid) may be an export advantage for Manitoba. The high sugar concentrations (>7 %) may be an export advantage for Manitoba food-type.
- Cadmium concentration in the seed greater than 200 ppb will be detrimental to soybean export. Cadmium is a problem in the Morden and Carmen areas. Varieties can be selected that accumulate lower concentration of cadmium in the seed. There are two types of cadmium accumulation; high and normal. Two out of the six varieties in this experiment were normal. Unfortunately, in regions of high soil cadmium, even normal accumulating soybean varieties can have seed concentrations exceeding or approaching the 200 ppb limit. These areas may not be suitable for food-type production. All food-type soybeans should be tested for cadmium accumulation prior to being recommended for growing.

Advantages

- Manitoba produced food-type soybeans that is high yielding in most location as eastern Canadian seed.
- The seed is rounder in appearance than eastern Canadian seed.
- The seed is low to medium oil concentration, which can be an advantage for some soy foods, like soymilk.

- The seed is higher in polyunsaturated fats and lower in unsaturated fats than eastern Canadian soybean.
- The seed is higher in sugar concentration than eastern Canadian produced soybean seed.
- The seed is higher in total isoflavone concentration, lutein and Vitamin E.

Disadvantages

- The seed is smaller in size and darker in appearance at most locations than eastern Canadian produced seed.
- The seed grown at many locations in Manitoba is lower in protein than seed produced in eastern Canada. Often it does not meet the 42 % target.
- The seed produced in some areas has excessively high concentration of cadmium which will limit its export.

Cereals

Effect of seeding rate and plant growth regulators on Winter Wheat

Nirmal Hari, Roger Burak, James Lindal

Cooperator

Ken Gross, Ducks Unlimited Canada

Background and Objectives

Winter wheat varieties have had a 21 per cent higher yield than Canadian Western Red Spring wheat over the past three years in the Prairie Provinces [Western Winter Wheat Initiative]. Return on investment can be more than two times higher than for spring wheat. In addition to providing an effective tool to manage pests, nutrients and moisture, winter wheat can improve crop rotations and distribute cropping activities, enhancing timeliness of operations.

Lodging is a major crop production issue, especially in high yielding winter wheat environments. Lodging can be managed through variety selection and agronomics. Crop varieties vary in their resistance to lodging, with stem length, thickness of stem internodes, root structure, and head density and shape affecting resistance to lodging.

Plant growth regulators (PGRs) are another management tool used to reduce lodging. PGRs are synthetic compounds that alter hormonal activity to modify plant growth and development. PGRs are used to improve crop standability, as they are intended to produce shorter, thicker, and stronger stems.

Similarly, seeding rate is another important factor that determines winter wheat yield. Yield advantage to higher seeding rates happens because of several factors, and not just because of weed competition. In areas where fusarium is a problem, higher plant populations may mean fewer tillers, which may mean more uniform flowering making a fungicide application more precise to protect both yield and quality.

The objective of this project was to evaluate the effects of different PGRs and seeding rates on winter wheat height, lodging and yield.

Materials and methods

Both trials were planted on Sep 15, 2015. At the time of seeding, 27 lbs/acre of P were applied where as later in the spring, 120 lbs/acre of N were broadcasted. For weed control, 0.81 litres/acre of Curtail and 0.48 litres/acre of Axial were applied on June 14. The trials were harvested on August 8 using Wintersteiger small plot combine. The plot size for these trials was $8.22m^2$.

In the seeding rate trial, three winter wheat varieties Gateway, Emerson and Moats were seeded in a replicated trial with three replications. Two seeding rates (30 plants/sq ft and higher seeding rate of 37 plants/sq ft) were evaluated for their effect on plant height, lodging and grain yield.

In second trial, PGR Manipulator was either applied at full dose or at two different times as Split application on three winter wheat varieties Gateway, Emerson and Moats. Application timings were around flag leaf emergence. Data on plant height, lodging and grain yield were taken to assess the effects.

Data were analysed using ANOVA and means were compared at P=0.05.

Results

Higher seeding rate did not have any effect on plant height, lodging and grain yield (Table 1). Although winter wheat variety Moats had higher lodging than other two winter wheat varieties, but lodging did not vary between normal and higher seeding rate treatments. Grain yield varied from 101.6 to 112.6 bushels/acre among different treatments, but differences were statistically non-significant.

Table 1. Effect of different seeding rates on winter wheat performance at Arborg site.

Treatment	Yield (bu/acre)	Plant height (inches)	Lodging (1-5 scale)
Moats high	104.2	39.3	3.3
Emerson high	101.6	39.0	1.6
Gateway high	112.6	35.0	1.0
Emerson regular	104.6	37.7	1.3
Moats regular	109.6	38.3	2.7
Gateway regular	108.1	34.0	1.3
P	0.20	0.07	0.0004
CV(%)	5.3	7.6	51

Table 2. Effect of plant growth regulator Manipulator on winter wheat at Arborg site.

Treatment	Yield (bu/acre)	Plant height (inches)	Lodging (1-5 scale)
Moats none	113.7	39.7f	2.0
Moats split app	105.8	37.0de	2.3
Moats full rate	113.5	34.3b	2.3
Emerson none	105.1	38.0e	1.0
Emerson split app	107.7	36.3cd	1.3
Emerson full rate	106.4	34.0b	1.0
Gateway none	116.3	34.7bc	1.0
Gateway split app	115.8	31.7a	1.0
Gateway full rate	111.4	30.3a	1.0
P	0.10	0.02	<0.0001
CV(%)	6.8	12.1	44

The use of plant growth regulator resulted in reduction in plant height, but it did not have any effect on lodging and grain yield (Table 2). Winter wheat plants were shorter when Manipulator was applied either at full or split dose. Although variety Moats had higher lodging than other two winter wheat varieties, but use of Manipulator did not reduce lodging in this variety.

Project findings

Winter wheat holds an important place in crop rotations on the Canadian prairie. The current study showed that higher seeding rate and use of plant growth regulator, Manipulator did not have any effect on lodging and grain yield. Although this PGR resulted in reduction in plant height but this change was not reflected in yield gain. More work is needed to identify best management practices that can maximize winter wheat yield and increase profitability for producers.

References

Western Winter Wheat Initiative. Grow winter wheat.
http://www.growwinterwheat.ca/wpcontent/
uploads/2016/12/WWWI-Grower-Guide-20161013JF_Approved-Web-Ready.pdf

Advanced Six-Row Feed Barley Trial

Nirmal Hari, Roger Burak and James Lindal

Cooperators

Dr. Ana Badea – Barley Breeder, AAFC Brandon
Rudy Von Hertzberg – Research Technician, AAFC Brandon

Background and Objectives

The barley breeding effort at AAFC Brandon is aiming to develop new varieties of six-row malting barley well-suited to western Canada with improved disease resistance and agronomic performance combined with enhanced quality. The lines that do not meet the quality malting profile are evaluated for feed purposes with a focus on high grain yield. In the current study, 12 barley varieties were evaluated at Arborg site.

Materials and Methods

In addition to two registered feed varieties, AC Ranger and Vivar, 10 numbered breeding lines were evaluated in a replicated trial (Table 1). These numbered entries are advanced breeding lines with potential advancement to the cooperative testing system.

Table 1. 2016 Advanced Six-Row Feed Barley Trial Varieties at Arborg, MB

AC Ranger	*A515-03-085*	*A515-05-008*	*A515-05-129*
Vivar	*A515-04-029*	*A515-05-028*	*A515-05-136*
A515-03-042	*A515-05-005*	*A515-05-102*	*A515-05-149*

Other trial details are as follows –
Number of replications – three
Seeding date –May 10
Fertilizer – 90 lbs/acre of N and 27 lbs/acre of P at the time of seeding
Weed control – 0.81 L/acre Curtail + 0.48 L/acre Axial on June 14
Harvesting – August 18
Plot size – 8.22m^2

Data on plant height, days to maturity, lodging and grain yield were taken and were statistically analyzed using ANOVA. The means were separated at P =0.05.

Results

The trial had a good CV (coefficient of variation) of 8.9% for grain yield. In the testing conditions at the Arborg site, none of the barley lines evaluated had higher yield or plumper grain than the check cultivars, AC Ranger and Vivar (Table 2). Based on the data collected from this site, none of the malting lines evaluated will be suited for feed since they do not present improvements over the feed cheeks.

Table 2. 2016 Advanced Six-Row Feed Barley Trial Results.

ENTRY #	ENTRY NAME	YIELD KG HA^{-1}	YIELD RANK	YLD AS %RANGER	DAYS TO MATURITY	HEIGHT CM	LODGING RATED 1-9	KERNEL WEIGHT g M^{-1}	TEST WEIGHT KG HL^{-1}	% PLUMP >6/64	GRAIN PROTEIN (%)
1	AC Ranger	7533	2	100	79	85.0	1.0	47.4	67.1	96.0	10.4
2	Vivar	7546	1	100	91	91.7	1.0	50.8	67.7	96.4	10.9
3	A515-03-042	7270	3	97	79	98.3	1.3	49.0	66.8	96.8	10.6
4	A515-03-085	6620	11	88	84	98.3	2.3	47.8	65.9	94.0	10.4
5	A515-04-029	6580	12	87	88	96.7	1.7	43.4	75.5	90.0	11.1
6	A515-05-005	7135	5	95	79	86.7	2.3	48.2	67.6	94.2	11.5
7	A515-05-008	6990	6	93	94	83.3	3.0	48.0	66.5	93.4	10.6
8	A515-05-028	6978	7	93	84	89.0	2.3	46.4	67.9	93.0	11.8
9	A515-05-102	6630	10	88	84	90.0	2.3	43.4	70.4	90.0	11.9
10	A515-05-129	6952	8	92	84	85.0	1.0	48.8	68.7	95.8	11.1
11	A515-05-136	7231	4	96	79	98.3	1.3	49.4	67.9	94.6	11.2
12	A515-05-149	6769	9	90	86	88.3	3.3	46.8	65.9	94.0	10.6
	GRAND MEAN	7020				90.9	1.9				
	CV	8.9				8.9	63.7				
	LSD	1060				13.6	2.1				
	No. of Reps	3			1	3	3	1	1	1	1

Project findings

Barley is commonly grown for malting but can also be grown for human food and animal feed. For feeding purposes, barley grain is used primarily as an energy and protein source in beef cattle diets. Ten advanced barley breeding lines evaluated in this trial did not show any promise as they were not better in grain yield as compared to check barley varieties.

Plant Growth Regulators in Spring Wheat

Nirmal Hari, Pam de Rocquigny, Roger Burak, James Lindal and Anne Kirk
Manitoba Agriculture

Collaborators

Scott Chalmers, WADO Manitoba Agriculture
Craig Linde, CMCDC Manitoba Agriculture

Background and Objectives

Lodging is a major crop production issue, especially in high yielding environments. Yield losses can range from 5 to 40%, with the greatest losses occurring when lodging occurs ten days to two weeks following head emergence. When the crop lodges early in the season, before full stem elongation, plants may recover by “elbowing” to an upright position. Once the crop has flowered, heads will not regain an upright position.

Lodging can be managed through variety selection and agronomics. Crop varieties vary in their resistance to lodging, with stem length, thickness of stem internodes, root structure, and head density and shape affecting resistance to lodging. Producers are encouraged to review lodging ratings in Seed Manitoba when selecting varieties. Seeding and nitrogen rates also play a role in lodging. Internode shading increases with increasing plant populations, which can increase internode elongation and create taller, weaker stems. High nitrogen rates can have a similar effect with excessive tillering leading to increased internode shading and elongation.

Plant growth regulators (PGRs) are another management tool used to reduce lodging. PGRs are synthetic compounds that alter hormonal activity to modify plant growth and development. PGRs are used to improve crop standability, as they are intended to produce shorter, thicker, and stronger stems. There are two main groups of PGRs, ethylene releasing compounds and gibberellin inhibitors. Gibberellin inhibitors such as Manipulator (active ingredient chlormequat chloride) are the more common type of PGR in Western Canada.

The effects of PGRs are not well known. There are reports of PGRs increasing yield, as well as reports of PGRs causing stem elongation and reducing yield. The objective of this project is to demonstrate the effects of PGR application on spring wheat height and yield.

Materials and Methods

Trials were conducted at the crop diversification centers in Portage, Melita, and Arborg in 2015, and in Melita and Arborg in 2016. Three spring wheat varieties were planted at each site, Waskada (CWRS, tall), AAC Brandon (CWRS, semi-dwarf), and AAC Penhold (CPSR). In 2016 a fourth variety, Prosper (CNHR), was also planted. Treatments included no PGR (check), manipulator at ideal timing (GS 31), split application of manipulator (GS 12-30 and GS31), and an unregistered PGR “PGR B” (GS 31). Plant height and yield data were collected in both years of the trial. Data were analysed using Analysis of Variance and means were separated at P =0.05.

Results

Plant Height

PGRs reduced plant height in all varieties in both years of the trial. On average, the single and split applications of Manipulator reduced plant height by 7 cm in 2015 and 8 cm in 2016. PGR B reduced plant height by an average of 5 cm in 2015 and 7 cm in 2016 (Figure 1 and 2). In 2015 there was no significant height interaction between variety and PGR treatment. In 2016 Waskada, the taller variety, had a greater height reduction with a single application of Manipulator than AAC Brandon, AAC Penhold, and Prosper.

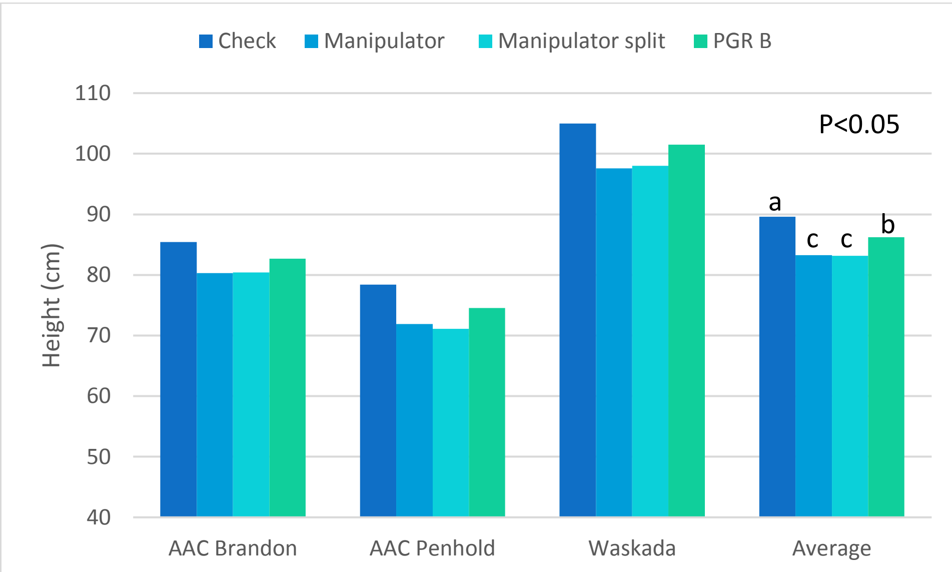


Figure 1. Impact of PGR application on height of three spring wheat varieties and average height in 2015. Treatments within the same year with the same letter are not significantly different (P<0.05).

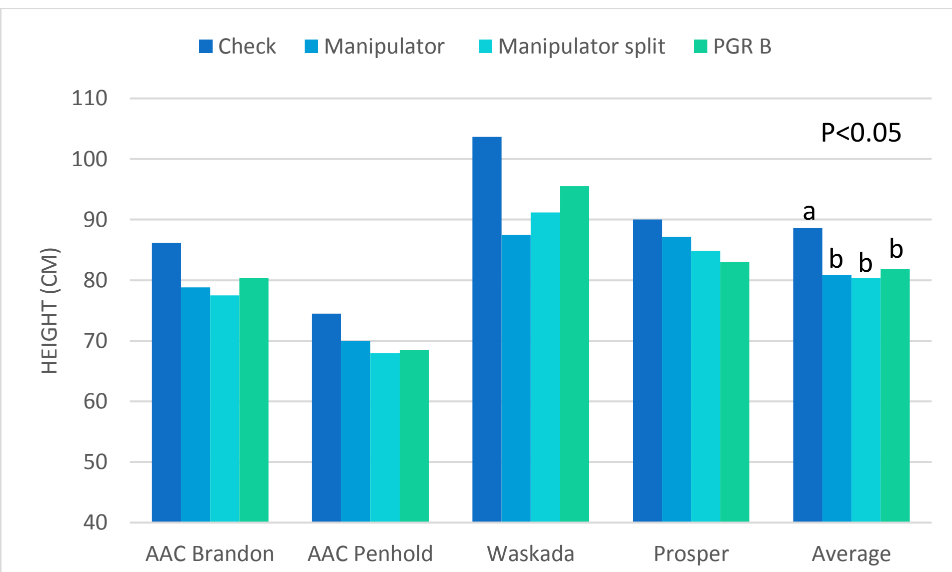


Figure 2. Impact of PGR application on height of four spring wheat varieties and average height in 2016. Treatments within the same year with the same letter are not significantly different (P<0.05).

Yield

Averaged across all varieties, PGR application did not increase yield in either year of the study. For the individual varieties, a single application of Manipulator resulted in a 4 bu/acre yield increase in Waskada in 2016 (Figure 4).

Yield decreases with PGR application were observed in both years of the study. Averaged across all varieties, in 2015 the split application of Manipulator resulted in a 3 bu/acre yield decrease from the check treatment (Figure 3). The split application of Manipulator resulted in a yield decrease compared to the check treatment in AAC Brandon and AAC Penhold in 2015, but there was no significant yield decrease with PGR application for Waskada. The single application of Manipulator and application of PGR B resulted in a significant yield decrease compared to the check in AAC Brandon in 2015, but not for AAC Penhold or Waskada (Figure 3).

Averaged across all varieties, in 2016 PGR B resulted in a 3 bu/acre yield decrease from the check treatment (Figure 4). Application of PGR B resulted in a yield decrease compared to the check in AAC Brandon and AAC Penhold in 2016, but not for Waskada and Prosper. Both the single and split applications of Manipulator resulted in a yield decrease in AAC Penhold in 2016, and the single application of Manipulator resulted in a yield decrease when applied to Prosper (Figure 4).

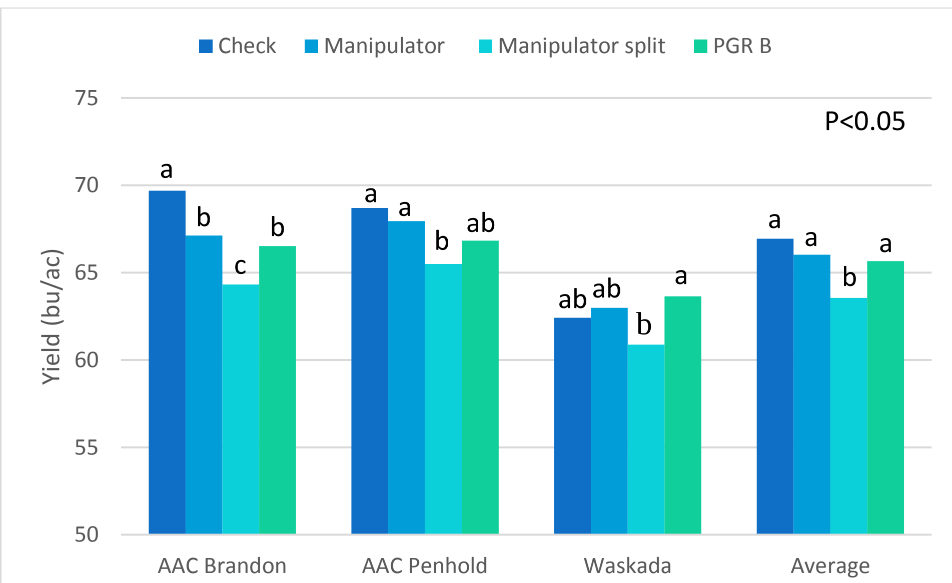


Figure 3. Impact of PGR application on yield of three spring wheat varieties and average yield in 2015. Treatments within the same year with the same letter are not significantly different (P<0.05).

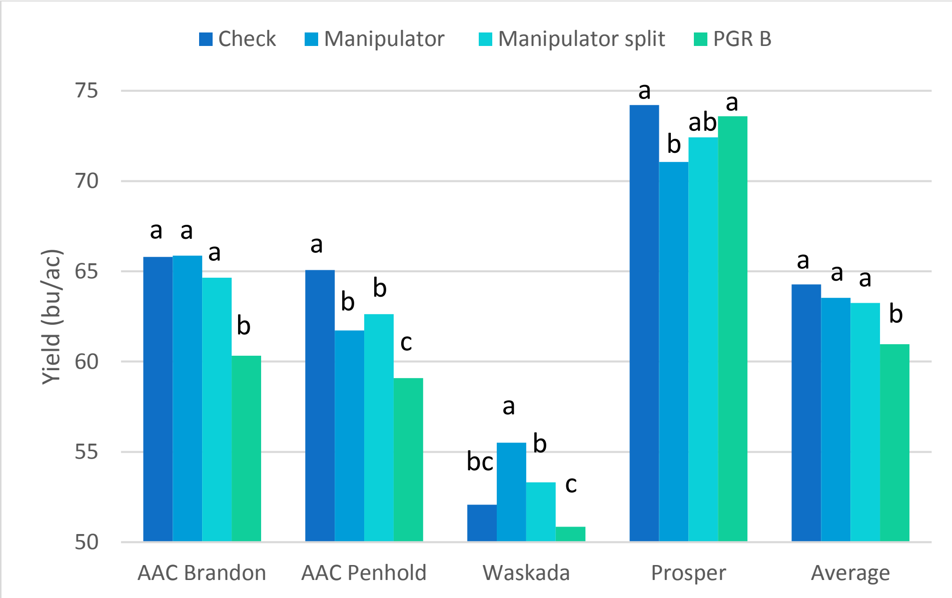


Figure 4. Impact of PGR application on yield of four spring wheat varieties and average yield in 2016. Treatments within the same year with the same letter are not significantly different (P<0.05).

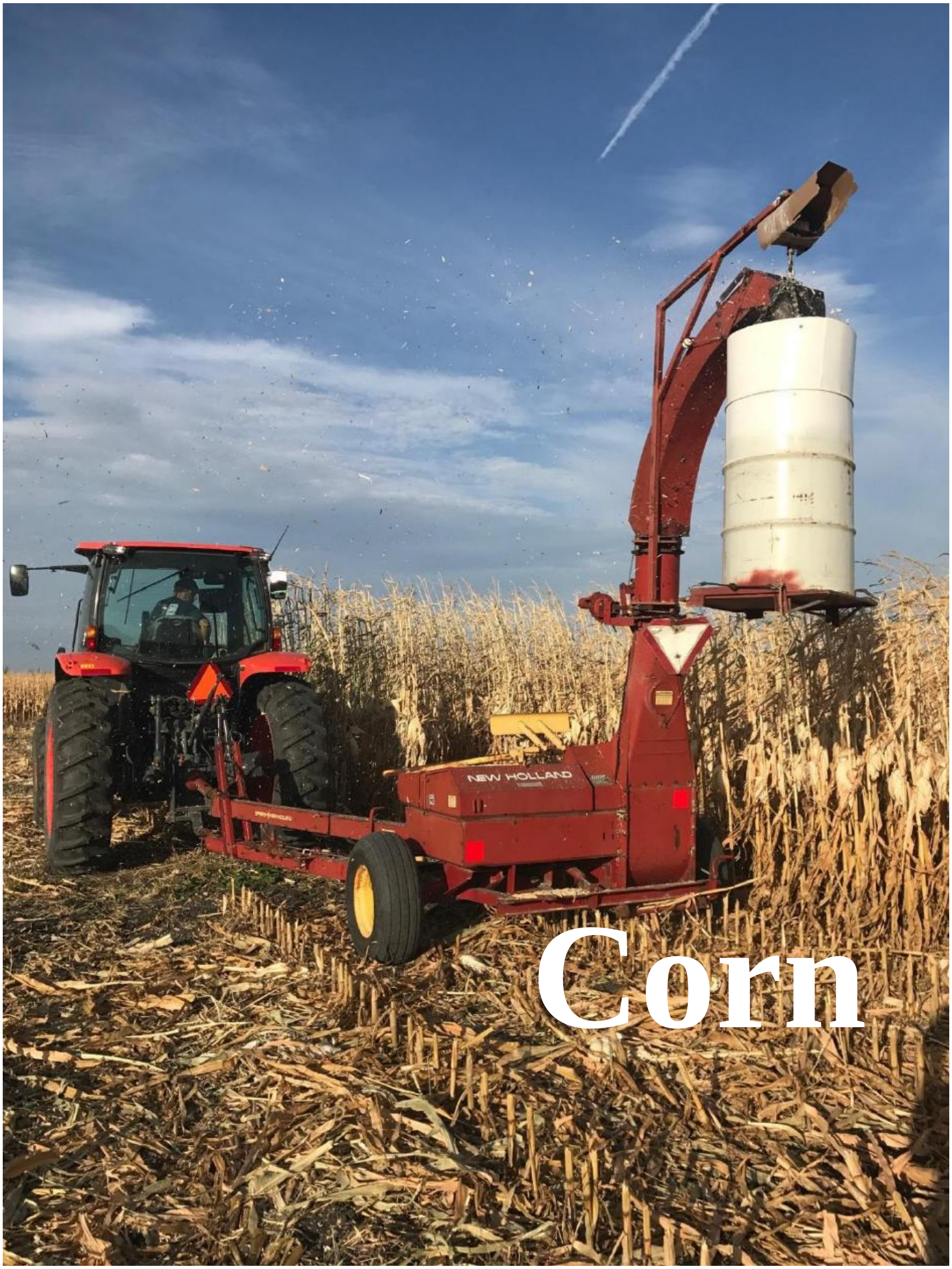
Project Findings

In both years of the study minimal lodging occurred at the trial locations and in most instances there was no yield benefit to applying PGRs. In 2016, a single application of Manipulator resulted in a significant yield increase in Waskada compared to the check. Waskada is the tallest variety included in this study, and in 2016 more lodging was observed in Waskada than the shorter varieties. PGR application reduced height of Waskada by 8 to 16 cm on average in 2016, which may have resulted in less lodging and could account for higher yields.

PGR application reduced plant height of all varieties, which in the event of lodging, would be expected to reduce lodging and increase yield potential. The results of this study are consistent with other research that have showed inconsistent yield benefits with PGR application. PGRs can be used as a risk management tool to reduce lodging in high input systems, but cannot be expected to show a consistent positive yield response.

Manipulator is registered for use in Canada, but is not registered for use in the USA. The USA has not established a maximum residue limit (MRL) for chlormequat chloride, therefore wheat treated with Manipulator cannot be exported to the USA. Producers are advised to check with their grain buyer before applying PGRs to their crop.

Corn



Evaluation of different Nitrogen decision guides in fertilizing Corn

Nirmal Hari, James Lindal, Roger Burak, Scott Chalmers, Craig Linde, John Heard
Manitoba Agriculture

Cooperators

Eric Unrau
Magda Rogalsky, University of Manitoba
Kelburn Farms
Manitoba Corn Growers Association
AgVise Laboratories
DeKalb Seeds

Background and Objectives

Manitoba Agriculture nitrogen rate guidelines for corn were developed before 1990 and are out-of-date for current yield levels. Recently North Dakota State University (NDSU) has released N rate guidelines for corn and a number of in-crop scouting measures can be used to assess sufficiency and need for more N. The following study was initiated with the objective to evaluate a number of N decision guides for suitability in fertilizing corn in Manitoba.

Materials and Methods

These trials were done at five different sites and Diversification Centres staff managed three (Melita, Carberry and Arborg) out of these five sites. Additional sites were at St Adolphe (Kelburn farm) and a farm field north of Morden and were managed by Crops Branch, University of Manitoba staff and Richardson staff.

Different nitrogen treatments (0-200 lb N/acre – Table 4)) were applied as post plant surface broadcast using Super U (46-0-0). To simulate the Y-drop application of side-dress stage N, liquid UAN (28-0-0) was applied at the 6 leaf stage of corn on each side of the corn plant (treatments 7 and 8). Site description and field activities are listed in Tables 1-3.

Table 1. Site cropping history, soil characteristics and 2016 growing conditions.

Site	***Kelburn***	***Carberry***	***Arborg***	***Morden***	***Melita***
Soil type	*Scanterbury clay*	*Ramada clay loam*	*Peguis clay*	*Neuenberg sand loam*	*Ryerson loam*
Previous crop	*Soybean*	*Canola*	*Wheat*	*Potatoes, Rye cover C*	*Wheat*
Soil analysis					
Nitrate-N (lb/ac in 0-24")	*71*	*55*	*106*	*35*	*57*
PSNT nitrate-N (lb/ac in 0-12'')	*170*	*74*	*254*	*63*	*95*
Organic Matter (%)	*7.7%*	*4.9%*	*8.6%*	*2.9%*	*4.0%*
P ppm Olsen	*28*	*8*	*47*	*33*	*7*
K ppm	*507*	*225*	*480*	*179*	*341*
pH	*7.1*	*6.0*	*8.0*	*7.8*	*8.0*
May-Sept weather					
Crop heat units (% of normal)	*112*	*109*	*106*	*107*	*108*
Precipitation (inches)	*16.1*	*12.2*	*11.7*	*18.1*	*14.2*
% of normal	*122*	*101*	*93*	*139*	*106*

Table 2. Field Practices.

Site	***Kelburn***	***Carberry***	***Arborg***	***Morden***	***Melita***
Planting Date	*May 13/16*	*17-May*	*20-May*	*04-May*	*13-May*
Hybrid	*DEC 26-28*	*DKC26-28*	*DKC 23-17*	*Pioneer 7958AM*	*DKC 26-28*
Population ('000/ac)	*32*	*32*	*32*	*31*	*32*
Side banded fertilizer					
MAP (lb P_2O_5/acre)	*40*	*54*	*90*	*40*	*40*
Potash (lb K_2O/acre)	*0*	*0*	*0*	*10*	*0*
Weed Control					
Herbicide 1	*post plant Glyphosate and Heat + Merge*	*Glyphosate on 14-Jun*	*Glyphosate on 10-Jun*	*Glyphosate and Heat + Merge on 09-May*	*Glyphosate and Heat + Merge on 21-May*
Herbicide 2	*Glyphosate on June 14*		*Glyphosate on 15-Jul*	*Glyphosate on 10-Jun*	*Maverick on 17-Jun*
Herbicide 3	*Basagran on July 08*			*Glyphosate on 20-Jun*	
Harvest	*11-Oct*	*09-Nov*	*04-Nov*	*04-Oct*	*21-Oct*

Table 3. Treatment applications and crop observations.

Site	***Kelburn***	***Carberry***	***Arborg***	***Morden***	***Melita***
Nitrogen Treatments					
Treatments 1-6	*20-May*	*15-Jun*	*08-Jul*	*09-May*	*13-May*
Treatments 7-8	*27-Jun*	*08-Jul*	*14-Jul*	*27-Jun*	*29-Jun*
Observations					
PSNT	*27-Jun*	*08-Jul*	*14-Jul*	*27-Jun*	*11-Jul*
SPAD	*nd*	*08-Jul*	*14-Jul*	*28-Jun*	*29-Jun*
GreenSeeker1	*27-Jun*	*08-Jul*	*14-Jul*	*28-Jun*	*29-Jun*
GreenSeeker2	*nd*	*18-Jul*	*nd*	*nd*	*20-Jul*
N Deficiency Leaf rating	*03-Aug*	*09-Aug*	*04-Aug*	*28-Jul*	*nd*
Stalk N	*11-Oct*	*nd*	*nd*	*nd*	*03-Oct*

- nd = not determined at this site
- PSNT (pre side dress nitrate-N test) soil sample is taken between the rows to a depth of 12" (values reported in Table 1)
- SPAD chlorophyll readings are taken mid-leaf of the earliest leaf with a developed collar. SPAD values are referenced as an index of those measured at full N rates.
- GreenSeeker readings of NDVI are taken with the pocket GreenSeeker.
- N deficiency ratings are the number of lower corn leaves with visible N deficiency (yellowing of the midrib). The value is the number of deficiency leaves observed in 10 plants.
- Stalk N is the end of season stalk nitrate test as an index of N sufficiency/excess.

Results
Results for each site are reported in Tables 4-8.

Table 4. St. Adolphe corn response to different N treatments.

Treatment (lb N/acre)	NDVI	Visual def.	Moisture (%)	Yield (bu/ac)	Test wt (lb/bu)
1=0N	0.69	9 a	26.8	202	52
2=40N	0.70	7 ab	26.6	201	52
3=80N	0.70	4 bc	26.7	211	51
4=120N	0.68	3 c	27.0	202	51
5=160N	0.69	3 c	26.8	203	52
6=200N	0.71	1 c	26.6	206	51
7=40N+40N	0.70	5 bc	25.8	204	50
8= 40N+80N	0.70	5 bc	26.1	204	51
Mean	0.7	5	26.5	204.1	51.1
Pr>F	0.9917	<.0001	0.0763	0.9321	0.6441
CV (%)	6	60	2	5	2

Values in columns followed by different letters are significantly different at the 5% probability level (according to Tukey-Kramer).

Table 5. Carberry corn N response to different N treatments.

Treatment (lb N/acre)	SPAD	SPAD Index	NDVI	Visual def.	Yield (bu/ac)	Green snap
1=0N	49.3	87%	0.38	5 a	120	1.0
2=40N	56.3	100%	0.44	1 b	115	1.5
3=80N	53.8	95%	0.41	1 b	111	1.5
4=120N	52.5	93%	0.48	0 b	123	1.8
5=160N	52.8	94%	0.44	0 b	119	2.3
6=200N	53.0	94%	0.39	0 b	123	2.3
7=40N+40N	49.0	87%	0.35	0 b	123	2.3
8= 40N+80N	56.3	100%	0.42	1 b	122	2.0
Mean	52.8		0.41		119	1.8
Pr>F	0.6484		0.1535	<.0001	0.7197	0.4312
CV (%)	14		22	89	3	115

Values in columns followed by different letters are significantly different at the 5% probability level (according to Tukey-Kramer).

- Volunteer wheat was not controlled until mid June and competed for N and early season corn growth.
- Severe wind caused green snap of plants. Values in table are the number of 10 plants that snapped.
- Deer damaged several of the plots adding variability to yield results.

Table 6. Arborg corn N response to different N treatments.

Treatment (lb N/acre)	SPAD	SPAD Index	NDVI	Visual def.	Moisture (%)	Yield (bu/ac)	Weed growth (lb/ac)	N in weeds (lb/ac)
1=0N	47.0 b	87	0.78	10 a	26.5	154 c	858	23
2=40N	50.0 ab	93	0.79	8 a	26.1	169 bc	444	13
3=80N	50.5 ab	94	0.78	5 b	25.5	186 ab	605	25
4=120N	54.3 a	100	0.80	3 bc	25.1	194 a	327	17
5=160N	54.1 a	100	0.81	2 bc	25.2	191 a	480	14
6=200N	53.2 a	98	0.79	1 c	25.7	193 a	599	19
7=40N+40N	50.0 ab	93	0.80	4 b	26.2	187 ab	616	19
8= 40N+80N	49.7 ab	93	0.80	3 b	25.7	194 a	911	37
Mean	51			4	25.8	183.4		
Pr>F	0.0014		0.4293	<.0001	0.1661	<.0001		
CV (%)	7		3	70	3	9		

Values in columns followed by different letters are significantly different at the 5% probability level (according to Tukey-Kramer).

- The broadcast N application was not applied until early July. A second flush of weeds was not controlled and biomass and N uptake was measured and reported in Table 6.

Table 7. Morden corn N response to different N treatments.

Treatment (lb N/ac)	SPAD	SPAD Index	NDVI	Visual def.	Moisture (%)	Yield (bu/ac)	Test wt (lb/bu)	Stalk N pm NO_3
1=0N	41.9 c	88	0.64	9 a	23	178	49	46
2=40N	46.7 ab	98	0.65	7 ab	24	194	52	502
3=80N	45.1 bc	94	0.69	6 bc	24	196	52	4102
4=120N	47.3 ab	98	0.70	4 cd	23	199	51	2234
5=160N	48.5 a	100	0.66	3 de	24	199	51	4234
6=200N	47.6 ab	100	0.69	1 e	23	197	50	3885
7=40N+80N	45.9 ab	96	0.67	5 bcd	24	186	51	2173
8= 40N+120N	46.7 ab	98	0.70	4 cd	23	184	51	3931
Mean	46		0.7	5	23	191	51	2638
Pr>F	<.0001		0.1500	<.0001	0.2183	0.1856	0.7873	
CV (%)	6		5	54	4	7	5	

Values in columns followed by different letters are significantly different at the 5% probability level (according to Tukey-Kramer).

Table 8. Melita corn N response to different treatments.

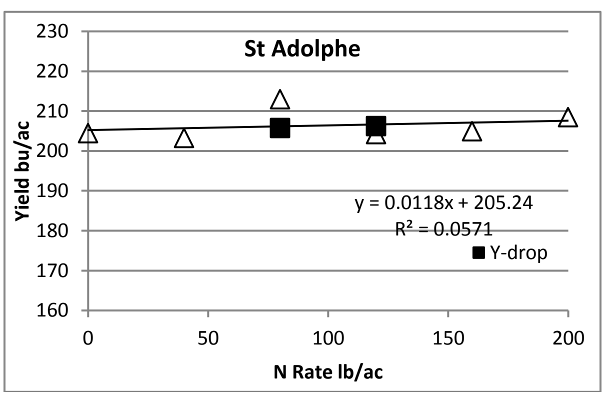
Treatment (lb N/acre)	*SPAD*	*SPAD Index*	*NDVI*	*Moisture (%)*	*Yield (bu/acre)*	*Test wt (lb/bu)*
1=0N	*41.4 bc*	*89*	*0.46*	*27.2 a*	*187 b*	*52*
2=40N	*42.4 abc*	*91*	*0.50*	*24.6 ab*	*210 ab*	*54*
3=80N	*42.6 abc*	*93*	*0.51*	*24.7 ab*	*214 ab*	*53*
4=120N	*45.6 a*	*100*	*0.52*	*23.7 b*	*223 ab*	*54*
5=160N	*42.8 abc*	*93*	*0.49*	*24.4 b*	*232 ab*	*53*
6=200N	*44.2 ab*	*96*	*0.53*	*24.5 ab*	*244 a*	*54*
7=40N+40N	*40.1 c*	*87*	*0.51*	*23.4 b*	*230 ab*	*54*
8= 40N+80N	*41.8 bc*	*91*	*0.56*	*23.8 b*	*228 ab*	*54*
Mean	*42.6*		*0.51*	*24.5*	*221*	*53*
Pr>F	*0.0039*		*0.6096*	*0.0064*	*0.015*	*0.2933*
CV (%)	*6*		*13*	*6*	*11*	*2*

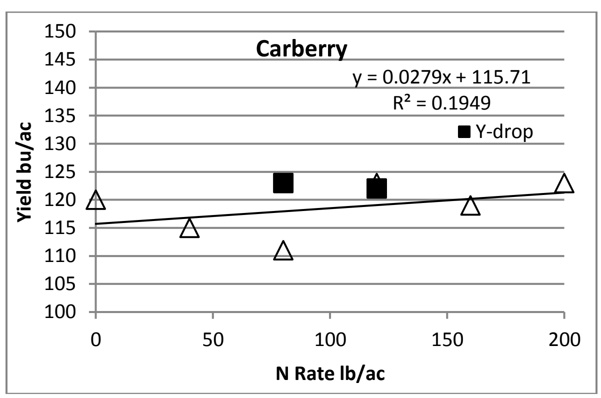
Values in columns followed by different letters are significantly different at the 5% probability level (according to Tukey-Kramer).

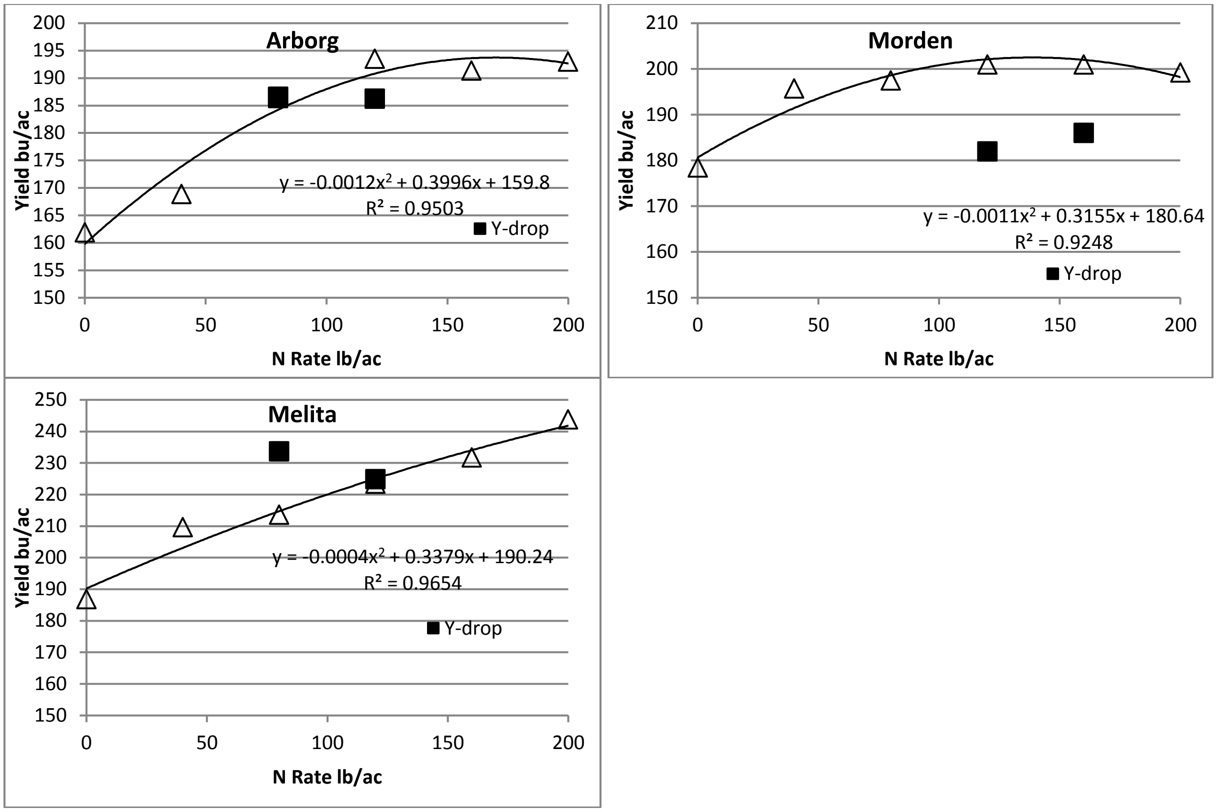
Corn did not respond to applied N at St Adolphe or Carberry sites, but responded significantly at Arborg and Melita and tended to increase at Morden (Figures 1-5).

The post plant applications to simulate the Y-drop applicator did not produce different yield than post plant surface applications of Super U. The exception was at Morden where the UAN application inadvertently splashed onto bottom leaves causing leaf burn and slightly lower yields (but non-significant). The application technique was modified to prevent such splash at other locations.

Few of the N decision methods or guides (Table 9) matched well with the actual N rate producing the most economic yield (Table 10). Even though visual N deficiency symptoms matched well with N rate at St Adolphe, Carberry, Arborg and Morden, they were not a particularly good guide for nitrogen sufficiency. Even where there was no yield response to N at St Adolphe, 9 of 10 plants had leaves with N deficiency symptoms (Table 4).







Figures 1-5. Nitrogen response of corn at St Adolphe, Carberry, Arborg, Morden and Melita.

Table 9. Decision criteria for N rate recommendations for corn.

Source	
MERN	*Determined using $5/bu corn and $0.50/lb N and by fitting a quadratic function to yield response (where applicable).*
Manitoba Agriculture	*Using N recommendations from soil fertility Guide for 130 bu/ac corn and soil test N.*[1]
NDSU	*Using N calculator based on soil texture, historic yields less than 160 bu/ac, soil test N and OM, $5/bu corn and $0.50 /lb N.*[2]
AgVise	*Using yield goal of 150 bu/ac for Morden and 125 bu/ac for other locations and soil test N.*
SPAD	*Sufficiency is the N rate when SPAD index is >95%.*
NDVI	*Using NUE web-based N rate calculator for Minnesota corn.*[3]
PSNT	*Measured on plots with base rate of 40 and using AgVise criteria for supplementation and yield goal of 150 bu/ac for Morden and 125 bu/ac for others. See Table 1 for PSNT amounts.*
Stalk nitrate	*Low (<250 ppm) = N was deficient, Marginal (250-700 ppm) = possible that N shortage limited yield, Optimal (700-2,000 ppm) = yield not limited by N shortage, Excessive (>2,000 ppm) = N rates was high or some other factor reduced yield.*

Table 10. Observed N response and predicted N needs.

Site	*St Adolphe*	*Carberry*	*Arborg (lb N/acre)*	*Morden*	*Melita*
MERN	***0***	***0***	***125***	***98***	***200+***
Mb Ag	*95*	*130*	*0*	*170*	*120*
NDSU	*0*	*95*	*0*	*112*	*93*
AgVise	*79*	*95*	*44*	*144*	*93*
SPAD	*-*	*40*	*120*	*40*	*120*
NDVI	*0*	*120*	*0*	*0*	*0*
PSNT	*10*	*75*	*10*	*128*	*55*
Stalk N	*80*	*-*	*-*	*80*	*-*

The lack of agreement between N guidelines and actual response may be caused by:

- Higher yields that we have previously experienced.
- Higher mineralization of N from organic matter.

Soil mineralization of organic matter obviously contributed greatly to the high check yields. A very crude calculation of N mineralization is shown in Table 11. The estimate is based on using a 1.12 lb whole plant N uptake/bu[4] less soil nitrate, less starter fertilizer N. The estimated mineralization values of 56 – 160 lb N/ac are much greater than normally anticipated. Unfortunately, measurements were not taken to allow consideration of nitrate-N from deeper depths or residual N at harvest.

Table 11. Crude estimate of nitrogen mineralization

Site	*St Adolphe*	*Carberry*	*Arborg lb N/acre*	*Morden*	*Melita*
Check Yield bu/ac	*202*	*120*	*154*	*178*	*187*
Est .N uptake[4]	*226*	*134*	*172*	*199*	*209*
Soil nitrate 0-2'	*71*	*55*	*106*	*35*	*57*
Starter fertilizer N	*4*	*6*	*10*	*4*	*4*
Mineralized N est.	*151*	*73*	*56*	*160*	*148*
Measured OM%	*7.7%*	*4.9%*	*8.6%*	*2.9%*	*4.0%*

Such high corn yields and large N mineralization rates challenge N recommendations developed with current preplant planning techniques. A next step would be to use combined models of soil N dynamics and crop growth adjusted with real-time weather information.

References

1) Manitoba Soil Fertility Guide. 1996. Manitoba Agriculture
2) Franzen. 2014. Soil Fertility Recommendations for Corn. NDSU SF722
3) http://www.nue.okstate.edu/SBNRC/mesonet.php
4) Bender et al. 2013. Better Crops. Vol.97 No. 1 p7-10.

Manitoba Corn Growers Silage corn variety evaluation trial

Nirmal Hari, James Lindal, Roger Burak

Collaborators

Manitoba Corn Growers Association

Background and Objectives

In Western Canada, barley is still the major silage crop. However, corn acres are also going up in the recent years. Statistical Canada predicted a 38% rise in corn acres in 2017 in Manitoba as compared to 2016. The difference in producing corn silage in the environment of the prairie of Western Canada than in southern Ontario and the U.S. Corn Belt is we have a shorter growing season. Now with the short-season corn varieties available, producers have more options to grow silage corn.

Manitoba Corn Growers Association coordinates varietal evaluation of potential new silage corn varieties in the province. These varietal trials are done at different sites in the province and Arborg is one of the site. This trial was conducted to see production potential of different silage corn varieties in Interlake region.

Materials and Methods

Design – Replicated Block design

Replications – Three

Number of Varieties – 23

Seeding date – May 20

Seeding rate – 28,000 plants/acre

Fertilizer – 90 lbs/acre of P at seeding

Harvesting date – Oct 13

Weed Control – Glyphosate @ 0.5L/acre at June 10 and July 15

During harvesting, 500 grams of silage sample were taken from each plot and were sent to laboratory for quality analysis. These samples were assessed for % TDN, ADF and NDF. Yield data were analyzed using ANOVA and the means were separated using least significant difference (LSD test at p = 0.05.

Results

Silage corn varieties tested in the trial did not differ in term of yield (Table 1). The yield ranged from 16.64 – 23.09 Mt/acre and numerically variety DKC 30-19RIB produced higher yield. The trial CV was 11.7% showing that the results are presentable. Different corn varieties varied in the moisture level at harvest and it ranged from 46.6 -55.7%. Please see table 1 for more details.

Project Findings

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

Table 1. Silage varieties performance at Arborg site during 2016.

CHU1	Hybrid	Distributor	65% Yield (Mt/ac)	Moisture at harvest (%)	TDN (%)	ADF (%)	NDF (%)
2125	A4177G3 RIB	PRIDE Seeds	16.66	48.31	67.74	28.92	49.46
2125	LR 9474VT2PRIB	Legend Seeds	18.32	52.36	66.46	30.12	52.01
2150	YUKON R	ELITE	20.6	49.47	66.42	30.16	53.74
2150	PV 60075 RIB	CPS-Proven Seed	20.14	49.01	67.78	28.88	49.68
2175	PS 2210VT2P RIB	DLF Pickseed	20.29	50.66	71.94	24.99	44.60
2200	A4415G2 RIB	PRIDE Seeds	18.33	49.16	65.46	31.06	53.68
2200	LR 9676VT2PRIB	Legend Seeds	19.64	49.03	67.96	28.72	49.76
2200	TH4578	Thunder Seeds	22.22	48.44	68.87	27.86	48.60
2200	TH7677	Thunder Seeds	17.9	51.33	69.75	27.04	47.39
2200	FUSION RR	ELITE	18.66	48.18	67.13	29.49	53.33
2200	E47A17 R	ELITE	20.16	50.09	74.45	22.64	39.45
2200	PS 2320RR	DLF Pickseed	20.39	48.18	68.43	28.28	50.14
2225	TH7578	Thunder Seeds	20.21	49.46	64.97	31.51	52.45
2250	LR 9579RR	Legend Seeds	22.8	54.2	70.01	26.80	46.06
2250	TH4126	Thunder Seeds	20.64	51.66	67.86	28.81	48.86
2250	X14123VH	DOW Seeds	19.45	54.95	68.42	28.29	48.54
2250	4085	DOW Seeds	20.41	48.35	68.39	28.31	48.86
2300	DKC 30-19RIB	DEKALB	23.09	46.6	70.88	25.98	45.41
2300	A4705HMRR	PRIDE Seeds	16.64	51.17	67.24	29.39	50.50
2300	DS80A27	DOW Seeds	17.63	49.5	73.18	23.83	44.09
2350	TH 7681	Thunder Seeds	18.15	55.77	71.00	25.87	46.15
2400	E50P52 R	ELITE	19.86	53.61	67.65	29.01	51.11
2600	X14225SX	DOW Seeds	19.97	55.76	69.59	27.19	49.70
	LSD			5.3			
	CV (%)		11.7	6.3			

Oilseeds

Flax Council of Canada Agronomy Trials

Nirmal Hari, Roger Burak, James Lindal

Collaborators

Rachel Evans, Flax Council of Canada

Background and Objectives

There is a sizeable gap between the yield potential of flax and the average yields observed in the Prairies. Whereas the 10-year average yield for Manitoba is 21 bu/acre (Yield Manitoba 2016), Flax Council of Canada (FCC) has set up an ambitious goal to raise yield levels up to 32 bu/acre by 2025.

In order to achieve higher yields on a commercial scale, best management practices (BMPs) are required. FCC planned four flax research trials to develop BMPs for the following elements:

A) Seed treatment and fertilizer rates;

B) Seeding date, rate and row spacing;

C) Herbicides and fungicide use; and

D) Crop stubble and flax production interaction.

An "ideal plot" treatment was used in the trials to characterize optimal agronomic practices and inputs. The 16 factors associated with the "ideal" plot are as follows:

Field selection

1. Use well-drained soil with very little salt.
2. Seed on pulse or cereal stubble.

Pre-seeding

3. Test soil for macro and micronutrients.
4. Apply pre-seeding herbicide (Authority® at 118 ml/acre; glyphosate at recommended rate for the corresponding formulation).
5. Treat seed with fungicide (Insure Pulse® at 300 ml/100 kg of seed).

Fertility management

6. Fertilize to 45 bu/ac yield target.
7. Optimize seed-placed fertilizer (15 lb/ac actual phosphate; zinc, if deficient, as Mosaic MicroEssentials Zinc®).
8. Side-band or mid-band remaining fertilizer, if possible.

Seeding

9. Use a high yielding variety (CDC Glas)
10. Target seeding on May 15th.
11. Seed at 9.6" row-spacing or similar 'regular' commercial row-spacing.

12. Seed at 45 lb/ac.
13. Seed at <1" depth

Pest, disease and pre-harvest management

14. Priaxor® for pasmo control (120 ml/ac).
15. All recommended herbicides, as required.
16. Desiccate at maturity with glyphosate (360 g active ingredient/ac) or Reglone®.

Flax trial D – Effect of stubble on the flax performance

Flax heavily relies symbiotic associations with arbuscular mycorrhizal fungi (AMF) to take up nutrients like phosphorus, which make it sensitive to previous crop stubble. Manitoba flax yields are lower (83% of check) when flax is planted on *Brassica* stubble. Canola does not rely on AMF to access phosphorus in the soil, so in canola years AMF are not supplied with their food source and populations decline. This results in fewer fungi populations for flax to associate with if seeded on canola stubble and causes a decrease is phosphorus uptake by flax. Cereals and pulses do associate with AMF, so they are a better stubble seeding option. A study by AAFC researchers found that flax grown on wheat stubble had greater establishment, early season biomass, phosphorus accumulation and higher yield than flax grown on canola. The objective of this trial was to demonstrate and quantify yield differences from varying previous crop stubble on flax yield.

Results

PESAI conducted trials A and C during 2016 season but unfortunately deer damaged the flax plots just before harvesting. For trial D, different stubble crops (Wheat, Peas, Flax, Corn, Soybean, and Canola) were successfully established in 2016 and the research will be continued in 2017.

Project findings

The trials A, C and D will be continued in 2017 at PESAI Arborg site.

References

[1] Yield Manitoba 2016. Table: Manitoba average crop yields, p. 6.
http://www.mmpp.com/mmpp.nsf/ym_2016_full_issue.pdf

Special Crops / Special Projects

Hemp Fibre and Grain Variety Trial

Nirmal Hari, Roger Burak, James Lindal

Cooperator
Parkland Crop Diversification Foundation (PCDF)

Background and Objectives
Hemp is remarkably versatile, capable of producing large yields of both fibre and grain. Varieties grown primarily for fibre are typically taller than grain varieties, although dual-purpose varieties are also available.

Recent changes to legislation around hemp production are designed to simplify the process for growers. For a detailed list of those changes, see the Health Canada Notice to Industry, Section 56 Class Exemption in Relation to the Industrial Hemp Regulations (Health Canada 2016). It is expected that changes will enhance the industry's production and market development goals (Canadian Hemp Trade Alliance 2016).

A new company, Hemp Sense, will be setting up a hemp fibre processing plant in Gilbert Plains, Manitoba. The plant will buy fibre left after the grain harvest, and will process hemp grain. Contact Hemp Sense Inc at info@hempsense.net for details.

The present study was planned to evaluate different varieties of hemp for fibre and grain quality.

Materials and Methods
Varieties: 12, Replications: 4, Plot size: 8.22 m^2

Test design: Randomized Complete Block Design

Seeding date: May 17

Fertilizer applied: 27 lbs/acre of P, 100 lbs/acre of N, 15 lbs/acre of S

Pesticide applied: Roundup WeatherMax @ 0.5L/acre pre-plant

Results
Unfortunately, birds damaged the plots before grain harvesting.

Project findings
Hemp varietal evaluation will be continued in 2017.

References
Health Canada (2016). Notice to industry regarding *Section 56 Class Exemption in Relation to the Industrial Hemp Regulations.* http://files.constantcontact.com/c90c7f21401/15d47c8d-1dde-48b9-8012-ece14544f9a3.pdf (accessed December 20, 2016).

Canadian Hemp Trade Alliance (2016). CHTA AGM president's report. November 14, 2016, Saskatoon, SK.

Determining excess moisture effects on Canola

Nirmal Hari, Roger Burak, James Lindal

Cooperators

Derrick Chomokovski, Manitoba Agriculture
Laura Grzenda, Manitoba Agriculture
Bifrost Agricultural Sustainability Initiate Committee (*BASIC*)

Background & Objectives

Canola is quite susceptible to water logging and shows a yield reduction if exposed to excess moisture in the earlier phase of crop growth. Wet soils cause an oxygen deficiency, which reduces root respiration and growth. This reduces nutrient uptake, and if conditions persist, plants can die or prematurely senesce (Canola Council of Canada). With wet conditions, roots may be shallow and not able to access nutrients once the soils begin to dry. A few days in waterlogged soil can be enough to kill canola plants, and yield loss is certain — although as canola plants age, they tend to be more resilient.

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

Materials and Methods

This trial was conducted in a Randomized Complete Block Design with three replications. Three canola varieties were planted at three seeding rates (see below for details). This trial was conducted both under irrigated and non-irrigated (on tile drained land) set up using same randomizations. Plot size was 7.1m^2 with row-to-row spacing at six inches. The trial was seeded on June 11 and 100 lb/acre of nitrogen and 15 lb/acre of sulphur were broadcasted in the soil before seeding. Further, 27 lb/acre of phosphorous were applied at the time of seeding. Weed suppression was achieved spraying Liberty (1L/acre) on July 6.

1. **Variety** (maturity and height from Mid Season Zone Summary at www.canolaperformancetrials.ca)
    a. L130 – approximately 93 days maturity, 44 inches height
    b. L252 - approximately 95 days maturity, 44 inches height
    c. L261 - approximately 96 days maturity, 49 inches height
2. **Seeding rate**
    a. Low – target population 6 plants/ft^2 (75% survival)
    b. Average – target population 9 plants/ft^2 (75% survival)

c. High – target population 12 plants/ft^2 (75% survival)

3. **Water Stress:**
   a. Natural precipitation (no stress): This trial set was grown on tiled land to mimic the ideal growing conditions.
   b. Excess moisture: This trial set was conducted on non-tiled land. Irrigation was started towards end July and a total of 4 inches of rainfall were put on the crop during three weekly simulated irrigations. Afterwards, irrigation were discontinued for remainder of growing season to allow the flooded plants grow to maturity. A rain gauge was used to estimate the simulated irrigation that were put on the crop in the irrigated trial.

Arborg got almost three inches of natural rainfall both in May and June, two inches in July and four inches in August. Overall the growing season was good and Arborg experienced near normal (351 mm) rainfall during May-Sep period.

Plant height was measured at flowering. The plots were combined using wintersteiger plot combine and yield and moisture were determined using this combine. The data were analysed using REML analysis to find out the effect of variety, seeding rate and irrigation on plant height and yield. Treatment means were compared at P =0.05.

Results

Overall irrigation treatment significantly reduced plant height at flowering (Figure 1) but this effect was more pronounced in canola variety L261 (Figure 3 – LSD value of 10.7).

Irrigation significantly improved Canola yields (Figure 1). Irrespective of seeding rate and variety, irrigated canola yielded almost eight bushels/acre more than non-irrigated canola plots. Similarly, plots with higher and medium seeding rates yielded higher than plots having lower seeding rate of canola (Figure 2 – LSD value of 3.7). A significant interaction was found between varieties and irrigation treatments (Figure 3). Irrigated plots of Canola varieties L130 and L252 had more yield than their counterparts in non-irrigated plots. Seeding rate, variety and irrigation interactions were not significant.

Figure 1: Excess moisture effects on Canola plant height at flowering (cm) and yield (bu/acre)

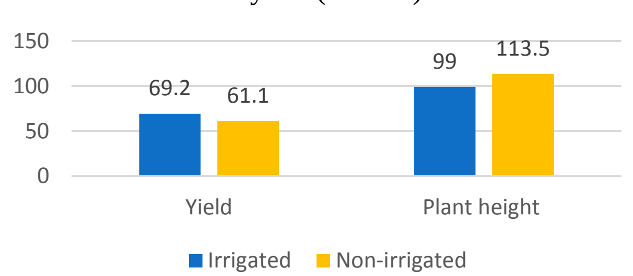
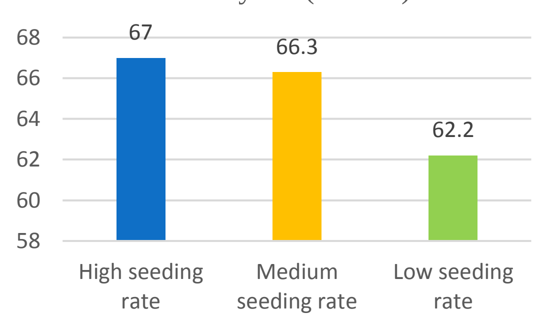
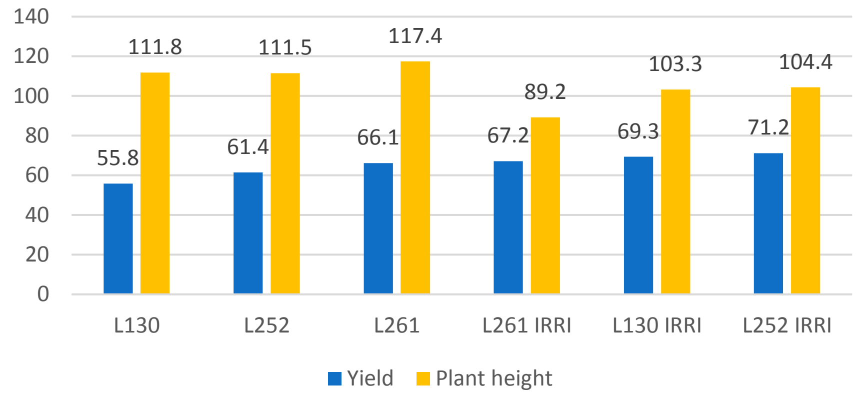


Figure 2: Seeding rate effects on Canola yield (bu/acre)



The current findings clearly demonstrated that four inches of excess moisture stress did not have any negative effect on canola yield. Conversely, it increased canola yield. One possible explanation is as the irrigation was started late in the season (end July) and the crop had already grown by that time, canola got benefitted from excess moisture rather than exhibiting any stress. The test canola varieties were efficient in using excess moisture for increasing yield if applied later in the season. Varietal differences existed in utilizing excess moisture and canola varieties L130 and L252 were more efficient.

Figure 3: Irrigation-variety interaction effects on plant height at flowering (cm) and canola yield (bu/acre)



Project findings

Irrigation treatment had effects on canola growth and yield. This is the first year of trial and it will be repeated again in 2017 with more observations on days to maturity and lodging, etc.

References

Canola Council of Canada. https://www.canolacouncil.org/.

Determining excess moisture effects on different flax varieties

Nirmal Hari, Roger Burak, James Lindal

Cooperators

Derrick Chomokovski, Manitoba Agriculture
Laura Grzenda, Manitoba Agriculture
Bifrost Agricultural Sustainability Initiate Committee (*BASIC*)

Background / Objectives

Over the growing season, flax water use may be as high as 41 cm (16 in.). During the seedling stage, water use will range from 1 to 3 mm/day, rising to a high of 7 mm/day during the flowering stage. The critical water requirement period for flax is from flowering to just prior to seed ripening (Saskatchewan Flax Development Commission). However, excess water at early crop stages might affect flax adversely. Chlorosis can occur on flax when soil moisture is high, particularly on calcareous (high lime) soils and it can significantly affect flax productivity. The flax variety AC Emerson has shown the greatest tolerance to chlorosis conditions (Manitoba Agriculture).

Flax reaction to excess moisture varies considerably depending on crop stage and soil type. A recent study from Manitoba shows that irrigation increased total average yield of flax, even when conditions of excess moisture were prevalent in 2016 (Cavers et al, 2017).

The current study was undertaken to understand excess moisture effects on different flax varieties. Eight commonly grown flax varieties were planted in a replicated trial both under irrigated and non-irrigated set up to see if there is any irrigation-variety interaction towards flax productivity.

Materials and Methods

Eight flax varieties were planted in a randomized block design and same randomizations were followed both in irrigated and non-irrigated trials. Non-irrigated trial was conducted on tile-drained land to mimic the ideal growing conditions. The trial details are as follows:

Treatments:	Eight varieties (Figure 1)
Replications:	Three
Plot size:	1.18m x 6m
Seeding date:	June 13, 2016
Fertilizer applied:	60 lbs. actual N, 15 lbs actual S and 27 lbs. actual P
Weedicide applied:	July 6 – Mextrol (0.5L/acre)
Harvest date:	Oct 28 (irrigated) and Nov 7 (non-irrigated)

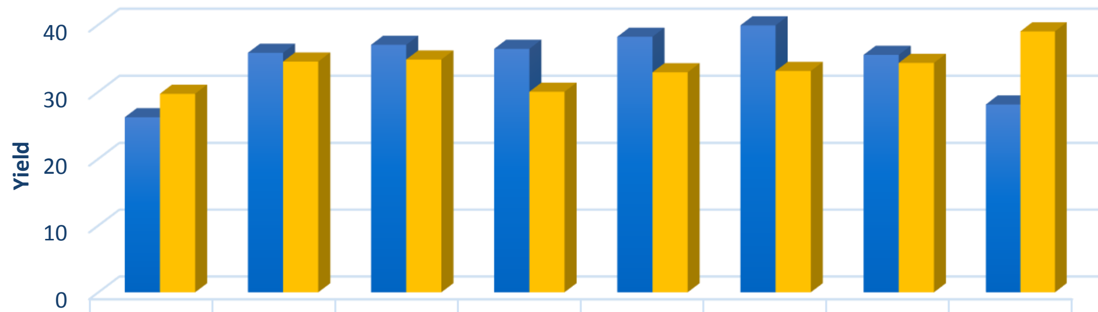
In non-irrigated trial, natural precipitation was recorded during 2016 growing season and it was near normal (351 mm from May-Sep). Irrigated trial was done on non-tiled land and a total of four inches of simulated rainfall was put on it starting late July and ending mid August. Afterwards irrigation was discontinued for remainder of the growing season.

Data on plant population were taken two weeks after emergence. Afterwards plant height at flowering and days to maturity (75% brown bolls) were recorded from each plot. Plots were harvested using Wintersteiger combine and yield and moisture were recorded. Data was analysed using REML analysis and means were separated at P = 0.05.

Results

There was no difference in flax yield between irrigated (34.4 bushels/acre) and non-irrigated treatments (33.5 bushels/acre) when data were combined over flax varieties. However, irrigation-variety interaction showed significant results (Figure 1). Flax variety CDC Sorrel suffered significant yield loss (about 11 bushels/acre), when grown under irrigated conditions. On the other hand, flax varieties Emerson and Prairie Saphire produced more yield (about 6.5 bushels/acre) with irrigation. All other flax varieties were similar in yield both under irrigated and non-irrigated trial sets.

Figure 1 : Effect of excess moisture on flax varieties yield (bu/acre)



	AAC Bravo	FP 2422	CDC Plava	Emerson	CDC Glas	Prairie Saphire	CDC Bethune	CDC Sorrel
Irrigated	26.2	35.8	37	36.4	38.2	39.9	35.5	28.1
Non-irrigated	29.7	34.5	34.8	30	32.9	33.1	34.3	39

Flax varieties AAC Bravo and CDC Sorrel had significantly less yield than all other flax varieties under irrigation while Prairie Saphire was the top yielder. On the other hand, CDC Sorrel out yielded all other flax varieties in non-irrigated trial (Figure 1).

Table 1. Excess moisture effects on plant height and days to maturity of different flax varieties.

	Plant height at flowering (cm)		*Days to Maturity*	
Variety	*Irrigated*	*Non-irrigated*	*Irrigated*	*Non-irrigated*
AAC Bravo	*61.8*	*36.4*	*121*	*122*
FP 2422	*66.0*	*49.1*	*112*	*112*
CDC Plava	*65.2*	*42.3*	*118*	*118*
Emerson	*65.2*	*44.9*	*109*	*116*
CDC Glas	*65.2*	*37.3*	*124*	*124*
Prairie Saphire	*66.9*	*51.6*	*118*	*124*
CDC Bethune	*65.2*	*43.2*	*119*	*116*
CDC Sorrel	*70.3*	*46.6*	*124*	*122*
LSD	*7.1*	*9.1*	*4.7*	*6.4*
CV(%)	*6.1*	*11.9*	*2.3*	*3.1*
P	*0.46*	*0.03*	*<0.001*	*0.008*

Plant population did not differ among different flax varieties both in irrigated and non-irrigated trials. Plant height at flowering did not vary among different flax varieties, when grown under irrigation (Table 1). Plant height differences, however, were evident among flax varieties in non-irrigation set. Irrigation resulted in 1.3-1.7 times increase in plant height in the flax varieties.

Different flax varieties varied in terms of days to maturity when grown under irrigated or non-irrigated conditions (Table 1). Irrigation has significant effect on flax varieties Emerson and Prairie Saphire and they took less number of days to mature in comparison to their plots grown under non-irrigated conditions.

Project findings

Irrigation had significant effects on flax growth and yield. In general, four inches of irrigation did not cause any reduction in flax yield. Flax varieties, however, showed variability in their reaction to excess moisture and it needs further testing. This is the first year of trial and this trial will be repeated in 2017.

References

Cavers, C. G., Fitzmaurice, J. L. and Grieger, L. (2017) Effect of Tillage Method and Soil Moisture Conditions on Crop Yields: A Preliminary Assessment. *Manitoba Agronomists Conference* Dec 13-14, 2017.

https://saskflax.com/growing/seeding.php.