IHARF

INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

2015 Annual Report

IHARF

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Introduction

The Indian Head Agricultural Research Foundation (IHARF) is a non-profit, producer directed applied research organization which works closely with various levels of government, commodity groups, private industry and producers.

Founded in 1993, the Mission of IHARF is to promote profitable and sustainable agriculture by facilitating research and technology transfer activities for the benefit of its members and the agricultural community at large.

IHARF Mandate

- Identify new research priorities required to meet the needs of agriculture now and in the future.
- Support public good research - research that has value to the public but is not tied to studying or promoting a specific product or service.
- Maintain strategic alliances with the agricultural community in order to strengthen the provincial research base.
- Play an active role in the technology transfer process and be involved in public education and awareness activities.
- Maintain a scientific research base at the Indian Head Research Farm.

IHARF Board of Directors

IHARF is led by a nine member Board of Directors consisting of producers and industry stakeholders who volunteer their time and provide guidance to the organization. Residing all across south eastern Saskatchewan, IHARF Directors are dedicated to the betterment of the agricultural community as a whole. The 2015 IHARF Directors included:

- Chris Brown - President *(Indian Head)*
- Travis Wiens - Vice President *(Milestone)*
- Terry Rein - Secretary / Treasurer *(Indian Head)*
- Fred Stilborn *(Balcarres)*
- Rick Procyk *(Fillmore)*
- Kyle Heggie *(Leross)*
- Cameron Gibson *(Kendal)*
- Ivan Ottenbreit *(Grayson)*
- Doug Hannah *(Foam Lake)*

Ex-Officio

IHARF receives additional guidance from an experienced team of Agriculture and Agri-Food Canada (AAFC) personnel at the Indian Head Research Farm, they included:

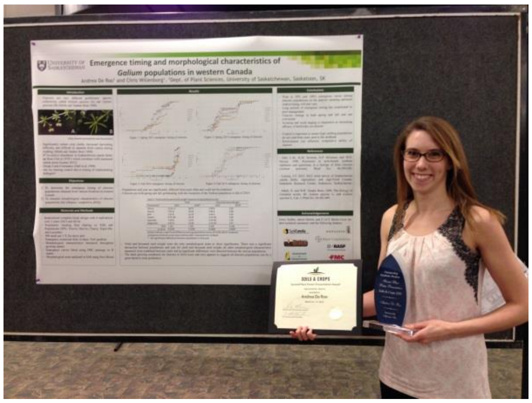
- Henry de Gooijer - Coordinating Biologist
- Bill May - Research Scientist
- Chris Omoth - Research Assistant

IHARF Staff

The 2015 team of IHARF staff included:

- Danny Petty - Executive Manager
- Chris Holzapfel - Research Manager
- Christiane Catellier - Research Associate
- Karter Kattler - Field & Plot Technician
- Dan Walker - Seasonal Technician
- Carly Miller - Summer Student

Dr. Guy Lafond Memorial Award



Guy had a passion for agricultural research and was dedicated to the advancement of the industry. He was instrumental in establishing the Indian Head Agricultural Research Foundation, and believed in IHARF's Mission, Mandate and the training of young agronomists.

The first recipient of the Dr. Guy Lafond Memorial Award was Andrea De Roo from Fairlight, Saskatchewan. Andrea is completing her Masters in Plant Sciences at the University of Saskatchewan, studying the genetic and morphological characterization of *Galium* species (cleavers) in western Canada.

Extension Events

Indian Head Crop Management Field Day

On July 21, 2015, IHARF hosted the annual Indian Head Crop Management Field Day. 217 producers and agronomists from across the Prairies came for tours led by IHARF, AAFC, University of Saskatchewan and industry specialists. Tours and presentations were provided by:

- Chris Holzapfel (IHARF)
- Andrea De Roo (University of Saskatchewan)
- Bill May (AAFC)
- Eric Johnson (University of Saskatchewan)
- Dr. Tom Warkentin (University of Saskatchewan)
- Dr. Kelly Turkington (AAFC Lacombe)
- Barb Ziesman (Saskatchewan Ministry of Agriculture)
- John Heard (Manitoba Agriculture, Food and Rural Development)
- Sherrilyn Phelps (Saskatchewan Pulse Growers)

AgriARM Research Update

On January 14, 2016, IHARF, along with Agriculture Applied Research Management (AgriARM) sites from across the province, jointly hosted the AgriARM Research Update. The event highlighted components of each organization's applied research and demonstration programs. Presenters for the day included:

- Chris Holzapfel (IHARF)
- Mike Hall (East Central Research Foundation)
- Dr. Ron Palmer (IHARF)
- Lana Shaw (South East Research Farm)
- Stu Brandt (Northeast Agriculture Research Foundation)
- Jessica Pratchler (Northeast Agriculture Research Foundation)
- Gazali Issah (Western Applied Research Corporation)
- Blake Weiseth (Wheatland Conservation Area)
- Gary Kruger (Saskatchewan Ministry of Agriculture , ICDC)

Presentations from each speaker are available for download at **www.agriarm.ca**.

IHARF Soil and Crop Management Seminar

On February 3, 2016, IHARF hosted its annual winter seminar in Balgonie, SK, highlighting results of the 2015 season and current industry issues. Over 200 guests took in presentations delivered by:

- Chris Holzapfel (IHARF)
- Bill May (AAFC)
- Dr. Tom Wolf (Agrimetrix Research & Training)
- Nathan Gregg (Prairie Agricultural Machinery Institute)
- Dr. Jamie Larsen (AAFC Lethbridge)
- Glen Blahey (Canadian Agricultural Safety Association)
- Ashlyn George (Lost Girls Guide to Finding the World)

Presentations from each speaker are available for download at **www.iharf.ca**.

2015 IHARF Partners

Every year, IHARF works with many organizations dedicated to advancing agriculture into the future. IHARF would like to thank all of our partners for their outstanding support of our efforts in 2015:

Platinum

- Agriculture & Agri-Food Canada - Indian Head Research Farm
- Agriculture & Agri-Food Canada - AgriInnovation Program
- BASF
- Bayer CropScience
- Canada / Saskatchewan ADOPT Program
- Saskatchewan Canola Development Commission
- Saskatchewan Ministry of Agriculture
- Saskatchewan Pulse Growers
- Western Grains Research Foundation

Gold

- Agriculture Development Fund
- IntraGrain Technologies
- Koch Agronomic Services
- Quarry Seed
- Syngenta

Silver

- Agriculture Funding Consortium
- Agrisoma Biosciences
- Dow AgroSciences
- Ducks Unlimited Canada
- E. I. du Pont
- Pioneer Hi-Bred
- Engage Agro
- Markusson New Holland
- Mustard 21
- Mosaic
- Saskatchewan Flax Development Commission
- Town of Indian Head
- University of Saskatchewan
- Yara

Bronze

- Crop Production Services
- Dekalb
- Delage Farms
- Farm Credit Canada
- FendX
- FMC of Canada
- HCI Ventures
- Monsanto BioAg
- NorthStar Genetics
- Paterson Grain
- Saskatchewan Wheat Development Commission
- SeedMaster
- TD Canada Trust
- Weather INnovations
- Wheatland Financial – Paul Kuntz

AgriARM

The Saskatchewan AgriARM (Agriculture Applied Research Management) program connects eight regional, applied research and demonstration sites into a province wide network. Each site is organized as a non-profit organization, and is led by volunteer Boards of Directors, generally comprised of producers in their respective areas.

Each site receives base-funding from the Saskatchewan Ministry of Agriculture to assist with operating and infrastructure costs; with project-based funding sought after through various government funding programs, producer / commodity groups and industry stakeholders. AgriARM provides a forum where government, producers, researchers and industry can partner on provincial and regional projects.

The eight AgriARM sites found throughout Saskatchewan include:

- Conservation Learning Centre (CLC), Prince Albert
- East Central Research Foundation (ECRF), Canora
- Indian Head Agricultural Research Foundation (IHARF), Indian Head
- Irrigation Crop Diversification Corporation (ICDC), Outlook
- Northeast Agriculture Research Foundation (NARF), Melfort
- South East Research Farm (SERF), Redvers
- Western Applied Research Corporation (WARC), Scott
- Wheatland Conservation Area (WCA), Swift Current

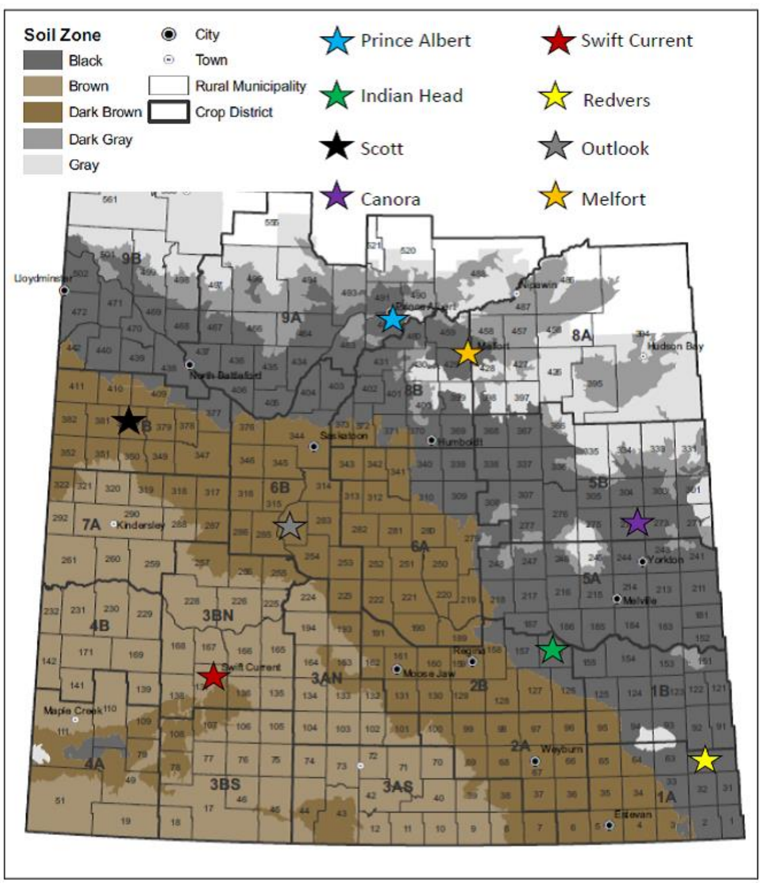


Figure 1. Locations of organizations comprising the Saskatchewan AgriARM Network.

Environmental Data

Weather data for Indian Head, Melfort, Scott, and Swift Current, Saskatchewan, are provided, as many of the studies were conducted at these locations and the data were combined for analyses. Data were obtained from an Environment Canada weather station found at each site, and accessed online [http://www.climate.weatheroffice.gc.ca/climateData/canada_e.html].

The 2015 growing season produced above average yields and quality amongst the crops grown at Indian Head. The spring began with adequate soil moisture levels which were required to carry the crop, as the first significant rainfall event didn't take place until the end of June. After that, Indian Head received timely rains and favorable growing conditions throughout the season. Though harvest was wrapped up relatively close to the long term average, as harvest went on, more rain events did delay field operations and the harvest of longer season crops.

Table 1. Mean monthly temperatures for the2015 growing season and long-term normals (1981-2010).

		Apr	May	Jun	Jul	Aug	Sep	Oct
					°C			
Indian Head	2015	4.8	10.0	16.2*	18.1	17.0	12.8	6.6
	normal	4.2	10.8	15.8	18.2	17.4	11.5	4.0
Melfort	2015	3.8	9.9	16.4	17.9	17.0*	11.9	6.6
	normal	2.8	10.7	15.9	17.5	16.8	10.8	3.3
Scott	2015	5.1	9.4	16.0*	18.1	16.8	11.0	6.1
	normal	3.8	10.8	15.3	17.1	16.5	10.4	3.3
Swift Current	2015	6.1*	10.0*	16.9*	19.2*	19.1*	12.9*	7.7*
	normal	5.2	10.9	15.4	18.5	18.2	12.0	5.1

* The value displayed is based on incomplete data

Table 2. Total monthly precipitation for the 2015 growing season and long-term normals (1981-2010).

		Apr	May	Jun	Jul	Aug	Sep	Oct	Total
					mm				
Indian Head	2015	9.5	15.6	38.3*	94.6	58.8	67.8*	39.0	323.6*
	normal	22.6	51.7	77.4	63.8	51.2	35.3	24.9	326.9
Melfort	2015	34.4	7.1	54.8	149.8	57.4*	70.0	33.0	406.5*
	normal	26.7	42.9	54.3	76.7	52.4	38.7	27.9	319.6
Scott	2015	15.4	4.1	19.4*	46.4	74.5	49.6	30.5	239.9*
	normal	21.6	36.3	61.8	72.1	45.7	36.0	17.9	291.4
Swift Current	2015	8.4*	0.0*	15.3*	93.2*	19.1*	44.9*	23.5*	204.4*
	normal	19.9	48.5	72.8	52.6	41.5	34.1	18.1	287.5

* The value displayed is based on incomplete data

Research

IHARF trials were situated at various locations in the Indian Head area, with the majority of projects located on NW26-18-12 W2 and NE27-18-12 W2. Each trial consisted of numerous plots, each representing a specific treatment being evaluated in that particular project (eg. rates, seed treatments, varieties, etc.). Apart from the specific treatments being evaluated, plots were generally cared for using best management practices and in a manner which was consistent with normal or typical practices in the Indian Head area. Deviations in agronomy and crop management have been specified where required as a result of the study objectives or treatments being evaluated and are indicated in the description of each trial. In general, plots were seeded as early as possible in mid-May to early June, with 8' x 35' plots and 12" row spacing using a SeedMaster air drill, or with 12' x 35' plots and 12" row spacing using a ConservaPak air drill. Cultivars and varieties were representative of those used by producers in the area, and recommended seeding practices (i.e. rate, depth) were typically used. Fertility and insect, weed and disease levels were normally kept non-limiting using commercial fertilizers and registered pesticide products so that yields would not be limited by anything other than the specific treatments being evaluated. Plots were desiccated or swathed when required, and harvested as closely as possible to the appropriate timing using a Wintersteiger plot combine, Kincaid-8 XP plot combine, or modified MF300 combine. Apart from the treatments being evaluated, all agronomy and crop management practices were consistent for every plot within a trial.

Statistical Analyses

The majority of trials were conducted using a randomized complete block design (RCBD), or a modified version of this experimental design, meaning each treatment is randomly assigned to plots within replicates (blocks). Split-plot designs were also frequently used. Treatments were replicated 4 times allowing for the statistical analyses of results to assess whether the observed differences in the responses (eg. plant density, height, seed yield) were an effect of the treatment being evaluated or due to natural variability or experimental error. If a difference between two treatments is significant, it should be repeatable and reasonably expected, under the conditions in which the trial was conducted. For agricultural research, a significance level of $\alpha=0.05$ is generally used, which more specifically indicates a 95% probability that an observed effect was caused by the treatment and was not due to random variability or experimental error.

In this report, statistical differences between treatments are represented by letters of the alphabet next to the observed mean (average) for each treatment. Treatment means with the same letter do not significantly differ, while means with different letters are significantly different from one another (Table 3). In the example below, there was no difference in plant density between the two treatments; however, Treatment 2 resulted in a significantly higher yield than Treatment 1.

Table 3. Example demonstrating how statistical results are presented in the report.

Treatment	**Plant Density** *(not significantly different)*	**Yield** *(significantly different)*
Treatment 1	87 a	32 b
Treatment 2	89 a	45 a

Units

Some data are reported in metric terms (i.e. yield responses shown in kilograms per hectare), particularly in cases where it was not practical to convert the values to bushels per acre (bu/ac), as in certain figures. For reference, yield values ranging from 1000-6000 kg/ha are shown with the corresponding values in bu/ac for each crop. Alternatively, multiplying the kg/ha by 0.8921 will provide the lbs/ac, making for an easy conversion to bu/ac.

Table 4. Conversion of kg/ha to bu/ac for various crops.

		kg/ha										
		1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000
Barley	bu/ac	18.6	27.9	37.2	46.5	55.8	65.1	74.3	83.6	92.9	102.2	111.5
Canola		17.8	26.8	35.7	44.6	53.5	62.5	71.4	80.3	89.2	98.1	107.1
Faba beans		14.9	22.3	29.7	37.2	44.6	52.0	59.5	66.9	74.3	81.8	89.2
Flaxseed		15.9	23.9	31.9	39.8	47.8	55.8	63.7	71.7	79.7	87.6	95.6
Oats		26.2	39.4	52.5	65.6	78.7	91.8	105.0	118.1	131.2	144.3	157.4
Peas		14.9	22.3	29.7	37.2	44.6	52.0	59.5	66.9	74.3	81.8	89.2
Soybeans		14.9	22.3	29.7	37.2	44.6	52.0	59.5	66.9	74.3	81.8	89.2
Wheat		14.9	22.3	29.7	37.2	44.6	52.0	59.5	66.9	74.3	81.8	89.2

Disclaimer

Disclosure of trade names does not imply any endorsement or disapproval of any specific product(s) and is only intended to differentiate treatments and allow producers to identify the specific technologies being demonstrated in the marketplace.

The Effect of Fungicide Application Timing on Disease Severity and Grain Yield of Winter Wheat

Description

Winter wheat response to foliar fungicide applications is not well documented in western Canada; however, foliar fungicides may provide an economic method for control of leaf and head diseases in situations where moisture conditions are favourable and yield potential is high. Local growers are becoming experienced in using foliar fungicides, but are unsure about the most effective timing of application or whether dual applications are economically viable. The objective of this study was to evaluate the yield and quality response of winter wheat to foliar fungicide applications at the flag leaf stage, early heading and both stages. The foliar fungicide treatments consisted of: 1) an untreated check, 2) a flag leaf application of Twinline (202 mL/ac), 3) an early heading application of Prosaro (324 mL/ac), and 4) both the flag leaf and early heading applications.

Results

Severity of leaf disease was rated using the McFadden scale (1-12) on ten plants per plot at the milk stage. Leaf disease was significantly higher in the check than with any fungicide timing application at Indian Head in all years. Differences in leaf disease between the two applications timings were likely a result of conditions experienced at different growth stages in a specific year; however, a dual application of fungicide often resulted in significantly less leaf disease than a single application (Figure 2).

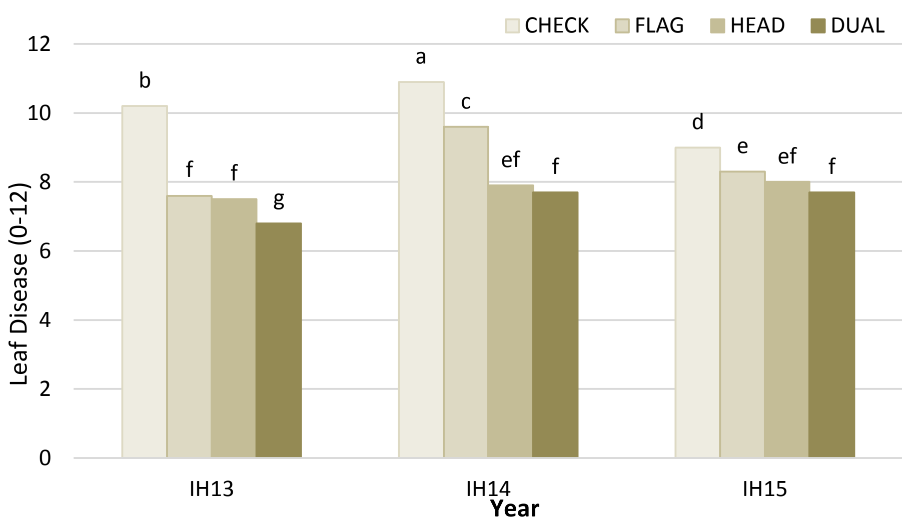


Figure 2. Winter wheat leaf disease severity as affected by different timings of foliar fungicide treatments.

Fusarium head blight (FHB) was assessed by rating the percent spike area affected for a minimum of 50 heads per plot at the milk stage. The FHB index is the product of the percent of infected heads (FHB incidence) and the percent area affected in the infected heads (FHB severity). Incidence of FHB in 2014 was particularly high due to a favorable disease environment, whereas no FHB was observed on plants in 2015 when the environment was extremely dry. When data from 2013 and 2014 were combined, the early heading fungicide application was the most successful in reducing FHB (Figure 3).

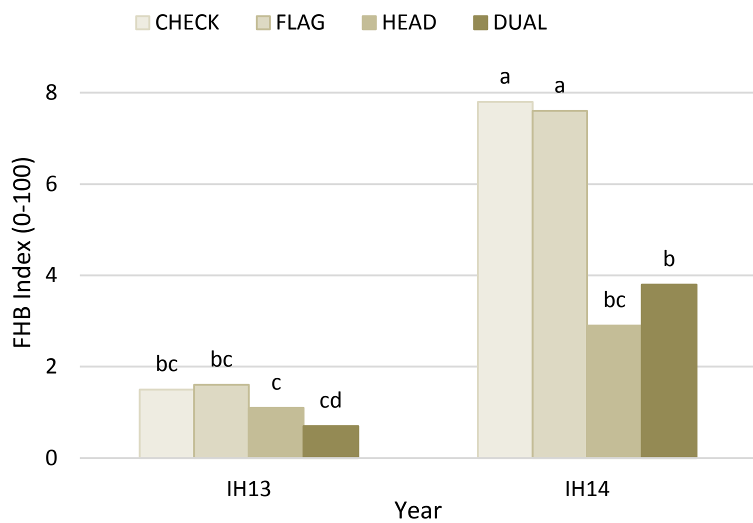


Figure 3. Winter wheat FHB index as affected by different timings of foliar fungicide treatments.

Yield response to fungicide application was similar over the three years. All fungicide application timings resulted in a significant increase in yield over the untreated check. There was no difference in yield between the two fungicide timings. There was a significant yield benefit with a dual application over single applications in 2014 only, when disease pressure was high (Figure 4).

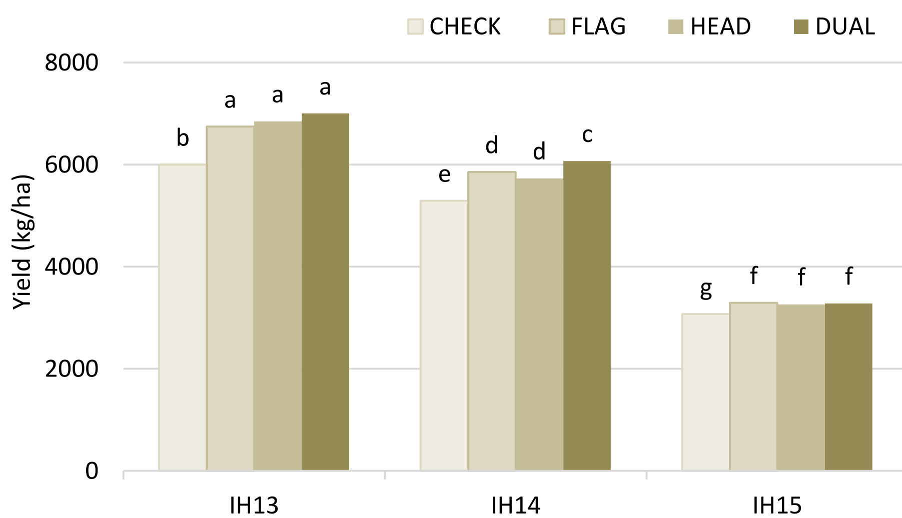


Figure 4. Winter wheat grain yield as affected by foliar fungicide treatments at Indian Head.

Conclusions

Both fungicide application timings tended to reduce leaf disease; however, only the later application reduced FHB infection. A dual application did not consistently provide an improvement over a single application at early heading, and choosing products registered for suppression of FHB (i.e. Prosaro, Caramba, etc.) can also protect against leaf disease later in the season. Thus, producers may achieve the most consistent benefits by deferring fungicide application until early heading, unless disease pressure is high early in the season.

Acknowledgements
This project was supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward 2 bi-lateral agreement, with in-kind support provided by Syngenta, Bayer CropScience and BASF.

Seed Treatment, Seeding Rates, and Foliar Fungicide Effects on Winter Wheat Yield and Quality

Description

One of the greatest challenges in winter wheat production is successful establishment and overwintering of the crop. One of the more effective methods of improving winter wheat establishment is to use higher seeding rates; however, the benefits to increased seeding rates ultimately need to be weighed against higher seed costs. Previous studies have shown that seed treatments were also effective for improving plant stands, winter survival and yield. In addition, foliar fungicides may provide an economic method for control of leaf and head diseases and recent field demonstrations have suggested that winter wheat is quite responsive to foliar fungicide. The objectives of this project were 1) to demonstrate the effects of using seed treatments and/or higher seeding rates to improve winter wheat establishment and 2) to investigate potential interactions between plant populations, seed treatments and foliar fungicide applications for winter wheat. Treatments are outlined in Table 5.

Table 5. Treatments evaluated in winter wheat establishment and disease management trial.

Trt	Seeding Rate (seeds/m^2)	Seed Treatment[Z]	Foliar Fungicide[Y]
1	200	no	check
2	300	no	check
3	400	no	check
4	200	treated	check
5	300	treated	check
6	400	treated	check
7	200	no	Fungicide
8	300	no	Fungicide
9	400	no	Fungicide
10	200	treated	Fungicide
11	300	treated	Fungicide
12	400	treated	Fungicide

[Z] Raxil Pro at 325 mL/100 kg seed
[Y] Twinline 0.2 L/ac at flag leaf and Prosaro 250 EC 0.324 L/ac at early heading

Results

Winter wheat establishment was estimated by measuring early season NDVI, an indirect measure of plant health and above-ground biomass. Unlike previous years, there was no effect of seed treatment or seeding rate on early-season NDVI in 2015 (data not shown, see 2013-2014 IHARF annual reports). Similar to previous years, however, the use of a fungicide and seed treatment had positive effects on yields and test weights (Table 6). Unexpectedly, yields and test weights were highest at the lowest seeding rate in 2015. This was likely due to extremely dry conditions early in the season combined with the delay in maturity that is often observed at lower seeding rates.

Table 6. Effect of fungicide, seed treatment, and seeding rate on winter wheat at Indian Head in 2015.

	Yield (kg/ha)	**Test Weight** (g/0.5L)
Seed Treatment		
Check	3369 b	396.8 b
Treated	3473 a	399.1 a
Seeding Rate		
200	3530 a	398.9 a
300	3390 b	397.4 b
400	3343 b	397.4 b
Fungicide		
Check	3336 b	396.4 b
Treated	3507 a	399.4 a

Conclusions

Seed treatments are a reasonably low cost tool that protect against seed decay and diseases, helping the crop get off to a strong start, and increasing the likelihood of successful overwintering. The response to seed treatments in these trials (including previous years) was strong with significant impacts on crop establishment and grain yield. The response to seeding rate in 2015 was influenced by non-typical weather conditions, thus producers should continue to follow the recommended seeding rate of 300 seeds/m^2 or higher when using treated winter wheat to increase the probability of strong establishment and overwintering. Foliar fungicide application has also consistently resulted in a significant yield benefit in winter wheat in these trials at Indian Head.

Acknowledgements

This project was supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward 2 bi-lateral agreement, with in-kind support provided by Syngenta, Bayer CropScience and BASF.

Limiting Losses and Improved N Efficiency in Winter Wheat through Stabilized N Application

Beres, B. (AAFC), Holzapfel, C. (IHARF), Hall, L. (U of A), and Mohr, R. (AAFC).

Description

Urea is the most widely used form of nitrogen fertilizer but is susceptible to environmental losses, depending on factors including temperature, soil texture, soil organic carbon, and whether products are incorporated. Urease and nitrification inhibitors may slow the process, retaining fertilizer nitrogen in the soil and gradually providing nitrogen to the crop. In addition to nitrogen placement, form and application timing, these products provide additional options for reducing environmental N losses. The objective of this project was to determine if N stabilizers can mitigate losses associated with N applications in winter wheat systems where some of the entire crop N requirements are applied in the fall. The 13 treatments evaluated were a combination of four N fertilizer forms (untreated urea; Instinct; SuperU; and ESN), and three different timing/placement treatments (100% side-banded at seeding; 30% side-banded with 70% broadcasted in the late fall; and 30% side-banded with 70% broadcast in the spring), plus a control (no N fertilizer applied). Instinct is a nitrification inhibitor, SuperU is a nitrification and urease inhibitor, and ESN is a slow-release polymer coated urea.

Results

The winter wheat yield response to the different N fertilizer products, timing, and placement is shown in Figure 5. These results include only data from Indian Head in 2015 and were not statistically analysed. In general, it appears that side-banding all N fertilizer at time of seeding produced the highest yields regardless of product. The N products appeared to negatively impact yield compared to untreated urea when N fertilizer was broadcasted in the fall or spring, and especially with ESN broadcasted in the spring.

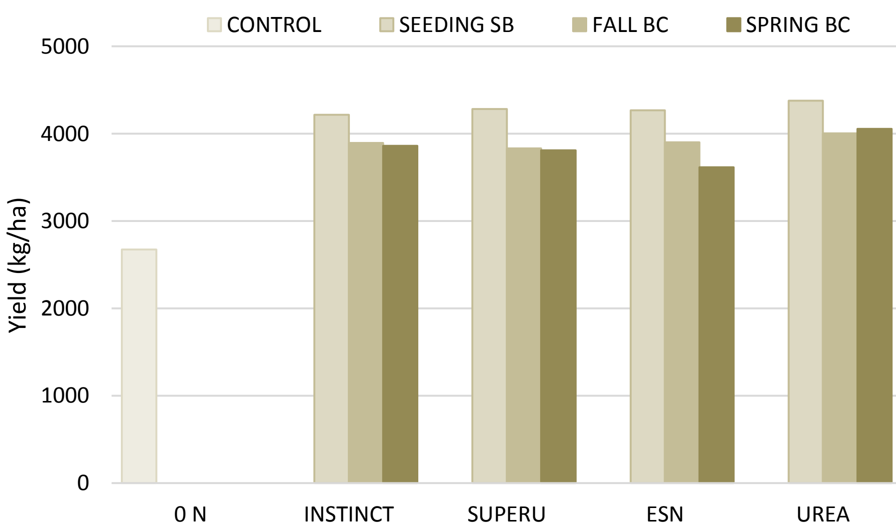


Figure 5. The effect of fertilizer product, placement, and timing on winter wheat yields at Indian Head in 2015.

Conclusions

The results are not conclusive as only one site-year of data is included. As N fertilizer losses are highly influenced by environmental conditions, the response seen at Indian Head in 2015 may or may not be typical, and it will be important to conduct this study at many sites over several years. This trial is being conducted at four sites and will be repeated in 2016. Final results with combined data analyses will be included in future annual report(s).

Acknowledgements

Support for this project was provided by Ducks Unlimited Canada and Agriculture and Agri-Food Canada, with in-kind support provided by Dow AgroSciences, Bayer CropScience and BASF.

Nitrogen Response of Modern versus Open-Pollinated Fall Rye Varieties

Description

Recent breeding efforts have improved the yield potential and other agronomic qualities of fall rye. Hazlet, the newest fall rye variety released by AAFC, has 16% higher yield potential than the check variety in Saskatchewan's Zone 1 & 2, while new European fall rye varieties have shown up to 30% higher yields. Fall rye is traditionally grown as a low-input crop, likely because it has relatively high nitrogen use efficiency compared to winter wheat. However, higher rates of nitrogen fertilizer may be required to reach maximum yield potential with modern fall rye varieties. The objective of this study is to contrast the nitrogen requirements of a high yielding hybrid with a conventional fall rye variety. The open-pollinated variety, Hazlet, and a hybrid, Brasetto, were each grown at six different N fertility rates (0, 50, 100, 150, 200, and 250 kg N/ha).

Results

Yield response quickly levelled off as nitrogen rates increased in both varieties. Estimated maximum yields were achieved at 112 kg N/ha and 124 kg N/ha for Hazlet and Brasetto, respectively. When averaged across nitrogen treatments, Brasetto was 25% higher yielding than Hazlet. Like in many cereal crops, protein was inversely related to yield as nitrogen levels increased. The effect of N rate on grain protein concentrations varied with variety. Both varieties had similar grain protein concentrations in the control treatment but protein was always higher for Hazlet when N was applied (Figure 6).

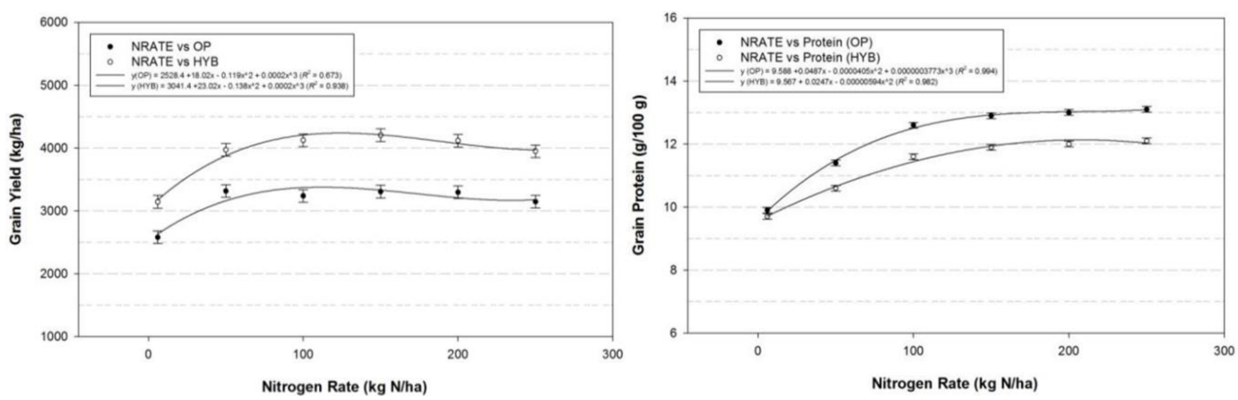


Figure 6. Effect of nitrogen rate on grain yield and grain protein of an open pollinated (Hazlet) and hybrid variety (Brasetto) of fall rye.

Conclusions

Grain yields for Brasetto were nearly 25% higher than Hazlet on average and the response to N fertilizer was similar for both varieties, indicating simply that the genetic yield potential of the hybrid variety is higher than the conventional variety. The maximum yield was achieved with 120 kg N/ha; however, profits were likely maximized at a lower rates as there was relatively small yield differences among fertilized treatments. The trial was conducted at a single site and year, thus results may vary under different conditions. The higher yield potential of the hybrid variety should be weighed against the increased seed costs.

Acknowledgements

This project was supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward 2 bi-lateral agreement, with in-kind support provided by industry partners. Protocols were developed by Laryssa Grenkow (Western Applied Research Corporation) who also sourced the seed for the project.

Comparison of Open-Pollinated and Hybrid Fall Rye under Conventional and Intensive Management Conditions

Larsen, J. (AAFC), Holzapfel, C. (IHARF), Coles, K. (Farming Smarter), Mohr, R. (AAFC), and Brandt, S. (NARF).

Description

Fall rye can be as profitable for Canadian farmers as intensively managed wheat because it can be grown productively on marginal land with minimal inputs. In addition, fall rye is extremely winter-hardy posing significantly less risk for winterkill compared to winter wheat. Hybrid rye from Germany has shown a 25-40% increase in yield and more consistent quality compared to Canadian open-pollinated (OP) varieties; however, hybrid rye seed is sold at a premium over OP seed. Producers will want to optimize the management package and maximize yields in order for the added cost of hybrid seed to fit their production model. The objectives of this study were to compare the productivity of Canadian OP and German hybrid fall rye varieties under different levels of crop inputs. Eight treatments were evaluated which included a combination of four fall rye varieties: two OP (Hazlet and AC Rifle) and two hybrids (Guttino and Brasetto), each grown under both conventional and intensive management systems. The difference in management factors between conventional and intensive management systems is outlined in Table 7.

Table 7. Management factors in conventional and intensive management treatments.

Management Factor	Conventional	Intensive
Total N	60 kg N/ha	120 kg N/ha
Fall ESN (side-banded)	0 kg N/ha	40 kg N/ha
Spring Agrotain (broadcast)	60 kg N/ha	80 kg N/ha
Seed treatment	none	Cruiser Maxx Cereals
Foliar fungicide	none	Caramba at flag leaf stage
Fall herbicide	2,4-D	2,4-D
Spring herbicide	none	broadleaf and grassy
Insecticide	none	as required

Results

The trial was conducted at four locations in 2015 (Medicine Hat, Indian Head, Melfort, and Brandon). Across all sites, the hybrids tended to out yield the OP varieties, and yields were higher in both varieties under the intensive system. These results were observed at Indian Head in 2015 (Figure 7).

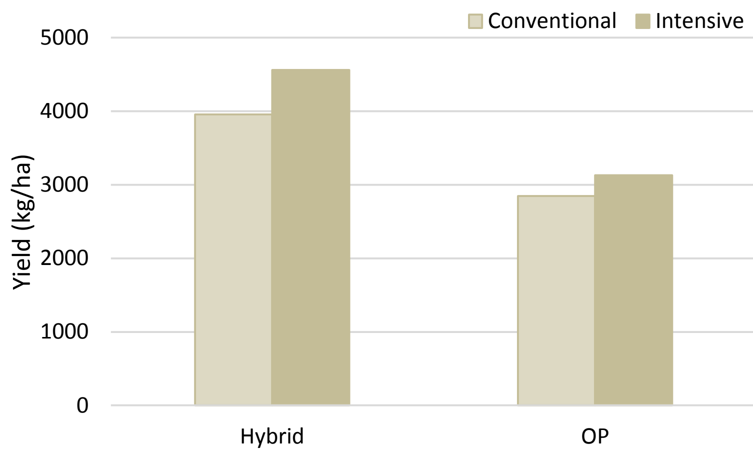


Figure 7. The effect of input system on hybrid and open-pollinated (OP) rye yield at Indian Head in 2015.

Test weight was not affected by variety or management treatment, but significant differences were found between varieties in their susceptibility to ergot. Hybrids were more susceptible to ergot, and both hybrids showed an increase in ergot under the intensive system. The higher ergot levels may have been from an increase in tillers or from environmental conditions at Indian Head in 2015.

Conclusions

An economic analysis was completed with all sites included (not shown) and it appears that although the cost of production is higher, hybrids were more economically viable than OP varieties. Across all sites, there was not a large difference in profits between intensive and conventional management strategies with the hybrids, however with the OP varieties it appears that the conventional management strategy might be most profitable based on the agronomic package used in this research project. The results from the first year of this trial are preliminary and the trial will be conducted again in 2016.

Acknowledgements

Support for this project was provided by the Western Grains Research Foundation and the Saskatchewan Winter Cereals Development Commission, with in-kind support provided by industry partners

Managing Fusarium Head Blight in Durum Wheat with Higher Seeding Rates and Foliar Fungicide Application

Description

Fusarium head blight (FHB) has been a major factor limiting durum wheat yields and grain quality in recent years. Durum is particularly susceptible to FHB and is a good test crop to evaluate the effects of various management practices for disease suppression. The optimum timing of fungicide application for FHB control is at early flowering; however, significant infection can still occur depending on the duration of flowering and environmental conditions. Producers are unsure of the benefit of utilizing two fungicide applications to manage for variability in crop stage and to reduce the risk of encountering environmental conditions conducive to disease development during flowering. Research conducted in eastern Saskatchewan has shown that increasing the seeding rate of durum wheat has not resulted in lower FHB infection and can actually result in higher disease pressure if it leads to a denser crop canopy or more lodging. However, higher seeding rates could result in a more uniform crop with less tillering, resulting in improved control of this disease when combined with a well-timed fungicide application. The objective of this project was to demonstrate the effect of using a combination of higher seeding rate and different timings of foliar fungicide application to reduce the impacts of FHB on the yield and quality of durum wheat. The twelve treatments evaluated were four fungicide application timings (control (no fungicide); T1 (75-100% head emergence); T2 (50% flowering); and both T1 + T2), each in combination with three seeding rates (200, 300, and 400 seeds/m^2).

Results

Head density increased with seeding rate, but not to the extent that plant density increased with seeding rate, indicating that individual plants responded to higher plant populations with reduced tillering.

Disease pressure was relatively high with approximately 30% incidence of FHB on average. The FHB index is the product of the percent of infected heads (FHB incidence) and the percent area affected in the infected heads (FHB severity). Seeding rate had no significant effect on FHB index or grain yield. The effect of fungicide application timing on FHB index and grain yield is shown in Figure 8. FHB index was highest in the control, slightly lower with the T1 application time, and lowest at the T2 and dual application times, which were statistically similar (Figure 8).

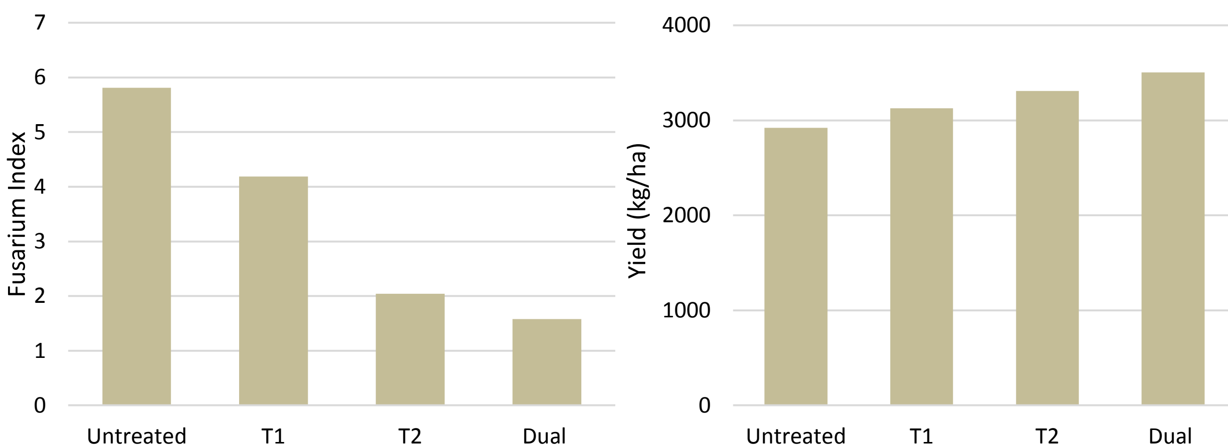


Figure 8. Effect of fungicide timing on *Fusarium* index and yield of durum wheat.

Test weight and seed weight were not affected by seeding rate, but fungicide treatment was significant to both. Test weight was the most responsive to fungicide treatment seeing up to 2.9% greater weights in the dual application over the control. Seeding rate did influence the percentage of Fusarium damaged kernels (FDK); FDK was reduced from 1.7% to 1.3% when seeding rate was increased to 400 seeds/m^2. Fungicide did not influence FDK.

Conclusions

A reduction in the number of tillers per plant resulting from increased seeding rate theoretically shortens the length of the period where wheat is susceptible to FHB infection, due to greater crop uniformity. Seeding rates targeting actual populations of 300 plants/m^2 were required to reduce the impacts of FHB at Indian Head in 2015. For fungicides to have an effect on FHB, timing is critical and dual applications may be necessary depending on disease pressure and the duration of heading. While there was no interaction between seeding rate and fungicide treatment, both practices were beneficial for FHB management in durum wheat.

Acknowledgements

This project was financially supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward 2 bi-lateral agreement, with in-kind support provided by BASF, Bayer CropScience and Dow AgroSciences.

Controlled Release Nitrogen Fertilizer for Improving Spring Wheat Yield and Protein

Description

High protein concentrations are desirable in wheat production and it is important to use adequate N fertility rates to avoid losses in grain quality. Growers have attempted to increase protein by applying more fertilizer N; however, this often leads to increased lodging and associated yield loss and difficulty with harvest. Controlled release N products can delay the conversion of fertilizer N into plant available forms, allowing for N uptake later in the growing season. Delayed N uptake supports protein formation, with the added benefit of reducing early season vegetative growth and potentially reducing lodging. The objective of this project was to demonstrate the effect of various controlled release N products for optimizing yield and grain protein while minimizing lodging in CWRS wheat.

The 11 treatments evaluated were five product blends: 1) 100% urea; 2) 50% ESN + 50% urea; 3) 50% SuperU + 50% urea; 4) 75% ESN + 25% urea; and 5) 75% SuperU + 25% urea; each applied at two N fertility rates (75 and 140 kg N/ha), plus an un-fertilized check. Controlled release N products are typically applied in a blend with untreated urea because they are more costly and to ensure an adequate amount of plant available N very early in the season.

Results

Lodging was least severe in the control and increased with N rate, but was relatively low overall. Increasing the N rate from 0 and 75 kg N/ha to 140 kg N/ha significantly increased yield by 55% and 5%, respectively. At both 75 and 140 kg N/ha, the highest yields were achieved with the 75:25 ESN/Urea blend, and showed a significant advantage over unblended urea (Figure 9).

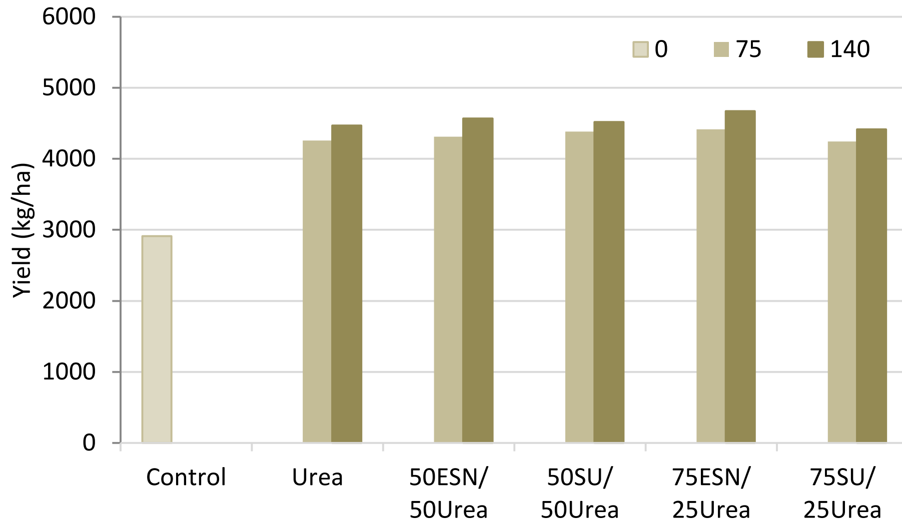


Figure 9. Effect of slow release nitrogen blends on spring wheat yield at Indian Head in 2015.

Grain protein showed a very strong response to N fertilizer rate, increasing from 10.5% grain protein with the control to 12.3% at 75 kg N/ha, and 14.5% at 140 kg N/ha. Protein was higher on average with unblended urea than with either the 50% or 75% ESN blends but did not differ from the SuperU blends. Protein was generally inversely related to yield.

Conclusions

Blends containing ESN generally resulted in the highest yields, but they also had the lowest protein. The performance of the products evaluated may differ under wetter spring conditions when the potential for losses due to denitrification and leaching is higher.

Acknowledgements

This project was financially supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward 2 bi-lateral agreement, with in-kind support provided by Koch Agronomic Services, Agrium, BASF, Bayer CropScience and Dow AgroSciences.

Optimal Nitrogen Rates for Spring Wheat with Plant Growth Regulators

Description

Wheat yield responds positively to fertilizer N up to an optimal rate at which further additions are no longer beneficial. Yield decrease beyond the optimal N rate can often be associated with crop lodging. Registration of plant growth regulators (PGR) could provide opportunities to enhance wheat yield and quality by reducing lodging, especially with higher fertility rates. The objective of this study was to determine whether higher yields and/or quality can be achieved with a combination of PGR applications and higher N fertility. The treatments evaluated were a combination of five N fertilizer rates (0, 50, 100, 150 and 200 kg N/ha) and two PGR treatments (untreated and treated).

Results

Height increased with N fertilization in both the control and PGR-treated wheat; however, wheat treated with PGR was significantly shorter than the untreated wheat at all N rates. Lodging occurred late in the season and was considered minor in all treatments. Lodging response to the treatments was similar to the height response where lodging increased with N rate in both control and PGR-applied treatments, but was significantly lower in PGR treated wheat at all N rates. Similar to the control treatments, wheat treated with PGR showed the typical diminishing yield response to increased N rates. However, PGR applications resulted in 6% yield increase when averaged across fertilizer rates, even with a low level of lodging overall. The highest yielding individual treatment was 150 kg N/ha combined with a PGR application (Table 8).

Table 8. Treatment comparisons for spring wheat plant height, lodging, and grain yield at Indian Head in 2015. Different letters indicate significant differences between the treatments.

	Plant Height (cm)		**Lodging Index** (1-10)		**Grain Yield** (kg/ha)	
	Control	PGR	Control	PGR	Control	PGR
7 kg N/ha	91.4 b	72.4 d	2.0 e	2.0 e	3071 f	3130 f
50 kg N/ha	100.3 a	85.7 c	2.8 bcd	2.0 e	3941 e	4231 d
100 kg N/ha	101.7 a	90.0 b	3.3 b	2.3 de	4460 cd	4839 ab
150 kg N/ha	100.3 a	91.8 b	4.0 a	2.5 cde	4693 bc	5030 a
200 kg N/ha	100.3 a	91.7 b	4.0 a	3.0 bc	4493 c	4807 ab

There was a tendency for lower protein content with PGR where slightly higher yields were achieved. This suggests that higher N rates may be required to maintain adequate protein levels when PGR application leads to higher yield expectations.

Conclusions

This trial demonstrated a strong response to N fertilizer and significant agronomic benefits to the PGR applications, even though it was a relatively dry year with minimal risk of yield loss due to lodging. These results, combined with results from previous studies, support the use of PGR to reduce spring wheat height and lodging while increasing yields. However, growers will need to ensure that any wheat treated with PGR will be marketable prior to using the products.

Acknowledgements

This project was financially supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward 2 bi-lateral agreement, with in-kind support provided by Engage Agro, Dow AgroSciences, BASF and Bayer CropScience.

Optimal Seeding Rates for Spring Wheat with Plant Growth Regulators

Description

Wheat yields generally respond positively to increased seeding rates, though the risk of severe lodging often also increases with higher seeding rates. In an effort to manage lodging in wheat, producers have tried growing semi-dwarf varieties or reducing seed and fertility inputs, at the risk of losing yield and quality. Registration of plant growth regulators (PGR) could provide opportunities to enhance wheat yield and quality by reducing lodging. The objective of this study was to determine whether higher yields and/or quality can be achieved with a combination of PGR applications and higher seeding rates. The treatments evaluated were a combination of five seeding rates (100, 200, 300, 400 and 500 seeds/m^2), with and without PGR application.

Results

The application of a PGR resulted in an average 12% height reduction. Plant height also declined linearly with increasing seeding rate; however, there was only a 3 cm difference between the shortest and tallest treatments. Application of PGR significantly reduced lodging, though lodging was relatively minor in all treatments. There was no lodging observed in PGR treated plots at the 300-500 seed/m^2 seeding rates. Yields were highest at approximately 200-300 seeds/m^2, with or without PGR. Yields were increased by 400 kg/ha with the PGR application, regardless of seeding rate (Figure 10). The PGR treatments did not affect test weight or seed weight.

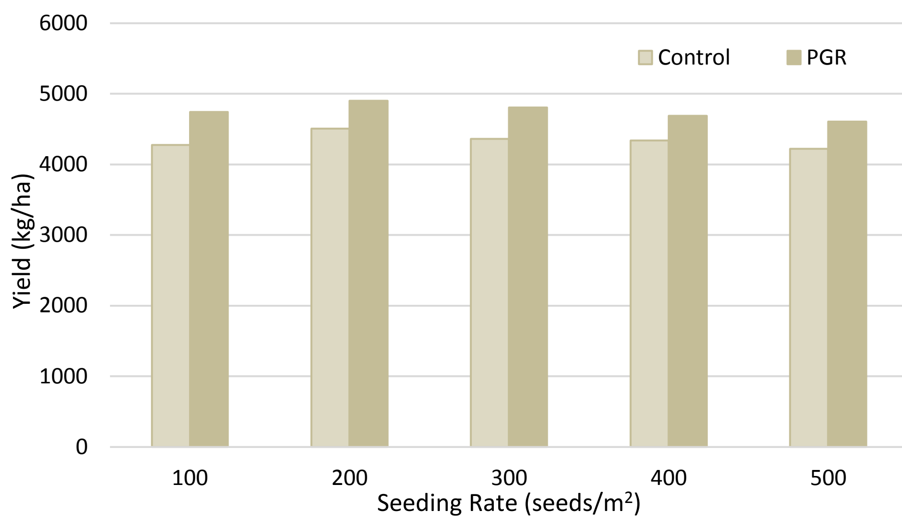


Figure 10. Effect of PGR in spring wheat on yield with increased seeding rate at Indian Head in 2015.

Conclusions

This trial demonstrated a strong response to N fertilizer and significant agronomic benefits to the PGR applications, even though it was a relatively dry year with minimal risk of yield loss due to lodging. The results of this trial also show no advantage to higher seeding rates, whether or not PGR was applied. These results, combined with results from previous studies, support the use of PGR to reduce spring wheat height and lodging while increasing yields. However, growers will need to ensure that any wheat treated with PGR will be marketable prior to using the products.

Acknowledgements

This project was financially supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward 2 bi-lateral agreement, with in-kind support provided by Engage Agro, Syngenta, BASF and Bayer CropScience.

Application Timing and Fertility Effects on Spring Wheat Response to Plant Growth Regulator

Description

Plant growth regulators (PGR) are typically used to reduce internode elongation in cereals to decrease plant height, thicken stems, and reduce the potential for lodging. Spring wheat yield is often limited by lodging when higher rates of inputs are utilized; thus, the reduction in lodging that could be achieved with PGR potentially allows for inputs to be increased to promote higher yields. The objective of this study was to determine the effect of application timing and fertility level on the response of spring wheat to the plant growth regulator Manipulator® (chlormequat chloride). The treatments included four PGR treatments: 1) No PGR, 2) Early application (late herbicide timing, growth stage Zadocks 21 - start of tiller formation), 3) Late application (growth stage Zadocks 31 - start of stem elongation), and 4) growth stage Zadoks 41 (Flag leaf), in combination with three fertility treatments: 1) 100%, 2) 125%, and 3) 150% of the recommended fertility package for spring wheat in the thin Black soil zone, for a total of 12 treatments. The trial was conducted in 2013, 2014, and 2015.

Results

The effect of PGR application and timing on spring wheat height, lodging and yield was similar across all trial years. An application of PGR at any time significantly reduced plant height relative to no PGR application. Fertility rate did not have any effect on height for the ranges examined (Figure 11). Applying PGR also significantly reduced lodging in plots. The latest application of PGR appeared to have a more significant role on height and lodging in 2015. Higher fertility treatments did show an increase in lodging, but this effect was not significant when a PGR was applied (Figure 11).

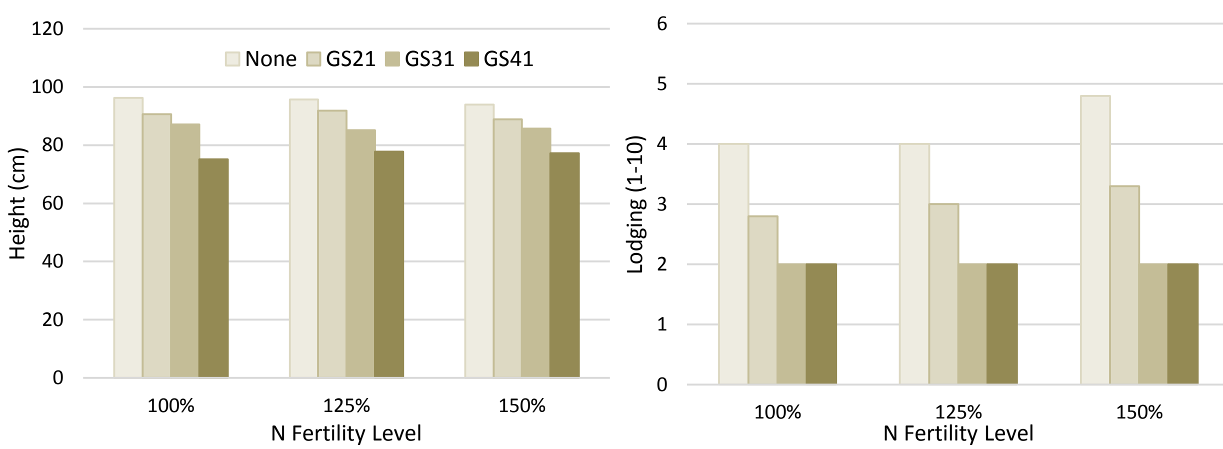


Figure 11. Effect of PGR timing and increasing N rates on height and lodging at Indian Head in 2015.

Yield increased with both the application of a PGR and with increased fertility rates. The interaction between PGR and fertility showed a greater yield benefit with PGR application when fertilizer rates were high (Figure 12).

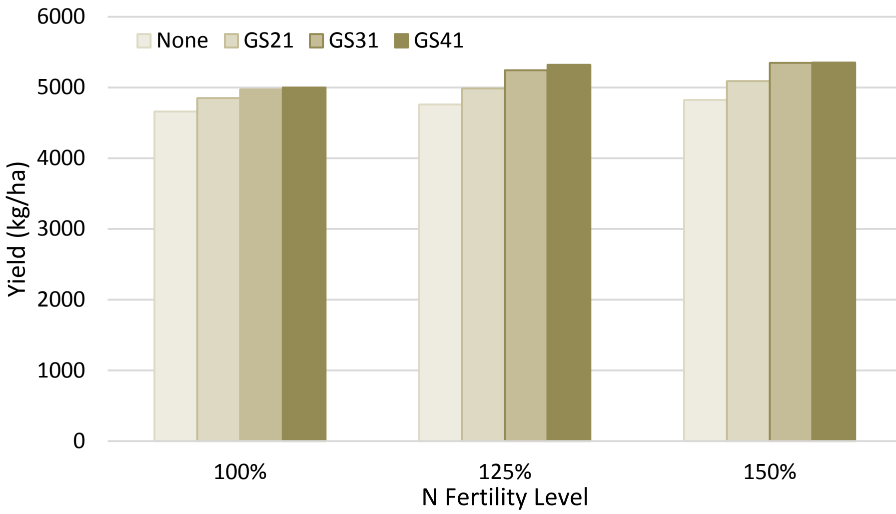


Figure 12. Effect of PGR timing and increasing N rate on yield of spring wheat at Indian Head in 2015.

Conclusions

Results were consistent across all years and indicate the potential for PGR applications to reduce height and lodging while enhancing wheat yields, particularly when combined with high fertility rates. Tank-mixing with herbicides is possible, but does not appear to be as effective as a later application of PGR.

Acknowledgements

Support for this project was provided by Engage Agro.

Genotype, Weather, Fungicide, and Glyphosate Effect on Spring Wheat Gluten Strength

Sapirstein, H. (U of M), Bullock, P. (U of M), Holzapfel, C. (IHARF)

Description

Canadian spring wheat quality has declined in recent years and reasons are not well known. Processing quality can be greatly influenced by a wide range of environmental and management factors, the most likely in recent years being the increased prevalence of fusarium, unpredictable and extreme weather, and the increased use of pre-harvest glyphosate. The objective of this study was to investigate the effects of environment, fungicide, and glyphosate as a harvest aid on gluten strength in CWRS wheat. Six different wheat genotypes (Carberry, Cardale, Glenn, Harvest, Stanley, and Stettler) were treated with 1) fungicide, 2) glyphosate, 3) fungicide and glyphosate, or 4) untreated, to evaluate the effect on wheat gluten strength, for a total of 24 treatments.

Results

The effect of the treatments on yield and test weight of each of the 6 genotypes is shown in Figure 13.

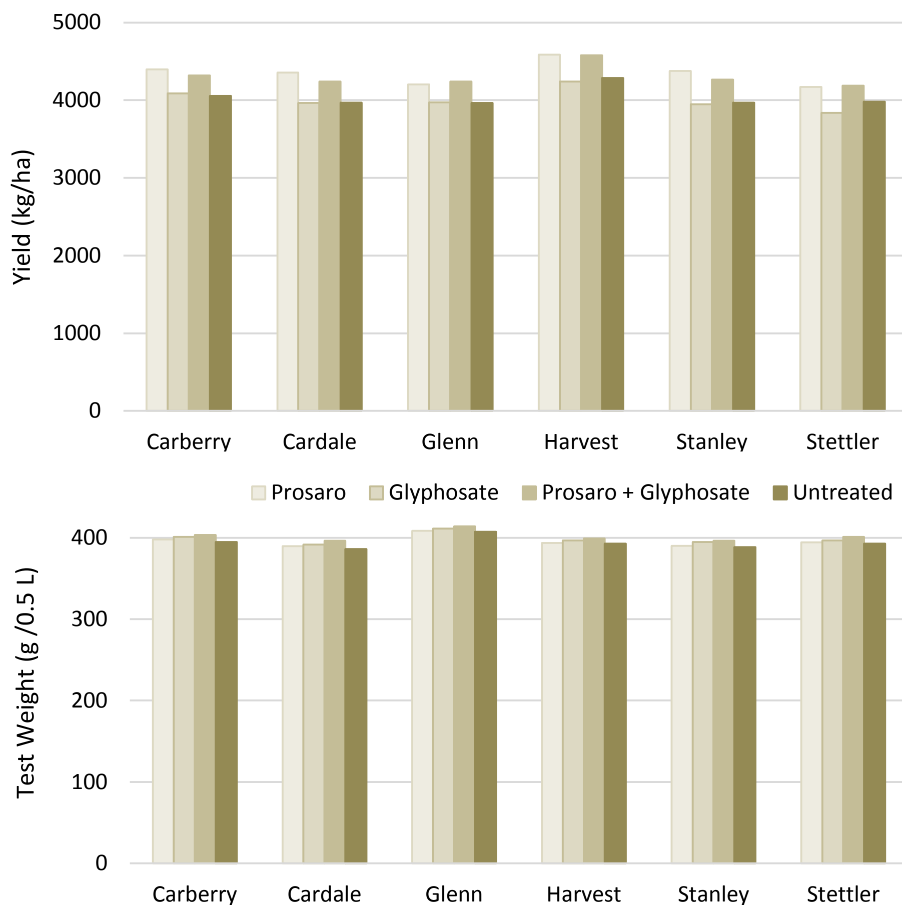


Figure 13. Effect of fungicide and glyphosate on yield and test weight of various wheat genotypes.

Conclusions

Results are preliminary and only reflect one site-year of data. This trial will be repeated in the 2016 season.

Acknowledgements

This study comprises one of four sub-projects of a larger study funded by the Western Grains Research Foundation, with in-kind support provided by industry partners.

Yield Response and Test Weight Stability of Oat to Fertilizer N

Description

Oat growers are looking for ways to increase their yield and maintain the quality of the oats they grow. Many are using high N rates with varying degrees of success due to lodging and decreased test weights. Research indicates that some cultivars have a more stable test weight than others as the nitrogen fertilizer rate is increased. In addition, new cultivars are available that growers have not had a chance to see evaluated in their own area. This demonstration will help producers choose the appropriate nitrogen rate and cultivar to achieve their management goals when growing oats. The treatments included four cultivars, and four N fertility rates (40, 60, 80, and 120 kg N/ha). The field trial was conducted at four locations in 2015, and different cultivars were chosen at each location based on popularity and potential for the region.

Results

At Indian Head in 2015 there were differences between the cultivars in their response to N fertilizer. Stride had slightly more lodging than the other three cultivars, though there was little lodging at Indian Head in 2015 (data not shown). Yield response to N fertilizer rates differed among the cultivars (Figure 14). The test weight declined as the N rate increased at Indian Head in 2015, but appeared to be more stable in some cultivars than others (Figure 15).

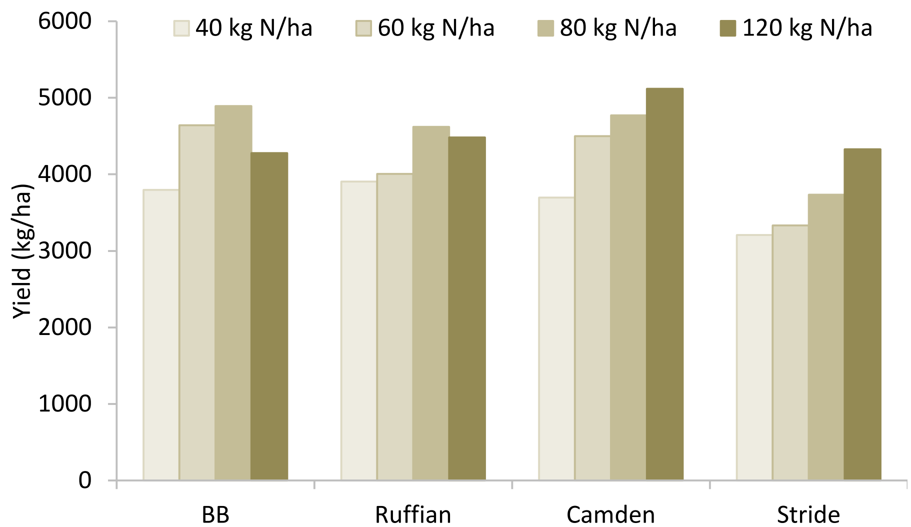


Figure 14. The effect of varying rates of N fertilizer on yield of four oat cultivars at Indian Head in 2015.

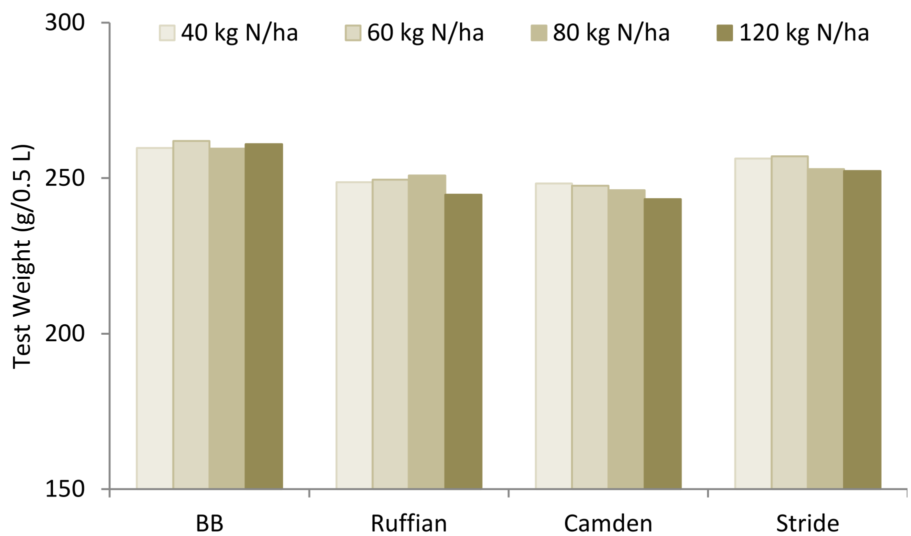


Figure 15. The effect of varying N rates on test weight of four oat cultivars at Indian Head in 2015.

Conclusions

The cultivars tested appear to differ in their yield potential, and in their yield and quality responses to varying rates of N fertilizer. Similar observations were made at other locations.

Acknowledgement

Funding for this study was provided by the Prairie Oat Growers Association through the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward 2 bi-lateral agreement, with in-kind support provided by industry partners.

Investigating Wider Row Spacing in No-Till Canola: Implications for Weed Competition, Response to Nitrogen Fertilizer, and Seeding Rate Recommendations

Description

Wider row spacing in canola production has been a topic of interest among canola growers and equipment manufacturers. With larger implements, producers could increase the timeliness of seeding and reduce fuel use and tractor hours. Past research on canola row spacing has led to varied conclusions in regards to canola yield response and agronomic implications, thus, revisiting the topic of row spacing in canola is well justified with the changes in canola varieties, fertilizer management and seeding equipment over the past twenty years.

Nitrogen-use-efficiency could potentially be increased with banded N at wider spacing due to reduced N losses; however, the potential for seedling injury also increases as the banded fertilizer becomes more concentrated with wider row spacing. As for seeding rate implications, it is possible that wider row spacing could result in a reduction in seeding rates as the within-row distance between seeds would decrease as row spacing is increased. From a weed management perspective, it is likely that canola would not compete as well against weeds as row spacing is increased, especially early in the growing season, though this may not be an issue with modern, herbicide tolerant hybrid canola varieties.

The objectives of this project were to evaluate the performance of canola grown in row spacings that exceed the conventional 10-12” width. Three separate field trials were designed to determine whether wider row spacing might affect current canola production recommendations regarding side-banded N fertilizer, seeding rates, and weed management. The treatments in the three trials consisted of 5 different row spacings (10”, 12”, 14”, 16”, and 24”) in combination with either 1) side-banded N fertilizer rates (0, 50, 100, and 150 kg N/ha), 2) seeding rates (1.5, 3.0, 4.5, and 6.0 kg/ha) or 3) weed control (no in-crop herbicide compared to a single in-crop herbicide application). The study was conducted in 2013, 2014, and 2015.

Results

1) *Implications for side-banded nitrogen fertilizer:*

In all years combined, canola plant density declined with both increased row spacing and with increased side-banded N rates, but there was no interaction between the two factors, indicating that the more concentrated band of N fertilizer at wider row spacing did not affect seedling survival. In 2015, seed yields were similar for row spacing ranging from 10-16” but significantly higher at 24” spacing. There was always a strong response to N rate with yields continuing to increase up the highest rate of applied N fertilizer (Figure 16).

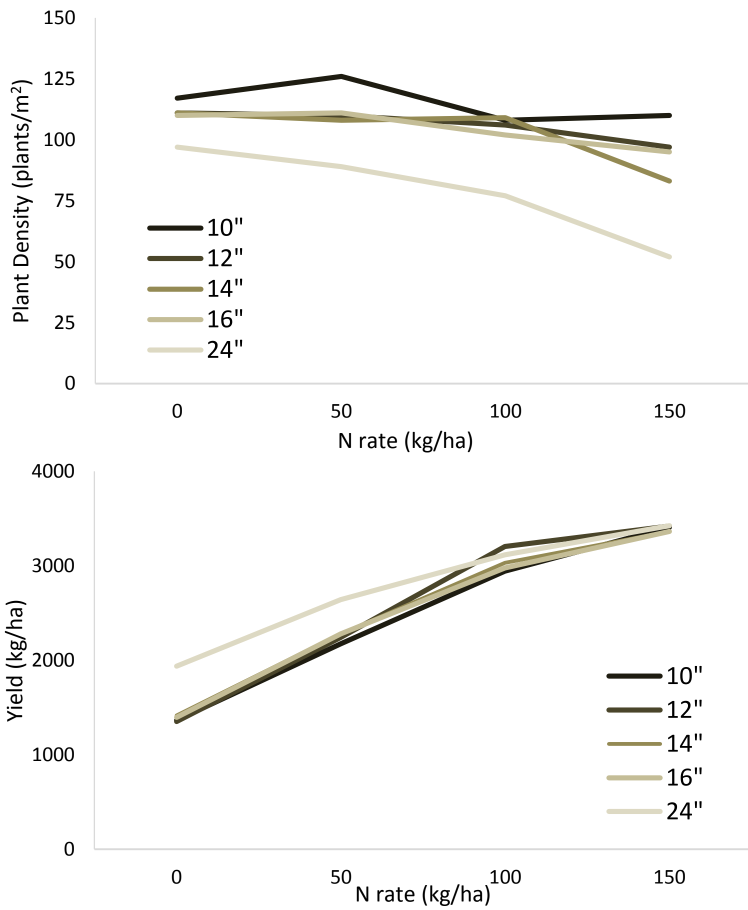


Figure 16. Effect of increasing N rate on canola plant density and yield at Indian Head.

Implications for seeding rates

Plant density declined in general with increased row spacing. Within each seeding rate, differences in plant density among row widths were not large enough to impact yield at 10”-16” row width, but decreased significantly at the 24” row width. As for yield, there was no interaction between row spacing and seeding rate, suggesting that the effect of seeding rate on yield was similar across row widths, and also that the effect of row spacing on yield was similar across seeding rates. Therefore, the results support the recommendation that similar seeding rates should be used regardless of row spacing.

Implications for weed control

In 2015, weed pressure was lower, but row spacing did have a significant impact on weed biomass, unlike in previous years. Without herbicide, weed biomass increased linearly with row spacing but there was no effect of row spacing on weed biomass when combined with an in-crop herbicide application. Effects of row spacing on seed yield were significant in 2015, but not in previous years. In 2015, the highest yields were achieved at the narrowest and widest row widths.

Conclusions

Canola emergence declined as row spacing increased, likely due to higher intraspecific competition among seedlings. The reduction in plant population was not generally large enough to be of agronomic concern, particularly among row widths of 10” to 16”. There was a significant reduction in plant density with 100-150 kg/ha of side-banded N; however, canola responded to side-banded N with increased yields right up to 150 kg N/ha. These results suggest that the N requirement of canola is likely similar regardless of row spacing, though high rates of applied N combined with wide row spacing may increase the risk of seedling injury.

Acknowledgement

Funding for this project was provided by the Saskatchewan Canola Development Commission, with in-kind support provided by Bayer CropScience.

Effects of Genetic Sclerotinia Tolerance and Foliar Fungicide Applications on Incidence and Severity of Sclerotinia in Canola

Description

Sclerotinia stem rot causes significant yield loss for canola in western Canada each year, though incidence and severity of the disease in any location is variable and dependent on environmental conditions. Foliar fungicides have been effective for managing sclerotinia; however, annual applications are not economically viable in many regions. Recently, canola varieties rated tolerant to sclerotinia stem rot have been distributed commercially. Under favourable conditions, tolerant varieties may nonetheless become infected with sclerotinia, thus foliar fungicide applications may still be beneficial. The objective of this trial is to examine the benefits and limitations of utilizing tolerant varieties and foliar fungicide applications to manage sclerotinia stem rot in canola, and to establish the conditions under which foliar fungicide applications may be beneficial when growing a tolerant variety. The treatments were a combination of two canola hybrids (susceptible (45H29 RR), and tolerant (45S54 RR), and four foliar fungicide timing treatments (untreated check, fungicide applied at 20% bloom, fungicide applied at 50% bloom, and fungicide applied at both stages). The study was conducted at five locations in 2015 (Indian Head, Melfort, Outlook, Brandon, and Melita).

Results

The tolerant variety exhibited significantly lower disease incidence than the susceptible variety, but disease incidence was low, ranging from 0-11% across sites. Fungicide application also significantly reduced disease incidence, but only in the susceptible variety (Figure 17). The overall yield response to fungicide was fairly weak, and only the fungicide application at 50% bloom provided a significant benefit over the control (Figure 17). It should be noted that the susceptible variety (45H29) appeared to have genetically higher yield potential overall, when comparing the effect of environmental conditions and disease incidence on yield of the two varieties.

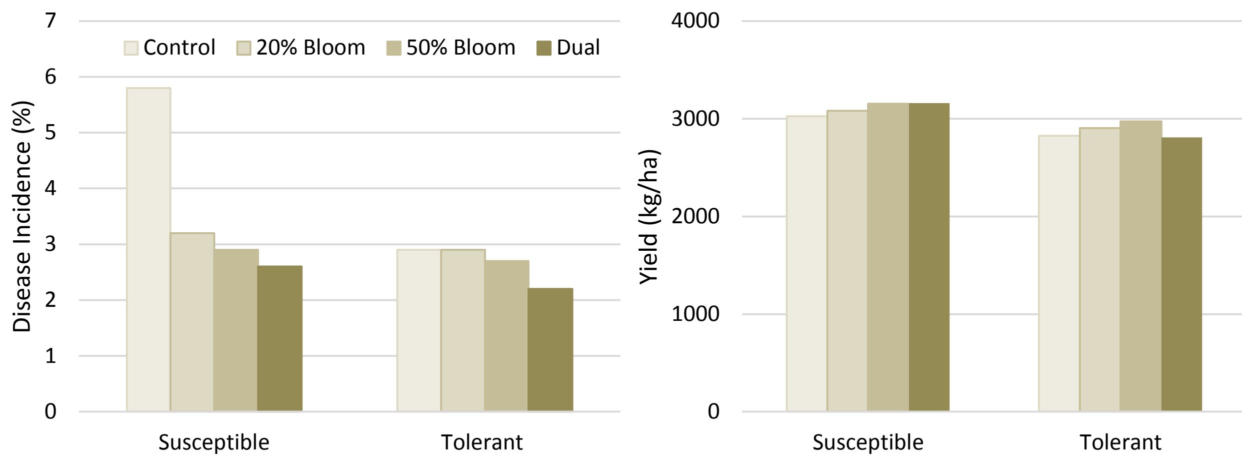


Figure 17. Sclerotinia incidence and mean yield with fungicide treatment across all locations in 2015.

Conclusions

This study showed that sclerotinia incidence and severity were reduced by either using a tolerant hybrid or fungicide applications; however, disease pressure was generally low and neither of the two management options fully controlled the disease when conditions were most favourable. Under low disease pressure, there was little benefit to applying fungicide on the tolerant hybrid. When a yield benefit to fungicide application was observed, yields tended to be higher with the later fungicide application. However, early infection produces the greatest potential yield loss; therefore, it is recommended to apply fungicide between 20-50% bloom, before a significant number of petals have dropped. The results of this study suggest that tolerant hybrids are effective for managing disease, and less likely to benefit from fungicide. Susceptible hybrids may provide a higher yield potential, at least under low disease pressure.

Acknowledgement

Funding for this project was provided by the Saskatchewan Canola Development Commission, with in-kind support provided by Pioneer Hi-Bred and BASF.

Canola Direct-Cut Harvest System Development

Description

The objective of this project was to evaluate the field performance of commercially available combine headers as part of a direct-cut harvest system in canola, compared with the conventional swathing operation. This study was conducted at the field scale, utilizing a 2014 New Holland CR8090 twin rotor combine. The combine was configured for canola based on the manufacturers recommended settings, and optimized for site conditions by harvesting adjacent crop and utilizing drop pans. Combine settings were not altered during or in-between the plot harvesting to maintain consistency between treatments. Three straight-cut header treatments were evaluated: 1) draper; 2) rigid; 3) extended knife (42” ahead of auger), along with the swathed treatment. Two canola varieties were evaluated: a standard variety (L130) and a variety with documented shatter resistant traits (L140P). Aluminum catch trays were placed in the plots at the time of swathing, and remained in the field until harvest in order to catch environmental losses experienced with the standing canola. At harvest, catch trays were also placed ahead of the combine in order to catch header losses. The study was conducted at Indian Head and Swift Current in 2014 and 2015.

Results

Conditions at Indian Head in 2015 were ideal for straight-cutting canola. Plant density was consistent and plants were upright and knitted together. The results showed that header losses can be significant when straight-cutting canola, and these losses should be weighed against the benefits of straight-cutting. The extended knife header appeared to be the most forgiving header for yield and canola feeding performance over the other header options (Figure 18). As expected, the shatter tolerant variety performed better than the standard variety against environmental and header loss. Swathing remains a good harvest management option for standard canola varieties.

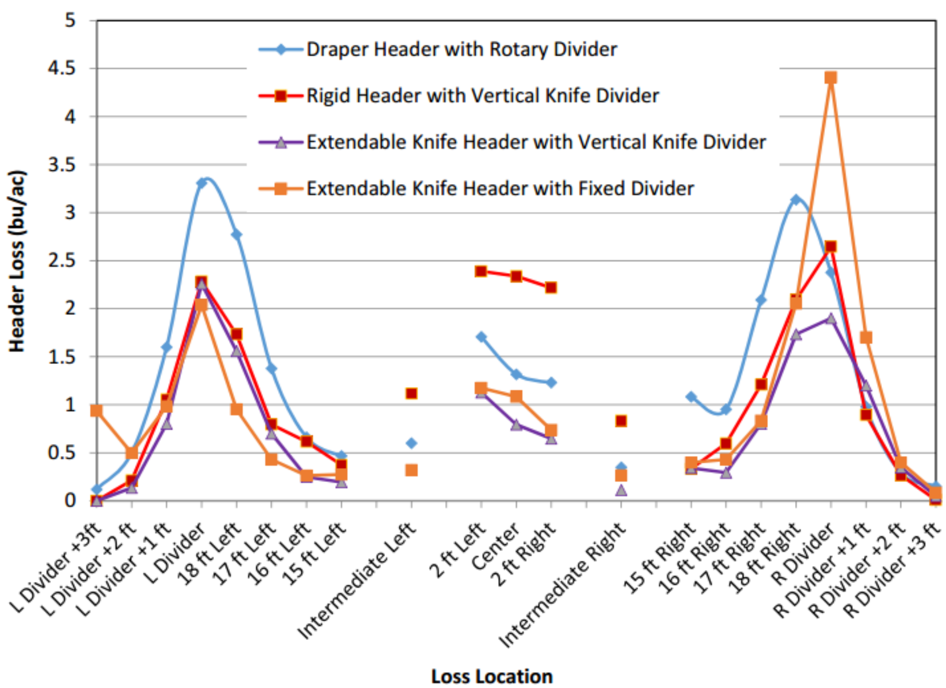


Figure 18. Canola seed losses across width of headers at Indian Head in 2015.

Conclusions

The project is scheduled to be completed after the 2016 growing season, when a comprehensive final report and recommendations will be made.

Acknowledgement

This project was led by the Prairie Agricultural Machinery Institute (PAMI) and financially supported by the Saskatchewan Ministry of Agriculture's Agricultural Development Fund (ADF) under the Canada-Saskatchewan Growing Forward 2 bi-lateral agreement, along with the Saskatchewan Canola

Development Commission and the Western Grains Research Foundation. In-kind support was provided by Bayer CropScience, Honey Bee Manufacturing and New Holland Agriculture.

Lumiderm Seed Treatment Effects on Emergence, Flea Beetle Damage, and Seed Yield of Canola

Description

Commercial canola seed is nearly always treated with a seed treatment to control various seedling diseases and protect against flea beetle damage. In cool springs, the protection of the seed treatment often wears off while the plants are still small, and under high insect pressure, foliar insecticide applications are frequently required at this critical time to prevent damage, and especially when plant populations are already low due to early-season stresses. Lumiderm (cyantraniliprole) seed treatment is a group 28 insecticide that is intended to provide extended control over conventional canola seed treatments, particularly when soils are cool and wet. The objective of this study was to determine if the addition of Lumiderm seed treatment with either Helix Vibrance or Prosper EverGol could reduce insect feeding from flea beetles and improve seedling establishment and seed yield at either low or recommended plant populations. The treatments consisted of the standard seed treatments products (i.e. Helix Vibrance (RR) or Prosper Evergol (LL)) with commercially-associated varieties (D3155C (RR) or L252 (LL)) with and without Lumiderm (625 g Cyantraniliprole), at two different seeding rates (60 or 120 seeds/m^2).

Results

The warm, dry spring and lack of flea beetle pressure in the plots resulted in no significant differences between treatments for plant density, early defoliation, biomass, and yield. Despite the relatively low flea beetle pressure, there was a tendency for less defoliation with the dual seed treatments (Prosper/Helix plus Lumiderm) relative to Prosper or Helix applied alone at the 3-leaf stage. NDVI (an approximate measure of plant biomass and vigour) also tended to be higher in Lumiderm treatments. This trend was most pronounced and only statistically significant in the Roundup Ready® canola where Helix Vibrance was the standard treatment (Figure 19).

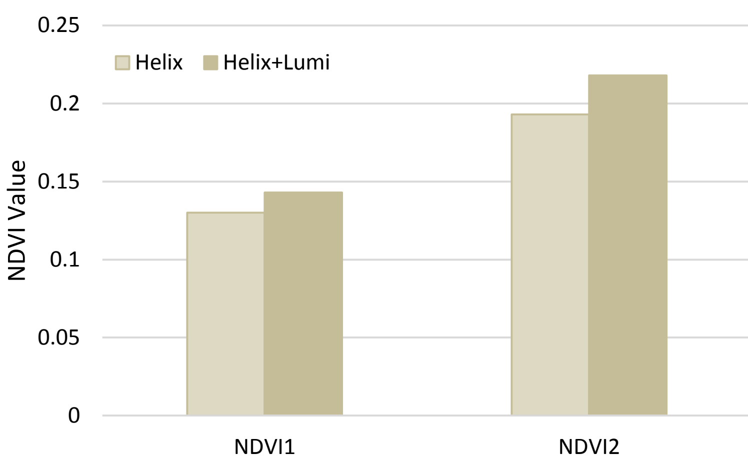


Figure 19. The effect of adding Lumidern to the seed treatment in RR canola on NDVI measurements in 2015.

Conclusions

Although flea beetles were present, pressure was low and the weather was warm and dry. Research has shown that the greatest benefits to Lumiderm generally occur under cool, wet conditions. Seed treatment did not affect plant populations or above-ground biomass yield; however, there was evidence of reduced defoliation and, for Roundup Ready® canola treated with Helix Vibrance, higher NDVI with the addition of Lumiderm. Seed yield was not affected by plant population or seed treatment, likely due to low seedling mortality and abundant moisture conditions during the latter half of the season combined with minimal defoliation and flea beetle pressure in the early season.

Acknowledgements

This project was financially supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward 2 bi-lateral agreement, with in-kind support provided by E. I. du Pont, Bayer CropScience and Pioneer Hi-Bred.

Safe Rates of Side-Banded and Seed-Placed P in Canola

Description

Canola is considered sensitive to seed-placed P fertilizer; however, producers would need to apply P at rates exceeding the recommended safe rates in order to satisfy the P required to maximize canola yield, while also maintaining long-term soil P fertility. Thus, many producers run a P deficit with canola, particularly when relying on seed-placed P. High rates of seed-placed P fertilizer may result in delayed emergence and reduced plant populations, potentially leading to lower seed yield and/or quality and increased weed competition. Side-banding P with other fertilizers is considered to be a safe and effective method of applying P fertilizer, particularly when higher rates are required; however, it may not be the most efficient method as side-banded P is less available early in the season. The objective of this study was to demonstrate the effects of increasing rates of phosphorus fertilizer on canola establishment and seed yield for both side-band and seed-row placement. The treatments evaluated were a control (no P fertilizer) and five P rates (20, 40, 60, 80 and 100 kg P_2O_5 ha^{-1}) which were either side-banded or placed in the seed-row.

Results

Canola emergence was not affected by P fertilizer rate or placement throughout the early growing season. In fact, seed placed P appeared to have an advantage over side-banded P for early season biomass. Averaged across P rates, early season biomass yields were 43% higher with seed-row placement than for side-banded P; however, seed yields were within less than 1% of each other. There were no significant yield differences among fertilized treatments, but there was a tendency for lower yields at 20 kg P_2O_5 relative to the higher rates with both placement methods (Figure 20).

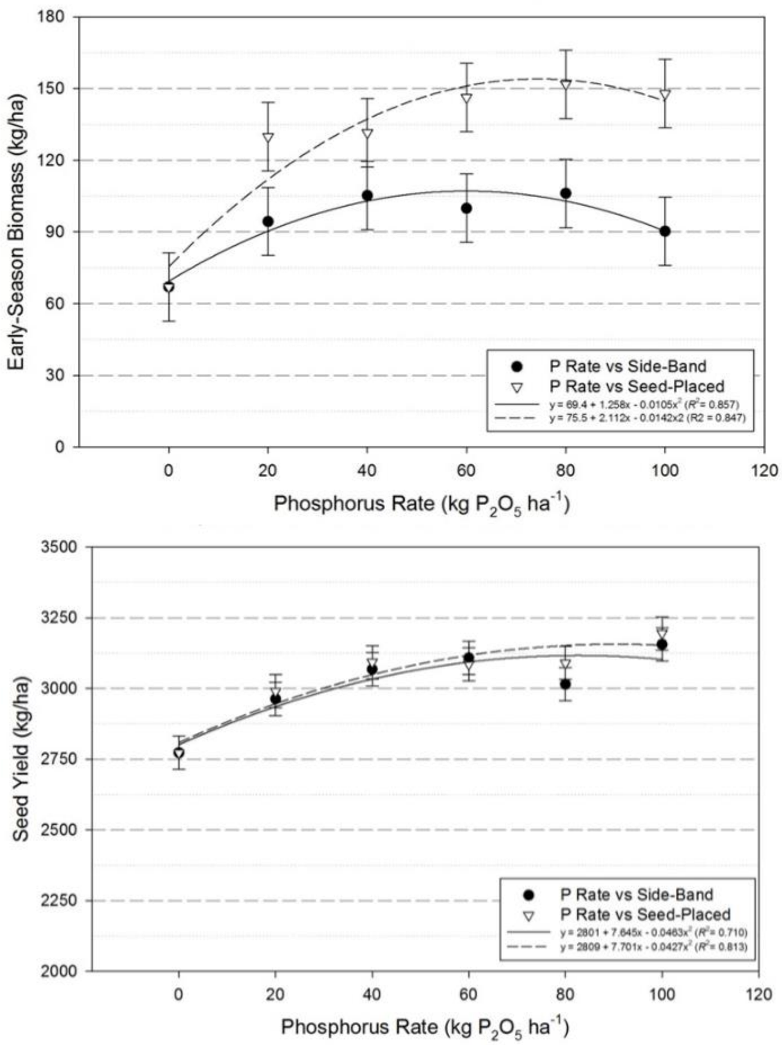


Figure 20. The effect of phosphorus rate on canola early season biomass and seed yield for side-banded and seed row-placed monoammonium phosphate at Indian Head in 2015.

Conclusions

There was no evidence of reduced emergence or seeding injury with high rates of seed-row placed P under the conditions encountered at Indian Head in 2015; however, more research encompassing a wider range of soil types and conditions is required before recommendations on maximum safe rates of seed-row placed P fertilizer can be changed. If growers choose to use rates exceeding the current recommendations, they are accepting a certain amount of risk, and should ensure adequate seeding rates and consider soil texture, organic matter and moisture conditions at planting. While seed-placement can have advantages over side-banding under certain conditions, particularly when residual P is low and soils are cool, in our experience, these advantages rarely translate into yield benefits.

Acknowledgement

This project was financially supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward 2 bi-lateral agreement, with in-kind support provided by industry partners.

Predicting Canola Phenology, Sclerotinia Incidence, and Yield with Weather-Based Tools

Description

The aim of the study is to develop models (weather based tools) to forecast canola phenology, sclerotinia incidence and canola yield. These tools will be freely available to western Canadian canola producers and industry. Models were developed by monitoring various parameters in the field: fixed time-lapse camera, physical canola growth stage, sclerotinia stem rot, canola yield, and agronomic field history/practices.

Three canola varieties varying in maturity ratings (early, mid, and late maturing) were seeded into replicated plots in early May. A fixed time-lapse camera was mounted after seeding and repeatedly photographed a 1 m diameter area five times a day in one plot of each of the three varieties (Figure 21).

Notes were taken on crop emergence (weeks 1-3), condition, and stage once a week throughout the growing season. A weather station was installed near the plots to monitor minimum and maximum temperatures, relative humidity, and precipitation. Micro-weather stations were also established in the crop canopy in one plot of each of the three canola varieties to measure conditions that could be conducive to disease development (Figure 21). After fruit development, sclerotinia disease incidence was assessed once a week for three weeks. Incidence was calculated by taking the number of infected plants in three 1 m row divided by the total number of plants.

Figure 21. Photograph showing fixed time-lapse cameras and micro-weather stations installed in plots of canola with differing maturity ratings.

Field trials were conducted in Manitoba, Saskatchewan, and Alberta in 2015. After comparing accumulated heat units from three thermal models, accumulated physiological-day (P-day) thresholds were selected for predicting the growth stages. When growth stages prediction thresholds for short-, mid, and long season cultivars were compared, differences among cultivar groups were determined. The newly developed sclerotinia stem rot (SSR) score card has both weather and agronomic variables as input variables and will be refined using 2016 and 2017 cropping season field data. The sclerotinia risk calculation index was also deployed at http://canoladst.ca for the 2016 field season in Manitoba, Saskatchewan, and Alberta (and will also be refined using field data from 2016 and 2017).

Acknowledgement

Support for this project was provided by Weather Innovations Consulting and Agriculture and Agri-Food Canada, through the Agri-Innovation Pulse Cluster 2 program, with in-kind support provided by Pioneer Hi-Bred and BASF.

Brassica carinata Advanced Yield Trial

Description

Brassica carinata, commonly known as Ethiopian mustard, has an oil profile optimized for use in the biofuel industry, specifically for bio jet fuel. This crop exhibits good resistance to biotic stressors, such as insects and disease, as well as abiotic stressors, such as heat and drought, and is well suited to production in semi-arid climates. In 2015, seven experimental *Brassica carinata* lines were evaluated relative to commercial varieties. IHARF has conducted varietal evaluations for *carinata* in collaboration with Agrisoma Biosciences since 2011.

Funding for this trial was provided by Agrisoma Biosciences.

Seeding Rate and Seeding Date Effects on Flax Establishment and Yield

Description

A minimum plant population of 300 plants/m^2 is typically recommended for optimal flax yields in Saskatchewan. Strong plant establishment is essential to obtain maximum flax yields, as flax is a poor competitor with weeds early in the season, and the crop often has difficulty recovering from a poor start or compensating for a low plant population. A more rapid and complete emergence can be achieved by delaying seeding until soils have warmed up. Conversely, flax requires a relatively long growing season and yield could be lost if the crop is seeded too late. The objective of this study is to demonstrate the potential benefit of using early maturing varieties and/or higher seeding rates, particularly when seeding flax early into cool soil. The 12 treatments were combinations of three seeding rates (low (35 kg/ha), normal (50 kg/ha), and high (75 kg/ha)), two seeding dates (early and late May), and two flax varieties: CDC Bethune (traditional), and FP2454 (earlier maturing).

Results

The results were identical to previous years. Higher seeding rates will decrease maturity requirements and increase yield in flax, but yield begins to decline at seeding rates above 55 kg/ha. Also, in both varieties, the number of days to maturity decreased significantly when seeding was delayed, and the two varieties did not differ in the number of days to maturity (Figure 22).

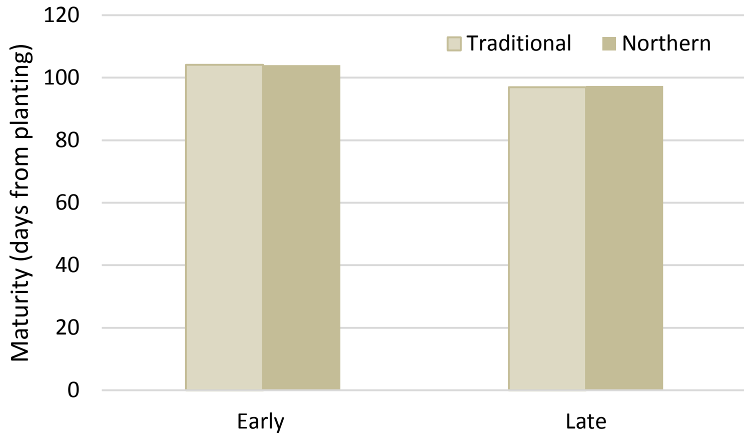


Figure 22. The effect of seeding date on maturity of two different flax varieties in 2015.

Also observed in previous years, the yield of the two varieties did not differ significantly or respond differently to seeding date (Figure 23).

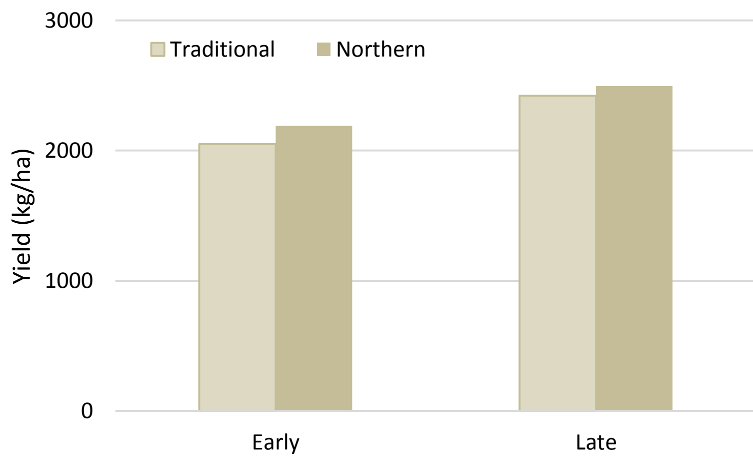


Figure 23. The effect of seeding date on yield of two different flax varieties in 2015.

Conclusions

The agronomic performance of flax was relatively insensitive to seeding dates and rates in this study. The results indicate that delaying seeding by 2-3 weeks may not necessarily result in lower yields or maturity issues; however, the risk of fall frost reducing yield and quality will increase as the date of maturity is pushed back, particularly in regions with shorter growing seasons.

The effect of seeding rate on yield was relatively small under the ideal emergence conditions at Indian Head in 2013-2015. Higher seeding rates are likely to be more beneficial under less favourable conditions at and following seeding. The higher seeding rate also tended to accelerate maturity which could be beneficial with delayed seeding or in northern environments.

Acknowledgements

Funding for this study was provided by the Saskatchewan Flax Development Commission through the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward 2 bi-lateral agreement with in-kind support provided by industry partners.

Row Spacing and Fungicide Effects on Flax Yield

Description

Pasmo (*Septoria linicola*) is the most common disease that affects flax yields in Saskatchewan and is most severe in wet environments and with dense crop canopies. Headline EC (250 g pyraclostrobin/L) is currently the only registered foliar fungicide for control of pasmo. Field trials at Indian Head over the past four years have shown a fairly consistent response to fungicide application with yield increases of nearly 30% when disease pressure was high, but less significant or no response in years or at locations where disease pressure was low. Management factors such as seeding rates, row spacing and fertility may indirectly affect flax response to fungicide by influencing the crop canopy. The objective of this project was to demonstrate the response of flax to fungicide, and to evaluate the effects of row spacing on crop response to fungicide. The ten treatments evaluated in this study were a combination of two foliar fungicide treatments (check, treated) with five different row widths (10”, 12”, 14”, 16”, and 24”).

Results

Fungicide did not have a significant impact on plant density, crop maturity, or yield in flax at Indian Head in 2015 (Table 9). Past studies have shown that a fungicide application will influence flax yield when disease pressure is high. Increased row spacing affected plant density, maturity and yield, as was shown in previous years. In 2015, there was a 28% yield loss when row width was increased from 10” to 24”.

Table 9. Separate effects of foliar fungicide and row spacing on plant density, maturity, and seed yield of flax at Indian Head in 2015.

	Plant Density (plants/m^2)	**Maturity** (days)	**Yield** (kg/ha)
Fungicide			
Treated	492 a	98.9 a	2015 a
Untreated	459 a	99.0 a	2070 a
Row Spacing			
25 cm (10”)	530 a	98.0 e	2276 a
31 cm (12”)	517 a	98.3 d	2194 b
36 cm (14”)	506 a	98.7 c	2068 c
41 cm (16”)	487 a	98.9 b	2040 c
61 cm (24”)	338 b	100.7 a	1635 d

Conclusions

Flax appears to benefit from narrower row spacing, likely because plants are relatively compact and canopy closure occurs later than other crops. Seeding flax at row widths greater than 14" is detrimental to yield. There was no interaction between row spacing and fungicide application because disease pressure was low and fungicide did not affect flax production overall. Certain sites observed yield increases with fungicide use when the environment was favorable for disease development. The variability in flax response to fungicide supports the recommendation to scout fields on an individual basis.

Acknowledgements

Funding for this study was provided by the Saskatchewan Flax Development Commission through the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward 2 bi-lateral agreement with in-kind support provided by BASF and Bayer CropScience.

Optimal N, P, and S Fertilizer Management for Flax Production

Description

Fertilizer is one of the largest input costs for most crops, including flax. Fertilizer typically provides a large return on investment when appropriate rates are applied. Flax responds well to N fertilizer application rates ranging from approximately 35-80 kg N/ha, depending on residual N and soil moisture. On the other hand, flax response to P fertilizer is less consistent and pronounced than with other crops. Still, many producers choose to apply at least enough P fertilizer to replace what the crop removes, as an important strategy for maintaining soil fertility and quality over the long-term. Potassium (K) and sulfur (S) are rarely deficient in most soils in Saskatchewan and flax seed yield responses to K and S fertilizer are not often observed. The objective of this study was to demonstrate the response of flax to varying rates of nitrogen (N), phosphorus (P), and sulfur (S) fertilizers.

Table 10. Treatments evaluated in the flax fertility trial at Indian Head in 2015.

#	Nitrogen (kg N/ha)	Phosphorus (kg P_2O_5/ha)	Sulfur (kg S/ha)
1	45	0	0
2	45	22	0
3	45	45	0
4	45	0	22
5	45	22	22
6	45	45	22
7	90	0	0
8	90	22	0
9	90	45	0
10	90	0	22
11	90	22	22
12	90	45	22
13	135	0	0
14	135	22	0
15	135	45	0
16	135	0	22
17	135	22	22
18	135	45	22
19	0	0	0

Results

Flax emergence was affected by N fertilizer rate but not P rate or S rate. There was a significant linear reduction in plants with increasing rates of side-banded N, but plant population was not reduced below 300 plants/m^2. As in previous years, flax yield was higher with the 90 kg/ha rate of N than the 45 kg/ha rate. On average, P fertilizer increased flax yields by approximately 58 kg/ha in 2015. Despite the low residual levels, there was no yield response to S fertilizer application in any of the experimental years.

Table 11. Effects of variable fertilizer rates (N, P, and S) on plant density, maturity, grain yield, and test weight of flax at Indian Head in 2015.

	Plant Density (cm)	Maturity (days)	Grain Yield (kg/ha)	Test Weight (g 0.5/L)
Nitrogen Rate				
45 kg N/ha	590 a	101.0 c	2106 b	328 b
90 kg N/ha	530 b	103.0 b	2153 a	331 a
135 kg N/ha	513 b	104.0 a	2094 b	332 a
Phosphorus Rate				
0 kg P_2O_5/ha	550 a	102.7 a	2079 b	330 a
22 kg P_2O_5/ha	537 a	102.7 a	2126 a	331 a
45 kg P_2O_5/ha	546 a	102.6 a	2148 a	330 a
Sulphur Rate				
0 kg S/ha	549 a	102.6 a	2110 a	331 a
22 kg S/ha	539.4 a	102.7 a	2125 a	330 a

Conclusions

This study has demonstrated that flax is more responsive to fertilizer applications when residual nutrients are low and other factors are limiting. Flax response to added N and P declined at higher rates, indicating that yield was limited by other factors. There was no response to S fertilizer application despite low residual levels and reasonably high flax yield. Further research is required to better understand flax response to N, P and S fertilizer applications and their interactions under various field conditions.

Acknowledgements

Funding for this study was provided by the Saskatchewan Flax Development Commission through the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward 2 bi-lateral agreement with in-kind support provided by industry partners.

Phosphorus Fertilization and Fungicide Effects on Faba Bean Establishment and Yield

Description

High yielding faba bean crops can remove large amounts of P from the soil. The amount of P exported in the seed ranges from 1.1-1.3 lbs P_2O_5 per bushel, with total uptake in the range of 1.8-2.2 lbs P_2O_5 per bushel. At Indian Head in 2014, early seeded faba beans yielded approximately 90 bu/ac, thus, the amount of P removed from the soil was substantial. Adequate P fertilization with faba bean production is important for long-term soil health.

Common faba bean diseases include chocolate spot, ascochyta leaf and pod spot, sclerotinia (white mold) and rust. The impact of disease on faba bean yields in Saskatchewan is uncertain; however, several fungicide products are registered to control or suppress these diseases in this crop.

The objective of this study was to demonstrate: 1) phosphorus fertilizer rate and placement effects on faba bean establishment and yield, and 2) faba bean yield response to applications of registered foliar fungicides. Faba bean P fertility practices and disease management with fungicides would not be expected to be correlated; however, these are two agronomic components that have not been examined in this region. The P treatments were a control (no P fertilizer) and 25 or 50 kg P_2O_5/ha, either side-banded or placed in the seed-row, with and without fungicide.

Results

Faba bean emergence was not affected by P fertilizer, indicating that the rates evaluated in this study were safe for seed-row placement under the soil and weather conditions experienced at Indian Head in 2015. Phosphorus treatment effects on yield were somewhat variable, though there was a tendency for higher yields at the seed placed 50 kg P_2O_5/ha rate (Figure 24).

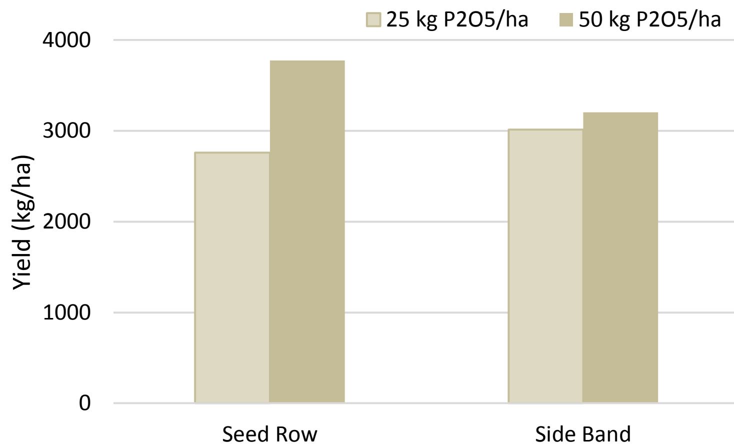


Figure 24. The effect of P placement on faba bean yield at two different rates.

The mean disease rating (scale 1-10) at maturity was 3.25 for the control (no fungicide) and 1.74 for the faba beans which received foliar fungicide, though yield did not significantly differ between the sprayed (48 bu/ac) and unsprayed (45 bu/ac) plots.

Conclusions

With modest yields at Indian Head in 2015, the faba bean crop removed approximately 51-63 kg P_2O_5/ha in the seed and would have required 82-96 kg P_2O_5/ha in total. A significant yield benefit was not detected with fungicide application; however, variability was high and the disease symptoms that were observed did not appear until relatively late in the season. Greater benefits from a fungicide application may be observed if disease symptoms occur earlier in the season.

Acknowledgements

This project was financially supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward 2 bi-lateral agreement, with in-kind support provided by BASF, FMC of Canada and Bayer CropScience.

Evaluating Inoculant Options for Faba Bean

Description

The objective of this study is to determine the effects of different types and rates of inoculants on faba bean production in various soil and climatic zones of Saskatchewan. Two faba bean varieties, Snowdrop (zero tannin) and FB9-4 (tannin), were evaluated with two rhizobia inoculants; a peat based seed-applied (Nodulator), and a granular in-furrow (TagTeam). Inoculants were applied at three rates of the granular formulation (0.5, 1 and 2X recommended application rate), with and without peat seed inoculant, and the peat seed-applied inoculant was also tested without granular inoculant. The trial was conducted at six locations in 2015.

Results

There were serious issues with plant stand establishment due to mechanical difficulties experienced at seeding time with the large-seeded FB9-4 variety. The yield data shown below was adjusted based on harvested area; however, concerns remain with the validity of the data as some plots had only short sections of rows harvested. Nonetheless, some observations were made at Indian Head in 2015. Granular inoculants by themselves appeared to have little effect on grain yield. With dual inoculation (peat plus granular), yield was significantly higher than the control treatments, but not significantly higher than peat inoculation on its own (Figure 25).

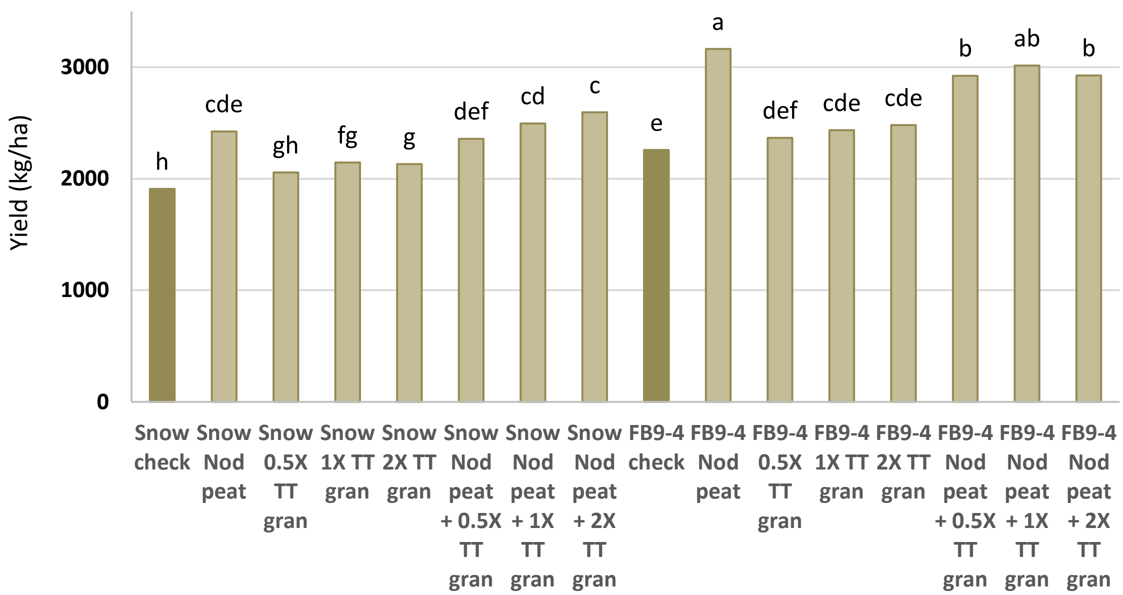


Figure 25. Yield response of two faba bean varieties to various inoculation treatments at Indian Head in 2015.

Conclusions

These results suggest that either the granular inoculants are ineffective or that they may have been damaged during re-packaging, transport or storage. Recommendations cannot be made based on the results observed at Indian Head in 2015, due to issues with plant establishment and concerns regarding the viability of the granular inoculant.

Acknowledgements

This project was led by the Western Applied Research Corporation (WARC) in Scott, Saskatchewan and was funded by the Saskatchewan Pulse Growers, with in-kind support provided by BASF, FMC and Monsanto.

Seeding Rates and Fungicide Options for Faba Bean

Description

Faba beans are a relatively new crop in Saskatchewan, but are growing in popularity. Regional best management practices for basic faba bean agronomy are still limited to growers. Two different trials were conducted to help develop management recommendations for producers interested in growing faba beans in Saskatchewan. The trials were conducted at five locations in 2015.

1) Seeding rate recommendation

A seeding rate of 45 plants/m^2 is generally recommended for faba bean, but seeding logistics can be problematic with the variability in seed size between varieties. The objective of this study was to evaluate whether higher seeding rates achieve better yields, while remaining logistically and economically feasible. The treatments consisted of five different seeding rates (20, 40, 60, 80, and 100 seeds/m^2).

Results

Faba bean yield exhibited a significant response to seeding rate under the dry conditions experienced in 2015. The optimal seeding rate for faba bean appears to be around 40 seeds/m^2 at Indian Head in 2015, but ranged between 40-60 seeds/m^2 across sites. Yield at Indian Head appeared to increase beyond the 60 seeds/m^2 rate, but such high rates are not likely economically or logistically feasible.

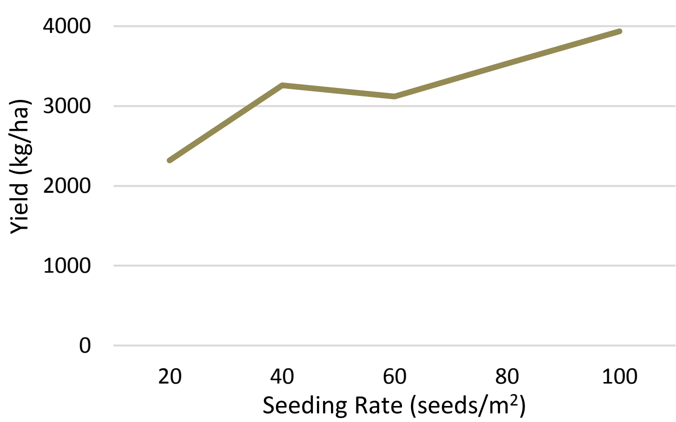


Figure 26. The effect of seeding rate on faba bean yield at Indian Head in 2015.

2) Fungicide options

Faba beans have a high tolerance for moisture; however, disease issues can arise under certain conditions. Chocolate Spot and Aschocyta are the two more prominent diseases that influence faba bean yield and quality. There are products registered for faba beans, but little information is given about control or suppression of specific diseases. The objective of this study was to determine the optimal timing of fungicide application for the control of Chocolate Spot and Aschocyta. Treatments consisted of 4 fungicide products (Priaxor, Propulse, Vertisan and Bravo) and two timings (10% and 50% flowering).

Results

Disease development progressed slowly in the early season and no significant differences between treatments were detected (Figure 27). The later application appeared to be more effective than the earlier application.

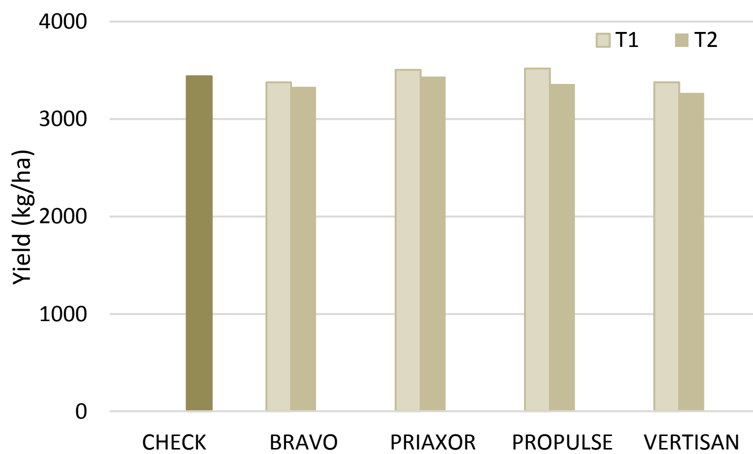


Figure 27. The effect of fungicide and spray timing on faba bean yield at Indian Head in 2015.

Conclusions

The trial will be repeated in 2016 and data from all locations will be utilized to develop recommendations.

Acknowledgements

This trial was conducted in collaboration with researchers at the University of Saskatchewan with funding provided by the Saskatchewan Pulse Growers, and in-kind contributions provided by BASF, Bayer CropScience, Syngenta and E. I. du Pont.

Adaptation and Development of Soybean Compared to Other Crops Under No-Till Management in Saskatchewan

Description

With the release of early-maturing varieties, soybean production has expanded into Saskatchewan with the highest rates of adoption in the southeast, and interest shown by producers throughout the province. The adoption of this crop in southeast Saskatchewan has coincided with unusually wet conditions which has delayed seeding for many growers and caused difficulties with production of traditional pulse crops such as field peas or lentils. Multiple factors have driven soybean adoption in Saskatchewan; however, there is still uncertainty regarding the crop's long-term yield stability relative to other crops, particularly in cooler and drier regions.

Three different varieties of soybeans, differing in maturity ratings, were planted alongside field peas, faba beans, and canola on three different seeding dates. The objectives of this study were: 1) to assess the risks associated with growing modern, early maturing soybean varieties under no-till in Saskatchewan compared to more traditional broadleaf crops and 2) to improve recommendations for the successful establishment of soybeans in southern Saskatchewan. The targeted seeding dates were T1) Early (first two weeks of May), T2) Normal (10-14 days after the 1st seeding date and T3) Late (10-14 days after the 2nd date). The crop/variety treatments were Canola (46H75 CL), Field pea (CDC Golden), Faba bean (Snowbird), and Soybean (NSC Tilston RR2Y, TH33003R2Y, and P002T04R). Multiple seeding dates were included to assess whether the relative performance of each crop changes as seeding is delayed and to broaden the range of environmental conditions. Multiple soybean varieties were included to ensure that our results would be applicable to the range of early maturing material available. The trial was conducted in Indian Head and Swift Current in 2014 and 2015, but data from each site were analyzed separately.

Results

All crops, especially soybeans, took longer to emerge with early seeding, but plant density was not affected by seeding date for canola, faba bean or soybeans. For peas, the highest plant density was observed at the last seeding date, while the lowest density was observed with mid-May seeding. Soybean maturity was highly affected by seeding date at Indian Head. Soybeans seeded on the first two dates at Indian Head emerged and matured at approximately the same time, regardless of the difference in seeding date. Yields for field peas and faba beans were significantly higher than soybeans at all three seeding dates and canola was higher yielding for the first two dates only. Overall, yields for canola, field pea, and faba bean did better than soybeans in 2015 (Figure 28).

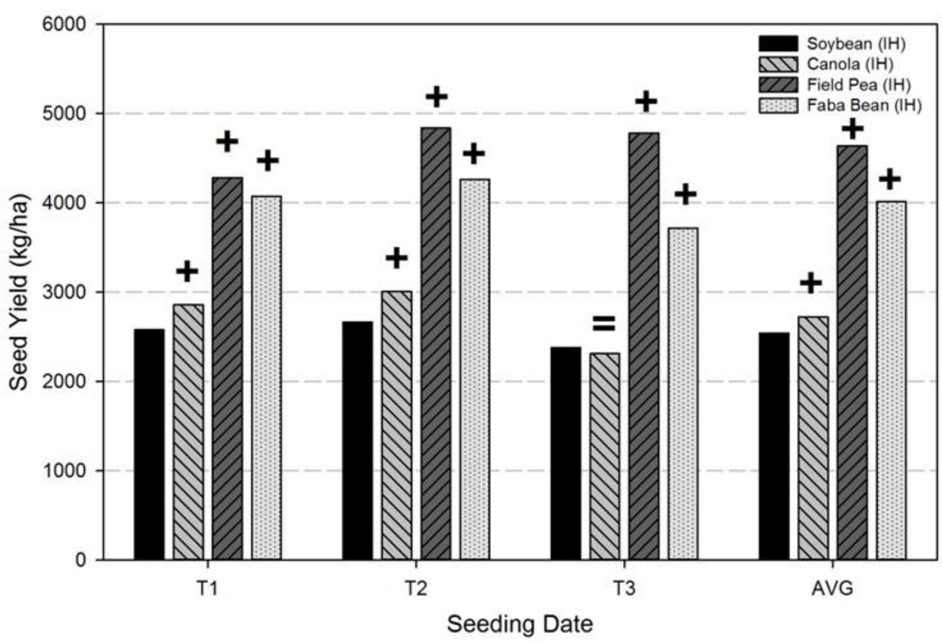


Figure 28. Mean yield and contrast results for seed yield at Indian Head in 2015. Soybeans are compared directly to canola, field pea, and faba bean. Yields within a group are either below (-), above (+), or equal (=) to soybean.

Conclusions

The trial will be repeated in 2016. As more data is accumulated, economic analyses will be completed to take into account the costs of production and gross revenues of the various crops as a function of seeding date.

Acknowledgement
Support for this project was provided by the Saskatchewan Pulse Growers and Agriculture and Agri-Food Canada, through the Agri-Innovation Pulse Cluster 2 program, with in-kind support provided by Pioneer Hi-Bred, NorthStar Genetics, BASF and Quarry Seed.

Seeding Rate and Depth Effects on Soybean Establishment, Maturity, and Yield

Description
As more producers opt to include soybeans as an alternative to other crops in their rotation, it is necessary to improve recommendations for the successful establishment of this crop in Saskatchewan. The objective of this study was to evaluate soybean response to seeding rates and depths. The treatments evaluated were a combination of two seeding depths (0.75" and 1.5") and seven seeding rates ranging from 15-85 seeds/m^2. The trial was conducted at Indian Head and Swift Current in 2014 and 2015.

Results
In 2015, plant density was significantly affected by seeding rate but not depth at both locations. Plant density increased linearly with seeding rate (Figure 29).

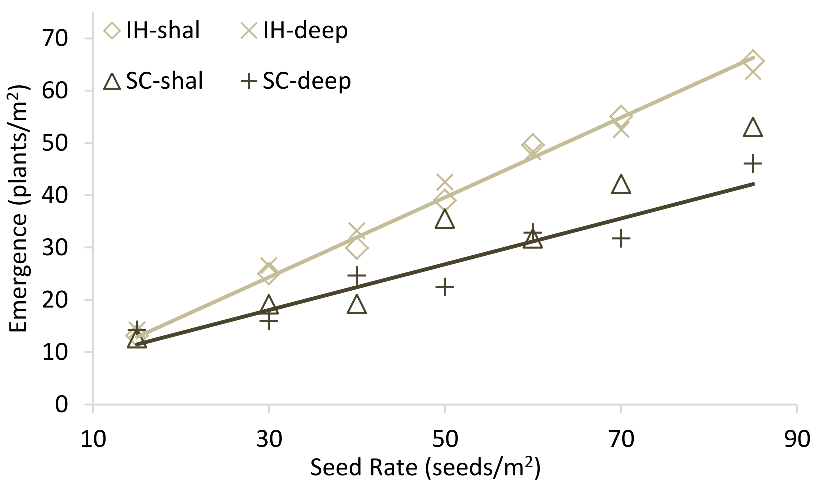


Figure 29. Seeding rate effects on soybean plant density at Indian Head and Swift Current in 2015.

Similarly, soybean seed yield at Indian Head was affected by seeding rate but not depth. There were no significant differences in yield at seeding rates of 60 seeds/m^2 and higher. Yield was relatively low at Swift Current in 2015, and was affected by both seeding depth and rate; deeper seeded treatments yielded significantly more overall, but the yield advantage was small (Figure 30).

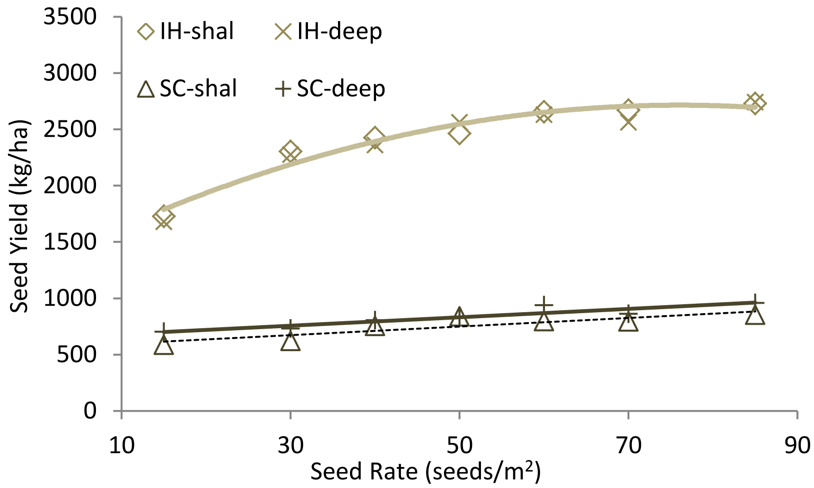


Figure 30. Seeding rate effects on soybean seed yield at Indian Head and Swift Current in 2015.

Conclusions

Results suggest that soybeans do not need to be seeded as deep as other pulse crops such as field pea or faba beans. Results also suggest that optimal seeding rates for soybeans in Saskatchewan may be higher than the current recommended rate; however, the cost of seed must be taken into consideration. The trial will be repeated in 2016.

Acknowledgements

Support for this project was provided by the Saskatchewan Pulse Growers and Agriculture and Agri-Food Canada, through the Agri-Innovation Pulse Cluster 2 program, with in-kind contributions provided by BASF and NorthStar Genetics.

Row Spacing Effects on Soybean Establishment, Maturity, and Yield

Description

As more producers opt to include soybeans as an alternative to other crops in their rotation, it will be necessary to improve recommendations for the successful establishment of this crop in Saskatchewan. The objective of this study was to evaluate soybean response to varying row widths, and to examine interactions with seeding rate. The treatments were a combination of five row widths (10”, 12”, 14”, 16”, and 24”) and three seeding rates (40, 50 and 60 seeds/m^2). The trial was conducted in 2014 and 2015.

Results

In both years, spring plant densities decreased with wider row spacing and increased with seeding rate, and there was no interaction between the two factors. Seed yield was affected by row spacing and seeding rate in 2015 and the interaction between these factors was also significant, indicating that response to row width varied among the seeding rates. The response to row spacing is in contrast to what was observed at Indian Head in 2014 (See 2014 Annual Report). In 2015, the highest yields were achieved at the narrowest spacing of 10” (Figure 31).

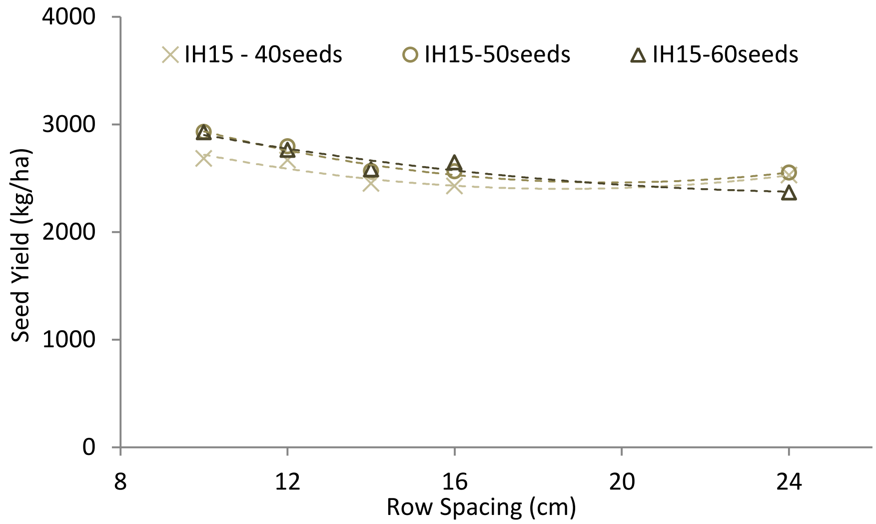


Figure 31. Row spacing and seeding rate effects on soybean seed yield at Indian Head in 2015.

Conclusions

Soybeans are frequently seeded with planters at up to 30” row spacing in traditional soybean growing regions. In short-season regions such as western Manitoba and southeast Saskatchewan, narrower row widths (<15”) are more likely to be successful, as seen at Indian Head in 2015. Nonetheless, yield did not decline significantly beyond the 14” row width and adequate canopy closure was achieved at all row widths, suggesting that this crop is relatively flexible with regards to row spacing. The trial will be continued in 2016.

Acknowledgements

Support for this project was provided by the Saskatchewan Pulse Growers and Agriculture and Agri-Food Canada, through the Agri-Innovation Pulse Cluster 2 program, with in-kind contributions provided by BASF and Pioneer Hi-Bred.

Developing Phosphorus Management Recommendations for Soybean Production in Saskatchewan

Description

Soybeans are substantial users of phosphorus, thus adequate P fertilization is important for long-term soil health. It has been shown that soybeans require approximately 1.35 lb P_2O_5 per bushel to grow and remove approximately 1.1 lb P_2O_5 per bushel when the seed is harvested. Currently, it is not clear whether soybeans are more responsive to banded or broadcast P fertilizer, or even to added P fertilizer at all. The objective of this study was to develop phosphorus management recommendations for soybeans in Saskatchewan by examining crop response to monoammonium phosphate (MAP, 11-52-0) rates and placement methods. Treatments were a combination of 3 P fertilizer rates (22, 45 and 90 kg P_2O_5/ha) and 3 placements (seed-placed (SP), side-banded (SB) and pre-seed broadcast (BC)). The trial was conducted at four locations in 2015.

Results

Seedling emergence was assessed at 2, 3, and 4 weeks after seeding, but there were no significant differences between treatments. There appeared to be a small reduction in emergence with seed-placed fertilizer at some locations. Yields were not significantly different at Indian Head (Table 12). At some sites, contrasts indicated lower yields with seed-placement relative to side-banding or broadcasting; however, this was only observed at the highest P rate.

Table 12. Effect of P levels and placement on soybean emergence and yield at Indian Head in 2015.

Treatment	Soybean Emergence (plants/m^2)	Seed Yield (kg/ha)
0 P	48.8	2632
22 P – SP	46.8	2689
22 P – SB	49.0	2818
22 P – BC	50.3	2707
45 P – SP	48.6	2669
45 P – SB	44.7	2736
45 P – BC	44.9	2766
90 P – SP	43.9	2762
90 P – SB	50.3	2715
90 P – BC	51.1	2741

Conclusions

These results are consistent with those from a similar study in Manitoba, where yield increases with P fertilizer were rare and reductions in emergence were only observed on coarse textured soils at the highest application rate. Regardless of the yield response to applied P, soybeans require large quantities of this nutrient and application rates should be adequate to maintain soil productivity over the long-term. Soybeans have been shown to respond to residual P, thus building up soil P in preceding years may be beneficial for production of this crop.

Acknowledgements

Funding for this project was provided by the Saskatchewan Pulse Growers, with in-kind support provided by Monsanto and BASF.

Developing Nitrogen Management Recommendations for Soybean Production in Saskatchewan

Description

As legumes, soybeans are capable of acquiring N through biological N fixation; however, soybeans require and remove substantial amounts of N in harvested seed. Proper inoculation is critical in regions where soybeans are newly introduced to the rotation, such as in Saskatchewan. Most soybean seed in Saskatchewan and Manitoba comes pre-treated with both a seed treatment and liquid inoculant. Applying both granular and seed applied inoculant has been a common practice for first time growers and it is also advised to use rates above those recommended by the product labels. Soybean response to different rates of granular inoculant in addition to the seed-applied product needs to be assessed over a range of environments. The objective of this study is to investigate soybean response to varying rates of granular inoculant rates and examine interactions with different sources of N fertilizer. The treatments evaluated were four granular inoculant rates (0, 1x, 2x and 4x the label recommended rate) with 4 N fertilizer treatments (0 N or 55 kg N/ha as side-banded urea, side-banded ESN® or post-emergent surface dribble-banded urea ammonium-nitrate). The trial was conducted at three sites in 2015.

Results

At Indian Head, soybean yield was affected by N treatment and granular inoculant rate. Yields were slightly higher with post-emergent UAN than with the other N treatments and there was a significant yield increase with up to the 1x label rate of granular inoculant. However, post-emergent UAN was only beneficial when no granular inoculant was applied. There was a tendency for higher yields with higher rates of granular inoculant, regardless of the N treatment (Figure 32).

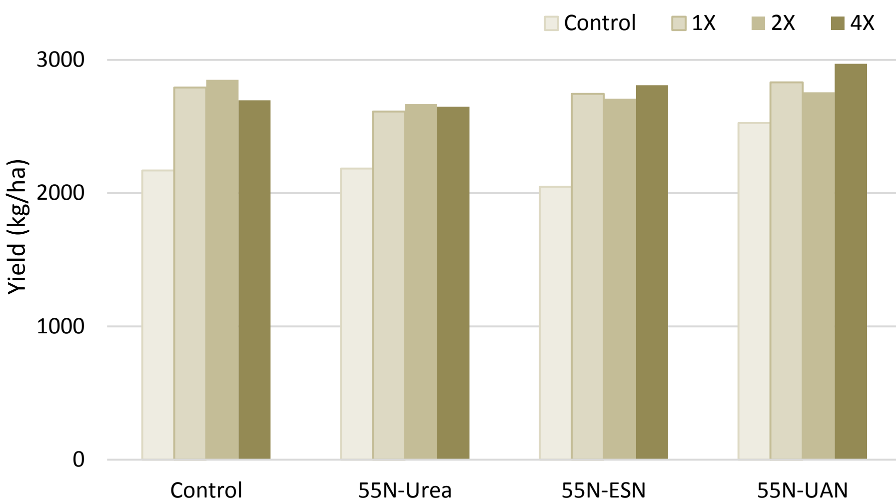


Figure 32. Effect of inoculant rate on soybean yield when fertilized with different types of N fertilizer.

Conclusions

Nitrogen fertilization generally resulted in increased above-ground biomass yield but rarely affected seed yields. The exception was specifically with post-emergent UAN in the absence of granular inoculant where there was a 16% yield increase. The results suggest that N fertilization is not beneficial with adequate inoculation and under reasonably high yielding conditions (as per regional yield potential). However, post-emergent applications during the early reproductive stages can provide significant yield benefits when nodulation is poor.

Acknowledgements

Funding for this project was provided by the Saskatchewan Pulse Growers, with in-kind support provided by Monsanto and BASF.

RR2 Soybean Variety, Inoculant, P and K Fertility, Seeding Rate and Seed Treatment Trials

Description

Soybean production has recently expanded to many parts of Saskatchewan. This crop has not historically been cultivated under dryland no-till production, and it is not known which varieties are best suited to local environmental conditions, or the best management practices in Saskatchewan. Four separate trials were initiated to: 1) test Quarry (Thunder Seeds) soybean varieties against competitive varieties to observe differences in days to maturity and gather relative yield performance data; 2) to test different rates and application methods of inoculating soybeans; 3) to test the effects of different rates of P and K fertilizer on soybeans; and 4) to test different seeding rates and several soybean seed treatments.

Results

Variety Trial

In 2015, soybean yields were closer to what can reasonably be expected at Indian Head as crops were not affected by an early killing frost as in the previous year. Yields differed significantly between varieties (Figure 33).

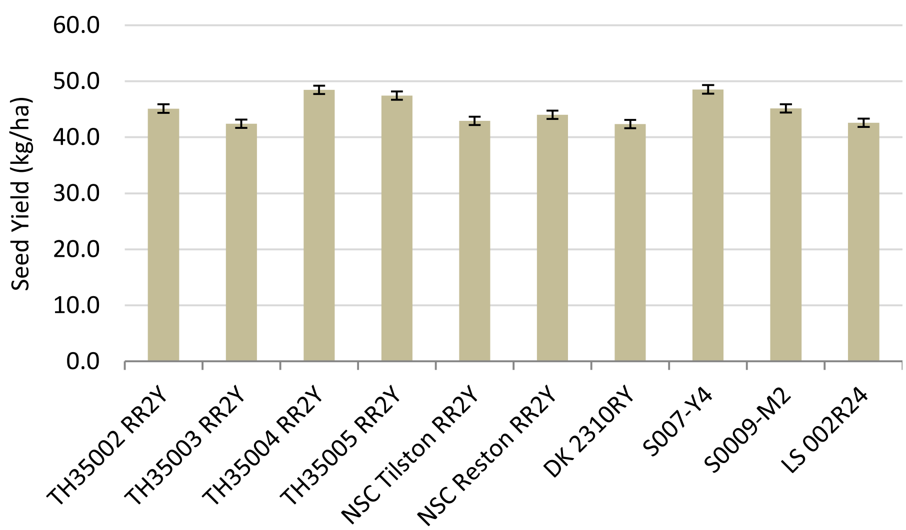


Figure 33. Yield of 10 commercial soybean varieties at Indian Head in 2015.

Inoculant Trial

The variety utilized in this trial was TH33003 R2Y and all seed was pre-treated with liquid inoculant (SoyRhizo). Various rates of the granular inoculant, NROW, was assessed for their effect on soybean yield. There was no significant benefit to increasing inoculant rate beyond 4 lb/ac in 2015 (Figure 34).

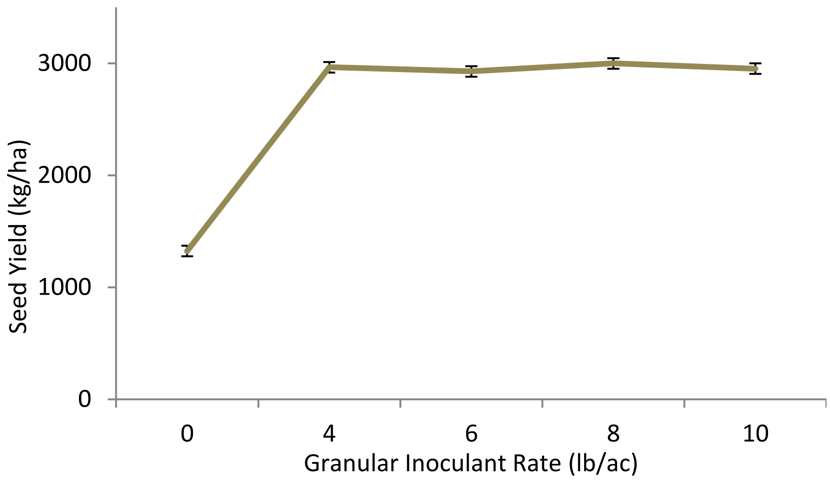


Figure 34. Yield response of soybean to different rates of granular inoculant at Indian Head in 2015.

Fertility Trial

Eight different fertility treatments were compared which differed in rate of side banded P (11-52-0) and K (0-0-60) fertilizers (Figure 35). Yield differences between treatments were not substantial.

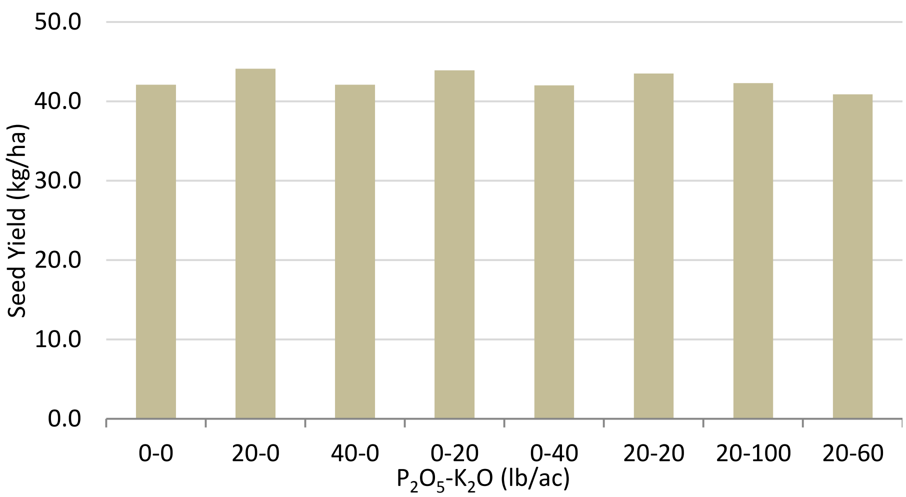


Figure 35. Soybean yield response to different rates of P and K fertilizer at Indian Head in 2015.

Seeding Rate and Seed Treatment Trial

Soybeans treated with three different seed treatments and an untreated control, were each sown at five different seeding rates to determine the effect on soybean yield (Figure 36). Response to seed treatments was variable and response to seeding rate was weak.

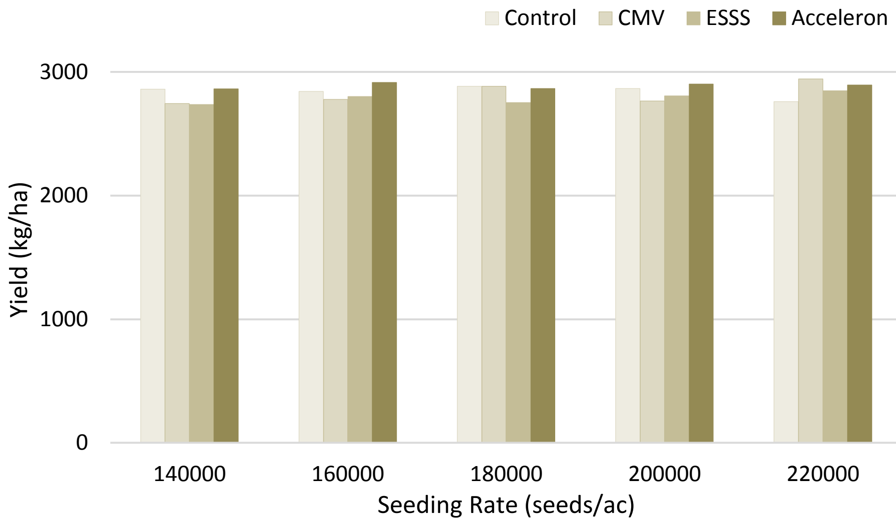


Figure 36. Soybean yield response to different seed treatments at a range of seeding rates at Indian Head in 2015.

Acknowledgement

Funding for these projects was provided by Quarry Seed.

New Insights into Natural Air Grain Drying

Description

This project aims to develop and test management practices for storing grain to achieve the following objectives: 1) to store the grain as safely as possible, with the least spoilage or deterioration; 2) to dry the grain quickly for sale to an acceptable moisture content, without over-drying; 3) to condition the grain efficiently, at the lowest cost and the least inconvenience; 4) to maintain a consistent moisture content from the top to the bottom of the bin.

A trial was conducted in 2015 which expanded on previous observations and findings. It had been determined in earlier trials that drying and cooling of stored grain using fans was influenced by ambient air conditions, and that different strategies could be developed which turn fans on or off based on the temperature differential between ambient air and grain, with offsets to achieve different objectives.

The control strategies tested in this trial and their grain storage objectives were:

1) ***Night Only***: in which fans run only between 9:00pm and 9:00am. This is a simple, low cost strategy as it does not require any complex calculations or expensive sensors. It does reduce fan running time by 50%, relative to continuous fan operation; however, it does not take into consideration the actual condition of the grain and outside air, which can result in increased grain moisture or missed opportunities for drying. It does keep the grain colder than continuous fan operation and therefore safer.
2) ***+1 Temperature Differential****:* in which the fans were activated only if air temperature was less than the grain temperature + 1°C. This strategy significantly reduces fan running time and does result in significant cooling and runs mostly when drying is occurring. The temperature-differential control strategy is also simple and easy to understand; but, it does require temperature sensors inside and outside of the bin and a controller.

3) ***+2 Temperature Differential***: in which fans were activated only if the air temperature was less than the grain temperature with an offset of + 2°C. The larger offset should result in increased fan use and potentially faster drying.

Methods

A total of six steel hopper bins were used to test the three different control strategies on both wheat and barley. All bins were equipped with horizontal perforated aeration tubes and attached fans. The bins were instrumented with sensors measuring the temperature and relative humidity of the air coming in through the fan, and the out-going air at the top of the bin. Additionally, each of the six bins was fitted with nine vertical sensor strings that were hung from the reinforced bin roof and evenly spaced throughout the bin, which contain temperature and relative humidity sensors every four feet. The moisture content of the grain in the bin was calculated using values from the sensors. The bins were equipped with a specially designed sampling tube which allowed grain sampling at four different points throughout the height of the bin, accessible from the ground, to confirm the actual grain moisture content (Figure 37). All six bins were outfitted with fan controllers. Three bins were filled simultaneously with freshly harvested grain in order to ensure that initial grain moisture content and initial temperature was similar for all three bins.

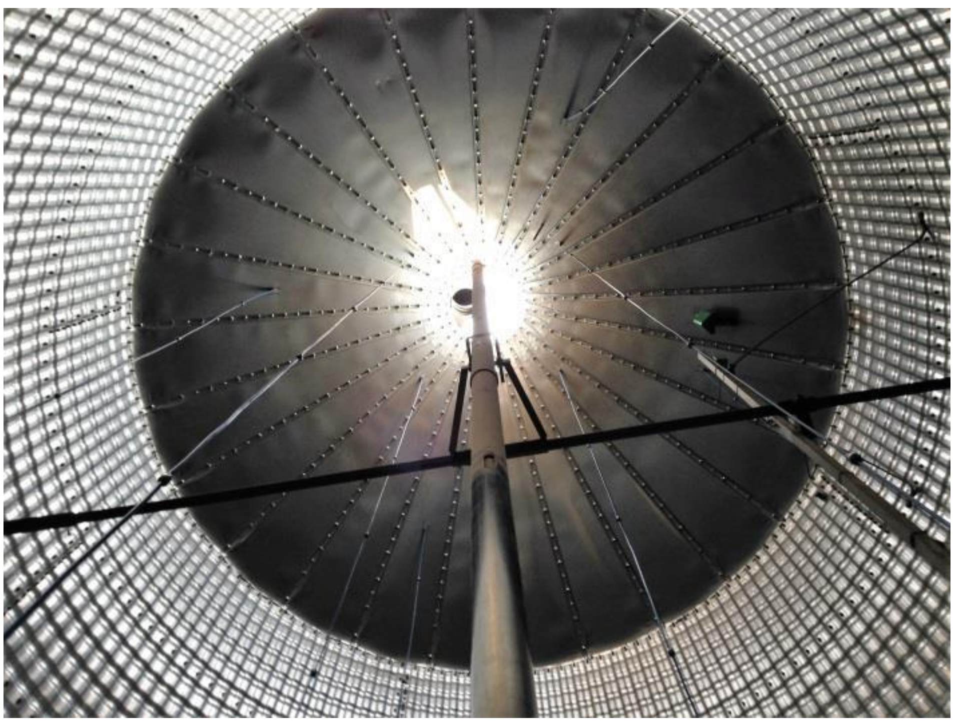


Figure 37. Sampling tube and sensor strings inside of test bin.

Results

A summary of the trial results is shown in Table 13. All strategies were successful in conditioning the grain, and the trial confirmed that different strategies can be utilized to achieve different grain storage objectives (cooling, drying, reducing fan running time); however, there are trade-offs to each strategy in terms of achieving a specific objective.

Table 13. Results of natural air grain drying trial at Indian Head in 2015.

	Bin 9	Bin 17	Bin 19	Bin 10	Bin 16	Bin 18
Control Strategy	Night	+1C	+2C	Night	+1C	+2C
Grain	Barley	Barley	Barley	Wheat	Wheat	Wheat
Capacity	2250 bu	3500 bu	3500 bu	2250 bu	3500 bu	3500 bu
Air flow rate (cfm)	743	1229	1229	743	1229	1229
cfm/bu	0.33	0.35	0.35	0.33	0.35	0.35
Fan start date	15 Aug	15 Aug	15 Aug	29 Aug	29 Aug	29 Aug
Fan shut down	28 Sept	26 Oct	28 Sept	28 Sept	26 Oct	26 Oct
Average initial MC (%)	17.6	16.8	17.6	16.3	16.7	16.4
Average Final MC (%)	14.6	14.8	13.9	14.7	15.2	15.0
MC change (%)	3.0	2.0	3.7	1.6	1.5	1.4
Average Final T (°C)	12.2	6.7	10.7	13.1	5.6	6.5
Duty Cycle (%)	40[i]	31	44	38[i]	27	31

[i] Night only strategy should result in 50% duty cycle; however, fans were turned off during rain events

It was also determined that fan control strategies which utilize only temperature differentials can be improved on in terms of drying efficiency – the strategies did not always accurately predict drying conditions, especially when relative humidity of the outside air was especially high. A new controller strategy was proposed and will be tested in the future:

4) ***Absolute humidity:*** in which the fan is activated if the absolute humidity of air in the bin is greater than absolute humidity of the outside air. It requires sensors for measuring the temperature and relative humidity of grain, discharge air and outside air. Even though this method requires additional sensors and a relatively complex controller, it is the best approach for determining not only if a drying condition exist, but also the degree of drying available.

Conclusions

The project is on-going and new methods are being evaluated every season. Fan control strategies that utilize time of day or temperature differentials have been shown to be efficient, safe, and simple to implement.

Acknowledgments

Funding for this project was provided by the Western Grains Research Foundation with in-kind support provided by Intra-Grain Technologies and Clews Management.