IHARF
INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

2016 Annual Report

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Contents

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 2016 IHARF Directors included:

- Chris Brown - President *(Indian Head)*
- Travis Wiens - Vice President *(Milestone)*
- Janel Delage - 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 include:

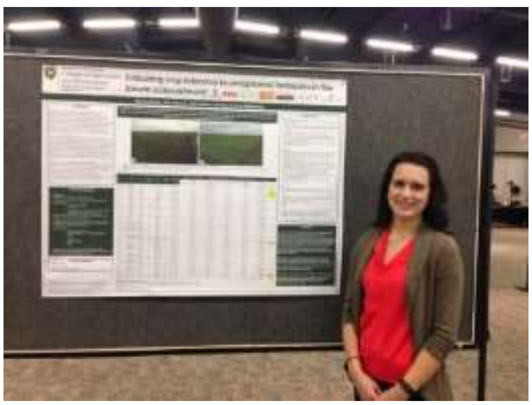
- Henry de Gooijer - Coordinating Biologist
- Bill May - Research Scientist
- Chris Omoth - Research Assistant

IHARF Staff

The 2016 team of IHARF staff included:

- Danny Petty - Executive Manager
- Chris Holzapfel - Research Manager
- Christiane Catellier - Research Associate
- Dr. Ron Palmer - Electronic Systems Engineer
- Andrea De Roo - Agronomy Research Intern
- Karter Kattler - Field & Plot Technician
- Dan Walker - Seasonal Technician
- Ted Lockert - Farm Technician
- Carly Miller - Summer Research Assistant
- Rizwan Faisal - Research Assistant

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 recipient of the Dr. Guy Lafond Memorial Award in 2016 was Moria Petruic from Avonlea, Saskatchewan. Moria is completing her Masters in Plant Sciences at the University of Saskatchewan, studying ways to optimize the competitiveness of flax through the utilization of integrated weed management.

Extension Events

Indian Head Crop Management Field Day

On July 19, 2016, IHARF and AAFC hosted the annual Indian Head Crop Management Field Day. 212 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)
- Moria Petruic (University of Saskatchewan)
- Bill May (AAFC)
- Dr. Randy Kutcher (University of Saskatchewan)
- Dr. Brian Beres (AAFC Lethbridge)
- Dr. Tyler Wist (AAFC Saskatoon)
- Corey Loessin (Saskatchewan Pulse Growers)

AgriARM Research Update

On January 12, 2017, IHARF, along with Agriculture Applied Research Management (AgriARM) sites from across the province, jointly hosted the AgriARM Research Update, as part of Crop Production Week in Saskatoon, SK. The event highlighted components of each organizations applied research and demonstration programs. Presenters for the day included:

- Chris Holzapfel (IHARF)
- Mike Hall (East Central Research Foundation)
- Stu Brandt (Northeast Agriculture Research Foundation)
- Jessica Weber (Western Applied Research Corporation)
- Chris Baan (Wheatland Conservation Area)
- Joel Peru (Saskatchewan Ministry of Agriculture, ICDC)
- Gary Kruger (Saskatchewan Ministry of Agriculture, ICDC)
- Garry Hnatowich (ICDC)

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

IHARF Soil and Crop Management Seminar

On February 1, 2017, IHARF hosted its annual winter seminar in Weyburn, SK, highlighting results of the 2016 season and current industry issues. Just over 100 guests took in presentations delivered by:

- Chris Holzapfel (IHARF)
- Bill May (AAFC)
- Dr. Richard Gray (University of Saskatchewan)
- Dr. Mario Tenuta (University of Manitoba)
- Dr. Yantai Gan (AAFC, Swift Current)
- Dr. Ron Palmer (IHARF)

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

2016 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 2016:

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
- Agrisoma Biosciences
- Koch Agronomic Services
- Quarry Seed
- Saskatchewan Flax Development Commission
- Syngenta
- Yara North America

Silver

- Arysta LifeScience
- Ducks Unlimited Canada
- E. I. du Pont
- Earth Alive Clean Technologies
- Engage Agro
- HCI Ventures
- Markusson New Holland
- Mosaic
- Pioneer Hi-Bred
- Weather Innovations
- University of Saskatchewan

Bronze

- Crop Production Services
- FendX
- FMC of Canada
- FP Genetics
- IntraGrain Technologies
- Monsanto BioAg
- NorthStar Genetics
- Saskatchewan Wheat Development Commission
- SeedMaster
- TD Canada Trust
- Town of Indian Head
- Wheatland Financial – Paul Kuntz

AgriARM

The Saskatchewan AgriARM (Agriculture Applied Research Management) program connects eight regional, applied research and demonstration organizations into a province wide network. Each location 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 organizations found throughout Saskatchewan include:

- Conservation Learning Centre (CLC), Prince Albert
- East Central Research Foundation (ECRF), Yorkton
- 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

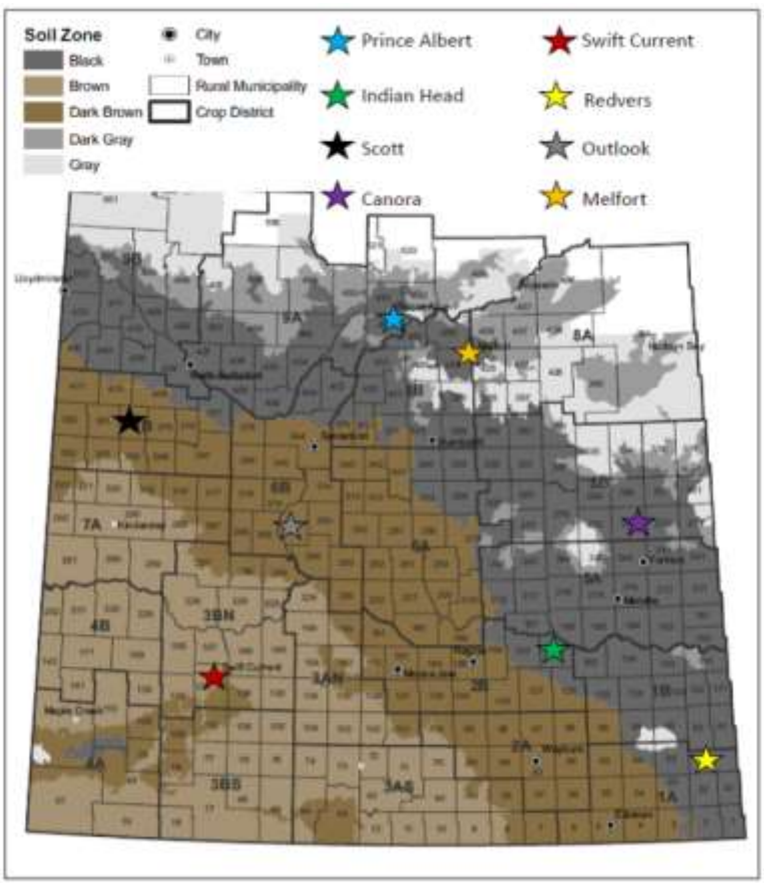


Figure 1. Locations of organizations comprising the Saskatchewan AgriARM Network.

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://climate.weather.gc.ca/historical_data/search_historic_data_e.html].

The 2016 growing season produced above average yields amongst the crops grown at Indian Head. The spring began with adequate soil moisture levels with timely rains received 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. Some plots were damaged by hail during storm events in June and July, delaying maturity slightly, while yield and quality appeared to be minimally affected.

Table 1. Mean monthly temperatures for the2016 growing season and long-term normals (1981-2010).

		Apr	May	Jun	Jul	Aug	Sep	Oct
					°C			
Indian Head	2016	3.8	12.8	16.9*	17.6*	16.9	12.8*	3.9
	normal	4.2	10.8	15.8	18.2	17.4	11.5	4.0
Melfort	2016	2.9*	13.6	17.1	18.1	16.3	12.0*	1.7*
	normal	2.8	10.7	15.9	17.5	16.8	10.8	3.3
Scott	2016	5.9	12.4*	15.8*	17.8	16.1	10.9	1.6*
	normal	3.8	10.8	15.3	17.1	16.5	10.4	3.3
Swift Current	2016	6.0*	13.1*	16.9*	17.6*	16.7*	12.5*	3.8*
	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 2016 growing season and long-term normals (1981-2010).

		Apr	May	Jun	Jul	Aug	Sep	Oct	Total
						mm			
Indian Head	2016	13.9	74.7	50.2*	107.9*	21.9	40.5*	63.5	372.6*
	normal	22.6	51.7	77.4	63.8	51.2	35.3	24.9	326.9
Melfort	2016	13.5*	16.8	53.2	128.7	80.8	41.3*	57.7	392*
	normal	26.7	42.9	54.3	76.7	52.4	38.7	27.9	319.6
Scott	2016	1.9	64.8*	20.8*	88.1	98.2	22.2	33.1*	329.1*
	normal	21.6	36.3	61.8	72.1	45.7	36.0	17.9	291.4
Swift Current	2016	20.7*	109.9*	56.1*	51.0*	41.5*	26.6*	43.4*	349.2*
	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 NW28-18-12 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.

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 at Indian Head have shown that seed treatments were 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 field demonstrations in recent years have suggested that winter wheat is quite responsive to foliar fungicide. The objective of this project was to demonstrate the relative contributions of each of these crop inputs to successful winter wheat establishment, yield potential, and grain quality. The study was conducted from 2014-2016. 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 and early-season growth was estimated by measuring NDVI, an indirect measure of plant health and above-ground biomass. Seed treatment and seeding rate both had a positive effect on early season growth in 2016, and the same result was found when all three years were analyzed together (data not shown). In the three years of the project, there was no early-season benefit to increasing the seeding rate beyond 300 seeds/m^2; however, there was minimal winter kill and excellent emergence in these years.

The use of a foliar fungicide had the greatest influence on yield in 2016. The use of a seed treatment positively influenced yield, but only in the absence of foliar fungicides (Figure 2, left). Seeding rates also had a positive influence on yield in 2016, and the effect was independent of seed treatment and foliar fungicide effects (Figure 2, right).

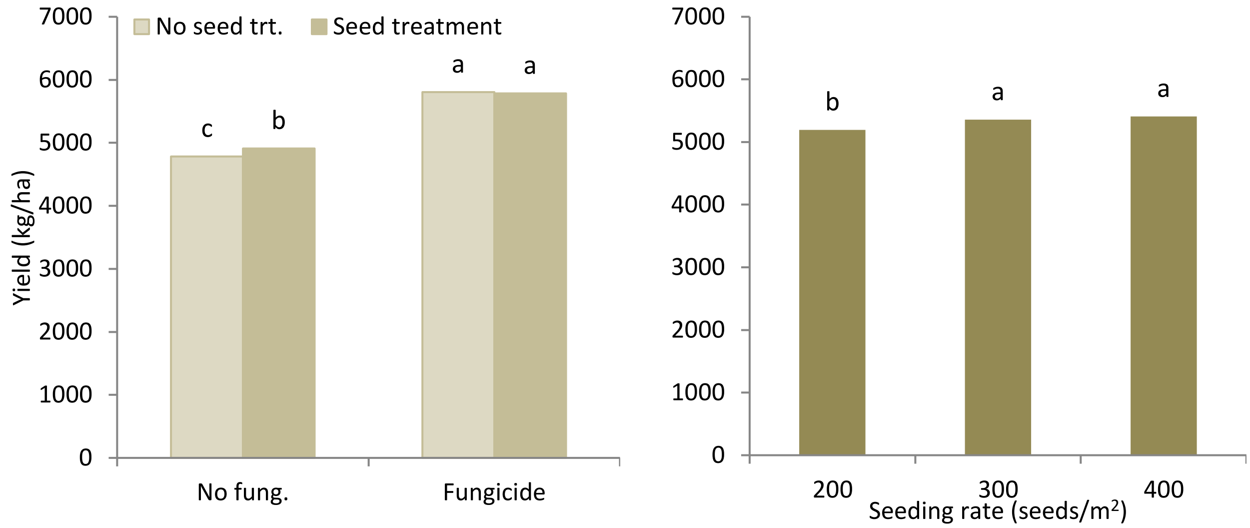


Figure 2. The effect of seed treatment and foliar fungicide application (left) and seeding rate (right, average of all treatments) on winter wheat yield at Indian Head in 2016.

Seed treatment and foliar fungicide application both significantly influenced yield when all three years were analyzed together. Seeding rate did not consistently provide a yield benefit, and the effect seemed to be more influenced by growing season conditions.

Conclusions

Overall, seeding rates, seed treatments and foliar fungicides contributed to winter wheat establishment and yield. Higher seeding rates can provide a buffer when faced with stressful winter and spring conditions. Winter wheat early season growth also consistently benefits from seed treatments, likely a result of the more stressful early season conditions relative to spring seeded crops. The yield benefit from seed treatment was small, but relatively consistent. Previous trials have shown dramatic improvements in stand establishment and yield with seed treatment under harsher winter and spring conditions. Foliar fungicide application consistently protected the yield potential of winter wheat in this trial. In general, there was very little interaction between the three factors over the three years of this trial, indicating that their effects are independent of each other.

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 the products are incorporated into the soil. 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

Winter wheat yield response to various N fertilizer products and application methods is below in Figure 3. These results only include data from Indian Head and have not been statistically analysed. It appears that no matter the N fertilizer product used, best yield results were obtained when applying the N fertilizer at the time of seeding in a side-band.

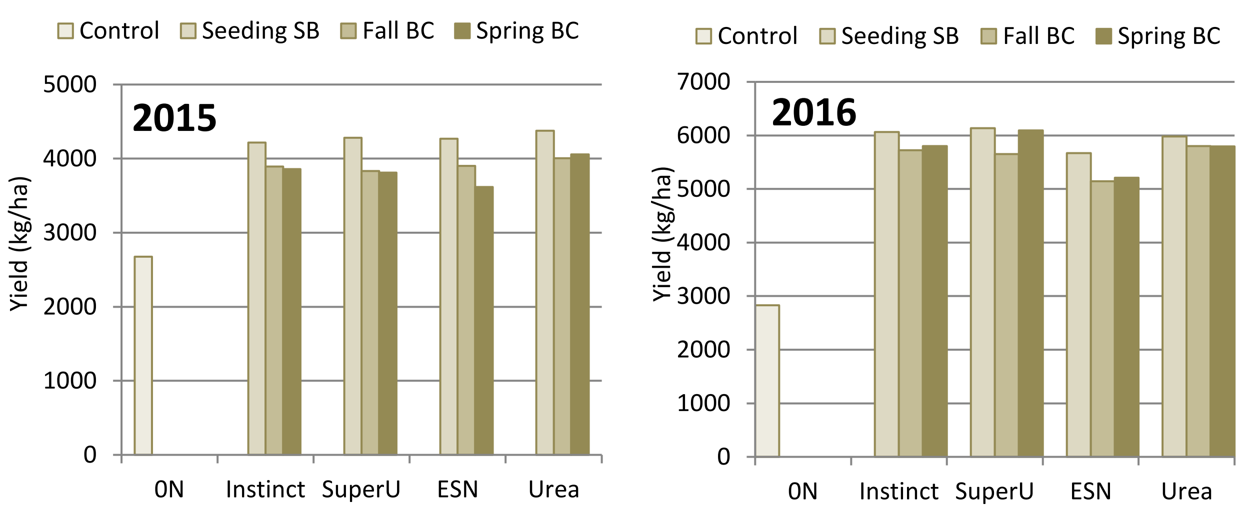


Figure 3. The effect of N fertilizer product, placement, and timing on winter wheat yields at Indian Head in 2015 and 2016.

Conclusions

N fertilizer losses are highly influenced by environmental conditions which can vary greatly from year to year. In 2015 and 2016, it was observed that placing all of the crops N fertilizer in a side band at seeding provided the best yield results.

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 Hybrid versus Open-Pollinated Fall Rye Varieties

Description

Commercial availability of new hybrid fall rye varieties has renewed interest in this crop. The three currently available European hybrids (Brasetto, Guttino and Bono) reportedly yield 120-126% of the highest yielding open-pollinated variety, Hazlet, on average in Saskatchewan. Fall rye has traditionally been 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). The trial was conducted at Indian Head in 2014-15 and 2015-16, and Melfort in 2015-16.

Results

The hybrid variety, Brasetto, yielded higher than the open-pollinated variety in all site-years. Both varieties responded similarly to varying rates of N fertilizer, even with varying yield potentials between the varieties and different growing conditions among the site years (Figure 4).

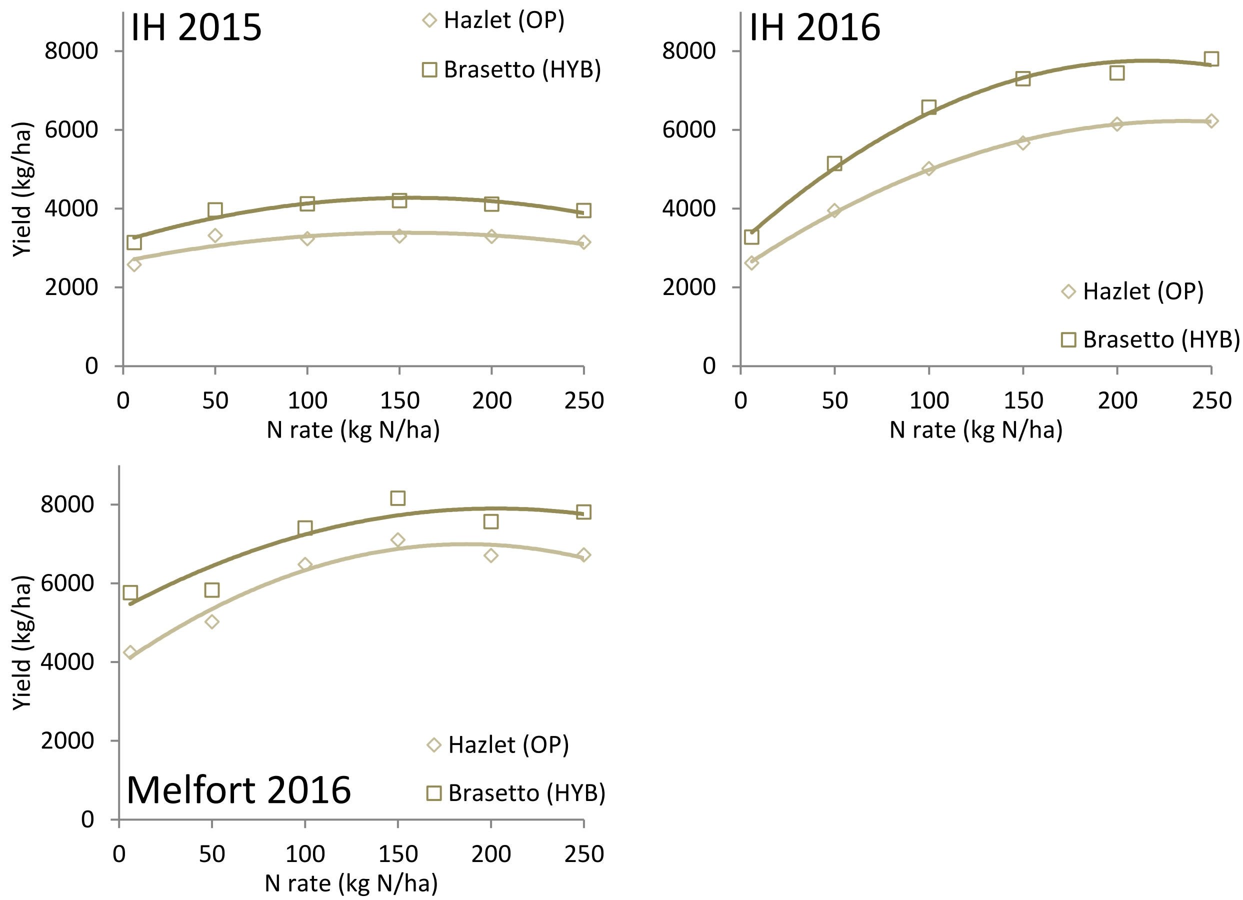


Figure 4. The effect of N fertilizer rate on open-pollinated (Hazlet) and hybrid (Brasetto) fall rye varieties at Indian Head in 2015 and 2016, and Melfort in 2016.

Conclusions

The results to date suggest that the response to N fertilizer is similar between OP and hybrid fall rye, despite the higher yield potential of the hybrid variety; however, the hybrid fall rye (Brasetto) was nearly 13% shorter than the OP variety.

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.

Seeding Rate Response of Modern Hybrid versus Open-Pollinated Fall Rye Varieties

Description

Three currently available European hybrid fall rye varieties (Brasetto, Guttino and Bono) reportedly yield considerably greater than the open-pollinated variety, Hazlet, on average in Saskatchewan. Fall rye has traditionally been grown as a low-input crop; however, seed costs for this crop will likely increase with the use of hybrid varieties. Growers would benefit from verification of optimal seeding rates with hybrid varieties relative to open-pollinated varieties. The objective of this project was to demonstrate the yield potential and relative response of open-pollinated and hybrid fall rye to a range of seeding rates. The study was conducted in Indian Head and Melfort in 2015-16.

Results

The OP variety (Hazlet) was more susceptible to lodging and produced fewer tillers and heads m^{-2} than the hybrid (Brasetto). Lodging was reduced by utilizing optimal seeding rates (170-230 seeds m^{-2}) and was negligible in the hybrid variety, regardless of seeding rate (data not shown). Brasetto yielded more than Hazlet at both locations, though the optimal seed rate for maximum yield was similar for each variety. At Indian Head, hybrid rye yield declined slightly at the highest seeding rates while the OP rye yield did not (Figure 5).

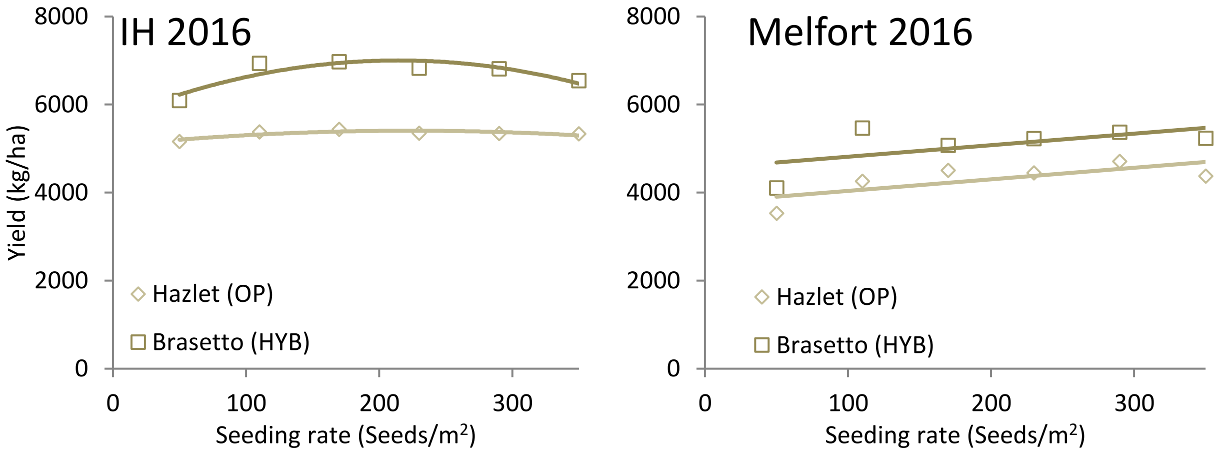


Figure 5. The effect of seeding rate on yield of open-pollinated (Hazlet) and hybrid (Brasetto) fall rye at Indian Head and Melfort in 2016.

Grain quality is also a factor that growers must consider, and one of the main reasons for down-grading in fall rye is ergot. Percent ergot declined with increasing seeding rates, and was highest in the hybrid variety at low seeding rates, but did not differ between varieties or seeding rates above 170 seeds/m^2 (data not shown).

Conclusions

Both hybrid and OP fall rye varieties appeared to respond similarly to seeding rate. The hybrid variety was higher yielding than the OP variety, though the higher yield potential must be weighed against increased seed costs. Overall, it appears that a target seeding rate of approximately 200 seeds/m^2 is sufficient to optimize both yield and quality regardless of variety. This trial will be repeated at Indian Head in 2016-17.

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.

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 management 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 6.

Table 6. 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

Although the project was conducted at four locations across the prairies, the results presented below (Figure 6) are only from Indian Head and have not been statistically analysed.

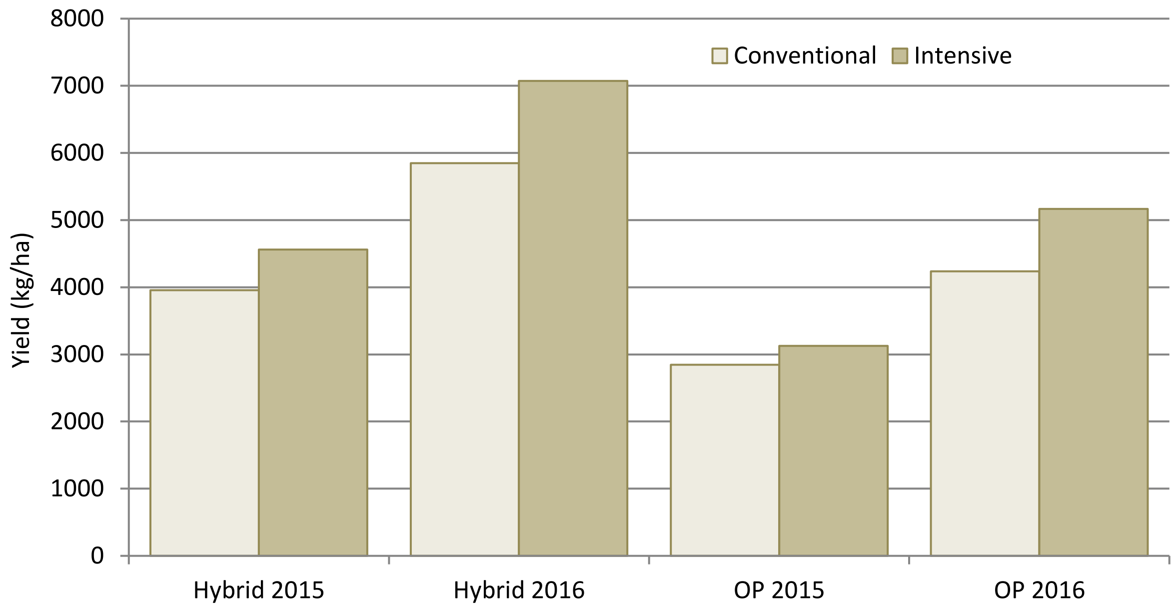


Figure 6. Input system on hybrid and open-pollinated (OP) rye yield at Indian Head.

As was expected, the hybrid rye varieties yielded higher in both years under the intensive management system. In previous years, it was seen that hybrid varieties were more susceptible to ergot.

Conclusions

A 2015 economic analysis across all four sites found that the conventional management strategy might be more profitable. A combined economic analysis for the multiple site years is being conducted, but the results were not available at this time.

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

Seed Treatment Evaluation for Spring Wheat

Description

To evaluate the effects of Rancona Pinnacle seed treatment on spring wheat emergence, early season growth, and yield relative to competitive products.

Flag-leaf Fungicide Products for Spring Wheat

Description

To evaluate the effects of Evito flag leaf fungicide on spring wheat disease, yield, and quality relative to competitive products.

Manipulator Wheat Variety Profiling Trial

Description

The objective of this study was to investigate differences amongst wheat varieties and classes and identify trends in responsiveness to plant growth regulator Manipulator (chlormequat chloride). Six wheat varieties (Plentiful, Utmost, Carberry, Strongfield, Transcent, and Elgin) were tested with and without an application of Manipulator.

Results

The application of the PGR (GS30) significantly reduced plant height on all wheat varieties tested, as well as increasing seed yield (Table 7).

Table 7. PGR and variety effects on wheat height and yield.

Variety	Untreated	PGR Applied
Height (cm)		
All Varieties	93.9 a	84.7 b
Plentiful	94.9 bc	85.3 ef
Utmost	93.5 bcd	83 f
Carberry	86.6 e	76.9 g
Strongfield	92.5 cd	84.4 ef
Transcend	100.8 a	92.4 d
Elgin	95.3 b	86.5 e

Variety	Untreated	PGR Applied
Grain Yield (kg/ha)		
All Varieties	3969 b	4565 a
Plentiful	3124 f	3924 e
Utmost	4239 c	4788 b
Carberry	3877 e	4201 cd
Strongfield	3971 de	4549 b
Transcend	3967 de	4607 b
Elgin	4639 b	5321 a

Though plant height was reduced and grain yield increased, the application of the PGR also reduced protein of all wheat varieties tested (Table 8).

Table 8. PGR and variety effects on wheat protein.

Variety	Untreated	PGR Applied
	Protein (%)	
All Varieties	15.0 a	14.5 b
Plentiful	15.9 a	15.2 bc
Utmost	14.9 cd	14.5 ef
Carberry	15.3 b	14.9 cd
Strongfield	14.9 cd	14.4 f
Transcend	14.7 de	13.9 g
Elgin	14.5 ef	14.0 g

Conclusion

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 in order to promote higher yields.

Acknowledgement

This project was supported 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, FHB 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

Figure 7 below shows the effects of the FHB fungicide and glyphosate treatments on grain yield from the 2016 project, while Figure 8 shows the effects on test weight.

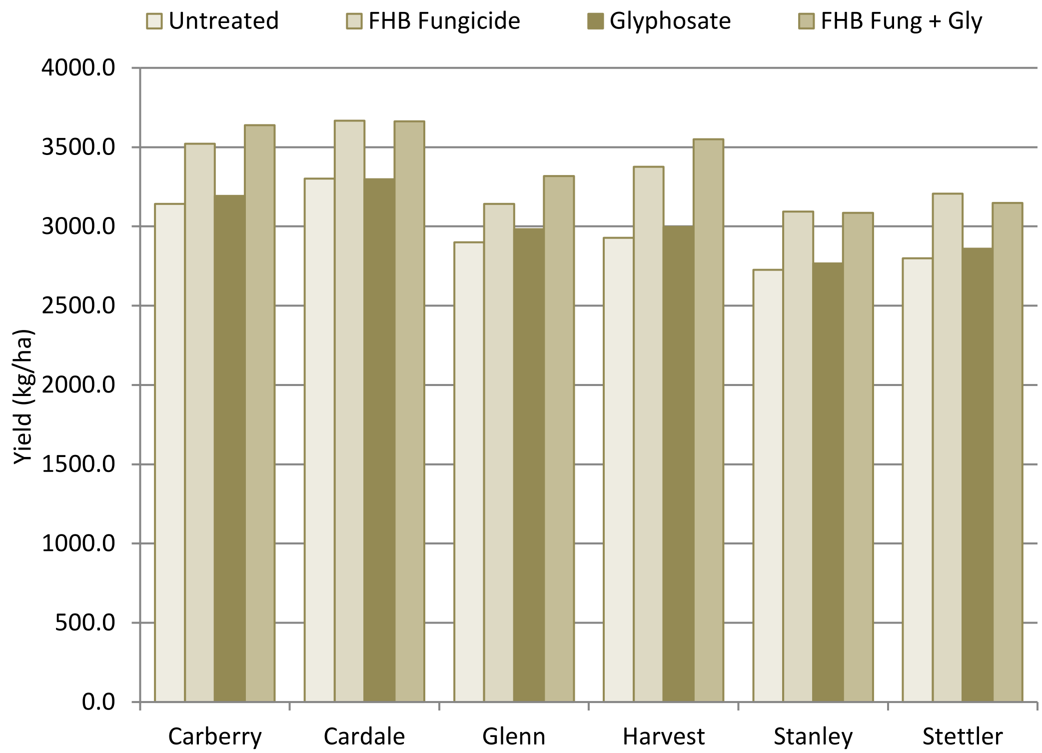


Figure 7. Effect of fungicide and glyphosate on yield of various wheat genotypes, Indian Head 2016.

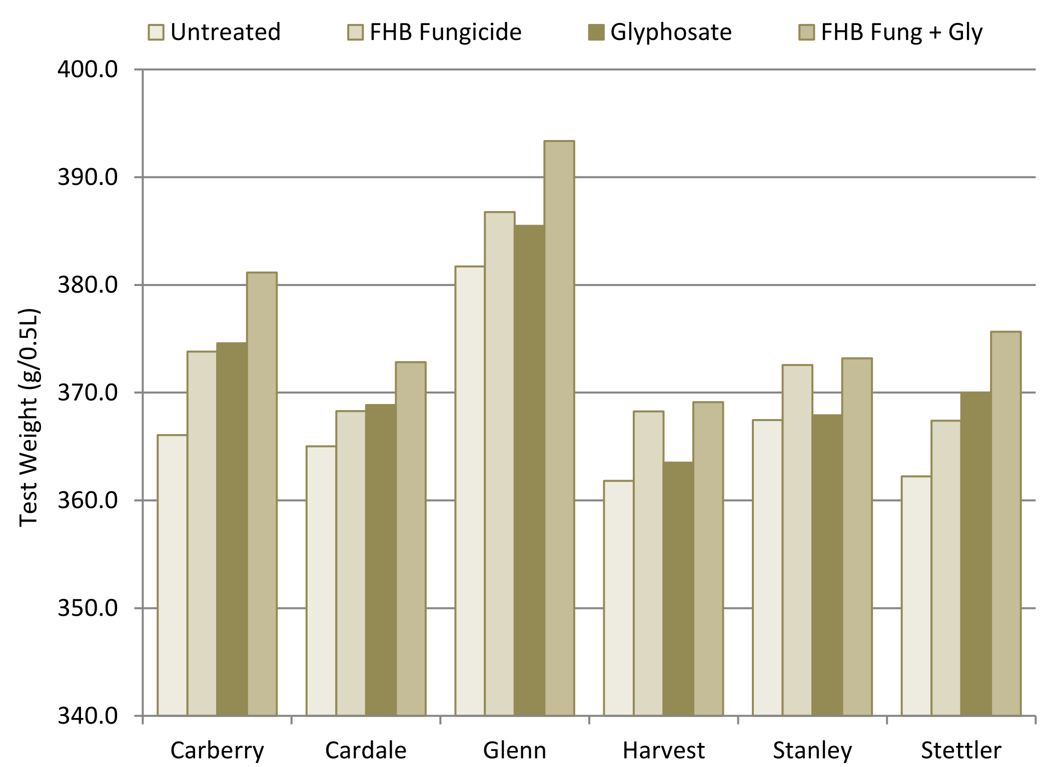


Figure 8. Effect of fungicide and glyphosate on test weight of various wheat genotypes, Indian Head 2016.

Conclusions

These results do not show the effects of the FHB fungicide and glyphosate effects on the gluten strength and milling quality of the wheat. Those tests are being performed at the University of Manitoba and the results are not available at this time.

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.

Wheat and Barley Response to Phosphorus and Potassium

Description

Crop uptake and removal of both phosphorus (P) and potassium (K) from the soil is substantial. Historically, there has been less emphasis on P and K fertility in crop production than on nitrogen (N) fertility, as N is the most yield-limiting nutrient and crop response to this nutrient is often substantial. Crop response to P and K fertilization is less obvious but not less important, usually manifested in early season growth and in crop and grain quality rather than absolute yield. At minimum, P and K application should be sufficient to replace what is removed in the crop in order to maintain long-term soil health, especially since recent figures suggest that over 80% of Saskatchewan fields are deficient in P. Potassium, however, is much less likely to be deficient in most Saskatchewan soils. The objectives of this project were to demonstrate the yield and quality response of spring wheat and 2-row malt barley to P and K fertilizer applications, and to provide an opportunity to discuss management considerations for these nutrients. Spring wheat (CDC Utmost) and malt barley (CDC Copeland) were each grown under varying rates of P (0, 30, and 60 kg P_2O_5/ha) and K (0 and 20 kg K_2O/ha).

Results

Early season crop biomass was not measured; however, plants receiving P-fertilizer treatments were visibly larger and growing more vigorously than those which did not receive any P fertilizer. This effect was most apparent prior to the in-crop herbicide applications and was observed in both wheat and barley.

Figure 9. Early season vegetative response to P fertilization in CDC Utmost CWRS wheat and CDC Copeland 2-row barley at Indian Head in 2016.

Grain yield was affected by P and K differently in the two crops. Yield response of barley to K fertilizer is difficult to explain: K did not affect barley yield when no P fertilizer was applied; however, yield increased with K fertilizer at 30 kg P_2O_5, and decreased with K at 60 kg P_2O_5. For wheat, the addition of 20 kg K_2O/ha did not affect yield regardless of P fertilizer rate (Figure 10).

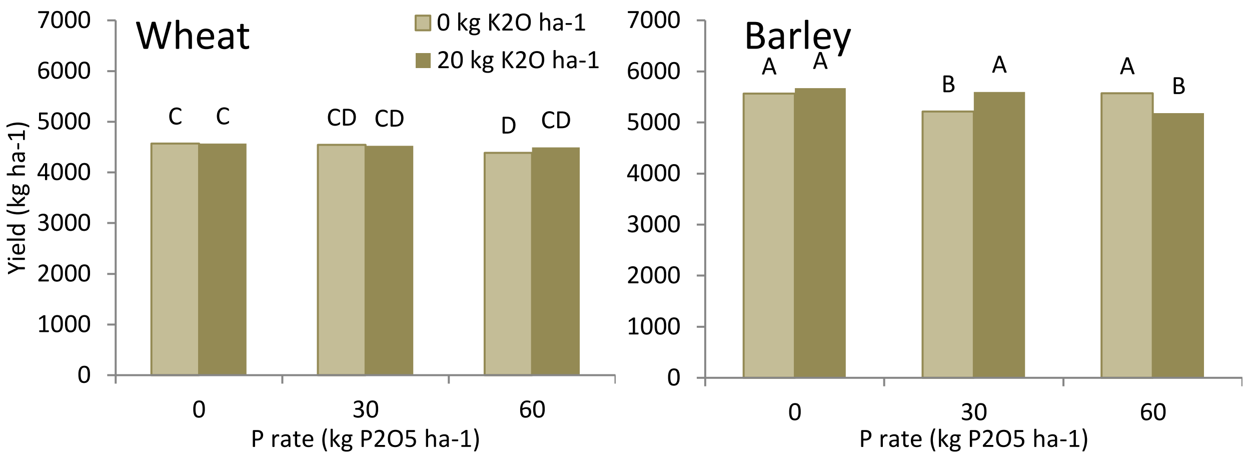


Figure 10. Effect of P and K fertilization on yield of spring wheat and malt barley at Indian Head in 2016.

Conclusions

Yield response to P is often unexpected or difficult to explain, particularly when residual levels are high or in high organic matter soils. P fertilization can often provide early season benefits, and maintaining or building soil residual P is important for long-term soil productivity. The benefit of K fertilization in Saskatchewan, particularly in high K soils, is less well understood. Some crops have shown a response to the Cl component of potash (KCl, 0-0-60). Sufficient potassium results in stronger straw and improved seed filling while a deficiency can result in stunted growth, delayed maturity, lodging and lower bushel weight. In this trial, KCl application did not affect crop lodging or any other grain quality parameters, and the yield response was not significant in wheat and inconsistent in barley. Consequently, we were unable to show that K was limiting or that K fertilizer application was agronomically beneficial. Ultimately, fertilizer application and appropriate rate for P and K should be based on soil properties, residual nutrient levels and long-term soil fertility goals.

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. Crop protection products were provided in-kind by BASF, Bayer CropScience and Syngenta.

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 regionally. 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 2016, and different cultivars were chosen at each location based on popularity and yield potential for the region.

Results

At Indian Head in 2016, the cultivars differed in yield overall, but did not differ in their response to N fertilizer (Figure 11). In previous years, there were differences between the cultivars in their response to N fertilizer. Test weight also differed between the cultivars but was not significantly affected by N rate at Indian Head in 2016 (Figure 12).

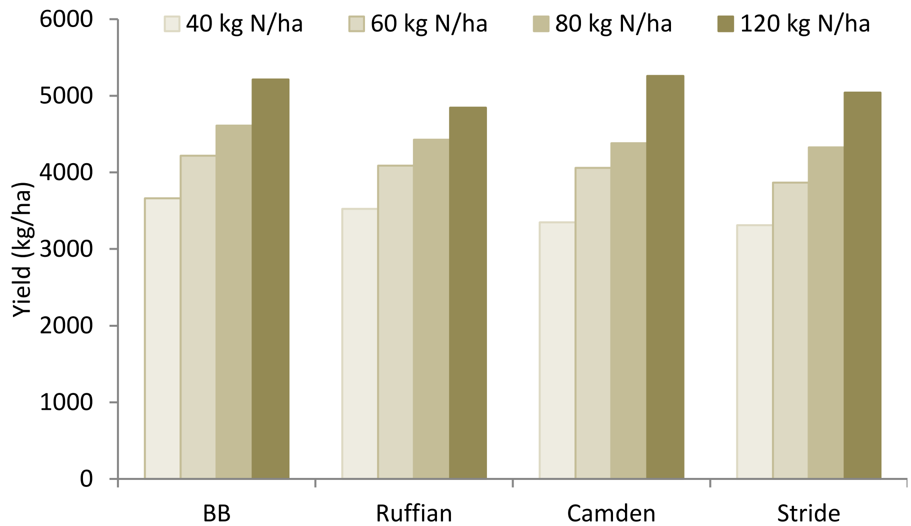


Figure 11. The effect of varying rates of N fertilizer on yield of four oat cultivars at Indian Head in 2016.

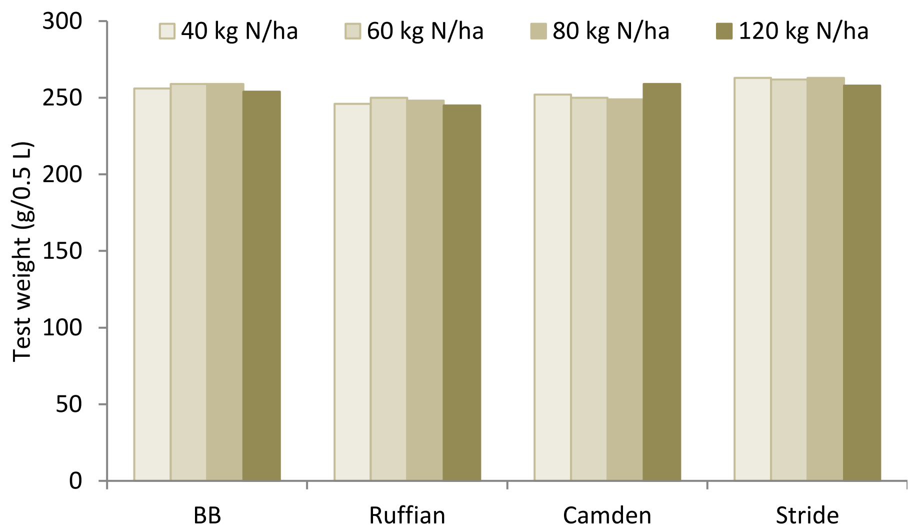


Figure 12. The effect of varying N rates on test weight of four oat cultivars at Indian Head in 2016.

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. Test weight appeared to be more stable in some cultivars than others, and dependent on environmental conditions, as the results differed between sites and years that the trial was conducted.

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 Side-banded 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.

The objectives of this project were to evaluate the performance of canola grown in row spacings that exceed the conventional 10-12” width. Two separate field trials were designed to determine whether wider row spacing might affect current canola production recommendations regarding side-banded N fertilizer and seeding rates. 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), or 2) seeding rates (1.5, 3.0, 4.5, and 6.0 kg/ha). The study was conducted from in 2013 to 2016.

Results

Implications for side-banded nitrogen fertilizer:

Results over all years showed that there was a significant reduction in plant density with increasing rates of side-banded N, at all row widths. At the 24” row spacing, plant populations started to decline with at as little as 50 kg N/ha of side-banded N, whereas significant stand reduction did not occur until higher rates of N were applied in all other row spacing widths (Figure 13). Even with the effects on emergence, canola responded well to side-banded N with increasing yields up to 150 kg N/ha in all years (data not shown). The results of this study suggest that the N requirements of canola are likely similar regardless of row spacing; however, high rates of side-banded N combined with wide row spacing may increase the risk of seedling injury.

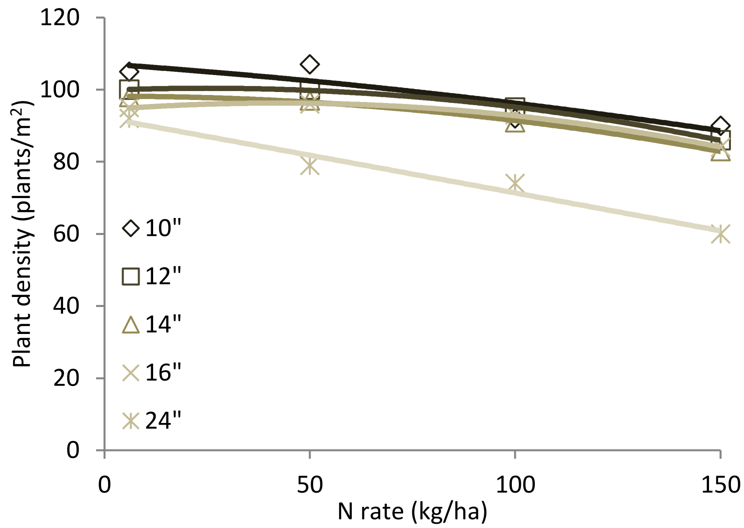


Figure 13. The effect of increasing N rate on canola plant density at varying row widths at Indian Head, averaged over four years (2013-2016).

Implications for seeding rates:

At all seeding rates, plant density decreased with wider row spacing, due to increased intraspecific competition, and the proportional decrease in plant population was greatest with higher seeding rates at the 24” row spacing (Figure 14). These results suggest that seeding rates should not be reduced below recommended rates as row spacing is increased. At the same time, there was little benefit to using seeding rates exceeding 90 seeds m^{-2} when planting canola at 24” row spacing. Yields did not differ significantly at seeding rates above 60 seeds/m^2, but were significantly lower at a seeding rate of 30 seeds/m^2.

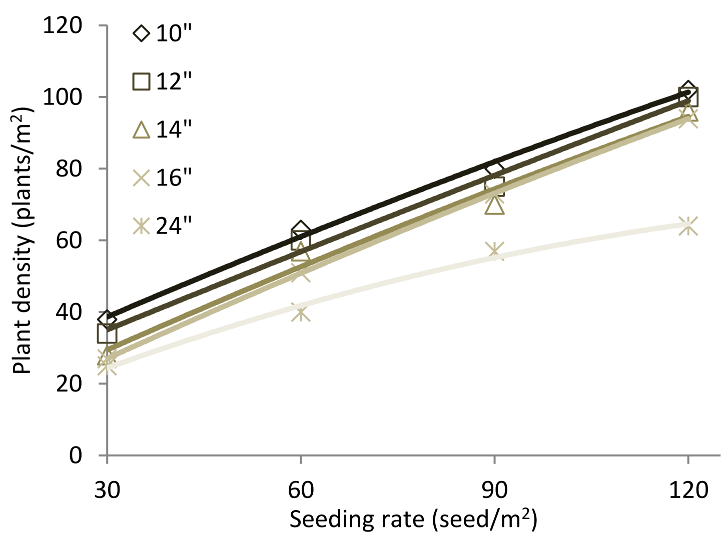


Figure 14. The effect of seeding rate on canola plant population at varying row widths at Indian Head, averaged over four years (2013-2016).

Conclusions

Canola is relatively insensitive to increasing row spacing, but there are many factors to consider in determining the optimal row spacing for individual farms. Narrower row spacing consistently produced amongst the highest yields, particularly when combined with high rates of side banded fertilizer. Row spacing as wide as 24" was also productive under the environmental conditions encountered but required timely, effective weed removal. Canola growing on wider row spacing did take longer to achieve canopy closure; however, the effects on maturity were negligible. For growers dealing with or looking to prevent the development of herbicide tolerant weeds, narrow row spacing can be an important component to integrated management strategies. Many of the major drawbacks to narrower row spacing are more logistic than agronomic (i.e. higher equipment operating costs, increased horsepower requirements / fuel use). For example, narrow row spacing can also make it considerably more difficult to seed into heavy crop residues. If slightly wider row spacing can lead to better seed placement in heavy residues, increased organic matter retention, better utilization of existing equipment, and lower seed-bed preparation requirements, there could be numerous, longer-term benefits not accounted for in this study.

Acknowledgement

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

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 15).

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 15). 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 15. 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 Cluster 2 program, with in-kind support provided by Pioneer Hi-Bred and BASF.

Managing Blackleg and Sclerotinia in Canola with Varietal Rotation and Fungicide Applications

Description

The two most widespread diseases affecting canola in western Canada are sclerotinia stem rot and blackleg. While the economics of fungicide applications can often be questionable for canola throughout much of Saskatchewan, recent disease levels been relatively high and some years (i.e. 2012) have resulted in substantial and widespread yield loss. Moreover, genetic resistance in various canola varieties are starting to breakdown due to tight rotations and the overreliance on a single method of control. Foliar fungicides can also reduce the impact of this disease and help slow the development of resistant strains. The proposed demonstration was to 1) measure the impacts of fungicide applications targeting both blackleg and sclerotinia on canola disease and yield and 2) provide a forum for discussion of BMPs (including varietal rotation) for reducing the impact of disease and the potential for breakdown of genetic resistance.

Results

Growing season precipitation along with overall yield potential was high, and across varieties and fungicide treatments, the canola yielded 3,330 kg/ha (59 bu/ac). Under the specific field conditions encountered, blackleg incidence was low (<3%) and there was no benefit (for either disease levels, yield or seed quality) to spraying for this disease (T1, 2-4 leaf stage). In contrast, sclerotinia stem rot pressure was relatively high and percent sclerotinia incidence averaged 30% in the unsprayed plots. Spraying fungicide at 20-50% bloom (T2) reduced sclerotinia incidence to 13% and resulted in 6%, or 3.4 bu/ac, higher yields. Spraying for sclerotinia also tended to result in larger seeds but slightly lower test weight. Disease levels, response to fungicide, and overall seed yields were similar for both varieties.

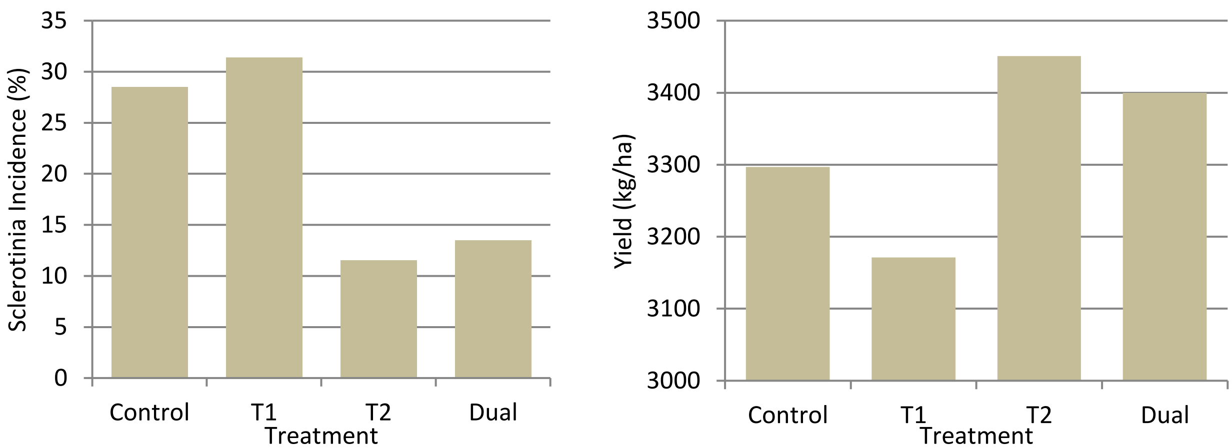


Figure 16. Effect of fungicide treatment on sclerotinia incidence and yield in canola, Indian Head 2016.

Conclusion

Overall, the project demonstrated that varietal resistance with diverse crop rotations can be sufficient to keep blackleg levels low and under such conditions, fungicides are not likely required or beneficial. Sclerotinia depends primarily on environmental conditions and its severity can vary widely from year-to-year. Fungicides are effective for minimizing the impact of sclerotinia but the challenge continues to be predicting the risk of disease since fungicides must be applied well before any symptoms appear. Tools such as risk assessment checklists, petal tests and sclerotinia depots are available to assist with decisions. Generally, if the likelihood of disease and yield potential is high, spraying is advised.

Acknowledgments

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 by Bayer CropScience, DuPont-Pioneer and BASF.

Enhancing Canola Yield with Improved Phosphorus Fertility

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, as well as 15kg/ha S added to five different P rates.

Results

As expected, side-banded (SB) P appeared to have less detrimental effects on canola plant densities than seed-placed (SP) P, with an additional reduction when S was added to the seed-placed P.

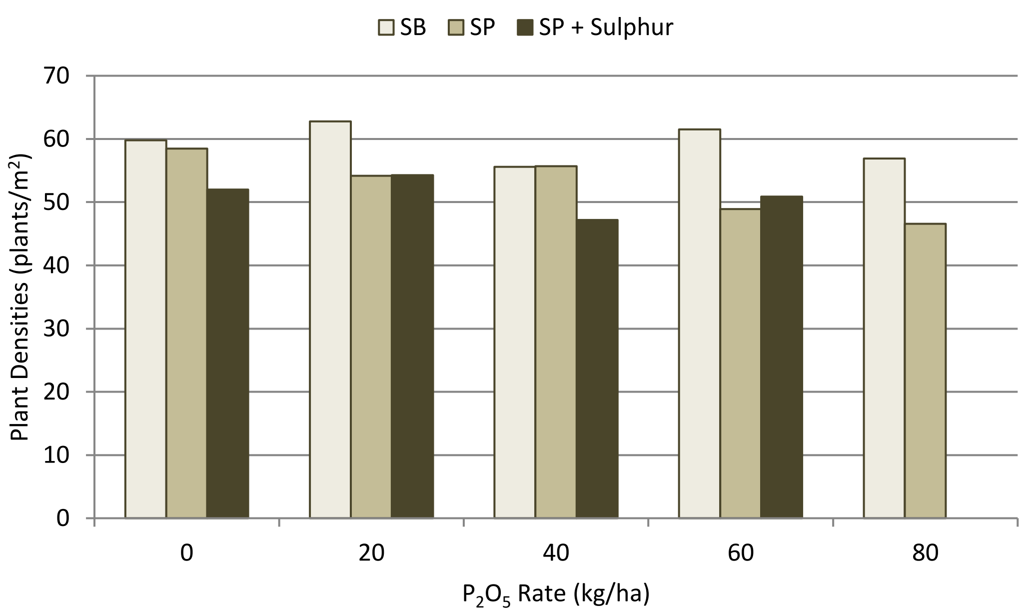


Figure 17. Effect of P_2O_5 rate and placement on canola plant densities at Indian Head, Melfort and Scott, 2016.

Yields tended to increase as P rate increased in the SB treatments, while yields plateaued at the mid-rate of P in the SP treatments. The addition of S to the seed row was detrimental in most cases with, with yield being reduced.

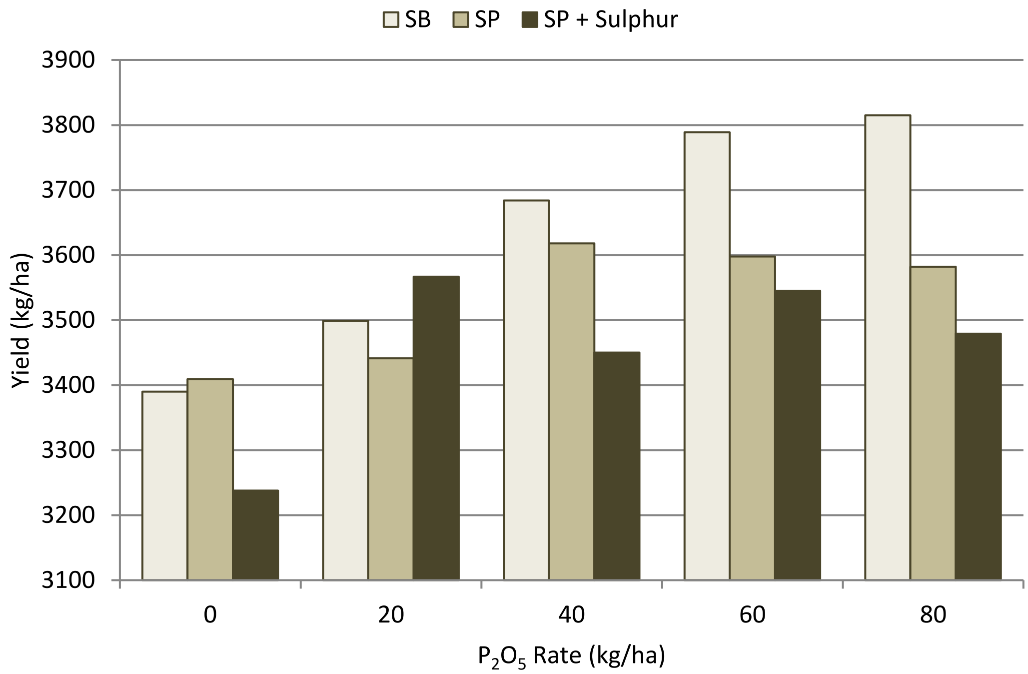


Figure 18. Effect of P_2O_5 rate and placement on canola yield at Indian Head, Melfort and Scott, 2016.

Conclusions

2016 was only the first year of this three year study. More in-depth analysis will be conducted as the project gathers additional site years of data.

Acknowledgement

This project was supported by the Saskatchewan Canola Development Commission, with additional in-kind support provided by Bayer CropScience and BASF.

Pre-harvest Options for Straight-Combining Canola

Description

One of the most critical factors for successful straight-combining is proper timing. Green stems and plant material can dramatically reduce efficiency while combining; it is important to avoid unnecessary delays in harvest which can result in greater potential for yield loss from shattering. Pre-harvest herbicide or desiccant applications can make this operation easier to time by allowing for earlier harvest, less variability, and (depending on the product) providing weed control benefits extending into the subsequent season. While many growers experienced with straight-combining canola tend to favour a pre-harvest application, it is important to recognize that it may not always be necessary, and that not all products are equal depending on the circumstances and specific objectives of the grower. The purpose of this project is to evaluate the differences in crop dry-down and fall weed control amongst registered pre-harvest herbicide/ desiccant options for straight-combining canola.

Results

Results showed that glyphosate applied alone (given 23 days to work) provided the most thorough dry-down, but was also the slowest acting. Diquat was highly effective as a desiccant providing dry-down and rapid activity but no perennial weed control. Saflufenacil did not dry down the crop to the same extent as glyphosate or diquat, but, when tank mixed with glyphosate, has the benefits of both providing weed control and contact efficacy that is less sensitive to crop stage or weather conditions than glyphosate on its own. All treatments improved dry-down relative to the control and none adversely affected grain quality or yield. Green seed counts were higher in the diquat treatment, but still under the threshold for down-grading. While not significant to grade, the green seed does illustrate the importance of spray timing for diquat.

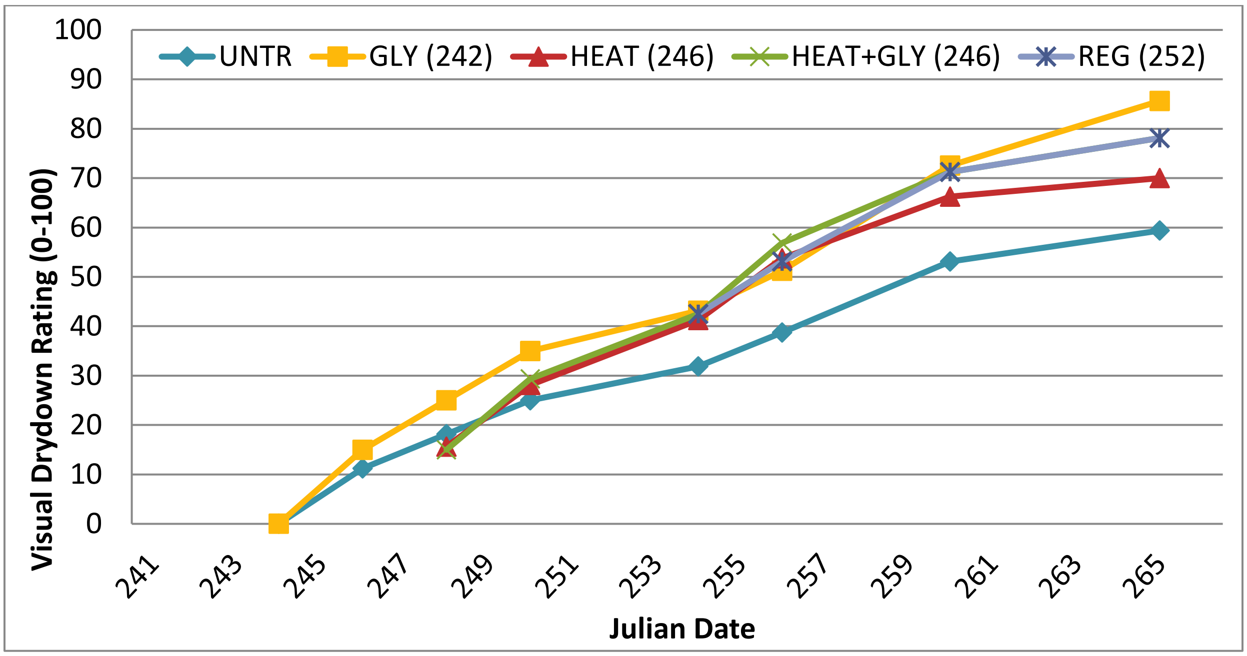


Figure. Visual stem dry down ratings from time of treatment application.

Conclusions

While pre-harvest applications will not necessarily result in earlier harvest, they can reduce the potential for unforeseen delays resulting from green stems or the crop not maturing as early as expected due to cool or wet conditions. In all situations, growers should take various factors into consideration when deciding whether to use a pre-harvest application and, if so, which product to apply. All products provided significant dry-down benefits relative to the untreated control. In uniform, weed free fields using a variety with good resistance to pod shatter /drop, the most cost effective option may often be to simply let the crop mature naturally. If variability or weeds are an issue or there are concerns about late harvest /environmental losses, then consider producer objectives when selecting a product. If the estimated harvest is still approximately 2 weeks away (or more), weed control is a priority, and the canola is not Roundup Ready®, applying glyphosate on its own will likely be a cost-effective and viable option. If conditions are cool and/or dry, or the anticipate harvest date is less than 2 weeks away, products with contact activity are likely more appropriate. In all cases, growers are urged to follow label directions which primarily means paying attention to crop stage (avoid applying too early) and using appropriate water volumes (~200 l/ha or 20 U.S. gal/ac are recommended for contact products like saflufenacil and diquat).

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 from Bayer CropScience, BASF, and Syngenta.

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 Indian Head, Swift Current and Humbolt in 2015 and 2016.

Results

2016 was the final year of the project. The Prairie Agricultural Machinery Institute (PAMI) has compiled a guidebook for straight cutting canola which can be found at the link below.

http://pami.ca/wp-content/uploads/2018/08/Straight-Cut_Canola_Guide_Book.pdf

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.

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 2016, eight experimental *Brassica carinata* lines were evaluated relative to commercial varieties. IHARF has conducted varietal evaluations for *carinata* in collaboration with Agrisoma Biosciences since 2011.

Brassica carinata (Ethiopian Mustard) Sulfur Response Trial

Description

To objective of this project was to evaluate the response of *B. carinata* to sulfur fertilization. Four different sulphur rates were evaluated. IHARF has conducted *B. carinata* projects in collaboration with Agrisoma Biosciences since 2011.

Seed Treatment Effects on Flax at Varying Seeding Dates and Rates

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

Seeding date and seeding rate both had a significant effect on plant density, maturity, and yield. Seed treatment had a significant effect on plant density and maturity, but it did not influence yield. While seed treatment had no significant effect on yield, they did increase plant density by 11% which could play a huge role if environmental conditions were unfavorable for adequate plant stands. Planting late also increased final plant populations by 18%, but also resulted in 75% lower yields than the early seeded treatment.

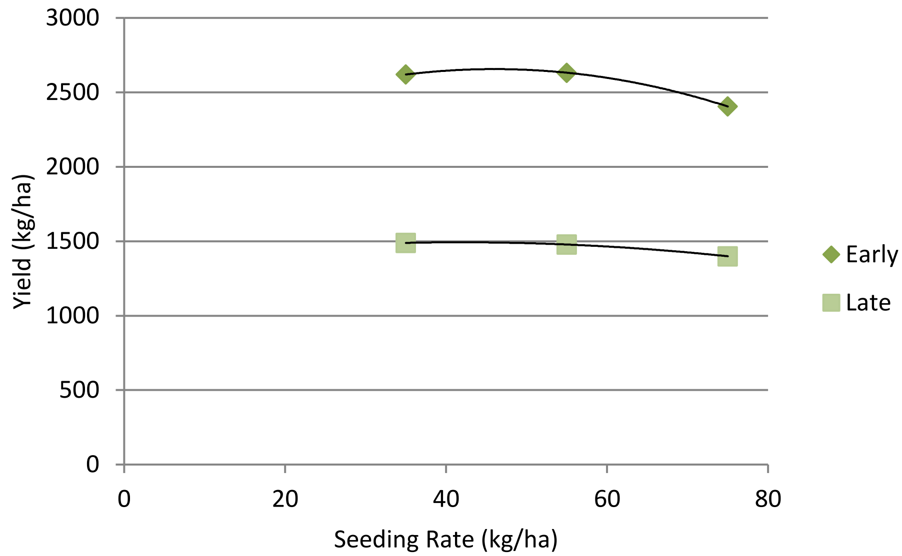


Figure 19. Effect of seeding rate and date on flax yield.

Conclusions

This project demonstrated that higher seeding rates combined with seed treatments can improve flax stand establishment in both early and late seeding dates. The greatest benefit is likely to occur when soils are colder during early seeding. Overall, these early results suggest flax should be seeded early at rates of 55 kg/ha to achieve maximum yield. Seed treatments show great potential in improving establishment, but their effect on yield is still uncertain depending on environmental influences.

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.

Flax Response to Fungicide at Varying Row Spacing

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

This project was conducted from 2014-2016; seed yield was affected by year, fungicide treatment and row spacing with a significant year x fungicide interaction. There was an ideal range in overall yield conditions over the study period with what were essentially considered below-average yields in 2014 (1313 kg/ha), average yields in 2015 (2014 kg/ha) and above-average yields in 2016 (2682 kg/ha), when averaged across treatments. The range of potential yields realized was ideal for testing the effects of row spacing on flax under contrasting environmental conditions. Focussing on fungicides, while the main effect (across years) was not statistically significant, numerically, yields were 6% higher with fungicide and the year x fungicide interaction revealed that the response to fungicide differed from year-to-year. Overall, these results are consistent with previous IHARF field trials which have shown substantial benefits under heavy disease pressure (up to 30% yield increase) but no benefit when Pasmo was not present, or at low levels.

Despite the wide range of conditions, row spacing effects on flax yield were consistent for all three years and showed a clear linear decline in flax yield when row spacing was increased from 25-61 cm. Averaged across years, yields declined by 28% from 2259 kg/ha to 1634 kg/ha for the range of 25 to 61 cm. Although the year x fungicide interaction was not significant, as a matter of interest, the observed proportional yield reductions across the range of row spacing levels tested were remarkably similar at 27%, 28%, and 28% in 2014, 2015 and 2016 respectively. No interactions between row spacing and fungicide were detected for yield either when averaged across years or for any individual years which suggested that the response to fungicide was not affected by row spacing and, alternatively, row spacing effects were consistent regardless of whether fungicide was applied or disease was a yield limiting factor.

Table 9. Effect of fungicide and row spacing on flax, 2014-16.

	Plant Density	Maturity[Z]	Yield
Row spacing	plants/m^2	days	kg/ha
25 cm (10”)	480 a	99.5 d	2259 a
31 cm (12”)	487 a	99.8 c	2161 a
36 cm (14”)	458 ab	100.2 b	2026 b
41 cm (16”)	438 b	100.3 b	1986 b
61 cm (24”)	332 c	101.8 a	1634 c
Fungicide	plants/m^2	days	kg/ha
No fungicide	434 a	99.8 b	1953 a
Fungicide	444 a	100.8 a	2073 a

[Z] 2015-16 only

Conclusions

Notably, there were no important agronomic interactions between foliar fungicide applications and row spacing for flax. Despite the hypothesis that wider row spacing may result in a more open canopy and subsequently less disease and potential benefit to fungicides, there was no evidence of this actually occurring. Yield increases with fungicide (or the lack thereof) were consistent across row spacing levels on average and within individual years. Similarly, the observed row spacing effects were consistent regardless of whether fungicide was applied.

Acknowledgements

Funding for this study was provided by the Saskatchewan Flax Development Commission, as well as 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 Nitrogen and Phosphorus Fertilizer Management for Flax

Description

The objective of this project is to evaluate the yield response of flax to wide range of rates and combinations of side-banded nitrogen and phosphorus fertilizer across varying environments in western Canada. 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.

Results

Although year-one results are only preliminary, flax response to N and P fertilization is presented below.

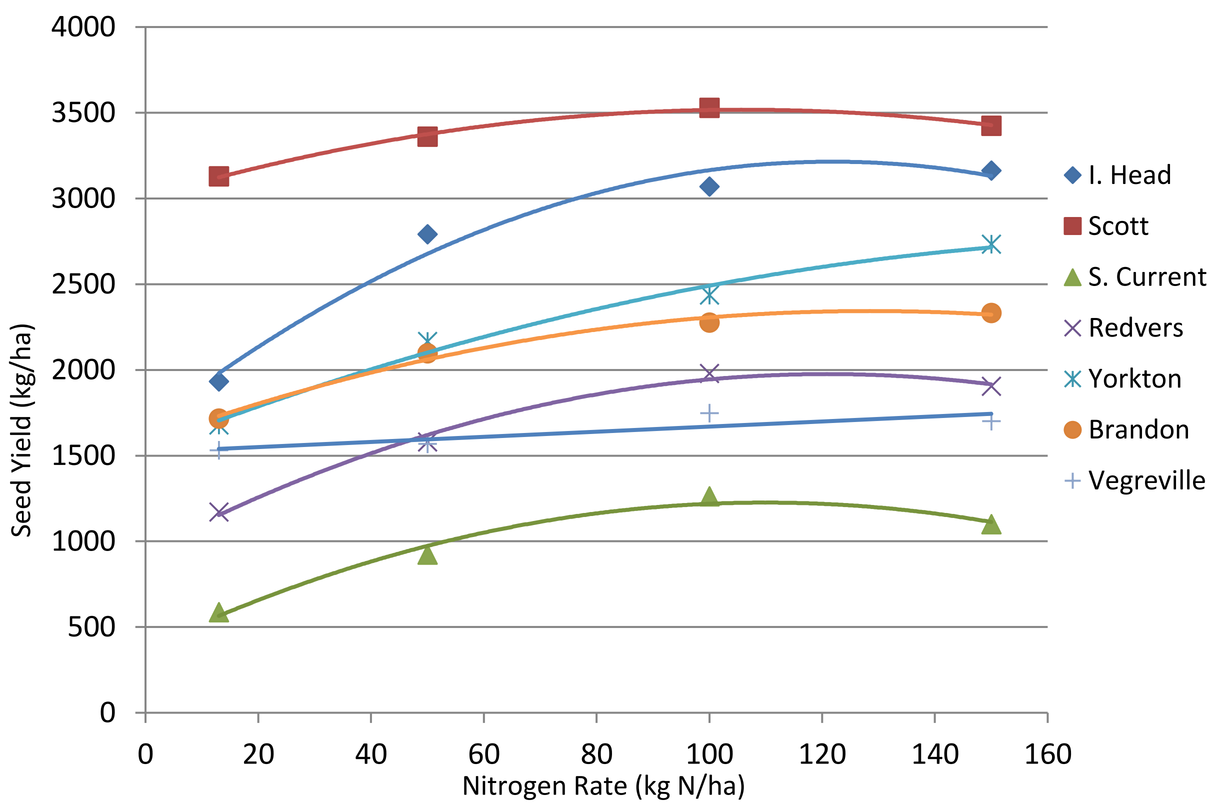


Figure 20. Flax yield response to N fertilizer at seven locations in western Canada, 2016.

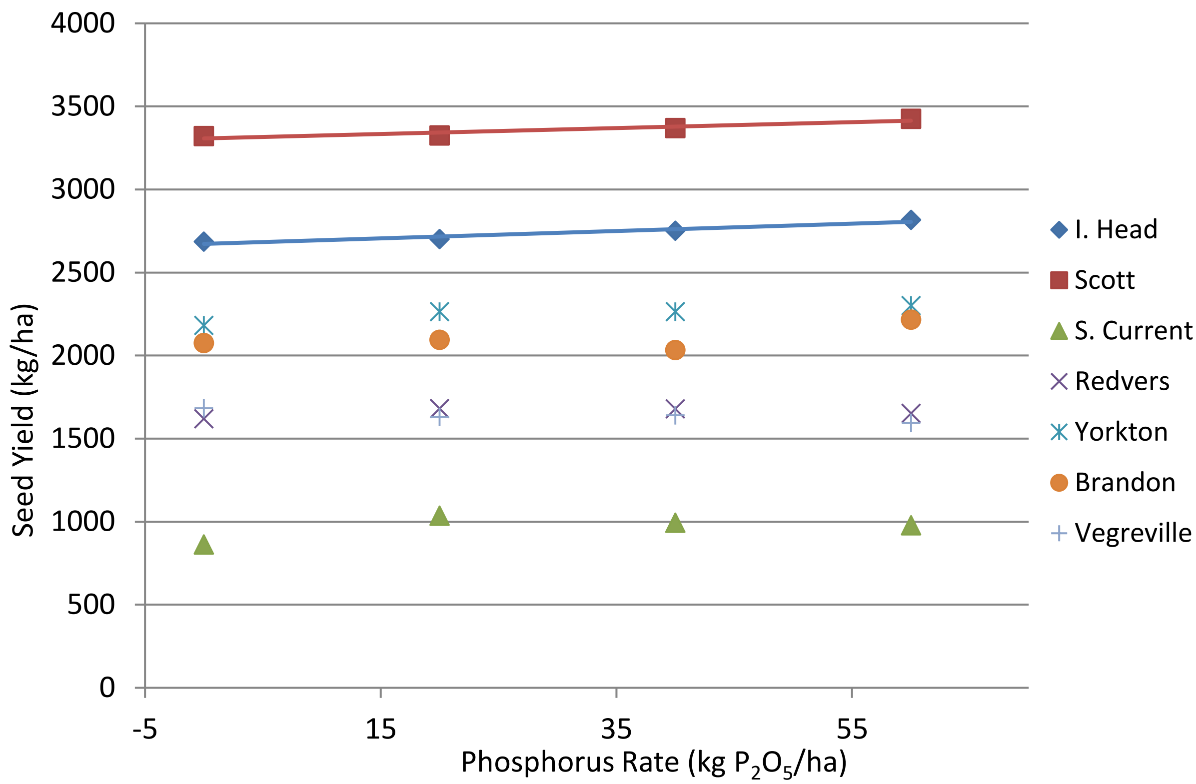


Figure 21. Flax yield response to P fertilizer at seven locations in western Canada, 2016.

Overall, results to date have shown consistent, and in some cases strong yield responses to relatively high rates of N fertilizer (i.e. > 100 kg N/ha) while responses to P fertilizer were much less frequent and, when they did occur, smaller. All factors considered, the results are largely consistent with previous research and bear in mind that the optimum economic N rate will often be slightly lower than that where maximum yield is achieved. The lack of a P yield response at many sites does not suggest that P fertilizer should not be applied to flax, but rather that current P fertilization practices are not likely major limiting factors to flax yield in western Canada. The lack of response to P fertilization at many sites may be explained by contributions of residual inorganic P and organic P mineralization, in addition to the strong AM fungi relationships that flax can develop to assist with P uptake.

There were significant reductions in plant density frequently detected with high rates of side-banded N, suggesting that care must be taken to ensure adequate seed/fertilizer separation during planting and/or that seeding rates must be sufficient to account for some loss. The extent of seedling loss at the affected sites ranged from 25-37%; however, high rates of P fertilizer did not affect emergence in any cases.

Conclusions

2016 was the first year of this project, being conducted at six locations in Saskatchewan, one in Manitoba, and one in Alberta. Additional findings will be compiled after the 2017 and 2018 growing seasons.

Acknowledgements

Funding for this project was provided by the Saskatchewan Flax Development Commission, the Western Grains Research Foundation, and the Saskatchewan Ministry of Agriculture through the Agriculture Development Fund, with in-kind support provided by BASF and Bayer CropScience.

Exploring the Merits of Sulfur Fertilization in Flax

Description

For most crops, including flax, fertilizer is one the largest input costs but typically provides a large return on investment when appropriate rates are applied. Flax often responds well to N and P fertilizer application, but not necessarily to S. While deficiencies of potassium (K) are unlikely in the heavy clay soils near Indian Head (and much of Saskatchewan), sulphur (S) availability is often considered marginal and may potentially limit yields under some circumstances. While documented responses to S fertilizer application are relatively rare for flax, field trials at Indian Head in 2013 detected an average 2.2 bu/ac yield increase (4.5%) with the addition of 12 lb S/ac. In 2014, under less favourable conditions, mean yields with S were 1.4 bu/ac (7%) higher than without; however, the site was variable and the observed difference was not statistically significant. This project was initiated to demonstrate 1) the response of three flax varieties to varying application rates of S fertilizer 2) assess whether S fertility is a potential factor limiting regional flax yields.

Results

Plant densities were high, attributable to the relatively high seeding rates and favourable conditions for emergence. Averaging 584 plants/m2, plant densities were similar for all three varieties and well beyond the minimum of 300 plants/m2 density recommended for optimum yield potential. Maturity varied slightly, albeit significantly with variety but was not affected by S rate. Averaging just over 102 days from planting, maturity (75% boll colour change) was relatively early for all varieties; this was not unexpected given the warm season and rapid, even emergence. Seed yields were well above average with an overall mean of 3224 kg/ha or 51 bu/ac. While the effect of S rate was not significant, yields tended to be higher where S was applied. At only 3% (89 kg/ha or 1.4 bu/ac) when averaged across the treatments where S was applied, the magnitude of the response was small and similar for all rates; thus indicating that 15 kg S/ha was sufficient to optimize yields. Varieties did have significant differences in yield, as projected by the seed guide.

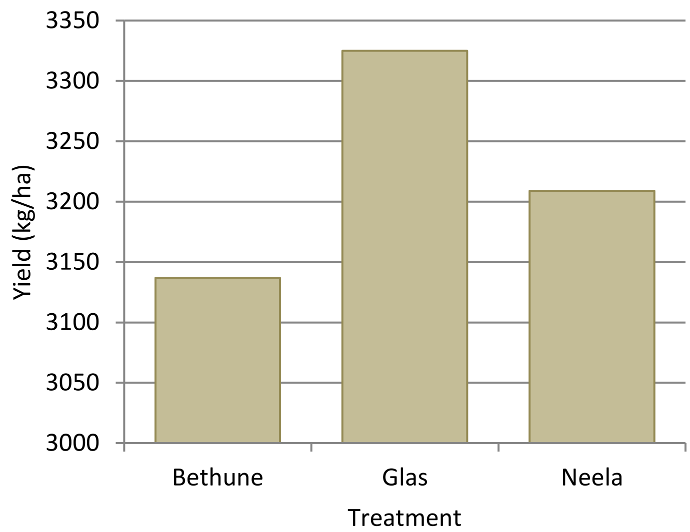


Figure 22. Effect of variety on seed yield.

Conclusions

While the gains were modest at only 3% when averaged across varieties, there was evidence of a response to S fertilizer; however, bear in mind that this was under high yielding, low residual soil S conditions and cannot be expected under all circumstances. While there was no overall interaction between variety and S rate detected, results for individual varieties suggested that the response was strongest with CDC Neela where the overall increase was 6%. The quadratic response indicated that relatively small rates of S fertilizer (i.e. 15 kg S/ha) are sufficient to optimize yield when additions of this nutrient are required. Because S is highly variable across the landscape, high soil test levels do not always guarantee that this nutrient will not be limiting, at least in certain parts of the field. Low soil test S levels can generally be trusted to suggest a high probability that this nutrient may be limiting with certain crops.

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 BASF and FMC of Canada.

Seed-Placed versus Side-Banded Phosphorus Fertilizer 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. The objective of this study was to demonstrate the effects of increasing rates of phosphorus fertilizer on faba bean establishment and seed yield for both side-banded (SB) and seed-placed (SP) P.

Results

The overall effect of P placement and rate was not significant for either counting date, indicating that emergence was not affected. At 16 days after planting, approximately half of the plants had emerged and there was no evidence to suggest that emergence was reduced by high rates of seed-applied P fertilizer based on both SP vs SB. At the second date, there was again no evidence to suggest that emergence was negatively impacted by high rates of seed-placed P fertilizer.

Conclusions

Overall, this project has demonstrated that faba beans can respond well to phosphorus (P) fertilizer application in low P soils and that they even respond to rates higher than those typically used by producers. The yield response to P was identical for the two application methods. While the lack of seedling toxicity at high rates of seed-placed P has been observed at our location with other sensitive crops (i.e. canola), extreme caution is recommended if considering seed-placing fertilizer at rates exceeding the traditionally recommended limits. Potential seedling injury is a complex issue that can be affected by many different factors including opener type (i.e. hoe vs disc), seedbed utilization, soil texture/chemistry, seeding depth, crop rotation/tillage system, and weather. Considering that this is only a single site-years' worth of data, results cannot be considered conclusive.

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. In 2016, two faba bean varieties, Snowdrop (zero tannin) and SSNS-1 (normal 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 2016.

Conclusions

2016 results from Indian Head have been excluded from this report as the faba beans were severely damaged by a mid-summer hail event.

Acknowledgements

This project was led by the Irrigation Crop Diversification Corporation in Outlook, Saskatchewan and was funded by the Saskatchewan Pulse Growers, with in-kind support provided by BASF and Monsanto BioAg.

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 2016.

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

2016 results from Indian Head have been excluded from this report as the faba beans were severely damaged by a mid-summer hail event.

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

2016 results from Indian Head have been excluded from this report as the faba beans were severely damaged by a mid-summer hail event.

Conclusions

The trial will be repeated in 2017 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 from 2014 to 2016, but data from each site were analyzed separately.

Results

At Indian Head, yields for all crops generally declined as seeding was delayed (Figure 23). The actual seeding dates for T1, T2 and T3 were respectively May 6, May 19 and June 2. An economic analysis on the profitability of each crop will be conducted after the conclusion of the project in 2017.

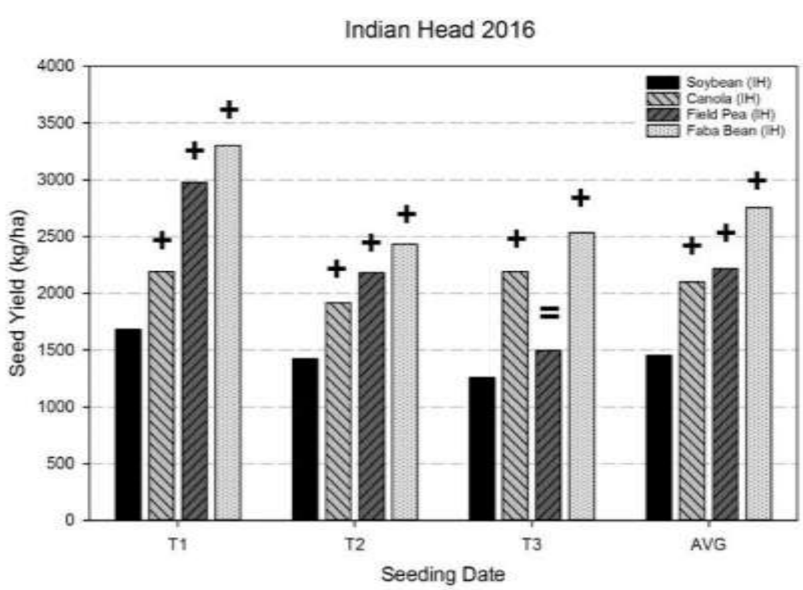


Figure 23. Seed yields for multiple crops at Indian Head, 2016.

Conclusions

The trial will be repeated in 2017. 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, 2015 and 2016.

Results

Overall, seeding depth had no effect on final plant populations of soybean at Indian Head or Swift Current. Seeding depth also had no effect on pod height; however, seeding rate did affect the height of the soybeans bottom-most pods. Maturity was affected by both seeding rate and depth, with deeper seeding and lower seeding rates both prolonging maturity. At Indian Head, seed yield was affected by seeding rate (Figure 24), but not by seeding depth.

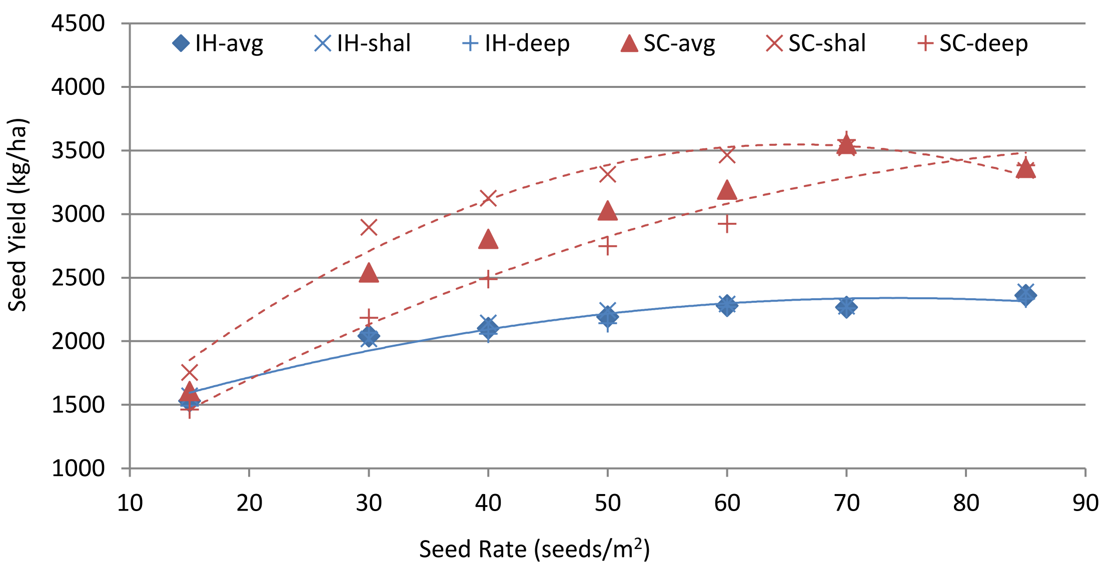


Figure 24. Seeding rate effect on soybean yield, 2016.

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 2017.

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

Spring plant densities were affected by seeding rate but not row spacing and there was no interaction between the two factors. As expected, plant densities increased linearly with increasing seeding rate and, averaged across row spacing levels, ranged from 41-63 plants m^{-2}. It is not uncommon for plant densities to decline as row spacing is increased; however, this was not observed under the optimal conditions for emergence and seeding rates evaluated at Indian Head in 2016. Pod clearance was measured at the 50 seeds m^{-2} seeding rate only and was not affected by row spacing. The overall average distance from the soil surface to the bottom of the lowest pod was 6 cm. Row spacing had no effect on maturity, but seeding rate did and there was no interaction between these two factors. Despite the relatively narrow range of seeding rates evaluated, there was a linear, 1.2 day spread in maturity between the lowest and highest seeding rates and, with no interaction, the seeding rate effect was consistent across row spacing levels.

Seed yield was affected by seeding rate but not row spacing and no row spacing x seeding rate interaction was detected. Averaged across row spacing treatments (and despite excellent emergence), soybean yields increased linearly with each incremental increase in seeding rate. Furthermore, with no row spacing × seeding rate interaction, the seeding rate effects were consistent at each row spacing level. On average, the yield spread between seeding rates of 40-60 seeds m^{-2} was 203 kg ha^{-1}. Over the past three years, row spacing effects on seeding rate have been variable. In 2014, yields increased with increasing row spacing until levelling off at 46 cm; however, in hind sight, this was largely attributed to granular inoculant effects that favoured wider row spacing. Granular inoculant rates are held constant across all treatments and, under the environmental conditions encountered in 2014, the applied rate was not sufficient to maximize yield, particularly at the narrower row spacing levels. In 2015, soybean yields were slightly but significantly higher at 25-30 cm row spacing but then constant for row spacing ranging from 36-61 cm. Adequate canopy closure was achieved in all treatments suggesting that this crop is still relatively insensitive to row spacing compared to many crops.

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 2017.

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, NorthStar Genetics, Quarry Seed 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 and 2016 (Indian Head, Melfort, Outlook and Scott, Saskatchewan).

Results

In nearly all cases, Melfort 2016 being the exception, plant densities at the 45 kg rate of seed-placed P were numerically similar to those observed in the control and there was never any indication of seedling injury at 22 kg P. While evidence of seedling injury was only observed at 38% of the sites, results to date show clear potential for soybean emergence to be negatively impacted by high rates of seed-placed P fertilizer under certain conditions. In 2016, Indian Head was the only site where there was a clear positive yield response to P fertilizer. At this site, yields increased quadratically with P, regardless of placement method. For the other sites where significant treatment effects on yield were detected, they were negative. At Outlook in 2015, there was a significant yield reduction when the highest rate (90 kg P_2O_5) was applied in the seed-row. Consequently, relative to the control, yields were slightly lower in the fertilized plots when averaged across rates and placement methods. Further evidence of this existed in the contrasts which indicated lower overall yields with seed-placement relative to side-banding or broadcasting; however, the reduction was only observed at the highest fertilizer rate.

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. This project is being continued in 2017 at all locations.

Acknowledgements

Funding for this project was provided by the Saskatchewan Pulse Growers, with in-kind support provided by Monsanto BioAg 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 locations in 2015 and 2016 (Indian Head, Outlook and Melfort, Saskatchewan).

Results

Averaged across treatments, yields ranged from 2334-4518 kg/ha (35-67 bu/ac) and were generally highest at Outlook, followed by Melfort and then Indian Head. Yields were affected by N treatment at 3/6 site-years, by granular inoculant rate at 5/6 sites and there was a significant N × inoculant interaction at 2/6 sites, in both cases at Indian Head. At Indian Head in 2015, there was no overall benefit to starter N (side-banded urea or ESN) but a modest yield increase with a late season application of UAN. In 2016 at Indian Head, starter N resulted in a slight yield increase over the control while the late season UAN again resulted in the highest overall yields. In both cases at Indian Head the N × inoculant interaction was significant, and showed that the benefits to N (regardless of form or timing) were only observed when no granular inoculant was applied. At Melfort in 2016 where initial residual N levels were high, soybean yields were highest with no supplemental N fertilizer, and significantly lower with side-banded urea. The inoculant effects were generally consistent across locations with significant benefits to dual inoculation at 5/6 site-years but no significant yield increases with rates of granular inoculant exceeding the label recommendation. The magnitude of the yield increases with dual inoculation ranged from 5% at Outlook in 2016 (not significant) to 53% at Indian Head in 2016 and averaged 25% across all six sites.

Conclusions

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. This project is being continued in 2017 at all three locations.

Acknowledgements

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

RR2 Soybean Variety Yield Trial

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. A trial was initiated to test Quarry (Thunder Seeds) soybean varieties against competitive varieties to observe differences in days to maturity and gather relative yield performance data.

Results

Soybeans yielded well at Indian Head in 2016. This variety trial saw a range of yields and days to maturity, with statistical significance included in the table below.

Table 10. Soybean variety trial results, Indian Head 2016.

Hybrid	Days to Maturity		Yield (kg/ha)		Yield (bus/ac)	
TH 35002R2Y	114.9	f	2460	bcd	36.5	bcd
TH 35003R2Y	115.6	ef	2475	bc	36.7	bc
TH 35004R2Y	118.6	c	2597	abc	38.5	abc
TH 35005R2Y	121.5	a	2678	ab	39.7	ab
NSC Watson RR2Y	110.1	h	2238	def	33.2	def
TH ex 870008	111.3	g	2121	f	31.5	f
TH exp 87003	116.3	ed	2710	a	40.2	a
TH 37004R2Y	119.5	b	2594	abc	38.5	abc
PE 2250 XTEND	115.1	f	2196	ef	32.6	ef
PE 2425 RR2Y	116.9	d	2389	cde	35.4	cde
PE 2450 XTEND	116.5	d	2376	cde	35.2	cde
PE 2475 XTEND	116.6	d	2379	cde	35.3	cde

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 2016 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 the ambient air and grain, with offsets to achieve different objectives. Additionally research from PAMI showed air flow rates could be lowered from the recommended 1.0 cfm/bu to 0.4 or 0.1 cfm/bu while maintaining efficient drying. The control strategies tested in this trial and their grain storage objectives were:

Continuously + 0.1 or 0.4 cfm/bu: in which fans were run continuously (24 hours/day) from the start to the end of the trial period. This strategy was used on bins 9 and 10. It is a very simple strategy as it does not require any sophisticated sensors and calculations. It results in a duty cycle of 100%; but, it does not accurately determine drying conditions and there are many hours that wetting occurs.

+2 Temperature Differential + 0.1 or 0.4 cfm/bu: 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 two 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 25). All six bins were outfitted with fan controllers. Paired bins were filled simultaneously with freshly harvested grain in order to ensure that initial grain moisture content and initial temperature was similar between them.

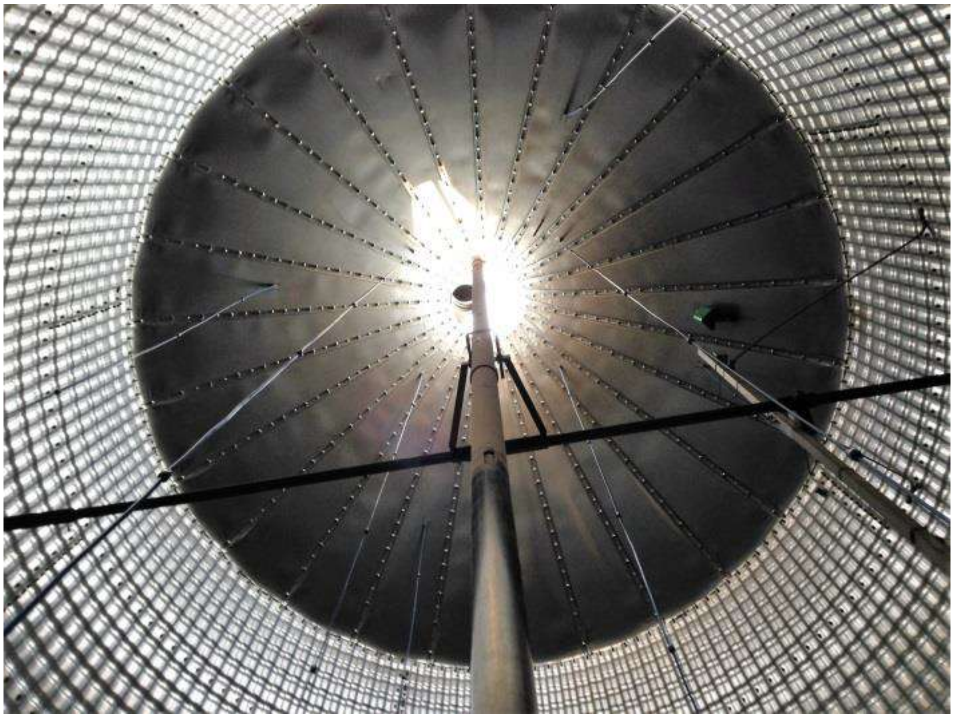


Figure 25. Sampling tube and sensor strings inside of test bin.

Results

A summary of the trial results is shown in Table 11. Unfortunately, controller error on the temperature differential bins resulted in the fans running incorrectly; therefore, no definitive conclusions can be made between continuous or differential fan controls this year. 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. While both air flow strategies appeared to successfully dry grain, the 0.4 cfm/bu flow rate was slightly better. From these results growers with the goal of increasing power efficiency, could reduce their fan specifications while maintaining ability to dry grain safely and effectively.

Table 11. Results of natural air grain drying trial at Indian Head in 2016.

	Bin 9	Bin 10	Bin 17	Bin 19	Bin 16	Bin 18
Control Strategy	Continuous	Continuous	+2C	+2C	+2C	+2C
Grain	Barley	Barley	Barley	Barley	Wheat	Wheat
Capacity	2250 bu	2250 bu	3500 bu	3500 bu	3500 bu	3500 bu
Air flow rate (cfm)	574	1530	893	2380	893	2380
cfm/bu	0.15	0.4	0.15	0.4	0.15	0.4
Fan start date	22 Aug	22 Aug	30 Aug	30 Aug	30 Aug	30 Aug
Fan shut down	22 Sept	22 Sept	22 Sept	22 Sept	16 Sept	16 Sept
Average initial MC (%)	18.7	18.1	18.9	18.5	14.8	15.4
Average Final MC (%)	15.2	13.3	17.8	16.7	14.1	14.2
MC change (%)	3.5	4.8	1.1	1.8	0.7	1.2
Average Final T (°C)	14.0	13.9	10.0	11.7	10.8	9.2
Duty Cycle (%)	74[i]	72[i]	39	43	47	47

[i] Continuous strategy should result in 100% duty cycle; however, fans were turned off during rain events

Conclusions

The project is on-going and new methods are being evaluated every season. Lowering fan air flow strategies from 1 cfm/bu to 0.4 cfm/bu have been shown to be efficient, safe, and simple to implement and to reduce the cost of power.

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