East Central Research Foundation

2015

Annual Report

Michael Hall

Research Coordinator

306 621 6032

www.ecrf.ca

Table of Contents

Introduction

The East Central Research Foundation (ECRF) is a non-profit, producer directed research organization which works closely with various levels of government, commodity groups, private industry and producers. Founded in 1996, the mission of ECRF is to promote profitable and sustainable agricultural practices through applied research and technology transfer to the agricultural industry.

In 2013, ECRF signed a memorandum of understanding with Parkland College that will allow the partners to jointly conduct applied field crop research in the Yorkton area. The City of Yorkton provided the college with a 5 year lease of land (108 acres) located just a half mile south of town on York lake road and another 60 acre parcel located just west of town. We will be entering the 4th year of that agreement.

Parkland College is the first regional college in Saskatchewan to undertake an applied research program. Parkland College is thrilled to be involved in applied research because it fits with one of their mandates to "serve regional economic development". The Partnership also provides the college with a location and equipment to use for training students. Both partners benefit from each other's expertise and connections. ECRF and Parkland College also have access to different funding sources which is another strength of the partnership.

ECRF Board of Directors

ECRF is led by a 6 member Board of Directors consisting of producers and industry stakeholders who volunteer their time and provide guidance to the organization. Residing all across East-Central Saskatchewan, ECRF Directors are dedicated to the betterment of the agricultural community as a whole. The 2015 ECRF Directors are:

- Glenn Blakely (Chairperson) – Tantallon, SK
- Fred Phillips (Vice Chairperson) – Yorkton, SK
- Blair Cherneski - Goodeve, SK
- Dale Peterson - Norquay, SK
- Wayne Barsby - Sturgis, SK
- Ken Waldherr - Churchbridge, SK
- Gwen Machnee – Yorkton, SK -Co-ordinator for University and Applied Research-Parkland College

Ex-Officio

- Charlotte Ward – Regional Forage Specialist- Saskatchewan Agriculture
- Lyndon Hicks – Regional Crops Specialist – Saskatchewan Agriculture

Staff

- Mike Hall – Research Coordinator
- Kurtis Peterson – Administrator
- Clark Anderson – Seasonal Equipment Technician
- Ashley Zelinski – Half Time Summer Student
- Heather Sorestad – Full Time Summer Student
- Laura Heinmiller – Part Time Summer Person

Agri-Arm

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

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

The eight Agri-ARM sites 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

For more information on Agri-Arm visit http://Agri-ARM.ca/

Farm sites

ECRF and Parkland College currently have two farm site locations. The south farm site is located a half mile south of Yorkton down York Lake Road. (SW 26 25 4 w2). The soil at this site is described in the table below:

Soil description for SW 26 25 4 w2 (South Farm site)

Factor	Comments
Drainage	Well drained
Soil Characteristics	Clay-loam; pH 7.6; Non-saline
Nutrient levels 2015	0-12 inch soil test levels (lbs/ac); N-NO3 12 (Deficient); P 36 (Marginal); K 1000 (Sufficient); S-SO4 22 (Marginal)

The west farm site is located just west of Yorkton NW 3 26 4 w 2. This is not great land and is used for forage experimentation. The soil is described in the table below:

Factor	Comments
Drainage	Moderately well drained
Soil Characteristics	Clay-loam; pH 7.9; Non-saline; Rocky
Nutrient levels 2014	0-12 inch soil test levels (lbs/ac); N-NO3 8 (Deficient); P 5 (Deficient); K 760 (Sufficient); S-SO4 9 (deficient)

At the last minute, 12 acres of rented land was secured just west of town and no soil sample was obtained. However, the land would be a clay-loam with similar characteristics to the south farm site.

Research and Statistical analysis

Unless stated otherwise all trials are small plot research. Plot size is typically either 12 or 22 feet wide and 35 feet long. The trials are seeded with a 10 foot wide Seedhawk drill and the middle 5 rows of plots are harvested using a small plot Wintersteiger combine. In the case for forage trials, the middle 5 rows of each plot are harvested with a small plot forage harvester.

Treatments are replicated and randomized throughout the field so that data may be analyzed. If a treatment is seeded in multiple plots throughout the field, experience tells us we are unlikely to obtain the same yield for each of these plots. This is the result of experimental variation or variation within the trial location. This variation must be taken into consideration before the difference between two treatment means can be considered "significantly" different. This is accomplished through proper trial design and statistical analysis.

Trials are typically set up as Randomized complete blocks, Factorial or split plot designs and replicated 4 times. This allows for an analysis of variance. If the analysis of variance finds treatments to differ statistically then means are separated by calculating the least squares difference (lsd). For example, if the lsd for a particular treatment comparison is 5 bu/ac then treatment means must differ more than 5 bu/ac from each other to be considered significantly (statically) different. In this example, treatment means that do not differ more than 5 bu/ac are not considered to be significantly different. All data in our trials must meet or exceed the 5% level of significance in order to be considered significantly different. In other words, the chance of concluding there is a significant difference between treatments when in reality there is not, must be less than 1 out of 20. For the sake of simplicity, treatment means which are not significantly different from each other will be followed by the same letter.

Extension Events

ECRF/Parkland College Farm Tour July 23, 2015

Tours

- Mid July, 2014 – Mike Hall trained students at experimental Farm for Parkland College's Ag. Operator Program – 6 students
- July 22, 2015
  - private Bayer tour -10 attending
- July 23, 2015
  - Annual farm tour -75 attending
- July 27, 2015
  - BASF Tour -50 in attendance
- July 30, 2015

- Cargill tour -3 in attendance
- August 6, 2015
  - SCIC European tour -40 in attendance
- August 10, 2015
  - BASF Richardson tour -11 in attendance
- August 11, 2015
  - SCIC tour -22 in attendance
- August 12, 2015
  - Yorkton distributors tour -40 in attendance
- August 13, 2015
  - BASF crop production services tour -6 in attendance
- August 19, 2015
  - Parkland Executive tour

Summary

Total number of field days held	11
Total number of producers attending field days	265

Agri-ARM Research Update

On January 14, 2016, the Agriculture Applied Research Management (Agri-ARM) sites hosted an update of their research at the Prairieland Park as part of the Crop Production show in Saskatoon. Presentations for that day are available from www.iharf.ca and included the following:

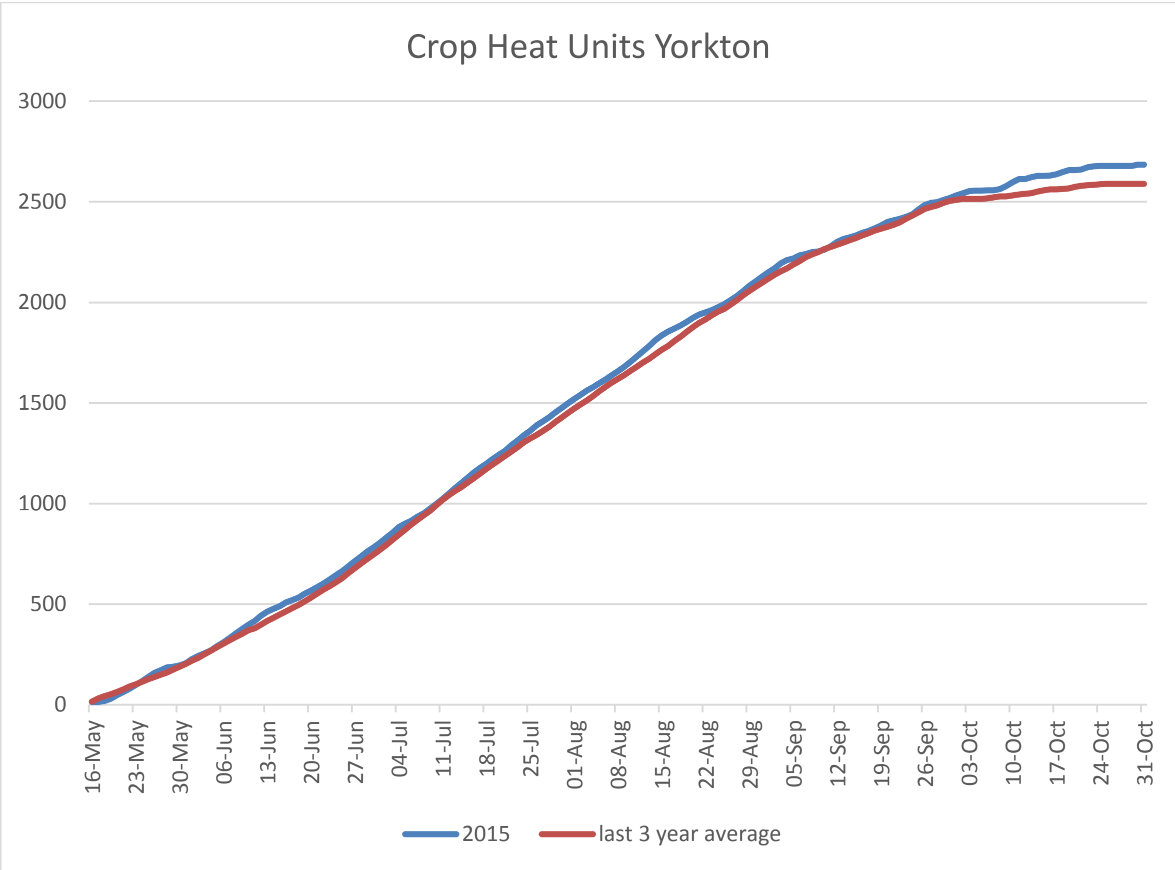
- Forage Termination: the risks of seeding wheat vs canola – Mike Hall ECRF/Parkland College
- New Insights into Natural Aeration Grain Drying-Ron Palmer IHARF
- Intercropping Chickpea and Flax-Lana Shaw SERF
- Tile Drainage in Northeast Saskatchewan-Stu Brandt NARF
- Micronutrient Testing Under Irrigation-Jeff Ewen ICDC
- Fabulous Faba beans: the fundamentals-Jessica Pratchler NARF
- Fertilizing Wheat for Protein-Gazali Issah-WARC
- Phosphorus Management Considerations for Southern Saskatchewan-Blake Weiseth WCA
- Promise in Plant Growth Regulators-Gary Kruger ICDC

Environmental Data

Data for Yorkton was obtained from Environment Canada from the following internet site: [http://www.climate.weatheroffice.gc.ca/climateData/canada_e.html]. Crop heat units were calculated using the formula available from Omafra website: [http://www.omafra.gov.on.ca/english/crops/pub811/10using.htm]

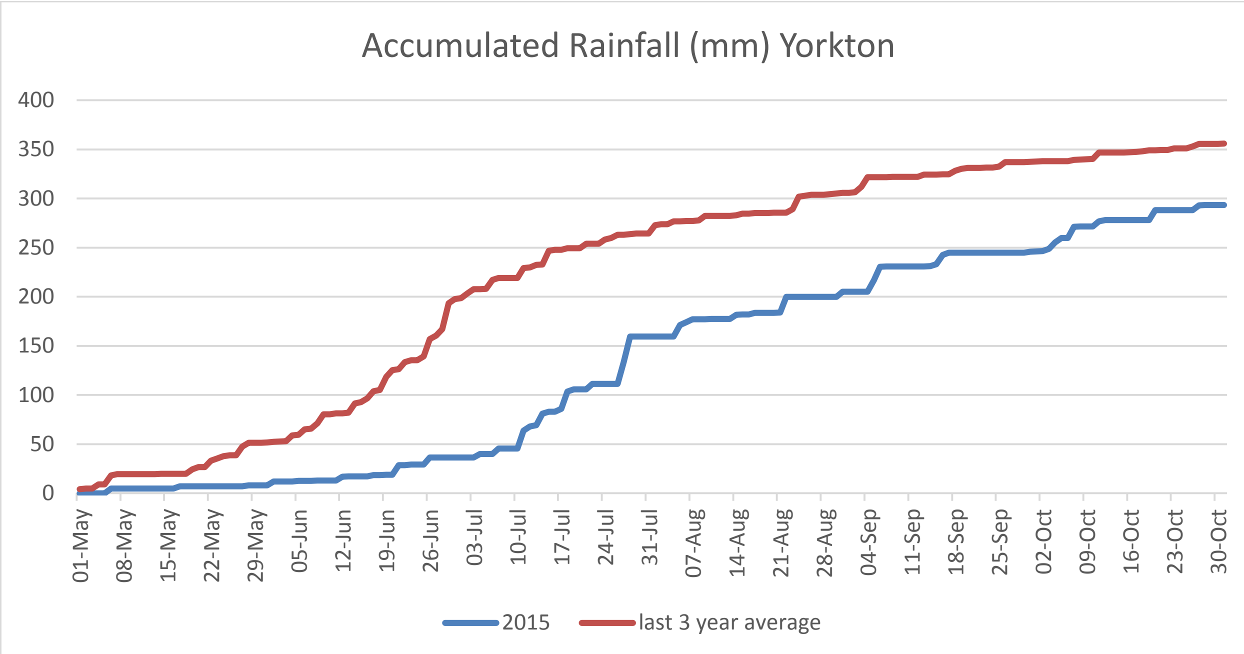
Overall, 2015 was a good year at the research farm and yields were average to above average depending on the trial. The crops suffered a frost evident (minus 2 to 4^{o}C) on May 30th. The Peas, Fababeans and cereals recovered nicely but many of the canola trials had to be reseeded due to frost and flea beetle damage. Flax was also thinned out by the frost. The accumulation of crop heat units was quite comparable to the last 3 year average until Oct when conditions were much warmer than normal (Table 1). This added heat was much needed to help Soybean, Fababean, late emerging or reseeded crops to mature.

Table 1.



Rain fall was below the last 3 year average (Table 2). It was particularly dry in early spring which in some cases lead to delayed emergence or variable emergence of some trials. Rainfall picked up in July which saved the yield potential of many crops.

Table 2.



Forage Termination Demonstration.

M. Hall[1], C. Ward[2]

[1]East Central Research Foundation/Parkland College, Yorkton, SK
[2]Saskatchewan Agriculture and Food, Yorkton, Sk

Abstract

Two trials were established to evaluate different methods of terminating an alfalfa/smooth brome stand before seeding canola and wheat. The methods compared were: 1. pre-harvest glyphosate (0.66 l/ac Transorb; Aug 8, 2014); 2. Spring glyphosate (1.33 L/ac Transorb May 9, 2015); 3. Spring glyphosate (0.66 L/ac Transorb May 9, 2015); 4. Spring glyphosate (1.33 L/ac Transorb May 9, 2015) + cultivation (May 25, 2015). The best approach in this study was to take the forage stand out with pre-harvest glyphosate (0.67 l/ac Transorb) and to seed Roundup Ready canola the following spring (Treatment 1). This provided the earliest maturing crop, the greatest yield and economic return. This approach conserved soil moisture and regrowth of smooth brome was effectively controlled in-crop with glyphosate. The pre-harvest approach failed with wheat as the brome regrowth emerged after the crop was seeded and there were no in-crop herbicide options to control smooth brome. Spring applications of glyphosate (either 0.67 or 1.33 l/ac Transorb) worked well at terminating the forage but having to allow the brome to regrow before spraying used up precious moisture reserves in a dry spring. As a result the emergence and crop maturity were delayed for both wheat and canola. The addition of cultivation with a spring glyphosate

expedited crop emergence for both wheat and canola as this improved seed row packing. This treatment improved canola yield but decreased wheat yield. Perhaps, wheat was not be able to compensate for early drought as well as canola.

Description

This study compares the ease of establishing wheat and canola crops into an alfalfa/brome stand which is terminated in the spring versus the year prior using glyphosate. The need for working the soil in spring was also assessed. A seed hawk drill was used for this trial to represent equipment farmers have available for seeding.

To achieve these objectives two trials were setup as RCBDs with 4 replications at the west farm site near Yorkton. Plot size was 34 by 50 ft. In the spring of 2015, one trial was established to wheat and the other to Roundup Ready canola. The following treatments to terminate an alfalfa/brome stand prior to seeding either crop where applied:

1. Pre-harvest glyphosate (0.66 L/ac Transorb Aug 8, 2014)
2. Spring glyphosate (1.33 L/ac Transorb May 9, 2015)
3. Spring glyphosate (0.66 L/ac Transorb May 9, 2015)
4. Spring glyphosate (1.33 L/ac Transorb May 9, 2015) + cultivation (May 25, 2015)

Table 1. shows the dates of all the operations and table 2 shows site conditions.

Table 1. Dates of Operations

Operation	Date
Pre-harvest glyphosate (Transorb 666 ml/ac) sprayed on trt 1 (both trials)	August 8, 2014
Forage cut from all treatments (both trials)	Sept 14, 2014
Glyphosate sprayed on treatments 2, 3 and 4 (both trials)	May 19, 2015
Cultivated treatment 4 (both trials)	May 23, 2015
Harrowed treatment 4 (both trials)	May 25, 2015
Seeded Canola and Wheat trials. Wheat received 197 lbs/ac urea, 25 lbs/ac ammonium sulphate and 50 lbs/ac ammonium phosphate. Canola received 222 lbs/ac urea, 62.5 lbs/ac ammonium sulphate and 50 lbs/ac ammonium phosphate.	May 25, 2015
Canola in trt 1 sprayed in-crop with glyphosate (400 ml/ac Transorb)	June 10, 2015
Table 1. Continued	

Operation	Date
Wheat in trt 1 sprayed in-crop with Puma + Prestige	June 11, 2015
Canola in trt 1-4 sprayed in crop with 333 ml/ac Transorb	June 18, 2015
Wheat in trt 1 sprayed with simplicity; Wheat in trt 2-4 sprayed with simplicity + curtail M	June 25, 2015
Pre-harvest (666 ml/ac Transorb)	Oct. 1, 2015
Harvested Canola Trial	Oct 11, 2015
Harvested Wheat Trial	Oct 15, 2015

Table 2. Site conditions

Factor	Comments
Drainage	moderately well drained
Soil Characteristics	Clay-loam; pH 7.9; non-saline; Rocky
Nutrient levels	0-12 inch soil test levels (lbs/ac); N-NO3 8 (deficient); P 4 (deficient); K 496 (Sufficient); S-SO4 6 (deficient)

Results

Glyphosate (0.67 l/ac Transorb) was applied pre-harvest on August 8, 2014 (trt #1) to both the Canola and Wheat trials. The forage was cut and havested by the farmer quite late (Sept 14). But by Sept 23 the pre-harvest treatment looked quite dead (Figure 1).

Figure 1. Pre-harvest glyphosate (0.67 l/ac Roundup transorb) applied August 8, 2014 (Trt 1.). Photo taken on Sept 23, 2014.

At the time of seeding (May 25, 2015) little evidence of sod regrowth was apparent in the pre-harvest treatment (#1) in either trial (Figure 2). However, by June 3 regrowth of the Smooth brome was quite apparent. This was not a problem in the canola trial as the regrowth was adequately controlled in-crop with an application of glyphosate (400 ml/ac Transorb) on June 10, 2015. In contrast, the regrowth was a serve problem in the wheat as it could not be controlled in-crop. Simplicity was tried in-crop as it has Japanese and Downy brome on its label but it had little effect on the advanced Smooth brome.

Figure 2. Pre-harvest glyphosate (0.67 l/ac Transorb) applied August 8, 2014 (Trt 1.). From left to right, photos were taken on May 26, 2015 and June 3, 2015.

The pre-harvest treatment (#1) was a complete failure with wheat and resulted in the least yield as it was over-run with Smooth brome (Figure 3 and 4). In contrast, treatment (#1) was the earliest maturing and highest yielding treatment with canola (Figure 3 and 5).

Figure 3. Pre-harvest glyphosate (0.67 l/ac Transorb) applied August 8, 2014 (Trt 1.). Canola on the left and Wheat on the right. The Wheat is over-run with Bromegrass. Photo taken Sept 2, 2015.

Figure 4.

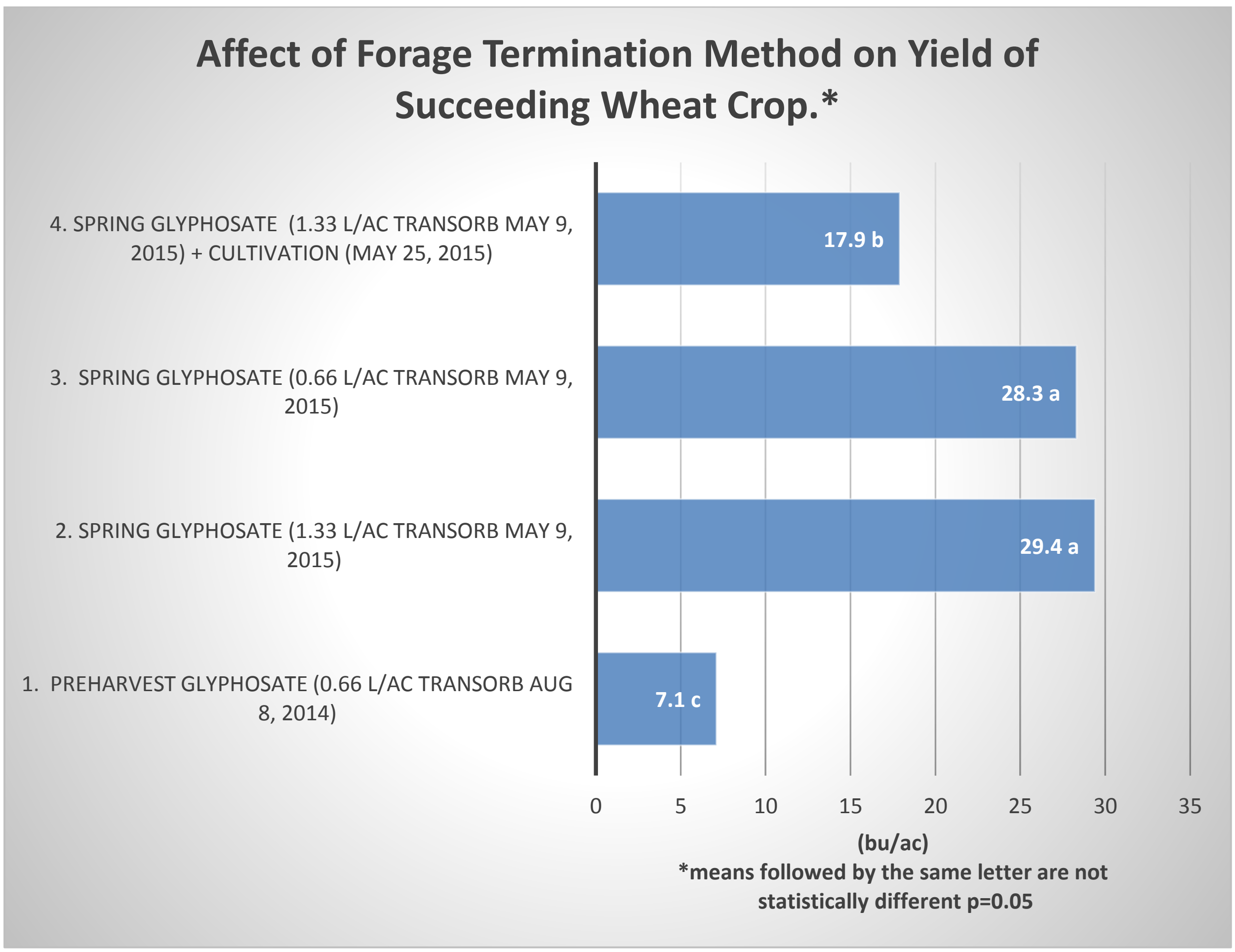
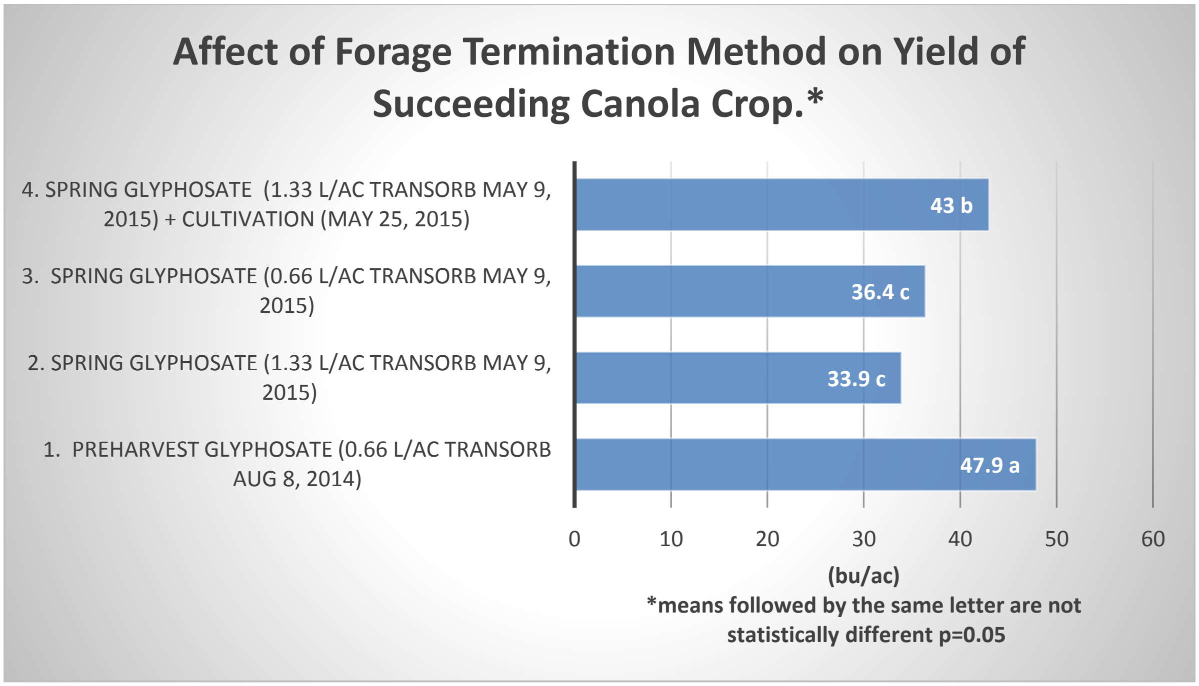


Figure 5.



The pre-harvest treatment (#1) was successful with canola due to weed control, early crop emergence and conservation of soil moisture. As noted in the environmental section of this report, the spring of 2015 was very dry. In treatments 2 and 3 precious soil moisture was used up as the Smooth brome had to be allowed to regrow before it was be successfully sprayed out with glyphosate on May 19, 2015. Thus canola seeded to these treatments sat in dry soil for 3 to 4 weeks before rain enabled germination. In contrast, the seed germinated within a few days in the pre-harvest treatment (#1) because soil moisture reserves were higher as a result of no plant growth in this treatment since the fall of 2014. Thus the emergence was much earlier in treatment 1 compared to either treatment 2 or 3 (figure 6).

Figure 6. Canola Emergence in treatment 2 (right) versus treatment 1(left). Seeded May 25 and picture taken June 18.

Emergence was also earlier in the cultivated treatment (#4). As with treatments 2 and 3 the brome was allowed to regrow and take up moisture before being sprayed out with glyphosate but the addition of cultivation improved the seed bed situation. The packing wheels were able to function properly in the softer cultivated soil but their width did not allow for adequate packing in the sod seeding treatments. The spring glyphosate + cultivation (trt4) resulted in the second highest canola yield because of its early crop emergence. However, it did not yield as well as the pre-harvest treatment (#1). Likely the result of greater brome regrowth and cultivation drawing down soil moisture reserves.

Like the canola trial, the wheat seed also remained dormant in the spring glyphosate treatments (#2 and 3) until the rains came. Again, emergence was earlier in the cultivated treatment (trt #4) due to better seed bed conditions and on row packing. However, unlike the results for canola the wheat in the cultivated treatment did not out yield the spring glyphosate treatments (#2 and 3). Perhaps wheat was not able to compensate as well as canola for the early drought conditions and its yield potential became set.

Conclusions

Under dry spring conditions, the conservation of soil moisture that comes with terminating the forage stand the year before can have a significant benefit the following year. Both wheat and canola germinated within a week within this treatment. When the forage was terminated in spring precious soil moisture was used up and the wheat and canola sat in dry soil for 3 weeks before rain enabled germination. Terminating the stand in early august likely caused some timing issues with the forage regrowth. Regrowth of forage occurred just after the crops were seeded in late May. This was not a problem for canola as in-crop application of Roundup provided adequate control. It was a severe problem in wheat as there are no in-crop herbicide options for the control of smooth brome. Terminating the stand in September instead of early August of the preceding year might have lessened this problem by delaying the regrowth of the smooth brome in crop. Seeding a Roundup Ready crop certainly is less risky in terms of control of forage regrowth. However, there are risks associated with a small seeded crop under less than ideal seed bed conditions.

Acknowledgements

This project was supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward bi-lateral agreement.

Rejuvenation of an **Alfalfa/Brome** Stand.

M. Hall[1], C. Ward[2]

[1]East Central Research Foundation/Parkland College, Yorkton, SK
[2]Saskatchewan Agriculture and Food, Yorkton, Sk

Abstract

This study looked at the impact of added fertility on forage rejuvenation. It also assessed various sod suppression techniques as a means to establish cicer milk-vetch within the forage stand. A balanced application of fertility (NPKS) increased forage yields by 50% whereas, the application of N alone did not

increase forage yield, despite low levels of soil N. Carryover effects from the fertility added in 2014 did not affect yields in 2015.

Sod suppression with glyphosate was the only treatment that resulted in the successful establishment of cicer milk-vetch by the following year. However, it is difficult to “dial in” the exact amount of suppression desired. The suppression in this study with glyphosate was severe and a season of forage harvest was forfeited. The forage did come back in the second year and yields were comparable to other treatments. It is debatable whether it is worth losing a year’s production of forage to establish cicer milk-vetch which still only constituted 8% of the stand the year following treatment.

Description

As a forage stand ages it becomes less productive and the legume component of the mixed stand decreases. Terminating and reestablishing a forage stand can be time consuming, expensive and may require a year of missed production. A strategy to rejuvenate depends on the condition of the stand. If the population of desirable species is high enough, the stand may only require added fertilizer to become more productive. In some cases the producer may only wish to re-establish the legume component of the stand. Alfalfa cannot be reseeded into a stand with even a relatively low presence of mature alfalfa due to autotoxicity. However, cicer milk vetch can be established because it is not affected by any allelopathy from alfalfa. Cicer milk vetch is a non-bloating legume which means the forage stand could also be used for pasture if desired. Cicer milk vetch may take longer to establish than other non-bloat legumes such as birdsfoot trefoil or Sainfoin but it is more persistent.

The general recommendation is to suppress the existing vegetation before trying to re-establish a new forage species. The challenge occurs when there is still a large proportion of desirable species present, such as smooth bromegrass that need to be maintained.

The objective of this project was to demonstrate different stategies to rejuvenate an old alfalfa brome stand. These strategies will include rejuvenation with fertilizer and different methods of introducing cicer milkvetch to the stand.

The trial was setup as an RCBD with 4 replicates on an alfalfa/brome stand. The treatment list was as follows:

1) Check
2) Sod-seed cicer milk-vetch early spring, no suppression
3) sod-seed cicer milk-vetch early spring, sod-suppression with glyphosate
4) sod-seed cicer milk-vetch in mid summer after first cut of forage crop
5) fertilize existing stand with 50 lbs/ac N
6) fertilize existing stand with 50-15-10-10 lbs/ac of NPKS

Dates of Operations and site conditions are found in tables 1 and 2, respectively.

Table 1. Dates of Operations

Operation	Date
Fertilizer applied to treatments 5 and 6	May 16, 2014
Roundup transorb (165 ml/ac) on trt 3	May 17, 2014
Seeded cicer milk vetch into trt 2 and 3. Packing not ideal but moisture good	May 21, 2014
Roundup transorb (495 ml/ac) on trt 3 (Respray because no impact from 1st spray)	May 27, 2014
Harvested alfalfa brome from trial. Cicer milk vetch too small to be in harvest material	July 9, 2014
Seeded cicer milk vetch into treatment 4	July 9, 2014
Cicer milk vetch emergence counts	August 12, 2014
Forage harvest second year, assessment of cicer milk-vetch establishment	July 2, 2015

Table 2. Site conditions

Factor	Comments
Drainage	moderately well drained
Soil Characteristics	Clay-loam; pH 7.9; non-saline; Rocky
Nutrient levels	0-12 inch soil test levels (lbs/ac); N-NO3 8 (deficient); P 4 (deficient); K 496 (Sufficient); S-SO4 6 (deficient)
Seeding condition	excellent

Results

On May 21, 2014 cicer milk vetch was seeded directly into sod (trt 2) and into sod which was suppressed by 165 ml/ac of Roundup Transorb (trt 3) (Figure 1). The seeding was done with a seed hawk drill which was not ideal. The packing wheels were too broad to properly pack the narrow opening within sod. However, the cicer milk vetch still emerged quite well as the soil moisture was excellent.

Figure 1. Treatment 3 on the day of seeding (May 21)

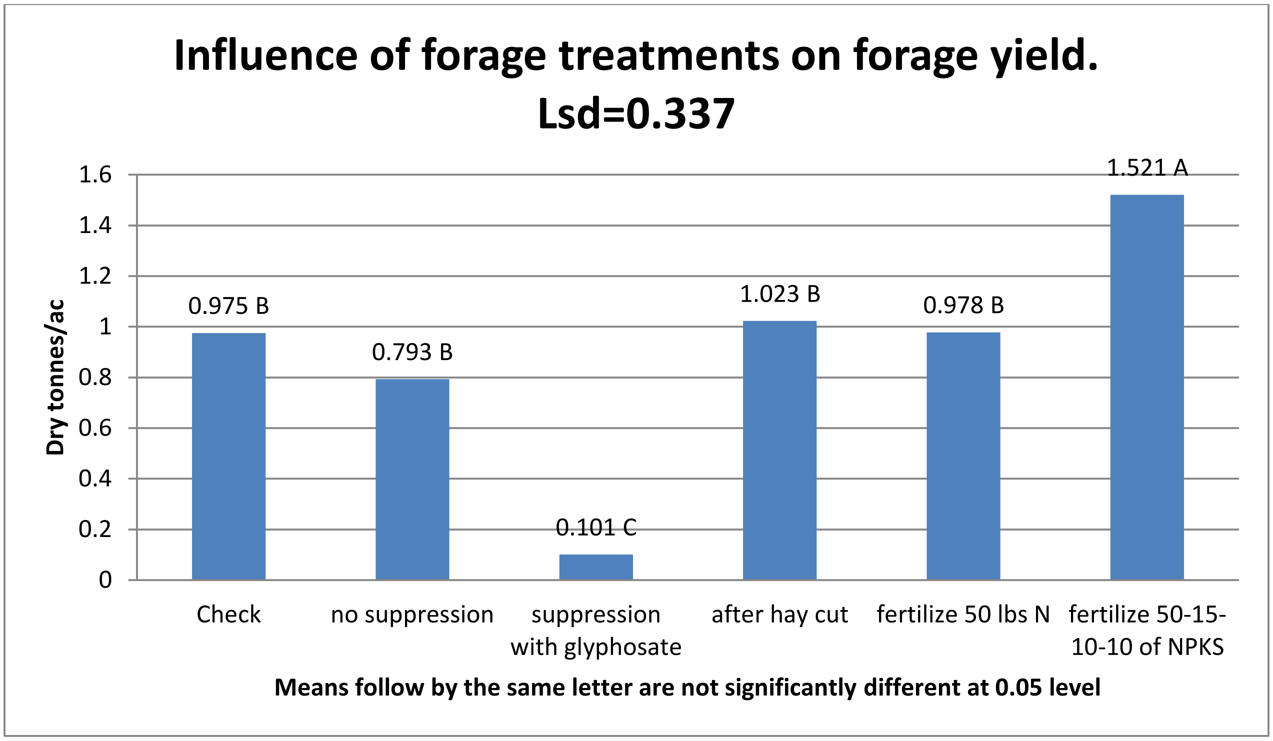
The application of 165 ml/ac of Roundup transorb on May 17 did not provide any suppression of the bromegrass. So on May 27, Roundup transorb was reapplied to plots at 495 ml/ac before the emergence of the cicer milk-vetch. This time the Roundup transorb greatly suppressed the bromegrass (Figure 2).

Figure 2. Treatments 2 and 3 June 9 (19 days after seeding)

On July 9, forage was harvested off the plots (Figure 3.). None of the cicer milk vetch was affected by this harvest as seedlings were well below the cutting height. Forage yields were greatly suppressed by the application of glyphosate (Figure 3 and 4). The application of glyphosate suppressed forage yield more than what was intended. Essentially a year of forage harvest was lost. The application of NPKS significantly increased forage yields by about 50% (Figure 4). This would be expected as soil test levels of nitrogen (N), Phosphorous (P) and Sulphur (S) were very low. However, forage yields were not increased by the application of Nitrogen alone despite very low levels in the soil. This demonstrates the need for a balanced approach to fertility. After the hay cut, cicer milk vetch was seeded into treatment 4.

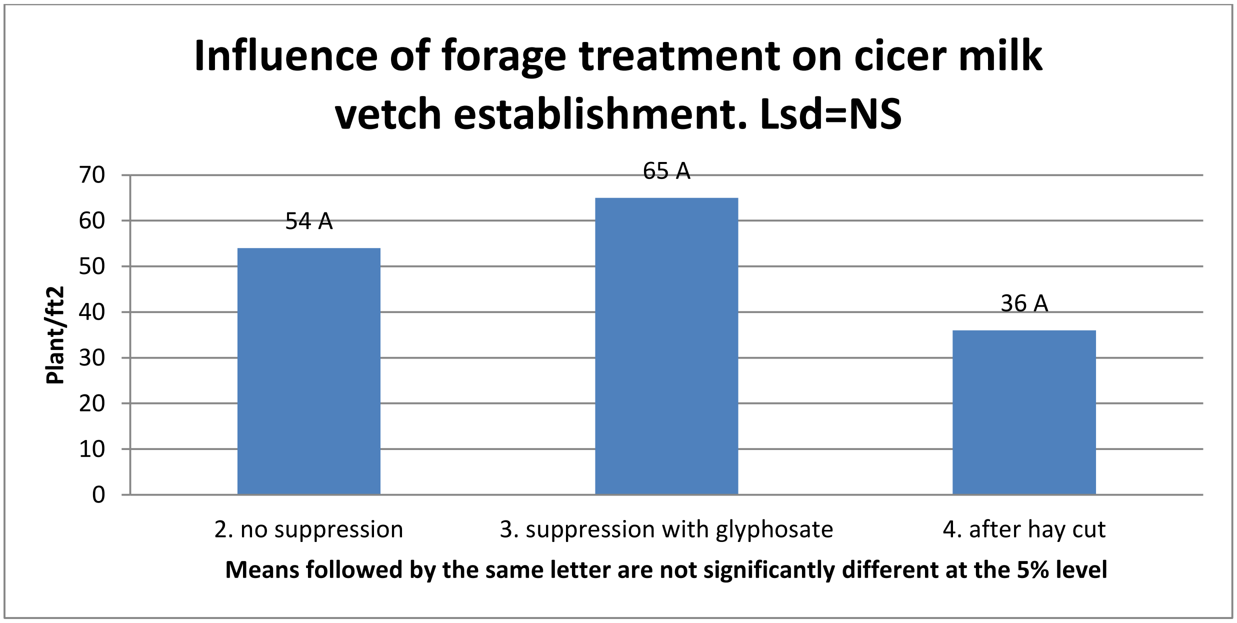
Figure 3. Forage treatment just prior to cutting for hay on July 9, 2014

Figure 4.



The establishment of cicer milk vetch was assessed on Sept 23, 2014. Plant counts were good for all treatments but somewhat variable. Thus no significant differences were observed between treatments despite some large numerical differences (Figure 5).

Figure 5.

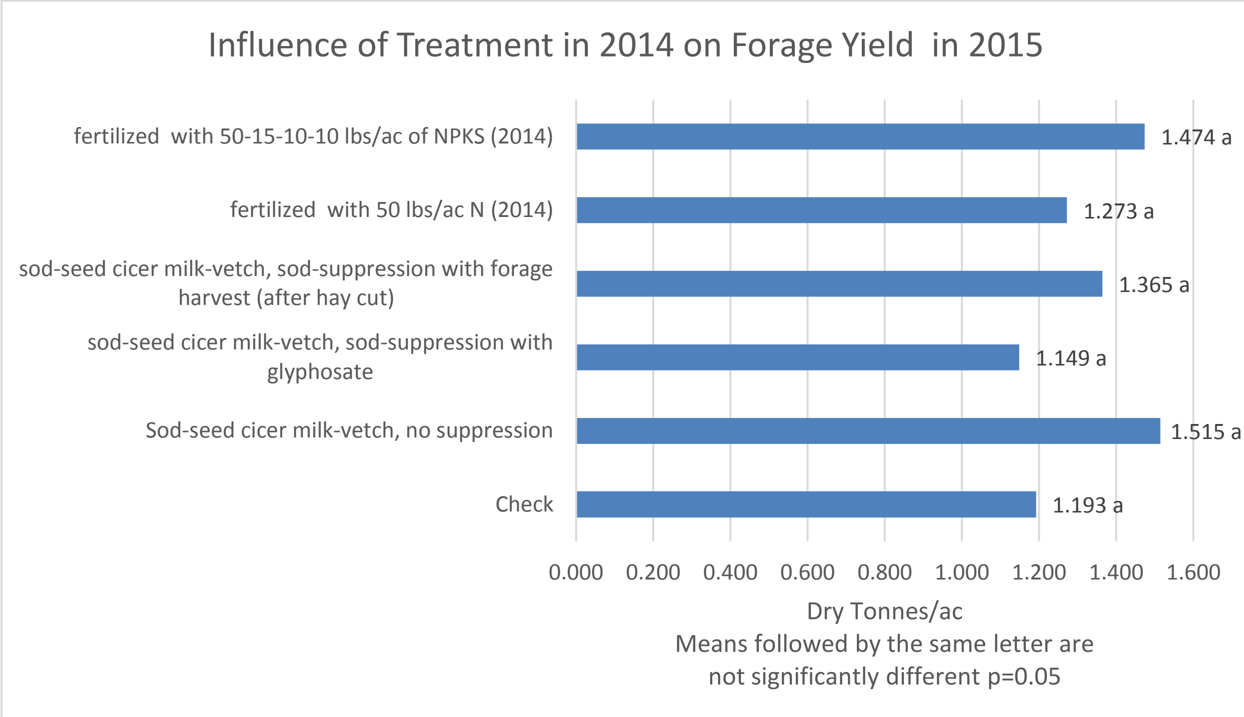


The size of the cicer milk vetch plants differed hugely between treatments. Plants were large and well developed in treatment 3 where the forage was suppressed by glyphosate (Figure 6). Not surprising as the suppression of the forage stand was quite substantial. Plants which were directly seeded into the stand without suppression or seeded after the hay cut were very small.

Figure 6. Establishment of cicer milk vetch by Sept 23, 2014

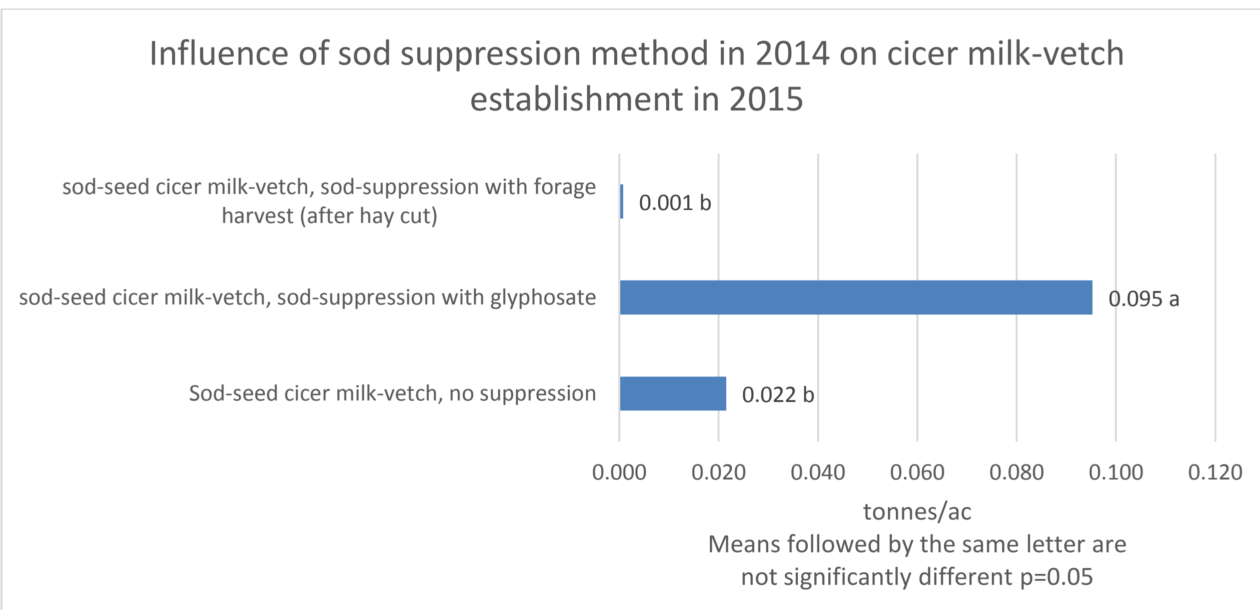
Forage yields the following year (2015) were quite variable and no statistical differences between treatment means could be detected. Forage yields averaged 1.3 dry tonnes/ac. There did not appear to be any carryover effect from the fertility added the previous spring. The yield of forage which had been badly suppressed the previous year was now comparable Figure 7.

Figure 7.



By 2015, cicer milk-vetch only established well were the forage had been badly suppressed the year prior with glyphosate (Figure 8). Even in this treatment it still only made up 8% of the stand.

Figure 8.



Conclusions

Soil fertility was quite low at this site and a balanced application of NPKS increased forage yield by 50% in the yield of application. The application of nitrogen alone did not increase forage yields despite low soil N levels. This demonstrates the importance of a balanced approach to fertility. The yield advantage from added fertility in 2014 did not appreciably carry over to 2015.

It is difficult to "dial in" the exact amount of forage suppression desired from the application of glyphosate. In this study the smooth bromegrass was greatly suppressed and the cicer milk-vetch established well in this treatment. However, it still only made up 8% of the forage stand in 2015. The cicer milk-vetch did not establish well in any other treatment. Despite the huge suppression of the forage stand with glyphosate in 2014, forage yields were comparable with other treatments by 2015. Despite the success of establishing cicer milk-vetch with glyphosate sod suppression it is not likely worth it as a year of production was lost. It is possible that the cicer milk-vetch may continue to expand within the stand and casual observations may be taken in the future in this regard.

Acknowledgements

This project was supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward bi-lateral agreement.

Impact of "Manipulator" on **Wheat** Varieties with Differing Lodging Resistance at high rates of N Fertility.

M. Hall[1]

[1]East Central Research Foundation/Parkland College, Yorkton, SK

Abstract

Manipulator is a plant growth regulator that is registered to reduce lodging in spring and winter wheat. This study examined the impact of Manipulator sprayed at Zadok 31 (first node detected) on two varieties of wheat sown with 100, 125 and 150 lbs/ac of actual nitrogen. Increasing nitrogen rate did not significantly increase either lodging or yield. Unity wheat was more susceptible to lodging than Goodeve and benefited more from the application of Manipulator. Applying Manipulator increased Unity yield from 46 to 56 bu/ac whereas it only increased Goodeve yield from 54 to 59 bu/ac.

Description

Producers push nitrogen rates inorder to increase yield and protein of wheat. However, too much nitrogen can result in lodging and yield loss. Producers can reduce lodging through the application of plant growth regulators (pgrs).

Manipulator (chlormequat chloride) is a plant growth regulator distributed by Engage Agro and is now registered for use in Saskatchewan. However, not all elevators are currently accepting wheat treated with Manipulator. Manipulator, is an anti-gibberellin, by reducing gibberellin biosynthesis it interrupts plant signals involved in stem elongation. The reduction in plant height leads to reduced lodging and greater yields. Manipulator is safer than other pgrs because of its wide window of application from Zadok 21 (main shoot 1 tiller) to Zadok 39 (flag). However, Engage Agro recommends Zadok 31 (1st node detected) as the ideal timing which has been proven long term based on European data. Although data from IHARF small plots consistently show better results at Zadok 39 (flag) there may be some risk with this timing. Instead of shortening and strengthening the bottom internodes, the middle internodes may shorten and strengthen which may actually worsen lodging under very adverse conditions. The early Zadok 21 timing is considered to be less efficacious. Manipulator is an anti-gibberellin. Major gibberellin production starts at Zadok 31 to coincide with stem elongation. Manipulator which is applied early has no efficacy until Zadok 31 by which time some of the product has been metabolized by the plant. So going early is equivalent to applying a reduced rate. Engage Agro considers the Zadok 31 timing the most efficacious followed by Zadok 39 and then Zadok 21.

The objective of this study was to compare the effectiveness of Manipulator applied at Zadok 31 (first node detected) on two wheat varieties with different resistance to lodging and at 3 rates of nitrogen. The wheat varieties were Goodeve and Unity with resistance to lodging ratings of “Very Good” and “Fair”, respectively. The nitrogen rates were 100, 125 and 150 lbs/ac of actual.

Table 1. shows the dates of all the operations.

Table 1. Dates of Operations

Operation	Date
Plot seeded	May 11, 2015
Emergence Counts	May 27, 2015
Simplicity + Frontline	June 2, 2015
Manipulator 620 applied at 1.8 L/ha at Zadok 31-first node detectable	June 15, 2015
Lodging Ratings	August 15, 2015
Pre-harvest Roundup	August 28, 2015
Harvested	Sept 2, 2015

Results

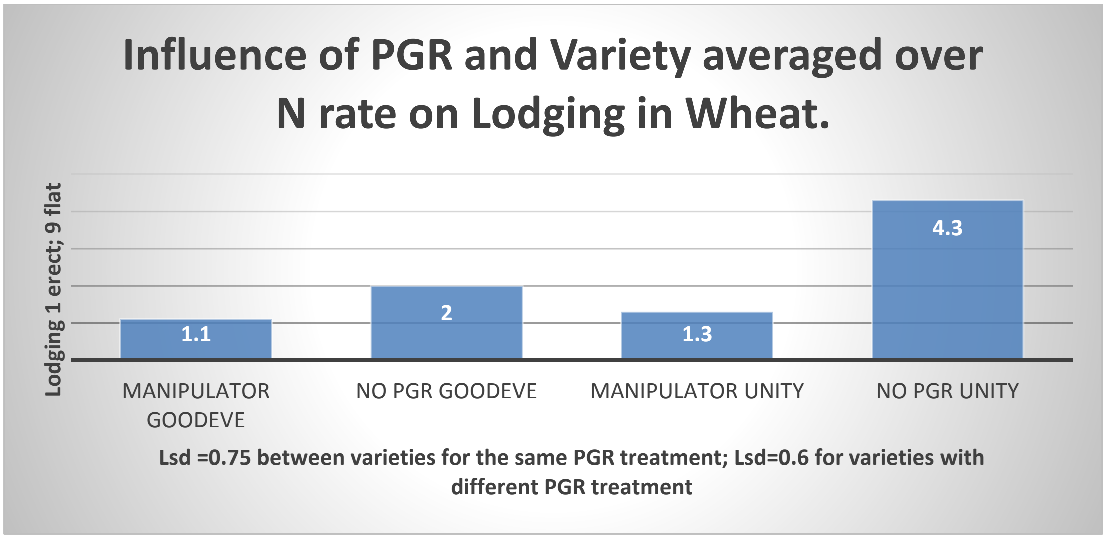
Crop emergence was good. It did decrease somewhat as nitrogen rates were increased. For Goodeve, plant populations declined from 23 to 20.5 plants/ft^2 as nitrogen rates were increased from 100 to 150 lbs/ac of actual. For Unity the decline was from 28 to 24 plants/ft^2.

Increasing nitrogen rate did not statistically increase lodging or wheat yield, even in the absence of a plant growth regulator. Yield was maxed out at 100 lbs/ac of actual nitrogen and grain protein was high (15%). Increasing nitrogen from 100 to 150 lbs/ac only increased protein by a few points.

Goodeve wheat resisted lodging quite well, even at 150 lbs/ac of Nitrogen (Figure 1 and 2).

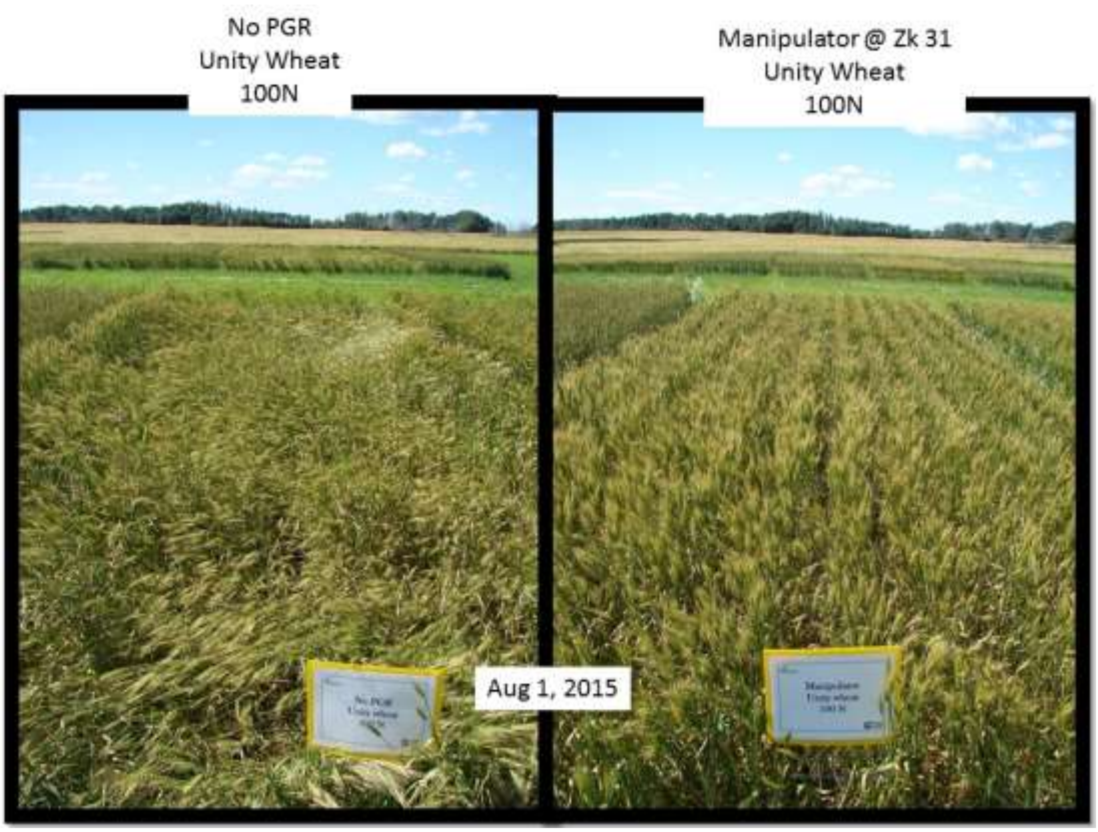
Figure 1. Goodeve Wheat Resists Lodging at 100 and 150 lbs/ac of Nitrogen.

Figure 2.



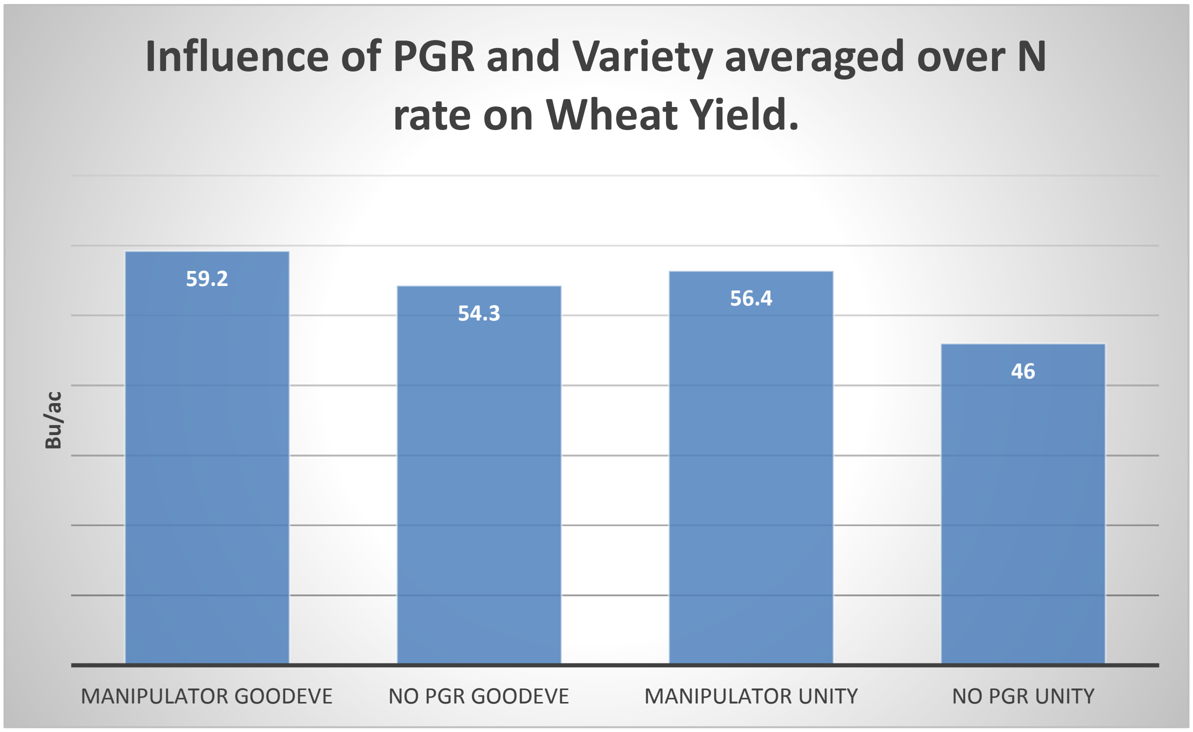
In contrast, Unity wheat was lodging even at 100 lbs/ac of nitrogen. However, with the application of Manipulator lodging was significantly reduced (Figures 2 and 3). Although Goodeve did not significantly lodge compared to Unity, the application of Manipulator improved its standability as well.

Figure 3. Lodging of Unity Wheat Significantly Reduced by the Application of Manipulator



The application of Manipulator statistically increased the yield of Goodeve and Unity wheat. Although there was not a statistically significant Variety by PGR interaction you can see there was a trend for Unity to be more responsive to the application of Manipulator than Goodeve (Figure 4). This makes intuitive sense as lodging was corrected to a greater degree in Unity from the application of Manipulator.

Figure 4.



<u>Conclusions</u>

The application of Manipulator at Zadok 31 (1st node detected) on wheat significantly reduced lodging and increased yield of both varieties of wheat. However, the benefit was greatest for the wheat variety Unity as it is more susceptible to lodging. Applying Manipulator increased Unity yield from 46 to 56 bu/ac whereas it only increased Goodeve yield from 54 to 59 bu/ac. Even though lodging levels were relatively low with Goodeve the application of Manipulator would have still been economical.

<u>Acknowledgements</u>

This project was supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward bi-lateral agreement.

Impact of “Manipulator” Timing and N Fertility on **Wheat** Lodging and Yield.

M. Hall[1]

[1]East Central Research Foundation/Parkland College, Yorkton, SK

Abstract

Manipulator is a plant growth regulator that is registered to reduce lodging in spring and winter wheat. This study examined the impact of Manipulator sprayed at growth stages Zadok 21 (main shoot 1st tiller) and Zadok 31(1st node detected) on wheat sown with three rates of 100, 125 and 150 lbs/ac of actual nitrogen. Yield potential was maxed out at 100 lbs/ac of actual nitrogen. Increasing nitrogen rates to 150 lbs/ac of actual nitrogen did not further increase yields or lodging when Manipulator was applied. The application of Manipulator at either growth stage significantly decreased lodging and increased yield in wheat from 48 to 58 bu/ac. While the application of Manipulator at growth stage Zadok 21 was efficacious in this study this may not always be the case. Studies from other sites have observed reduced efficacy when Manipulator is applied early at Zadok 21 compared to the later Zadok 31 stage.

Description

Producers push nitrogen rates inorder to increase yield and protein of wheat. However, too much nitrogen can result in lodging and yield loss. Producers can reduce lodging through the application of plant growth regulators (pgrs).

Manipulator (chlormequat chloride) is a plant growth regulator distributed by Engage Agro and is now registered for use in Saskatchewan. However, not all elevators are currently accepting wheat treated with Manipulator. Manipulator, is an anti-gibberellin, by reducing gibberellin biosynthesis it interrupts plant signals involved in stem elongation. The reduction in plant height leads to reduced lodging and greater yields. Manipulator is safer than other pgrs because of its wide window of application from Zadok 21 (main shoot 1 tiller) to Zadok 39 (flag). However, Engage Agro recommends Zadok 31 (1st node detected) as the ideal timing which has been proven long term based on European data. Although data from IHARF small plots consistently show better results at Zadok 39 (flag) there may be some risk with this timing. Instead of shortening and strengthening the bottom internodes, the middle internodes may shorten and strengthen which may actually worsen lodging under very adverse conditions. The early Zadok 21 timing is considered to be less efficacious. Manipulator is an anti-gibberellin. Major gibberellin production starts at Zadok 31 to coincide with stem elongation. Manipulator which is applied early has no efficacy until Zadok 31 by which time some of the product has been metabolized by the plant. So going early is equivalent to applying a reduced rate. . Engage Agro considers the Zadok 31 timing the most efficacious followed by Zadok 39 and then Zadok 21.

The objective of this study was to compare the effectiveness of Manipulator at reducing lodging and increasing yield under 3 nitrogen rates and at two timings. The nitrogen rates evaluated were 100, 125 and 150 lbs/ac of actual N. The timings were Zadock 21 (4 leaf 1 tiller) and Zadock 31 (First detectable node). The wheat variety used was Unity which has only a “Fair” resistance to lodging.

Table 1. shows the dates of all the operations.

Table 1. Dates of Operations

Operation	Date
Plot seeded	May 11, 2015
Emergence Counts	May 27, 2015
Simplicity + Frontline	June 2, 2015
Manipulator 620 applied at 1.8 L/ha at Zadok 21-main stem 1^{st} Tiller	June 5, 2015
Manipulator 620 applied at 1.8 L/ha at Zadok 31-first node detectable	June 15, 2015
Lodging Ratings	August 15, 2015
Pre-harvest Roundup	August 28, 2015
Harvested	Sept 3, 2015

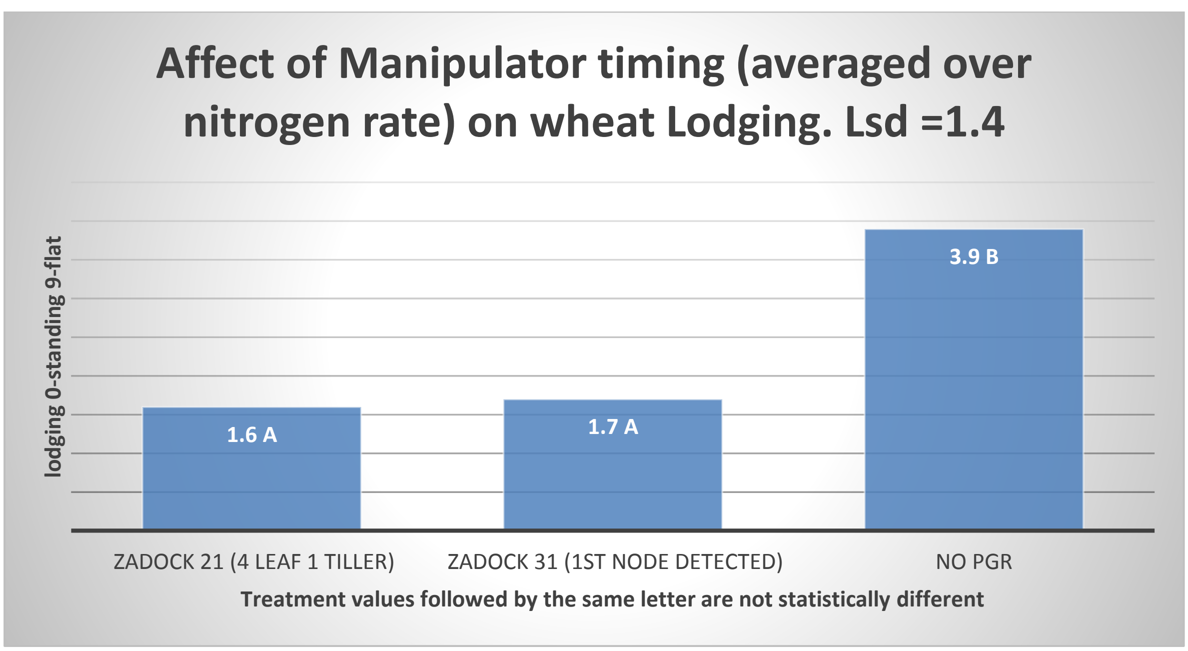
Results

Crop emergence was below target but was decent. Plant population decreased from 24 to 19 plants/ft2 as nitrogen rates were increased from 100 to 150 lbs/ac of actual nitrogen.

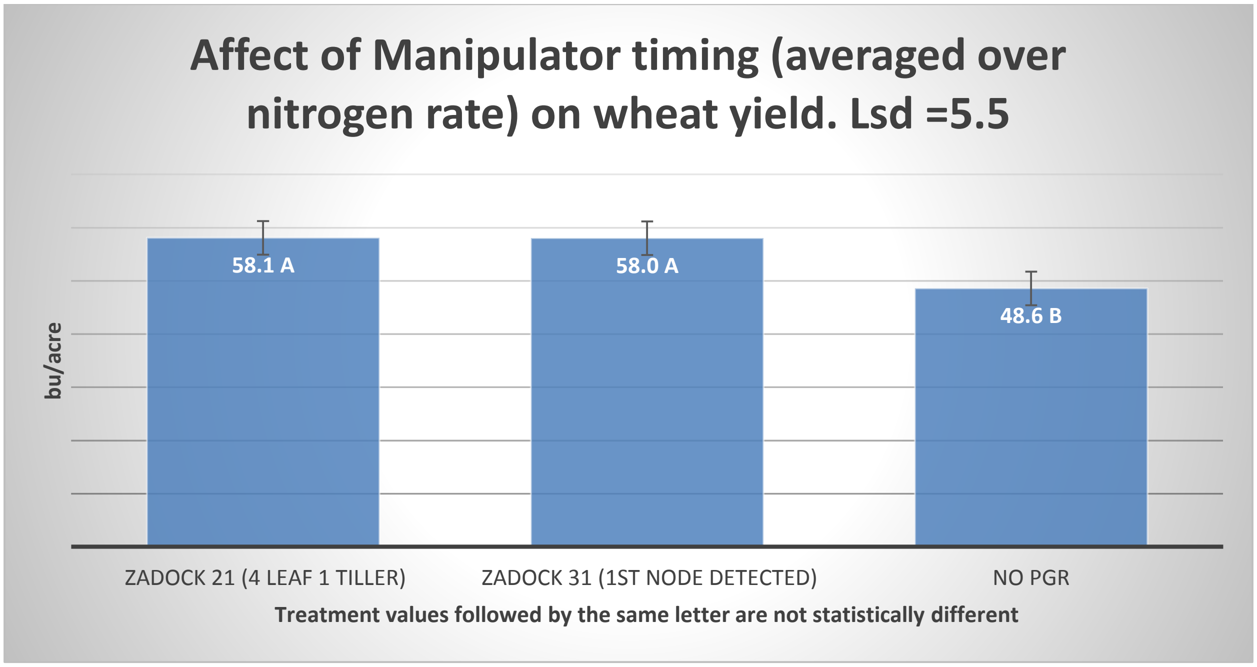
Increasing nitrogen rate did not statistically increase lodging, even in the absence of a plant growth regulator. The application of a growth regulator was found to reduce lodging (Figure 1, 2) however, no differences between timings were detected (Figure 2).

Figure 1. Manipulator Versus no Applied Plant Growth Regulator

Figure 2.



Increasing nitrogen rate from 100 to 150 lbs/ac of actual did not increase yield. However, it did increase percent grain protein from 14.3 to 14.9. The application of Manipulator significantly increased yield by 10 bushels. There was no difference between timings.



Conclusions

The application of Manipulator at either Zadok 21 (main stem 1st tiller) or Zadok 31 (1st node detected) significantly reduced lodging and increased yield potential from 48 to 58 bushels/ac when using a variety with only fair resistance to lodging. Research from other Agri-ARM sites suggest Zadok 39 (flag leaf) may be the ideal staging for Manipulator. However, this timing is not preferred by Engage Agro as it has the potential to worsen lodging under adverse conditions. In this study lodging was reduced significantly at Zadok 21 which is much more convenient for farmers as it coincides with herbicide application. However, other studies have noted reduced efficacy at this early timing. Applying Manipulator with fungicide at flag is also convenient for farmers but Agri-ARM research has shown fungicide at early heading for leaf disease control and suppression of fusarium head blight is a better approach. Unfortunately, Manipulator cannot be combined with fungicide at early heading. The best approach for most farmers is to apply Manipulator at Zadok 31 followed by fungicide at early heading. However, there may be cases where the producer can achieve good efficacy and forego another pass over the field by applying Manipulator at herbicide timing or flag leaf fungicide timing. Engage Agro advises that the application of Manipulator is most efficacious at Zadok 31 followed by Zadok 39 and then Zadok 21.

Acknowledgements

This project was supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward bi-lateral agreement.

Evaluation of Seed Treatments on **Wheat** Seed.

M. Hall[1]

[1]East Central Research Foundation/Parkland College, Yorkton, SK

Abstract

This study evaluated the impact of commercially available seed treatments on the emergence, seedling weights and yield of wheat. The seed treatments were evaluated at seeding depths of 1 and 1.5 inches. Unfortunately, a seed lot with a high fungal screen was not supplied. Conditions at seeding were ideal. As a result the wheat seedlings did not suffer much from root rot disease. Apart from some modest reductions in lodging by a couple seed treatments, no benefit from seed treatment was observed. Though not statistically significant the trend for some of the seed treatments was a reduction in seedling dry weight and crop yield. These results were not expected. It is possible that non uniform coverage of seed treatment played a role in the poor performance of the seed treatments.

Description

The original objective of this study was to compare the emergence and yield of a poor wheat seed lot with commercially available seed treatments. The poor wheat seed lot was to contain high fungal screens. However, the wheat seed supplied was of good quality. The trial in this study was set up as a small plot 2 order factorial with 4 replicates on rented land just west of Yorkton (Figure 1).

Figure 1. Wheat Seed Treatment Trial Near Yorkton

The first factor compared seeding depths of 1 and 1.5 inches. The second factor compared the following seed treatments:

- No seed treatment
- Insure
- Cruiser Maxx cereals
- Cruiser Maxx Vibrance cereals
- Raxil Pro
- Raxil Pro Shield

Table 1. shows the dates of all the operations for 2015.

Table 1. Dates of Operations for 2015

Operation	Date 2015
Trial seeded	May 8
Emergence counts	May 28
Crop biomass	May 28 & 29
Prosaro applied early heading	July 5
Harvest	Sept 8

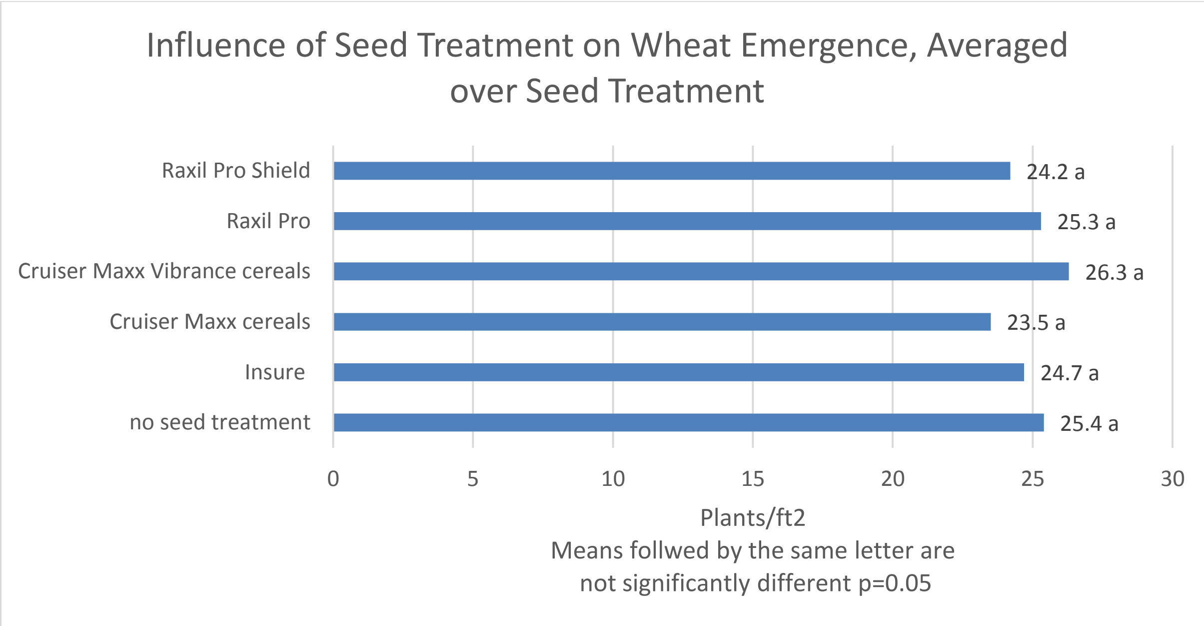
Seed treatments were applied in small batches using spray bottles and cement mixing action until all seed was uniformly pigmented.

Results

When averaged over seed treatment, increasing seeding depth from 1 to 1.5 inches decreased wheat emergence significantly from 26.1 to 23.7 plants/ft^2, respectively. Increasing seeding depth also decreased seedling dry weights from 5.4 to 4.8 grams/ft^2. However, changes in seeding depth did not affect yield which was 62 bushels for both depths.

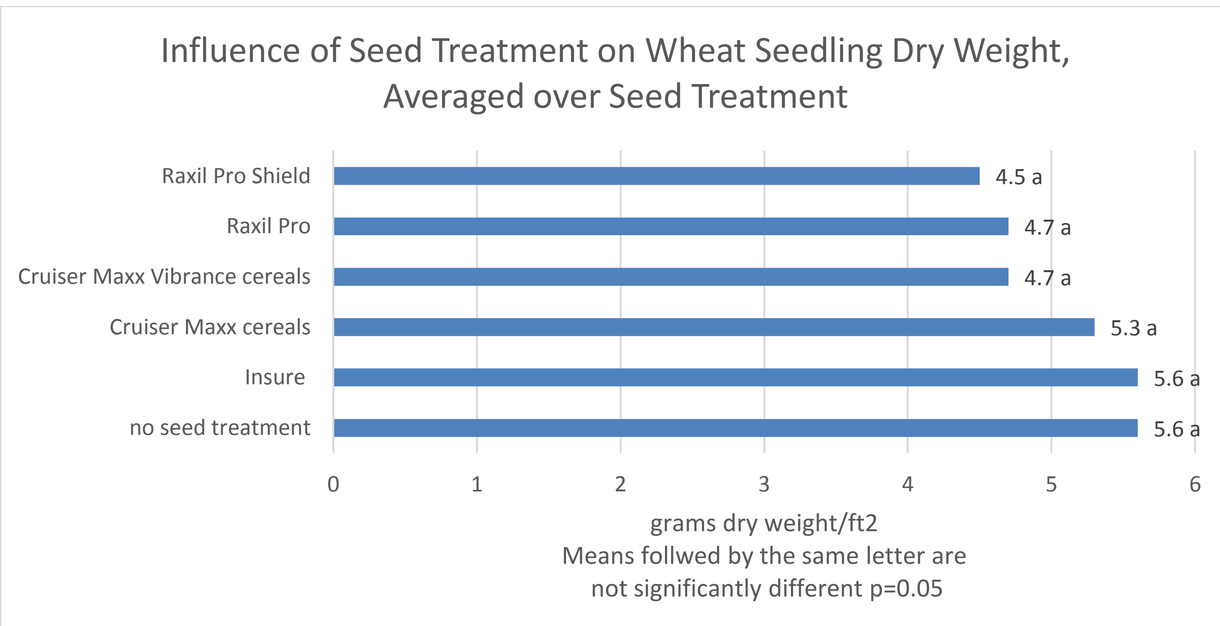
When averaged over seeding depth, seed treatment did not statistically affect seedling emergence (Figure 2).

Figure 2.



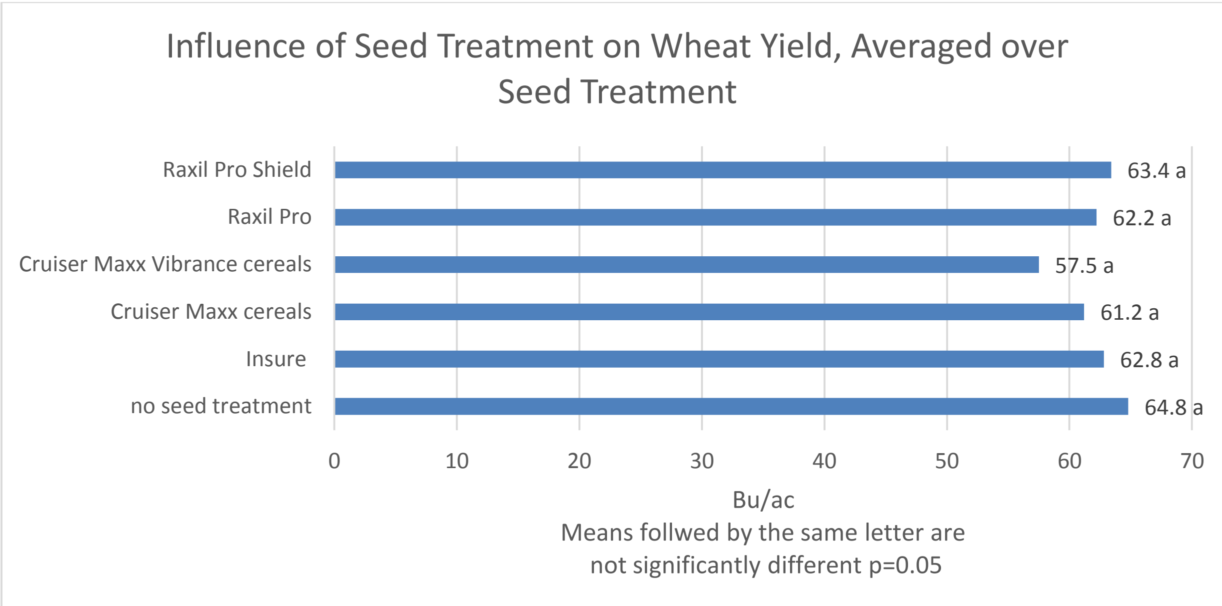
Some of the seed treatments appeared to reduce seedling weights compared to the no seed treatment check. However, none of the differences were statistically significant (Figure 3).

Figure 3.



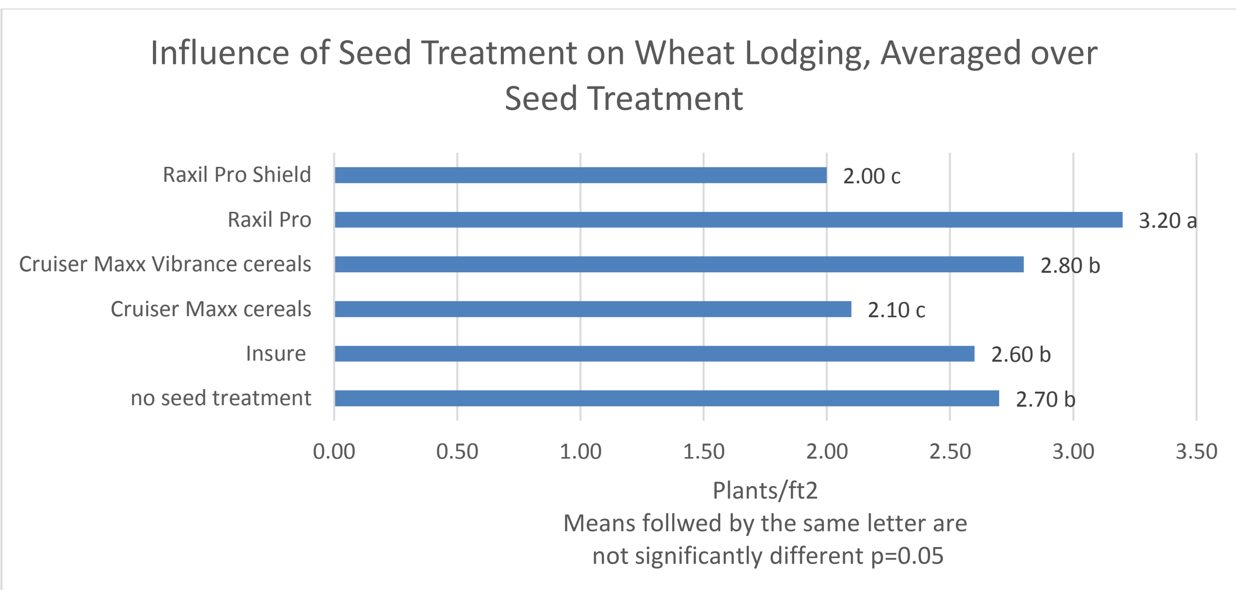
While there was a fair bit of yield variance between treatments no statistical differences between means could be detected (Figure 4). No yield benefit from seed treatment could be detected. In fact, all seed treatments resulted in less yield that the untreated check.

Figure 4.



There were some statistically significant differences with lodging between seed treatments (Figure 5). Seed treated with Raxil Pro Shield and Cruiser Maxx cereals had statistically less lodging compared to all other treatments.

Figure 5.



<u>Conclusions</u>

There was little root rot pressure in this study. The seed did not carry high fungal screens and conditions were ideal for emergence after seeding. Apart from some modest reductions in lodging from some seed treatments, no benefit from seed treatment could be detected in this study. In fact the trend was for seed treatment to reduce seedling dry weights and crop yield. Not the result expected. Seed treatments were applied to seed in small batches with spray bottles and cement mixing action. It is quite possible this still did not achieve uniform application to the seed. This may be a contributing factor for the poor performance of seed treatment in this study

Acknowledgements

This project was supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward bi-lateral agreement.

Alliance Seed **Wheat** Variety Trial

M. Hall[1]

[1]East Central Research Foundation/Parkland College, Yorkton, SK

Abstract

Between the CWRS varieties, AAC Elie significantly out yielded AAC Prevail VB. Prevail lodged significantly more than Elie which is probably the main reason for the poorer yield performance. However, Prevail's poorer emergence may have also been a contributing factor. These results contrast information found in the seed Guide that shows Prevail to be higher yielding than Elie and rates both varieties as having "Good" resistance to lodging.

AAC Innova (CWGP) was found to be a high yielding low lodging variety whereas, AAC Tenacious (CPSR) was found to be a low yielding variety susceptible to lodging. Both these results are in keeping with information found in the Provincial Seed Guide.

Description

A small plot RCBD variety trial with 4 replicates was established on rented land just west of Yorkton (Figure 1). The trial consisted of wheat varieties which are of interest to Alliance Seed. Only the registered varieties are presented in this report. These include AAC Elie and AAC Prevail VB which are Canada Western Red Spring Wheat varieties, AAC Tenacious VB which is a Canada Prairie Spring Red Wheat and AAC Innova which is a Canada Western General Purpose Wheat.

Figure 1. Alliance Seed Wheat Variety Trial Near Yorkton

Table 1. shows the dates of all the operations.

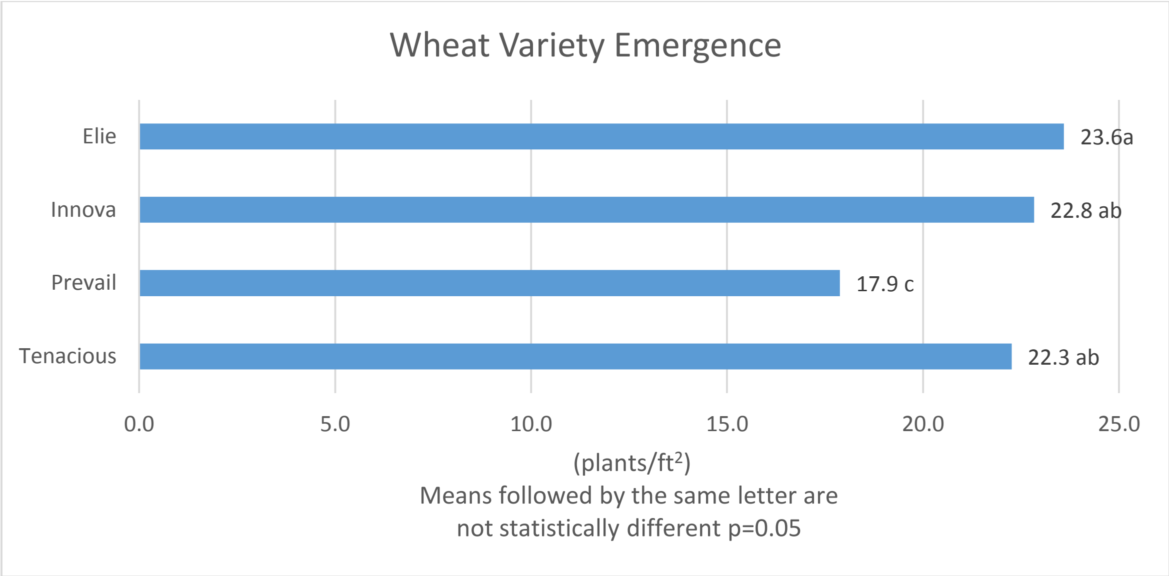
Table 1. Dates of Operations in 2015

Operation	Date
Trial seeded	May 11
Emergence Counts	May 27
Simplicity + Frontline	June 2
Prosaro @ early heading	July 5
Lodging Ratings	August 15
Pre-harvest Roundup	August 28
Harvested	Sept 9

Results

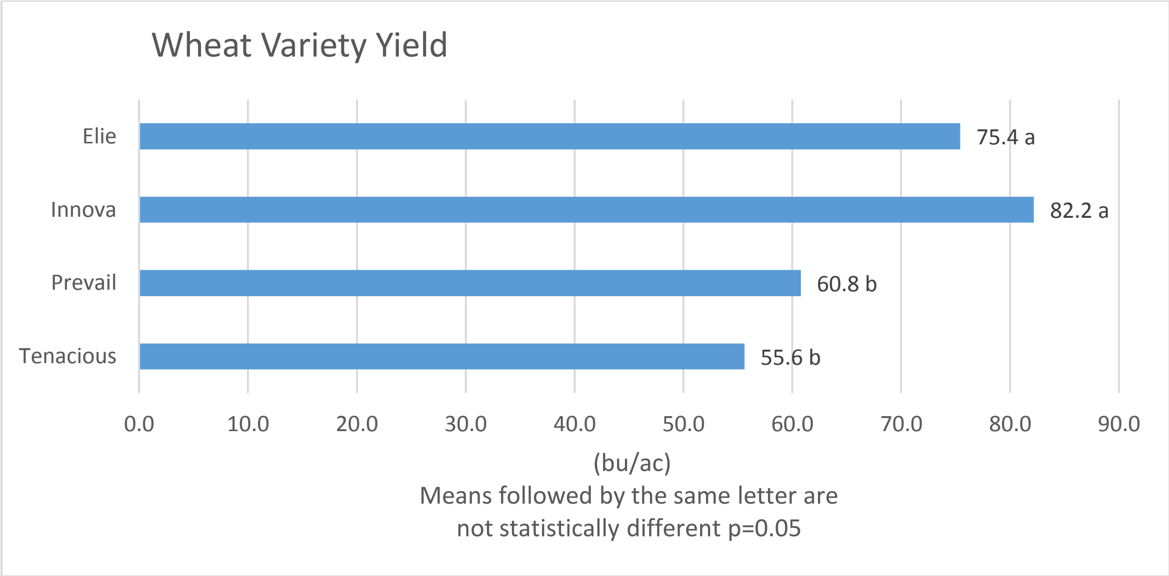
Overall wheat emergence was good. However, emergence was lower for the wheat variety Prevail (Figure 2).

Figure 2



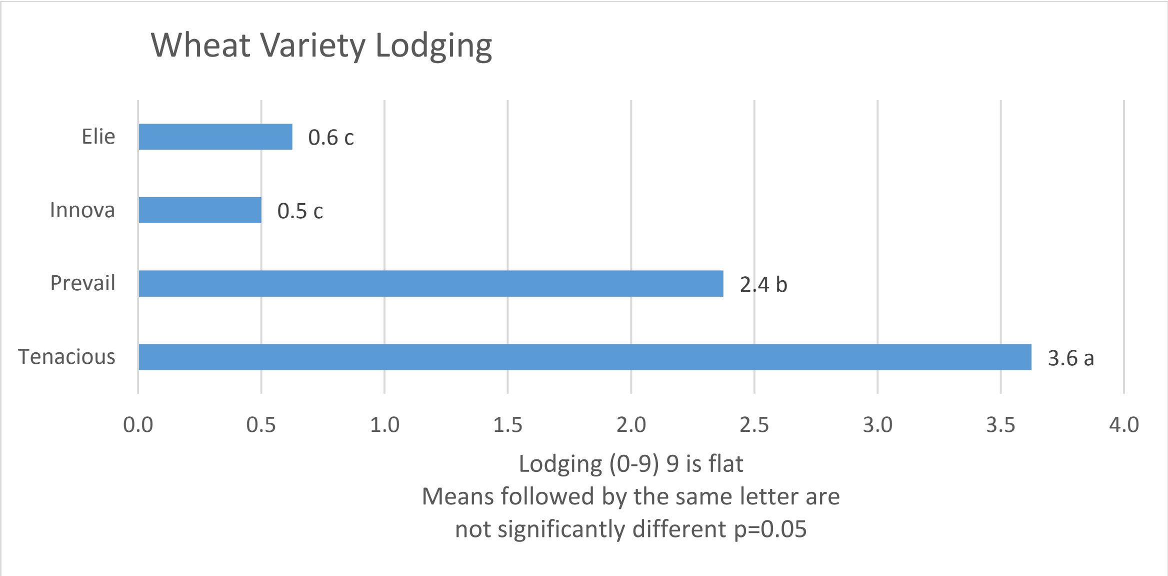
Elie and Innova significantly yielded more than Prevail and Tenacious (Figure 3).

Figure 3



Elie and Innova also suffered significantly less lodging than Prevail and Tenacious (Figure 4). This likely contributed to their greater yield potential. According to the Saskatchewan Variety Guide, Elie, Innova and Prevail are all rated as having "Good" resistance to lodging. Whereas, Tenacious is only rated as fair. Based on the results from this study, Prevail did not have the same level of resistance to lodging as Elie or Innova.

Figure 4.



Conclusions

The wheat varieties Elie and Innova yielded significantly more than Prevail and Tenacious. The yield potential of Prevail and Tenacious were likely reduced by greater levels of lodging. The emergence of Prevail was lower than the other varieties and this too may have limited its yield.

Acknowledgements

This project was supported by the Alliance Seed.

Demonstrating Fungicide Timing for Leaf and Head Disease on Spring **Wheat**.

M. Hall[1]

[1]East Central Research Foundation/Parkland College, Yorkton, SK

Abstract

Various combinations and timings of fungicide for the control of leaf spot disease and Fusarium head blight were evaluated on spring wheat. All fungicide treatments significantly reduced leaf spot disease but differences in Fusarium damaged kernels (FDK) were not apparent. Control of leaf spot disease was better where Twinline was used at flag compared to Prosaro at heading. The additional use of Propiconazole at 4 lf stage did not reduce the presence of leaf spot disease by late summer. Though the

application of fungicide increased wheat yield by 8 bushels on average, differences between treatment means could not be separated statistically. Yield data was too variable due to variable amounts of lodging through the trial.

Description

The objective of this project was to demonstrate the effect of various fungicide timings on leaf spot disease, fusarium head blight and yield of spring wheat. To this end a small plot RCBD trial was establish on rented land just west of Yorkton. The fungicide treatments evaluated were as follows:

1. No fungicide
2. T1- Propiconazole (full rate) with herbicide + T2- twinline @ flag
3. T2- twinline @ flag
4. T1- Propiconazole (full rate) with herbicide + T3- Prosaro @ heading
5. T3-Prosaro @ heading
6. T1-Propiconazole (full rate) with herbicide + T2-twinline @flag + T3 -Prosaro @ heading
7. T2-twinline @flag + T3 -Prosaro @heading

Table 1. shows the dates of all the operations for 2015.

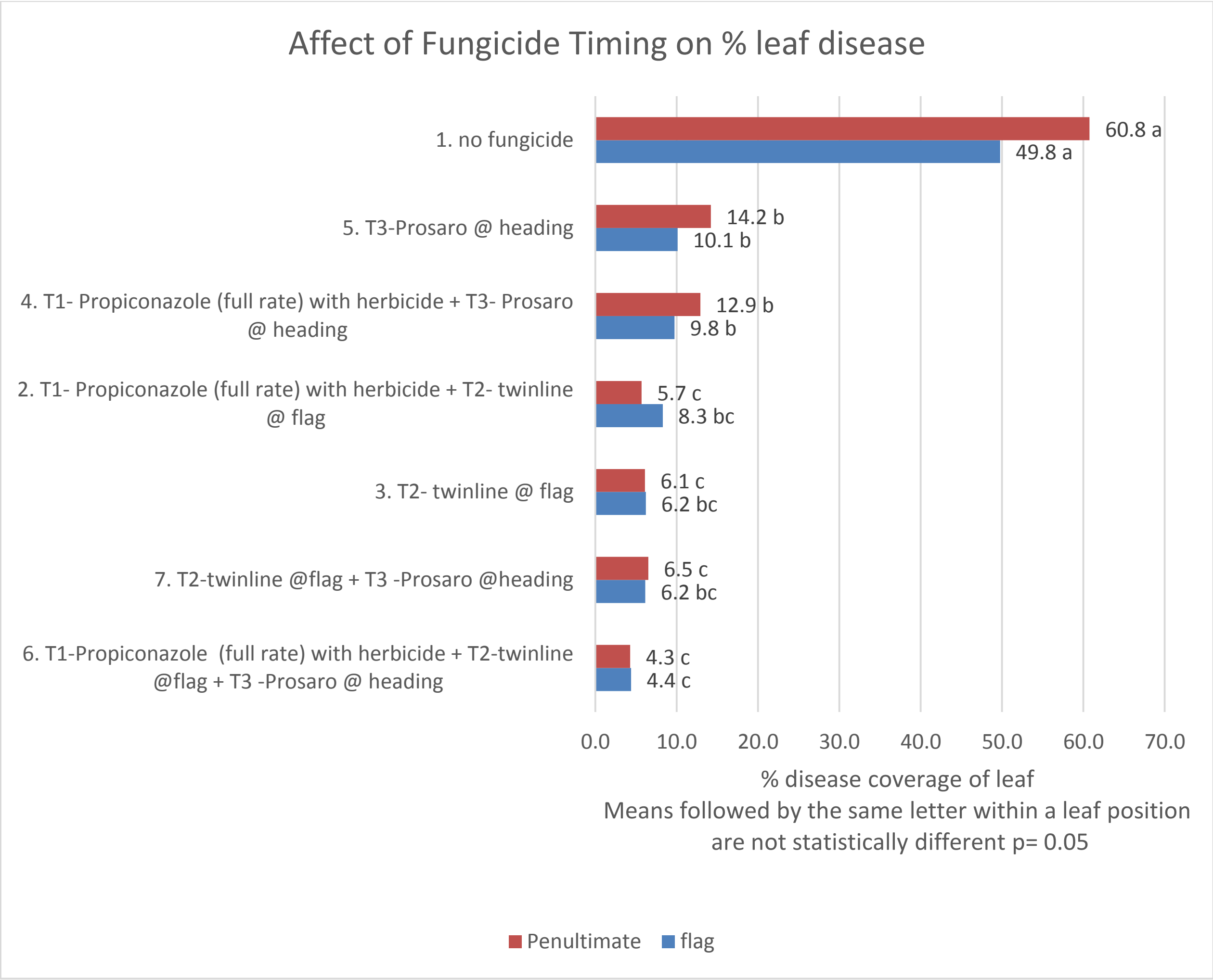
Table 1. Dates of Operations for 2015

Operation	Date 2015
Trial seeded	May 11
Emergence counts	May 27
Propiconazole (full rate) on treatments 2, 4 and 6	June 5
Twinline @ flag on treatments 2, 3, 6 and 7	June 29
Prosaro @ early heading on treatments 4, 5, 6 and 7	July 5
Leaf disease ratings	July 27
Harvest	Sept 8

Results

All fungicide treatments statistically and substantially reduced the coverage of leaf spot disease on the flag leaf and penultimate leaf when assessed on July 27 (Figure 1).

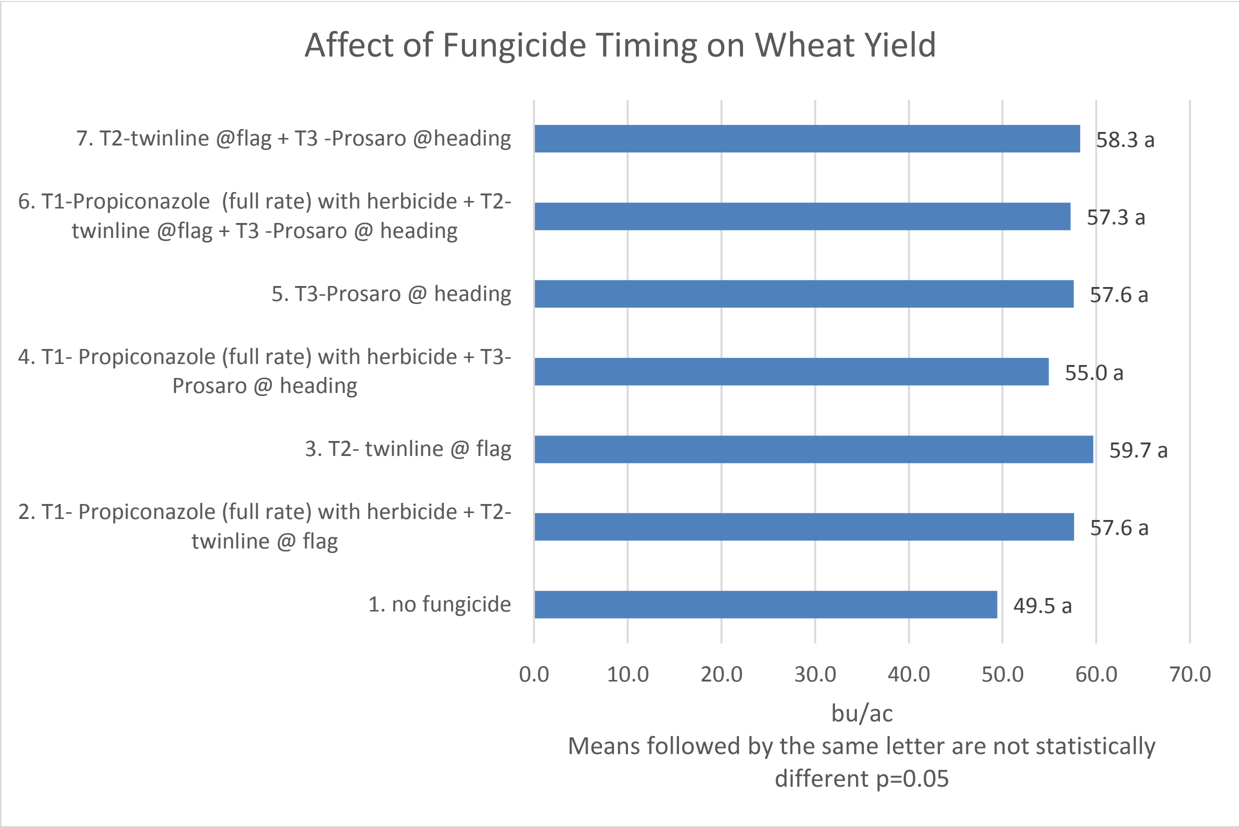
Figure 1.



Leaf disease levels tended to be higher where Prosaro had been used instead of Twinline. This is not surprising as Twinline is sprayed earlier at the flag stage and Prosaro is sprayed later at early heading for control of leaf disease and fusarium head blight. The application of Propiconazole with the herbicide timing (4 lf) provided no additional suppression of leaf disease whether it was applied prior to Twinline @ flag or Prosaro @ early heading. Again, this is not surprising as the Propiconazole was applied at about the 4 leaf stage and can only protect the leaves present at that time. Fusarium Head blight levels were low and no visual difference between treatments were observed.

On average, wheat yielded 8 bu/ac less when not treated with fungicide (Figure 2). Unfortunately, the yield data was too variable to statistically separate means. Lodging was an issue in the trial and the degree of lodging varied with landscape position. This would have added variability to the yield data. The degree of lodging between treatments did not differ statistically. Grain protein was around 14.5 and did not vary much between treatments.

Figure 2.



Less than 0.25% FDK is required for No. 1 CWRS. The levels from this trial hovered between 0.3 and 0.35% and none of the fungicide treatments appeared to lower levels over that found in the no fungicide check.

Conclusions

The application of fungicide significantly reduced the occurrence of leaf spot diseases in wheat but did not reduce FDK. Leaf disease levels tended to be higher where Prosaro had been used instead of Twinline. This is likely because Prosaro is sprayed later at early heading compared to Twinline which is sprayed earlier at flag. The early application of Propiconazole at 4 leaf stage did not further reduce the occurrence of leaf spot disease by late summer. It is not likely to have served any benefit. The application of fungicide increased wheat yield by 8 bu/ac on average but differences between treatment yield means could not be separated statistically due to yield variability resulting from variable lodging.

Acknowledgements

This project was supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward bi-lateral agreement.

Evaluating Various Esn:Urea Blends on Nitrogen Use Efficiency in **Canola** and **Wheat**.

M. Hall[1]

[1]East Central Research Foundation/Parkland College, Yorkton, SK

Abstract

This study evaluated blends of Environmentally Smart Nitrogen (ESN) with urea at 0, 25, 50 and 75%. These blends were evaluated at rates of 80, 100 and 120 lbs/ac of actual nitrogen in wheat and canola. The canola trial had to be reseeded due to flea beetles and frost, so no treatment effects on emergence were seen or would be expected. It was still possible to evaluate nitrogen use efficiency but no yield or economic benefits in canola could be detected with any of the ESN blends.

For wheat, increasing the portion of ESN in the blend from 0 to 75% increased grain protein from 13.5 to 14.8 percent. Wheat grain yield was increased by 0.12 tonnes/ac (almost significant at p=0.05) by using a 25% ESN blend over straight urea. There was no yield benefit when the portion of ESN in the blend was increased to 75%. The 25% ESN blend provided the greatest economic returns of $27.32 and $32.14 per acre under low and high protein spread scenarios, respectively. There was no economic benefit as the portion of ESN was increased to 75%. An ESN blend higher than 25% may be still prove to be of value in an wetter year but this was not the case in this trial.

Description

Environmentally Smart Nitrogen (ESN) is polymer coated urea which delays the release of nitrogen. This has the potential to increase seed safety and possibly improve nitrogen use efficiency. The objective of this study was to evaluate various ESN blends at different rates of nitrogen applied to wheat and canola. To achieve these objectives a small plot 2 order factorial with 4 replicates was conducted for canola and wheat on land just outside of Yorkton. The first factor compared the following blends:

- 0% ESN- Straight Urea
- 25% ESN
- 50% ESN
- 75% ESN

The second factor then looked at each of these blends at 80, 100 and 120 lbs/ac of actual nitrogen.

The treatments were evaluated in terms of crop emergence and yield. Lodging and protein was also evaluated for wheat.

Tables 1 and 2 show the dates of all the operations for 2015.

Table 1. Dates of Operations for Canola ESN Trial in 2015

Operation	Date 2015
Trial seeded	May 3
Sprayed for Flea beetles	May 25
Reseeded Canola Trial	May 31
Emergence counts	June 12
Roundup Transorb (0.33 l/ac)	June 13
Reglone desiccation	Sept 12
Harvest	Sept 18

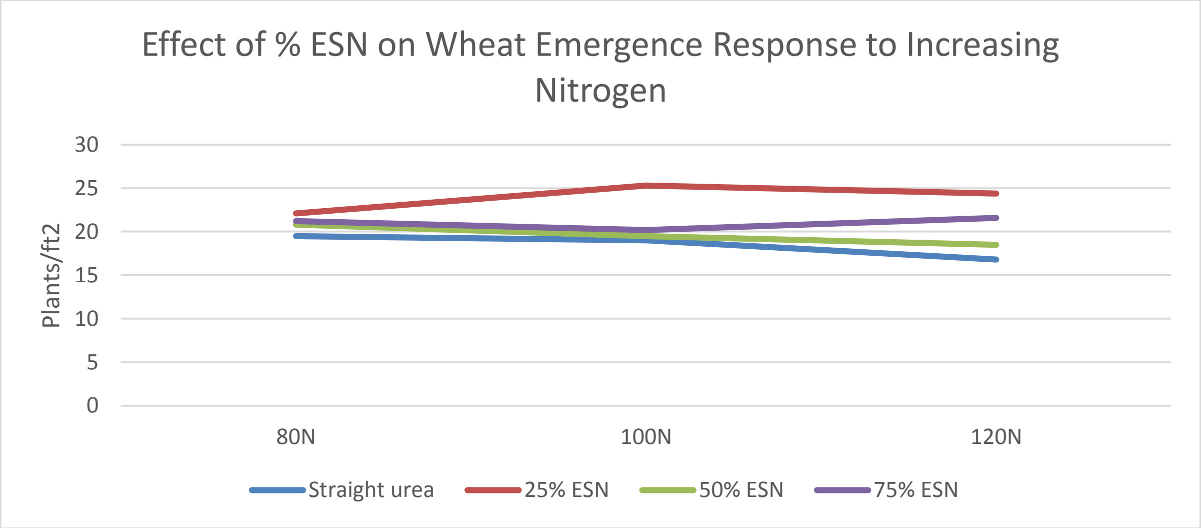
Table 2. Dates of Operations for Wheat ESN Trial in 2015

Operation	Date 2015
Trial seeded	May 12
Crop Emergence Counts	May 27
Prosaro	July 5
Lodging ratings	August 14
Harvest	Sept 10

Results for Wheat

While not quite statistically significant, there was a trend for the emergence of wheat to decline somewhat with increasing rate of nitrogen when straight urea was used (Figure 1). Blends containing ESN tended to have greater plant emergence particularly at the high rate of nitrogen. This result is not surprising as ESN is expected to increase seed safety.

Figure 1.



No significant interaction between ESN blend and nitrogen rate was detected for either lodging or yield for Wheat. Thus only main effects have been presented in Table 1. Lodging was not significantly affected by either ESN blend or nitrogen rate. However, there was a trend for lodging to increase as actual nitrogen rate was increased from 80 to 120 lbs/ac. Wheat yield was maximized at 80 lbs/ac of actual nitrogen. Further increases to 120 lbs/ac did not affect yield but it did increase protein from 13 to 14.9 percent. A blend of 25% ESN increased yield by 0.12 tonnes/ac and grain protein by 3 points over the use of straight urea. Increasing the ESN in the blend from 25 to 75% significantly decreased yield and increased grain protein. Blends of 75% ESN may not have released enough nitrogen in early spring to maximize yield particularly since spring soil moisture conditions were dry.

Table 1. Main Effects of ESN blend and Nitrogen Rate on Lodging, Yield, Grain Protein and Gross Income (Less the Cost of ESN) for Wheat.[1]

				Prot. Premium/Discount from 13.5% ($/tonne)			Gross Income $ (Less the Cost of ESN)	
Main effect	Lodging (0 to 9)[5]	Yield (t/ac)[5]	Protein (%)[6]	Historically low Protein Spread[3]	Historically high Protein Spread[4]	Cost of ESN ($/ac)[2]	Historically low Protein Spread	Historically high Protein Spread
ESN Blend								
100% Urea	3.5 a	1.59 ab	13.5	0	0	0	357.75	357.75
25% ESN	2.8 a	1.71 a	13.8	1.08	3.9	1.52	385.07	389.89
50% ESN	2.4 a	1.64 ab	13.8	1.08	3.9	3.05	367.72	372.34
75% ESN	3.5 a	1.52 b	14.4	3.24	11.7	4.57	342.35	355.21
Nitrogen Rate								
80 lbs/ac Actual N	2.8 a	1.64 a	13	Not applicable	Not applicable	Na	Not applicable	Not applicable
100 lbs/ac Actual N	2.7 a	1.59 a	13.6	Not applicable	Not applicable	Na	Not applicable	Not applicable
120 lbs/ac Actual N	3.7 a	1.6 a	14.9	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

[1] Assuming $225/tonne CWRS at 13.5 protein
[2]Based on $570/tonne urea versus $705/tonne ESN on April 8
[3] $0.36/tonne/point of protein %
[4] $1.30/tonne/point of protein %
[5]Means followed by the same letter are not significantly different at 0.05% level
[6]No statistics, based on 1 rep of data

A number of assumptions and comparisons went into the economic analysis. The base wheat price used was $225/tonne for a 13.5 protein #1 CWRS wheat. The price received for the grain in each treatment was then adjusted based on the protein content of the grain. Values were adjusted by $0.36 and $1.30/tonne per percentage point to represent low and high protein spread scenarios, respectively The cost of ESN on a per acre basis was calculated using a local price of $570/tonne for urea and $705/tonne for ESN.

Using the above assumptions, the gross income per treatment less the cost of ESN in the blend was calculated (Table 1). A comparison of these values reveals that the blend containing 25% ESN provided the greatest economic gain. The 25% ESN blend, at an average rate 100 lbs/ac of actual N, provided an additional income of $27.32/ac ($385.07-$357.75) when protein spreads are low and $32.14/ac ($389.89-$357.75) when protein spreads are high. There was no economic benefit from using ESN at 75% of the blend even though this blend increased protein levels as yield was substantially reduced.

Results for Canola

The canola trial had to be reseeded due to excessive flea beetle damage and frost. As a result, treatment effects on canola emergence were not apparent and all plots emerged well at about 10 plants/ft^2. Though it was still possible to detect nitrogen use efficiencies, none were observed. Table 2 only presents the main effects of ESN blend and Nitrogen rate as no interactions were detected. No significant differences were detected between any treatment means. Numerically, yield was maximized at 100lbs/ac of actual nitrogen and none of the ESN blends yielded more than straight urea. As a result, the use of esn provided no economic benefit.

Table 2. Main Effects of ESN blend and Nitrogen Rate on Yield and Gross Income (Less the Cost of ESN) for Canola.[1]

Main effect	Yield (t/ac)[3]	Cost of ESN ($/ac)[2]	Gross Income $ (Less the Cost of ESN)
ESN Blend			
100% Urea	1.00 a	0	462
25% ESN	0.96 a	1.52	442.00
50% ESN	0.93 a	3.05	426.61
75% ESN	0.97 a	4.57	443.57
Nitrogen Rate			
80 lbs/ac Actual N	0.93 a	Na	Not applicable
100 lbs/ac Actual N	0.99 a	Na	Not applicable
120 lbs/ac Actual N	0.98 a	Na	Not applicable

[1] Assuming $462/tonne CWRS at 13.5 protein
[2]Based on $570/tonne urea versus $705/tonne ESN on April 8
[3]Means followed by the same letter are not significantly different at 0.05% level

Conclusions

The use of ESN had no yield or economic benefit when used on canola.

While not quite statistically significant at p=0.05, there was a wheat yield benefit of 0.12 tonnes/ac when a 25% ESN blend was used. However, this yield benefit was lost as the portion of ESN in the blend increased to 75%. Perhaps too much nitrogen was being held back with this blend under the dry soil conditions experienced in spring. A late release of nitrogen would also explain the higher grain protein content associated with the 75% ESN treatment. Economically, a blend containing 25% ESN provided the greatest economic returns under both high and low protein spread scenarios. The economic benefit was reduced as ESN was increased to 50% of the blend and there was no economic benefit with a 75% ESN blend. Blends containing 75% ESN have been recommended by industry and may be of benefit under wetter conditions than were experienced in this trial.

Acknowledgements

This project was supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward bi-lateral agreement.

The Impact of "Lumiderm" over Standard **Canola** Seed Treatments on Flea Beetle Control and Plant Vigor.

M. Hall[1], C. Holzapfel[2], C. Catellier[2], G. Issah[3], J. Weber[3], S. Brandt[4], J. Pratchler[4], G. Lewko[5]

[1]East Central Research Foundation/Parkland College, Yorkton, SK; [2]Indian Head Agricultural Research Foundation, Indian Head, SK; [3]Western Applied Research Corporation, Scott, SK; [4]Northeast Agriculture Research Foundation, Melfort, SK;[5]Conservation Learning Center, Prince Albert, SK

Abstract

Dupont markets Lumiderm, a new canola seed treatment which is purported to further decrease flea beetle feeding and increase seedling vigor when added to conventional seed treatments such as Helix Vibrance and Prosper EverGol. To test the efficacy of Lumiderm, trials were established at Yorkton, Indian Head, Scott, Melfort and Prince Albert. Some benefits were observed but were inconsistent across locations. The addition of Lumiderm to Helix Vibrance significantly increased emergence at Yorkton and Scott but differences could not be detected at the other locations. The addition of Lumiderm to Prosper EverGol did not affect emergence. There was a trend for the addition of Lumiderm to Helix Vibrance to reduce cotyledon damage but the differences were small and only statistically significant at Indian Head. The high rate of Lumiderm provided similar results to Helix Vibrance alone. No significant increase in seedling growth or crop yield could be detected from the addition of Lumiderm to Helix Vibrance or from a high rate of Lumiderm compared to Helix Vibrance alone. The addition of Lumiderm to Prosper EverGol did not significantly affect emergence, flea beetle feeding damage on cotyledons or seedling weights at any of the locations. However, despite the absence of any detectable early season benefit, the addition of Lumiderm to Prosper EverGol did provide a significant 3 bushel yield increase at Yorkton and Melfort. Overall, this study was able to detect some modest benefits from the addition of Lumiderm to

conventional canola seed treatments under low to moderate flea beetle pressure. However, results were not consistent across locations and it was not possible to connect any early season benefits with an increase in crop yield. The small plot research in this study may not be properly assessing the value of seed treatment, as flea beetles are a highly mobile pest. Even if a seed treatment is working well there would be new recruits constantly coming in from the surrounding area.

Description

Dupont markets Lumiderm, a new seed treatment which can be added to existing canola seed treatments to further reduce flea beetle feeding. Other studies have indicated that the addition of Lumiderm seed treatment can improve seedling vigor and final yield of canola even in the absence of flea beetle feeding.

The objective of this study was to determine if the addition of Lumiderm to the standard seed treatments of Helix Vibrance and Prosper EverGol could reduce insect feeding (ie flea beetles, cutworms or root maggots), improve seedling vigor and increase canola yield.

To accomplish this objective small plot trials were conducted near Yorkton, Indian Head, Prince Albert, Scott and Melfort. Two separate trials were conducted at each location. The first trial assessed the addition of Lumiderm to Helix Vibrance with RR canola. The second trial assessed the addition of Lumiderm to Prosper EverGol with LL canola. Each trial was designed as 2 level factorial with 4 replications. The trial at Prince Albert was more of a demonstration as treatments were not randomized within blocks. The first trial looked at the following two factors with Roundup Ready canola:

First factor (Seed Treatment):

- Canola seed treated with Helix Vibrance
- Canola seed treated with Helix Vibrance + Lumiderm
- Canola seed treated with a high rate of Lumiderm

Second factor (Seeding rate)

- 60 seeds/m^2
- 120 seeds/m^2

The second trial looked at the following two factors with Liberty Link canola:

First factor (Seed Treatment):

- Canola seed treated with Prosper EverGol
- Canola seed treated with Prosper EverGol + Lumiderm

Second factor (Seeding rate)

- 60 seeds/m^2
- 120 seeds/m^2

Tables 1 and 2. shows the dates of all the operations for each site site.

Table 1. Dates of Operations for RR canola trial

Operation	Yorkton	Indian Head	Prince Albert	Scott	Melfort
Pre-seed burn-off	May 30	May 9	Na	May 8	Na
Seeded Trials	June 1*	May 15	May 21	May 14	May 27
Crop emergence (1 leaf stage)	June 8	June 3	June 1	June 1	Na
In-crop herbicide Roundup	June 13	June 15	Na	June 15	Na
Crop Emergence (3 leaf stage) and plant sample weights for both trials	June 22 and 23	June 10	June 18	June 9	June 25
In-crop herbicide Roundup	July 7	Na	June 18	Na	Na
Fungicide for Sclerotinia	Na	July 6	Na	Na	Na
Desiccation	Sept 13	Sept 1	Na	Aug. 31	Sept 1
Yield (Direct Combined)	Sept 18	Sept 8	Sept 24	Sept 10	Sept 12

*Trial was originally seeded on May 2 but had to be reseeded on June 1 due to frost and flea beetles

Table 2. Dates of Operations for LL canola trial

Operation	Yorkton	Indian Head	Prince Albert	Scott	Melfort
Pre-seed burn-off	May 30	May 9	Na	May 8	Na
Seeded Trials	June 1*	May 15	May 21	May 13	May 27
Crop emergence (1 leaf stage)	June 8	June 3	June 1	June 1	Na
In-crop herbicide Centurion + Liberty	June 13	June 15	Na	June 15	Na
Crop Emergence (3 leaf stage) and plant sample weights for both trials	June 22 and 23	June 15	June 18	June 9	June 25
In-crop herbicide Liberty	July 7	Na	June 18	Na	Na
Fungicide for Sclerotinia	Na	July 6	Na	Na	Na
Desiccation	Sept 13	Sept 1	Na	Aug. 31	Sept 1
Yield (Direct Combined)	Sept 18	Sept 8	Sept 24	Sept 10	Sept 12

*Trial was originally seeded on May 2 but had to be reseeded on June 1 due to frost and flea beetles

Results

Weather

Mean monthly temperature and precipitation for the 2015 growing season at Prince Albert, Indian Head, Scott, Melfort and Yorkon are presented in table 3. Rainfall in May and June was well below average at all sites with the exception of Prince Albert where rainfall was closer to historical averages. Scott was still below average rainfall for the month of July. However, for the rest of the locations rainfall from July onward was either near or above normal. Wet conditions were an issue at Prince Albert and Melfort for part of the year. Prince Albert received considerable rainfall in the month of August and Melfort suffered a large rain event on July 27th of 139.7 mm within 6 hours. Under these conditions soils were saturated for a number of days. Overall, sites experienced average to above average temperatures. However, May was a little cool for Prince Albert, Scott and Melfort. Yorkton suffered a killing frost of -2 to -4 ºC on May 30 and both the RR and LL canola trials had to be reseeded.

Table 3. Mean monthly temperatures and precipitation amounts along with long-term (1981-2010) normals for the 2015 growing seasons at Indian Head, Melfort and Yorkton in Saskatchewan.

Location	**Year**	**May**	**June**	**July**	**August**	**Avg. / Total**
		------------------------------*Mean Temperature (°C)* ------------------------------				
Prince Albert	2015	9.0	15.6	18.2	16.5	14.8
	Long-term	***10.4***	***15.3***	***18.0***	***16.7***	***15.1***
Indian Head	2015	10.3	16.2	18.1	17.0	15.4
	Long-term	***10.8***	***15.8***	***18.2***	***17.4***	***15.6***
Scott	2015	9.4	16.0	18.1	16.8	15.1
	Long-term	***10.8***	***15.3***	***17.1***	***16.5***	***14.9***
Melfort	2015	9.9	16.4	17.9	17.0	15.3
	Long-term	***10.7***	***15.9***	***17.5***	***16.8***	***15.2***
Yorkton	2015	10.5	16.7	19.3	17.5	16.0
	Long-term	***10.4***	***15.5***	***17.9***	***17.1***	***15.2***
		-------------------------------- *Precipitation (mm)* ------------------------------				
Prince Albert	2015	21.4	61.2	76.6	106.6	265
	Long-term	***41.5***	***68.6***	***76.6***	***61.6***	248
Indian Head	2015	16	38	95	59	207
	Long-term	***52***	***77***	***64***	***51***	***244***
Scott	2015	4.1	19.4	46.4	74.5	144
	Long-term	***34.8***	***61.8***	***72.1***	***45.7***	***214***
Melfort	2015	7	55	150	57	269
	Long -term	***43***	***52***	***77***	***52***	***226***
Yorkton	2015	8	28	123	46	205
	Long-term	***51***	***80***	***78***	***62***	***272***

No significant interactions between seed treatment and seeding rate were detected for any measure at any location. Thus means for seed treatments have been presented as an average over seeding rate. Likewise, means for seeding rate have been presented as an average over seed treatment. Statistics have not been applied to the Prince Albert data as it was setup more as a demonstration without treatments being randomized within blocks.

Emergence

Not surprisingly, increasing seeding rate significantly increased emergence (Table 4). At Yorkon emergence for LL canola was similar to RR canola trial however, the data is missing. There were likely some seeding rate issues at Prince Albert as emergence was higher than targeted seeding rates and emergence of the LL canola was not higher for the higher seeding rate.

Table 4. Effect of Seeding Rate on RR and LL Canola Emergence (Plants/m2 @ 1-3 lf), Averaged over Canola Seed Treatments

Location	RR Canola*		LL canola*	
	60 seeds/m2	120 seeds/m2	60 seeds/m2	120 seeds/m2
Yorkton	44 b	56 a	missing	missing
Melfort	38 b	62 a	42 a	67 a
Scott	38 b	77 a	33 b	66 a
Prince Albert***	117	173	136	130
Indian Head	43 b**	86 a**	53 a	91 a

*Means followed by the same letter within a location are not significantly different
**Means averaged only over Helix Vibrance + Lumiderm and High rate of Lumiderm

The addition of Lumiderm to Helix Vibrance significantly increased emergence of RR canola at Yorkton and Scott (Table 5). The high rate of Lumiderm also significantly increased emergence over Helix Vibrance alone at Scott. No significant differences in emergence were dectected between seed treatments in the LL canola trial.

Table 5. Effect of Canola Seed Treatment on Canola Emergence (Plants/m2 @ 1-3 lf stage), Averaged over Seeding Rate.

Location	RR Canola*			LL canola*	
	Helix Vibrance	Helix Vibrance + Lumiderm	High rate Lumiderm	Prosper EverGol	Prosper EverGol + Lumiderm
Yorkton	46 b	60 a	44 b	Missing	Missing
Melfort	56 a	50 a	45 a	61 a	48 a
Scott	52 b	63 a	59 a	53 a	46 a
Prince Albert***	144	152	139	161	118
Indian Head	41 a**	45 a**	41 a**	72 a	72 a

*Means followed by the same letter within a location are not significantly different
**Means from 60 seeds/m2 only
***Demonstration – no statistics

Cotyledon Damage

Overall, flea beetle damage on cotyledons was fairly minor. Changing seeding rate did not affect flea beetle damage (Table 6) except in Indian Head where increasing seeding rate significantly reduced flea beetle damage on LL canola. Intuitively, increasing seeding rate would be expected to reduce flea beetle damage as there are more plants for a given population of flea beetles. However, this was not observed consistently.

Table 6. Effect of Seeding Rate on Flea Beetle Damage to RR and LL Canola Cotyledons (% damage @1-3 lf), Averaged over Canola Seed Treatments

Location	RR Canola*		LL canola*	
	60 seeds/m2	120 seeds/m2	60 seeds/m2	120 seeds/m2
Yorkton	3.8 a	4.8 a	4.6 a	3.4 a
Melfort	4.5 a	5.9 a	2.5 a	4.4 a
Scott	0.8 a	0.9 a	0.3 b	0.8 a
Prince Albert***	9.9	13.9	10.6	6.4
Indian Head	4.4 a**	3.2 a**	5.6 a	3.6 b

*Means followed by the same letter within a location are not significantly different
**Means averaged only over Helix Vibrance + Lumiderm and High rate of Lumiderm
*** Demonstration - no statistics

While not many statistical differences could be detected between seed treatments, there was a fairly consistent trend for the addition of Lumiderm to the conventional seed treatment to modestly decrease cotyledon damage from flea beetle feeding (Table 7). Indian Head saw a statistically significant, albeit small, reduction in flea beetle damage from the addition of Lumiderm to Prosper EverGol. The only other statistical difference detected was at Yorkton, where significantly more cotyledon damage was associated with the high rate of Lumiderm in the RR canola trial.

Table 7. Effect of Canola Seed Treatment on Flea Beetle Damage to RR and LL Canola Cotyledons (% damage @1-3 lf), Averaged over Seeding Rate.

Location	RR Canola*			LL canola*	
	Helix Vibrance	Helix Vibrance + Lumiderm	High rate Lumiderm	Prosper EverGol	Prosper EverGol + Lumiderm
Yorkton	3.5 a	3.1 a	6.1 b	4.6 a	3.4 a
Melfort	4.9 a	4.4 a	6.4 a	4.1 a	2.8 a
Scott	1.1 a	0.3 a	1.3 a	0.6 a	0.4 a
Prince Albert***	11.8	9.5	14.5	7.3	9.8
Indian Head	6.2 a**	3.5 a**	5.3 a**	5.9 a	3.3 b

*Means followed by the same letter within a location are not significantly different
**Means from 60 seeds/m2 only
***Demonstration – no statistics

Seedling wt/m^2 @ 3lf

Not surprisingly, increasing seeding rate significantly increased seedling dry weight/m^2 (data not shown). No significant differences in seedling weight could be detected between seed treatments at any location for either RR canola or LL canola (Table 8). Seedling dry weights/m^2 from Yorkton, Melfort and Scott are very similar whereas, dry weights from Indian Head are lower than the other sites. This is not a concern as slight differences in staging and environmental conditions can make big differences in seedling biomass at early developmental stages. Moreover, comparisons between sites are not relevant. There was a trend for the addition of Lumiderm to Helix Vibrance to increase seedling dry weights but then the opposite trend was observed for 3 sites with the addition of Lumiderm to Prosper EverGol.

Table 8. Effect of Canola Seed Treatment on RR and LL Canola Cotyledons Seedling dry weight (grams/m2 @1-3 lf), Averaged over Seeding Rate.

Location	RR Canola*			LL canola*	
	Helix Vibrance	Helix Vibrance + Lumiderm	High rate Lumiderm	Prosper EverGol	Prosper EverGol + Lumiderm
Yorkton	88 a	97 a	89 a	118 a	97 a
Melfort	130 a	142 a	108 a	118 a	93 a
Scott	88 a	118 a	100 a	93 a	72 a
Prince Albert	na	na	na	na	na
Indian Head	10.0 a**	10.3 a**	9 a**	15 a	16 a

*Means followed by the same letter within a location are not significantly different
**Means from 60 seeds/m2 only

Yield

Increasing seeding rate of LL canola significantly increased yield at Indian Head and Melfort (Table 9). While there were no significant differences for the rest of the comparisons there was a trend for higher yields with the higher seeding rate.

Table 9. Effect of Seeding Rate on RR and LL Canola Yield (bu/ac), Averaged over Canola Seed Treatment.

Location	RR Canola*		LL canola*	
	60 seeds/m2	120 seeds/m2	60 seeds/m2	120 seeds/m2
Yorkton	46.9 a	48.1 a	52.8 a	53.6 a
Melfort	51.0 a	55.2 a	49.2 b	55.0 a
Scott	63.2 a	64.1 a	64.0 a	67.6 a
Prince Albert	73.1 a	70.5 a	79.3 a	79.6 a
Indian Head	54.2 a**	55.7 a**	55.8 b	57.2 a

*Means followed by the same letter within a location are not significantly different
**Means averaged only over Helix Vibrance + Lumiderm and High rate of Lumiderm

The addition of Lumiderm to Helix Vibrance or the high rate of Lumiderm did not significantly increase the yield of RR canola over Helix Vibrance alone (Table 9). There was a huge yield response at Prince Albert but this response is suspect as the trial was only a demonstration. The addition of Lumiderm to Prosper EverGol did significantly increase the yield of LL Canola at Yorkton and Melfort. It did not significantly affect yield at the rest of the sites.

Table 9. Effect of Canola Seed Treatment on RR and LL Canola Yield (bu/ac), Averaged over Seeding Rate.

Location	RR Canola*			LL canola*	
	Helix Vibrance	Helix Vibrance + Lumiderm	High rate Lumiderm	Prosper EverGol	Prosper EverGol + Lumiderm
Yorkton	48.5 a	46.2 a	47.8 a	51.7 b	54.7 a
Melfort	52.8 a	53.5 a	53.0 a	50.3 b	53.9 a
Scott	61.7 a	64.7 a	64.5 a	66.2 a	65.4 a
Prince Albert***	57.9	72.6	84.9	80.0	78.9
Indian Head	54.1 a**	53.9 a**	54.5 a**	56.3 a	56.7 a

*Means followed by the same letter within a location are not significantly different
**Means from 60 seeds/m2 only
***Demonstration – no statistics

Root Maggot and cutworm feeding

Cutworms did not have a noticeable presence at any of the locations.

Root maggot ratings were not taken at Indian Head, Prince Albert and Yorkton because their presence was not deemed high enough to warrant assessment. Ratings were taken at Melfort and Scott but no significant treatment effects were detected.

Summary and Conclusions

The addition of Lumiderm to Helix Vibrance significantly increased emergence at Yorkton and Scott. There was a trend for the addition of Lumiderm to Helix Vibrance to reduce cotyledon damage but this difference was only significant at Indian Head. Compared to Helix Vibrance alone, no significant increase in seedling growth or crop yield could be detected from the addition of Lumiderm or from the high rate of Lumiderm.

The addition of Lumiderm to Prosper EverGol did not significantly affect emergence, flea beetle feeding damage on cotyledons, or seedling weights at any of the locations. However, despite the absence of any detectable early season benefit, the addition of Lumiderm to Prosper EverGol did provide a significant 3 bushel yield increase at Yorkton and Melfort.

This study was able to detect some modest benefits from the addition of Lumiderm to conventional canola seed treatments under low to moderate flea beetle pressure. However, it was not able to connect any reductions in cotyledon damage, improvement in emergence, or seedling growth with an increase in crop yield.

The small plot research in this study may not be properly assessing the value of seed treatment, as flea beetles are a highly mobile pest. Even if a seed treatment is working well, there would be new recruits constantly coming in from the surrounding area.

Acknowledgements

This project was supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward bi-lateral agreement.

Effect of Fungicide on **Canola** Disease and Yield.

M. Hall[1]

[1]East Central Research Foundation/Parkland College, Yorkton, SK

Abstract

This study evaluated the impact of Priaxor and Lance on canola disease and yield. While treatments containing Priaxor significantly reduced the incidence of blackleg in canola, it did not result in a yield increase. A yield increase from the application of Lance for the control of Sclerotinia could not be detected either.

Description

A trial was setup to evaluate the impact of Priaxor and Lance on the suppression of blackleg and Sclerotinia, respectively in Canola. The trial was setup as a small plot RCBD with 4 replicates on rented land just west of Yorkton (Figure 1).

Figure 1. Canola Fungicide Trial Just West of Yorkton

The treatments were as follows:

- No Fungicide
- Priaxor at 2 to 4 leaf stage
- Priaxor at 6 leaf stage
- Priaxor at 6 leaf stage + Lance at 30% bloom
- Lance at 30% bloom

Table 1. shows the dates of all the operations for 2015.

Table 1. Dates of Operations for 2015

Operation	Date 2015
Trial seeded	May 6
Sprayed flea beetles	May 25
Reseeded Trial	May 26
Liberty + Centurion	June 13
Priaxor for treatment 2 (2-4 lf stage)	June 14
Priaxor for treatments 3 and 4	June 23
Lance for treatment 5	July 17
Harvest	Sept 11
Blackleg ratings	Sept 14

Results

Due to excessive flea beetle damage the trial was reseeded. The second time around emergence was excellent averaging around 10 plants/ft^2. Treatments containing Priaxor significantly reduced the incidence of Blackleg in canola (Figure 2).

Figure 2.

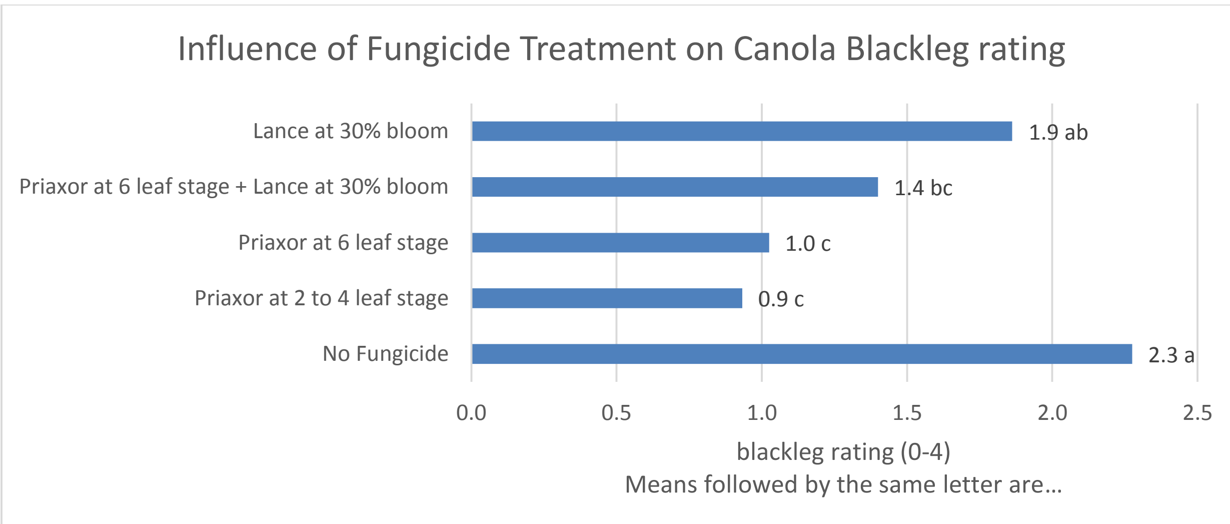


Figure 3 shows you visually the level of control achieved by Priaxor sprayed at the 6 leaf stage.

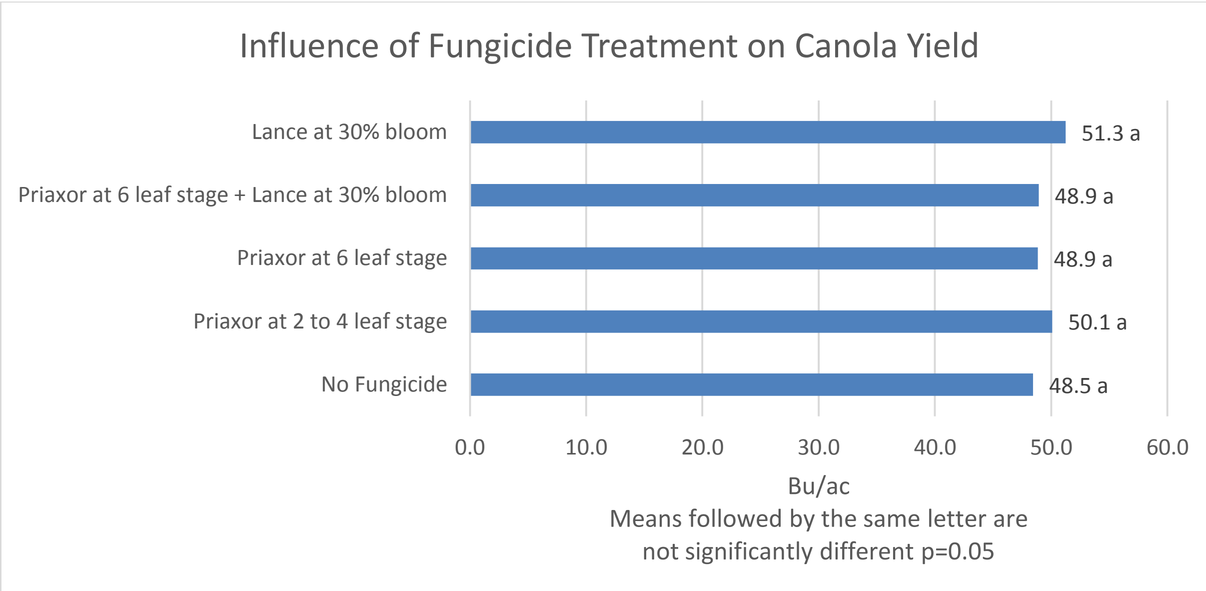
Figure 3 Incidence of Blackleg in Canola Stems Taken After Harvest

No Fungicide

Priaxor at 6 leaf stage

Despite the greater level of blackleg control in canola by Priaxor treatments no significant differences in yield could be detected between any fungicide treatments and the no fungicide check (Figure 4).

Figure 4



The presence of blackleg may not have been serious enough to reduce yield potential.

Conclusions

The application of Priaxor significantly reduced the visual symptoms of blackleg but did not result in a detectable yield increase. The application of Lance did not result in a detectable yield increase despite the presence of Sclerotinia.

Acknowledgements

This project was supported by BASF

Effect of Row Spacing and Seeding Rate on the Production of Bush, Semi-bush and Upright Statured Varieties of **Soybeans**.

M. Hall[1]

[1]East Central Research Foundation/Parkland College, Yorkton, SK

Abstract

The performance of 3 soybean varieties presenting “bushy”, “semi-bushy and “erect” statures were compared at 10 and 20 inch row spacing and target plant populations of 175,000 and 200,000 plants per

acre. Row spacing and plant population did not significantly affect maturity. Plant population did not affect yield but row spacing did affect yield depending of the variety. The erect statured variety Tilston was unaffected by changes in row spacing. In contrast, the semi-bushy variety Anola significantly yielded less at the 10 inch row spacing. The bushy variety Gladstone followed a similar pattern to Anola but the yield difference was not significant. The yield performance of some bushier varieties may be reduced by solid seeding (10 inch row spacing). However, it is not likely worth the expense of purchasing specialized equipment to accommodate wider row spacing.

Description

The objective of this trial was to determine if optimum row spacing and plant population differs between soybean varieties representing "bushy", "semi-bushy and "erect" statures. To achieve this objective, a 3 order factorial with 4 replications was established on the main farm site just south of Yorkton. The soybean varieties Gladstone (bushy stature), Anola (semi bushy stature) and Tilston (upright stature) were compared at 10 vs 20 inch row spacing and target populations of 175000 and 200000 plants per acre.

Table 1. shows the dates of all the operations for 2015.

Table 1. Dates of Operations for 2015

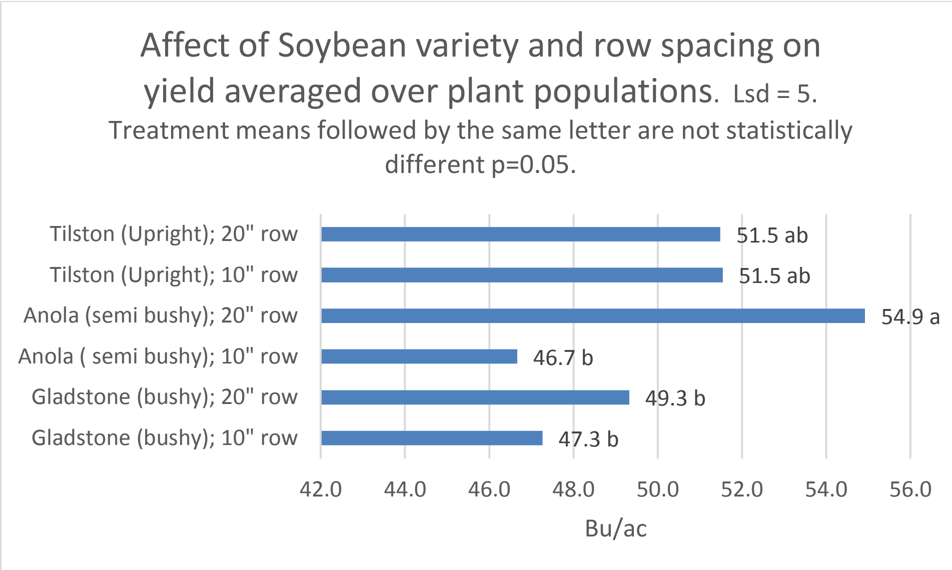
Operation	Date 2015
Trial seeded	May 21
Emergence counts	June 5
In crop Roundup Transorb (0.66 l/ac)	June 13
In crop Roundup Transorb (0.66 l/ac)	July 7
Harvested Soybeans	Oct 2

Results

The soybeans emerged well has they came out of the ground 2 days after the late spring frost. When averaged over row spacing, plant populations per acre of 187,000 and 200,000 were achieved for Gladstone, 165,000 and 182,000 for Anola and 167,000 and 187,000 for Tilston. So not perfect, but reasonably close to the targeted 175,000 and 200,000 plants/ac.

Row spacing and plant population had little affect on maturity. Differences in plant population did not affect yield. However, row spacing did affect varieties differently in terms of yield (Figure 1).

Figure 1.



The upright statured variety Tilston was not affected by increasing the row spacing from 10 to 20 inches. In contrast, the semi-bushy variety Anola yield significantly better at the 20 inch row spacing than the 10 inch by 8 bushel/ac. Gladstone followed a similar trend to Anola but the yield differences were not significant.

Conclusions

It was hypothesized that the erect variety Tilston would be poorer yielding at the wider row spacing as it takes more time for an erect variety to achieve canopy closure. Apparently, Tilston has exhibited resilience to wider row spacing at other locations (personal communication North Star Genetics). As expected the bushier varieties performed better at the wider row spacing. Soybeans can produce well at both 10 and 20 inches. Farmers need not invest in seeders with wider row spacing. However, if farmers are solid seeding soybeans (10 inch row spacing) they may want to avoid some bushier varieties.

Acknowledgements

This project was supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward bi-lateral agreement.

The Value of New **Legume** Crops in Rotation with **Wheat**.

M. Hall[1]

[1]East Central Research Foundation/Parkland College, Yorkton, SK

Abstract

This is just the first year of a two year project and no final conclusions can be made at this time. Canola, faba beans, Soybeans and Peas were established in 2015. Emergence and yields of the crops were good excepting the yield of faba beans which was low. This is likely the result of dry conditions early in the season and an elevated field position. Faba bean require lots of moisture. Faba beans in lower field positions from other trials yielded considerably more. Next year, the nitrogen response of wheat on the various crop stubbles will be evaluated. This will indicate the influence of the preceding crop on subsequent wheat yields and protein.

Description

This is only an interim report from the first year of a two year project. Last season plots of canola, soybeans, faba beans and peas were established in a split plot design located on our main farm site south of Yorkton. Five plots by 4 replications were established for each crop (Figure 1).

Figure 1. Legume Crop Rotation Study (Establishment year)

In 2016, wheat will be seeded into each stubble type at 5 different rates of nitrogen ranging from 0 to 120 lbs/ac of actual. The objective for the establishment year is only to compare the productivity of the various crop species. The main objective in the second year is to determine the nitrogen and non-nitrogen benefits from the preceding crop on wheat. In other words, how does the preceding crop type influence the nitrogen response of wheat. Which legume rotation system was the most economical will also be assessed.

Table 1. shows the dates of all the operations for 2015.

Table 1. Dates of Operations for 2015

Operation	Date 2015
Canola seeded with 222 lbs/ac urea, 62.5 lbs/ac ammonium sulphate and 50 lbs/ac of ammonium phosphate	May 2
Faba bean and Peas seeded with granular inoculant and 29 lbs/ac of ammonium phosphate	May 5
Soybeans seeded with granular inoculant and 29 lbs/ac of ammonium phosphate	May 21
Canola reseeded due to late spring frost	June 1
Odyssey + Centurion on Faba beans and Peas	June 8
Table 1. Continued	
Operation	Date 2015
Roundup Transorb (0.33 l/ac rate) on Canola	June 13
Roundup Transorb (0.66 l/ac rate) on Soybeans	June 13
Centurion on Faba beans and Peas	June 18
Desiccated Peas with Reglone	August 21
Harvested Peas	August 24
Harvested Canola	Sept 19
Harvested Soybeans	Oct 2
Harvested Faba beans	Oct 10

Results

The canola in this trial had to be reseeded due to frost. The faba beans and peas were damaged by the frost but were able to adequately regrow. The soybeans emerged two days after the frost and were unaffected. Crop emergence was good for the legumes and excellent for the canola (Table 2). The faba bean yield was disappointingly low. Faba beans enjoy lots of moisture and the season started out dry and the trial site was in an elevated field position. Faba bean yields from other trials in lower field positions yielded 30 bushels more.

Table 2.

Crop Specie	Emergence (plants/ft2)	Yield (bu/ac)
Canola	8.5	46.0
Faba bean	5.1	54.5
Soybean	3.9	45.9
Peas	7.3	42.0

Next year the nitrogen response of wheat grown on each of the stubble types will determine the value of the preceding crop to the total rotation.

Conclusions

None to be made until next year.

Acknowledgements

This project was supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward bi-lateral agreement.

Flax Response to Fungicide at Varying Row Spacing and Nitrogen Levels

M. Hall[1], C. Holzapfel[2], S. Brandt[3].

[1]East Central Research Foundation/Parkland College, Yorkton, SK
[2]Indian Head Agricultural Research Foundation, Indian Head, SK
[3]Northeast Agriculture Research Foundation, Melfort, SK

Abstract

Field trials were conducted at Indian Head in 2015 to demonstrate row spacing and fungicide effects and interactions with flax. The treatments were a combination of five row-spacings (25-61 cm) and two fungicide (treated vs untreated) levels. At Yorkton and Melville field trials in 2015 were conducted to demonstrate nitrogen rate (30 to 150 lbs/ac) and fungicide effects with flax. Increasing row spacing at Indian Head reduced emergence; however, plant populations were considered sufficient for all row spacing treatments. Increasing row spacing also delayed maturity but by less than 1 day within the practical range of 25-41 cm. Yields declined with increasing row spacing. Flax at 25 cm yielded higher than all other treatments and yields continued to decline as spacing was incrementally increased. No interactions between fungicide and row spacing or fungicide and nitrogen rate were detected at any

location. At the 5% level of significance, the application of fungicide did not significantly affect maturity or yield. However, there was a trend for applied fungicide to increase yield by 9 and 5% at Yorkton and Melville, respectively. There was also a trend for the application of fungicide to delay maturity of flax by 5 days at Yorkton. Increasing nitrogen rates from 30 to 150 lbs/ac increased yield by 23% at Yorkton and by 55% at Melfort. Yield continued to increase substantially up to a 150 lbs/ac at Melfort but tended to level off around 90 to 120 lbs/ac at Yorkton. Increasing nitrogen rates substantially delayed maturity at Yorkton but not Melfort. High rates of nitrogen are known to delay maturity but these effects were likely accentuated Yorkton as increasing rates of nitrogen tended to decreased plant populations.

Objectives and Rationale

Project objectives:

The objectives are to demonstrate the response of flax to fungicide applications at three locations in Saskatchewan and to evaluate fungicide interactions with row spacing at Indian Head and nitrogen fertilizer rate at Melfort and Yorkton.

Project Rationale:

Pasmo is the most common disease that affects flax yields in Saskatchewan and, like many diseases, is more severe under wet conditions and with heavy crop canopies. With respect to foliar fungicide options, several products are registered to control this disease; however producers frequently question the potential return on investment for fungicide applications on flax. Past field trials and demonstrations at Indian Head have shown reasonably consistent responses to fungicide applications with yield increases of 20-30% when disease pressure is high; however, these benefits are only realized when Pasmo is present therefore scouting remains important. Focussing on row spacing, past research in Saskatchewan has shown no yield difference for row spacing ranging from 10-30 cm (4-12”) but information is limited for spacing beyond 30 cm. We know that flax can compensate for reduced emergence through increased branching to a certain extent but this crop is a relatively weak competitor with weeds early in the season and there are concerns as to whether row spacing ≥ 30 cm will limit yields. With respect to fungicide interactions with row spacing, it is conceivable that disease might be reduced at wider row spacing due to increased air flow through the canopy; but denser canopies are often also conducive to higher yields.

In regards to nitrogen rate, past research and producer testimonials suggest that high rates of nitrogen are possible without lodging. Most producers apply 40 to 80 lbs/ac of actual nitrogen, however it is possible that flax will respond to eve higher rates under high yielding conditions and with fungicide application.

Methodology:

Fungicide by Row Spacing

The “Fungicide by Row Spacing” field trial was established near Indian Head, Saskatchewan (R.M. #156) in 2015. The treatments were factorial combination of 5 row spacing treatments (25, 30, 36, 41, and 61 cm or 10, 12, 14, 16 and 24”) and two fungicide treatments (untreated and treated). The treatments were arranged in a split plot design with fungicide treatment as the main plots and four replicates.

All pertinent agronomic information and dates of field operations are presented in Table 1. The plots were planted using a SeedMaster plot drill with eight openers whose position was adjusted to achieve the various row spacing. All fertilizer was side-banded at planting.

Weeds were controlled using registered pre-emergent and in-crop herbicide applications and the fungicides were applied as per protocol with a field sprayer. The fungicide treatments were applied at full bloom and the product used was Headline EC (250 g pyraclostrobin l^{-1}) at a rate of 0.4 l ha^{-1}. The plots were terminated using glyphosate using 890 g glyphosate ha^{-1} all except the outside rows were mechanically harvested using a Wintersteiger plot combine.

Various data were collected over the course of the growing season and from the harvested grain samples. Plant emergence was determined in the spring by counting the number of seedlings in two separate 1 m rows per plot and calculating the average plants m^{-2}. Days from planting to maturity (75% of bolls turned brown) was recorded for each plot. Yields were determined from the harvested grain samples and are corrected for dockage and to 10% seed moisture content.

Response data were analysed separately each year using the Mixed procedure of SAS 9.3 with the effects of row spacing, fungicide and their interaction fixed. Treatment means were separated using Fisher's protected LSD test and orthogonal contrasts were used to determine whether the responses to row spacing were linear or quadratic (curvilinear) in shape. All treatment effects and differences between means were considered significant at $P \leq 0.05$.

Table 1. Selected Agronomic Information for Flax "Fungicide by Row Spacing" Trial at Indian Head.

Description	2015	
Previous Crop	Spring Wheat	
Pre-Emergent Herbicide 1	April 29	890 g glyphosate ha^{-1} + 140 g sulfentrazone ha^{-1}
Pre-Emergent Herbicide 1	April 29	3.8 kg triallate ha^{-1}
Seeding Date	May 8	
Variety	CDC Bethune	
Seed Rate	50 kg ha^{-1}	
Fertility (kg $N-P_2O_5-K_2O-S$ ha^{-1})	95-22-11-11	
Plant Density	June 4	
In-Crop Herbicide 1	June 10	175 g fluazifop-P-butyl ha^{-1}
In-Crop Herbicide 2	June 13	99 g clopyralid ha^{-1} + 553 g MCPA ester ha^{-1}
In-Crop Herbicide 3	June 24	44 g clethodim ha^{-1}
Foliar Fungicide	July 5	99 g pyraclostrobin ha^{-1}
Pre-Harvest Application	August 24	
Harvest Date	September 13	

Fungicide by Nitrogen Rate

The "Fungicide by Nitrogen Rate" trials were established near Yorkton and Melfort Saskatchewan in 2015. The trials were split-plot designs with 4 replicates. The main plot factor was "Fungicide" which contrasted no fungicide with the application of Headline EC (250 g pyraclostrobin l^{-1}) at a rate of 0.4 l ha^{-1} at full bloom. The split plot factor was "Nitrogen Rate" and contrasted nitrogen rates of 30, 60, 90, 120 and 150 lbs/ac of actual nitrogen.

Table 2 contains the agronomic information for the "Fungicide by Nitrogen Rate" trials conducted near Yorkton and Melfort. Plots were seeded with a Fabro disc drill (7 inch row spacing) and a Seedhawk drill (10 inch row spacing) at Melfort and Yorkton, respectively. At seeding 15 kg ha^{-1} of P_2O_5 was seed placed at Melfort and banded to the side at Yorkton. Nitrogen was side banded and varied with treatment. Plots were harvested using a Wintersteiger plot combine at both locations. Whole plots were harvested at Melfort (8.71 m^2) whereas, only the middle 5 rows of each plot were harvested at Yorkton (13.5m^2).

Table 2. Selected Agronomic Information for Flax "Fungicide by Nitrogen Rate" Trials at Yorkotn and Melfort.

Description	Yorkton	Melfort
Previous Crop	Spring Wheat	Spring Wheat
Pre-Emergent Herbicide 1		
Pre-Emergent Herbicide 1	—	
Early Seeding Date	May 2	May 19
Variety	CDC Bethune	CDC Bethune
Seed Rate	50 kg ha^{-1}	50 kg ha^{-1}
Plant Density	May 19	
In-Crop Herbicide 1	June 8 44 g clethodim ha^{-1}	June 16 44 g clethodim ha^{-1}
In-Crop Herbicide 2	June 15 75 g clopyralid ha^{-1} + 421 g MCPA ester ha^{-1}	
In-Crop Herbicide 3	June 18 44 g clethodim ha^{-1}	
Foliar Fungicide	July 10 99 g pyraclostrobin ha^{-1}	July 16 99 g pyraclostrobin ha^{-1}
Disease Ratings		September 26
Pre-Harvest Application	September 12	September 11

Harvest Date	September 19	September 28

Results:

Growing Season Weather

Mean monthly temperatures and precipitation amounts for Indian Head, Melfort and Yorkton during the 2015 season are presented relative to the long-term averages in Table 3. Seed and fertilizer were placed into adequate soil moisture. However, the spring as a whole was extremely dry at all locations with no significant precipitation events until late in June. From this point onwards, moisture conditions were generally considered adequate. Emergence was uneven at Melfort due to dry conditions and in Yorkton as the result of a killing frost of minus 2 to 4 degrees Celsius on May 30. This thinned out the flax stand and likely impacted yield. Melfort also received 139.7 mm of rain within 6 hours on July 27th. This excess moisture stayed for many days, creating variable soil saturation across the trial.

Table 3. Mean monthly temperatures and precipitation amounts along with long-term (1981-2010) normals for the 2015 growing seasons at Indian Head, Melfort and Yorkton in Saskatchewan.

Location	Year	May	June	July	August	Avg. / Total
		------------------------------*Mean Temperature (°C)* ------------------------------				
Indian Head	2015	10.3	16.2	18.1	17.0	15.4
	Long-term	*10.8*	*15.8*	*18.2*	*17.4*	*15.6*
Melfort	2015	9.9	16.4	17.9	17.0	15.3
	Long-term	*10.7*	*15.9*	*17.5*	*16.8*	*15.2*
Yorkton	2015	10.5	16.7	19.3	17.5	16.0
	Long-term	*10.4*	*15.5*	*17.9*	*17.1*	*15.2*
		-------------------------------- *Precipitation (mm)* ------------------------------				
Indian Head	2015	16	38	95	59	207
	Long-term	*52*	*77*	*64*	*51*	*244*
Melfort	2015	7	55	150	57	269
	Long -term	*43*	*52*	*77*	*52*	*226*
Yorkton	2015	8	28	123	46	205
	Long-term	*51*	*80*	*78*	*62*	*272*

Flax Response to Row Spacing and Fungicide

The analyses of variance for each crop response variable are provided in Table 4 and main effect means are presented in Table 5.

Table 4. Foliar fungicide and row spacing effects on plant density, maturity and seed yield of flax at Indian Head in 2015.

	Plant density	Maturity	Yield
	2015	2015	2015
Effect	--	p-values [Z]	-------------------------------------
Fungicide (F)	0.383	0.778	0.773
Row spacing (RS)	< 0.001	< 0.001	< 0.001
F × RS	0.726	0.150	0.777

[Z] p-values ≤ 0.05 indicate that a treatment effect was significant and not due to random variability

Plant density was affected by row spacing but not fungicide and with no interaction between factors. Emergence declined as row spacing was increased (Table 5). While the curvilinear responses were not quite significant at the desired level, plant populations tended to be similar for row spacing from 25-41 (10-16”) cm but populations at 61 cm (24”) were significantly lower than all the narrower row spacing treatments. This is a common observation in row spacing trials and is due to increased intraspecific competition with wider row spacing at any given seeding rate. Final populations in all treatments were considered sufficiently high to not be limiting to yield.

Flax maturity was affected by row spacing but not fungicide, regardless of the row spacing level (i.e. no interaction). While statistically significant, the row spacing effect was small with less than a 1 day difference for spacings ranging from 25-41 and a 2.7 day delay in maturity at 61 cm relative to 25 cm row spacing. This effect has been documented in other crops as well but row spacing (within this range) generally has less impact on maturity than other factors such as N fertility level or seeding rate.

Table 5. Least squares means for main effects of foliar fungicide and row spacing on plant density, maturity and seed yield of flax at Indian Head in 2015.

Main effect	Plant Density	Maturity	Seed Yield
	2015	2015	2015
Fungicide	----------- plants m^{-2} -----------	---- days ----	------------- kg ha^{-1} -------------
Fungicide [Z]	492 a	98.9 a	2015 a
No fungicide	459 a	99.0 a	2070 a
S.E.M.	24.7	0.18	93.0
Row spacing			
25 cm (10”)	530 a	98.0 e	2276 a
31 cm (12”)	517 a	98.3 d	2194 b
36 cm (14”)	506 a	98.7 c	2068 c
41 cm (16”)	487 a	98.9 b	2040 c
61 cm (24”)	338 b	100.7 a	1635 d
S.E.M.	23.4	0.14	93.0
Contrast	-------------------------------------	p-values [Y]	--------------------------------------
RS – linear	< 0.001	< 0.001	< 0.001
RS – quadratic	0.052	0.033	0.558

[Z] 0.4 l Headline EC ha^{-1} applied at full bloom (approximately 7 days after 1st flowers noted)
[Y] p-values ≤ 0.05 indicate that a treatment effect was significant and not due to random variability

Seed yield was affected by row spacing but not fungicide and, again, there was no RS × FUNG interaction detected in either year (Table 4). According to the orthogonal contrasts, yield declined linearly (but not quadratically) with row spacing. Flax grown at 25 cm (10") yielded significantly higher than any other treatments. Further declines in yield were detected as spacing was incrementally increased to 61 cm, at which point mean yields were 28% lower than yields at 25 cm.

While the effect of fungicide on flax yield was not significant, significant yield benefits are frequently detected with fungicide applications in this crop. As a crop protection product, fungicides typically only result in yield gains if: 1) the target disease is present at high enough levels to negatively impact yield and 2) factors other than disease are not more limiting to yield. In 2015 at Indian Head, yields were reasonably high but there was very little disease present with only minor symptoms appearing close to maturity when the potential to cause yield reduction was negligible.

Flax Response to Fungicide and Nitrogen rate

Table 6. Foliar fungicide and nitrogen rate effects on plant density, maturity and seed yield of flax at Yorkton in 2015.

	Plant density	Maturity	Seed Yield
Effect	----------------	p-values [Z]	----------------
Fungicide (F)	0.282	0.171	0.107
Nitrogen Rate (NR)	0.110	<0.001	0.001
F x NR	0.728	0.730	0.201

[Z] p-values ≤ 0.05 indicate that a treatment effect was significant and not due to random variability

Flax Response to Nitrogen rate and Fungicide

The analyses of variance for each crop response variable are provided in Tables 6 for Melfort and Yorkton. No interactions between Fungicide and Nitrogen rate were detected at either location. Thus only main effect means for Yorkton and Melfort are presented in Tables 7 and 8, respectively.

Table 6. Foliar fungicide and nitrogen rate effects on plant density, maturity and seed yield of flax at Yorkton and Melfort in 2015.

	Plant density	Maturity	Seed Yield
Yorkton	----------------	p-values [Z]	----------------
Fungicide (F)	0.282	0.171	0.107
Nitrogen Rate (NR)	0.110	<0.001	0.001
F x NR	0.728	0.730	0.201
Melfort			
Fungicide (F)	0.877	—	0.200
Nitrogen Rate (NR)	0.423	—	<0.001
F x NR	0.573	—	0.986

Plant density was low at both Melfort and Yorkton. Dry seed bed conditions at Melfort may have been an issue. While not significant at the 5% level there was a strong trend for reduced emergence of flax as nitrogen rates were increased at Yorkton (Table 7). This has been observed many times with the SeedHawk drill and inadequate separation with the banded fertilizer must be occurring. Seed safety was not an issue at Melfort. Increasing nitrogen rate significantly delayed maturity at Yorkton (Table 7) but did not affect maturity at Melfort (data not shown). Increasing nitrogen rate is known to delay maturity in many crops but the delay in maturity at Yorkton may have been accentuated by decreasing plant populations with increasing nitrogen. The fact that N rate did not affect maturity at Melfort was unexpected, but may reflect the wet conditions experienced latter in the growing season. Seed yield was increased significantly with applied nitrogen at both locations. Yields continued to increase strongly up to 150 lbs/ac at Melfort with a yield gain of 55% between the lowest and highest rates. There was a yield gain of 23% between the highest and lowest N rates at Yorkton but yields started to level off between 90 to 120 lbs/ac. Yield response to nitrogen was undoubtedly high in Melfort as the trial area had not received nitrogen for the past 5 years. Soil tests revealed marginal levels of soil N were present at the Yorkton site.

The application of fungicide did result in higher seed yields of 9 and 5% at Yorkton and Melfort, respectively (Tables 7 and 8). However, differences could not be separated at the 5% level of significance at either location. Pasmo levels were very low at Melfort. Disease levels were also low at Yorkton but ratings did indicate lower levels of disease were fungicide had been applied. Fungicide delayed maturity by 5 days at the Yorkton site but this was not significant at the 5% level (Table 7). No effects of Fungicide on maturity were detected at Melfort as disease levels were very low.

Table 7. Least squares means for main effects of foliar fungicide and nitrogen rates on plant density, maturity and seed yield of flax at Yorkton in 2015.

Main effect	Plant density	Maturity	Seed Yield
Fungicide	-----plants m^{-2}------	---days---	---------- kg ha^{-1} -------
Fungicide [Z]	116 a	122.4 a	1959 a
No fungicide	130 a	117.5 a	1796 a
Nitrogen Rate (actual)			
30 lbs/ac	152 a	114.9 c	1633 b
60 lbs/ac	132 a	117.8 bc	1869 a
90 lbs/ac	123 a	120.6 ab	1908 a
120 lbs/ac	114 a	121.5 ab	1981 a
150 lbs/ac	96 a	124.8 a	2015 a

Table 8. Least squares means for main effects of foliar fungicide and nitrogen rates on plant density, maturity and seed yield of flax at Melfort in 2015.

Main effect	Plant density	Seed Yield
Fungicide	-----plants m^{-2}------	---------- kg ha^{-1} -------
Fungicide [Z]	173 a	2212 a
No fungicide	174 a	2099 a
Nitrogen Rate (actual)		
30 lbs/ac	178 a	1657 c
60 lbs/ac	168 a	1932 c
90 lbs/ac	164 a	2282 b
120 lbs/ac	170 a	2333 ab
150 lbs/ac	187 a	2575 a

Conclusions and Recommendations

Flax yields were reduced with increasing row spacing. This is not to say that seeding equipment with row spacing ≥ 30 cm (12") cannot be used to seed flax; however, with all other factors being equal, lower mean yields or increased yield variability may occur as row spacing is increased. No interactions between fungicide and row spacing or fungicide and nitrogen rate could be detected at any of the locations. No fungicide affects were significant, however there was a trend for the application of fungicide to increase yields by 9 and 5% at Yorkton and Melfort. There was a trend for fungicide to delay maturity at Yorkton but no such affects were observed at Indian Head or Melfort. Disease levels were low at all locations, as spring was very dry. The variability in fungicide response reinforces the recommendation to scout fields on individual basis and each year prior to committing to a fungicide application. While scouting for many diseases can be difficult at the time when fungicides must be applied, in the years where the greatest responses were observed substantial disease was already observed on the bottom leaves and lower stem at mid-bloom.

Flax responded well to added nitrogen at both Yorkton and Melville with yield gains of 23 and 55%, respectively. Optimum N rates were in the range of 90 to 150 lbs/ac. This is higher than expected. High rates of nitrogen are known to delay maturity and this was the case at Yorkton. Lower emergence associated with high rates of N at Yorkton would have also contributed to the delay in maturity and may have held yield back. Added nitrogen did not affect emergence or maturity at Melfort.

Extension and Acknowledgement

This demonstration was a formal stop during 2015 IHARF ECRF and NARF Crop Management Field Days. The tours were well attended and signs were in place to acknowledge the support of the

Saskatchewan Flax Development Commission (SaskFlax) and the ADOPT program. At IHARF, the provincial oilseed specialists were on site to discuss major issues in flax production and some of the treatments being demonstrated. These results were presented by Chris Holzapfel and Stu Brandt on the 2015 Provincial Oilseed Producer Meetings (Nov. 16-20) and by Chris Holzapfel at CropSphere 2016. Results from the project will be made available in the 2015 IHARF Annual Report (available online) and also through a variety of other media (i.e. oral presentations, popular agriculture press, fact sheets, etc.) as opportunities arise.

Seeding Date and Seeding Rate Effects on **Flax** Establishment and Yield

M. Hall[1], C. Holzapfel[2], S. Brandt[3].

[1]East Central Research Foundation/Parkland College, Yorkton, SK
[2]Indian Head Agricultural Research Foundation, Indian Head, SK
[3]Northeast Agriculture Research Foundation, Melfort, SK

Abstract

Field trials were conducted at Indian Head, Melfort and Yorkton in 2013-15 to demonstrate flax response to seeding rates with early and late planting dates. Early seeding sometimes reduced plant density and in other cases increased it. The overall effect of seeding date on plant density was relatively small. Late seeding did consistently reduce days from seeding to maturity, but the early seeded treatments still matured before the late seeded ones. Seeding date had a variable effect on yield, but on average, late seeding was slightly higher yielding. Variety had small and variable effects on plant density, days to maturity and yield. Effects on plant density and maturity likely were of minimal practical significance, but the small yield advantage of the northern adapted variety when averaged across trials is worth noting even though we did not test the statistical significance of this difference. As expected higher seeding rates resulted in increased plant density and slightly earlier maturity but had only a small effect on yield. Any observed benefits to rates beyond the typical 45-55 kg ha^{-1} were unlikely to justify the added seed cost.

Objectives and Rationale

Project objectives:

The objective of this project was to demonstrate the effects of low, medium and high seeding rates at early and late seeding dates on establishment and seed yield of two flax varieties.

Project Rationale:

For optimal flax yields, minimum plant populations of 300 plants m^{-2} are typically recommended in Saskatchewan. Past research has shown that this minimum threshold was only achieved 60% and 73% of the time with early and late plantings, respectively. This suggests that producers must pay close attention to emergence with their seeding practices, adjusting rates if necessary, and that future flax agronomic research needs to focus on management effects on flax establishment. Flax is a poor competitor with weeds early in the season and experience has shown that this crop has difficulty recovering from a poor start; therefore, problems with plant establishment often result in sub-optimal yields. Postponing seeding until soils have warmed up can result in more rapid and complete emergence; however, flax requires a relatively long growing season and yields can be compromised if seeding is delayed too long. It is typically recommended that flax be seeded by mid-May. The proposed project will help producers see the potential benefits of using higher seeding rates, particularly when seeding early into cool soils.

Methodology:

Field trials were completed in 2013, 2014 and 2015 by the Indian Head Agricultural Research Foundation (IHARF) and by the Northeast Agriculture Research Foundation (NARF) in 2014 and 2015 as well as the East Central Research Foundation (ECRF) at Yorkton in 2015, on behalf of the Saskatchewan Flax Development Commission. The trials were located on no-till fields (spring wheat stubble) near Indian Head, (R.M. #156), and on conventionally tilled fields near Melfort, SK (R.M. 428). The treatments were a factorial combination of two seeding dates (early May and late May), three seeding rates (low, normal and high) and, beginning in 2014, two varieties for a total of 12 treatments. The treatments were arranged in split-plot design with seeding dates as the main plots and seeding rates and varieties as the sub-plots. The targeted seeding dates (SD) were early (as early as possible) and late (late-May). The actual seeding rates (SR) for three SR treatments were 35-39 kg ha^{-1} (low), 50-55 kg ha^{-1} (normal) and 69-75 kg ha^{-1} (high). The two variety (VAR) treatments were CDC Bethune (traditional) and FP2454 (northern adapted). In 2015, the normal seeding rate had to be excluded from the analyses at IHARF due to the factorial design and a seeding error which resulted in an incorrect rate for the late-seeded FP2454 at the 55 kg ha^{-1} target seeding rate. Actual dates of seeding are provided in Table 1. Seeding progressed earlier at Indian Head than at Melfort in both 2014 and 2015. This likely reflected that the snow cover leaves and soil warm up earlier at the more southerly located Indian Head site.

Table 1. Early and late seeding dates at Indian Head, Melfort and Yorkton SK during 2013 to 2015.

Seeding Date	Indian Head			Melfort		Yorkton
	2013	2014	2015	2014	2015	2015
Early	May11	May 11	May 2	May 16	May 19	May 2
Late	May 29	May 27	May 28	June 2	June 2	May 22

At Indian Head in all three years, flax was direct-seeded using a SeedMaster plot drill equipped with 8 openers spaced 30 cm apart and a trimmed plot length of 10.5 m. Urea, monoammonium phosphate, potassium chloride and ammonium sulphate were side-banded at rates considered sufficient to ensure that nutrient availability was not limiting. Weeds were controlled using registered pre-emergent and in-crop herbicide applications with products and application times tailored to control the specific species encountered each year and for each seeding date. To help ensure that Pasmo infection was not a limiting factor, foliar fungicide was applied in both years, again, with separate applications for each seeding date. Plant densities were estimated by counting the number plants in 4 x 1 m sections of crop row. No lodging was observed in any of three growing seasons, therefore detailed notes were not taken and lodging data are not presented. Days from planting to maturity were recorded for all plots and the plots were considered mature when approximately 75% of the bolls had turned colour. Pre-harvest glyphosate was applied in 2014 and 2015 to terminate weeds and assist with crop dry down with separate applications for each seeding date. The centre five rows of each plot was straight-combined using a Wintersteiger plot when it was fit to so with separate harvest dates for each seeding date whenever feasible. The harvest samples were cleaned and weighed with yields expressed in kg ha^{-1} and corrected to 10% seed moisture content.

In preparation for seeding at Melfort, in both years, 100 kg N/ha as 34-0-0 was broadcast over the entire plot area. For each seeding date, the soil was tilled and packed 1 to 3 days before seeding. Flax was seeded using a Fabro seeder (7 in row spacing) and 15 kg of P_2O_5/ha of 11-52-0 was added to the seed row. CDC Bethune and FP2454 were used for both dates. For post-emergent weed control, registered in-crop herbicide applications which were selected to control the specific species encountered on the site. Plant densities were estimated by counting the number plants in 2 x 1 m sections of crop row in each plot. Lodging at Melfort was estimated using the Belgian lodging scale but treatment related differences were very small and not significant and lodging data are not presented. Days from planting to maturity were recorded for all plots in both years and were defined as the date when approximately 75% of the bolls had turned colour. Pre-harvest glyphosate was applied in to terminate weeds and assist with crop dry down with a separate application for each date. Each plot was straight-combined using a Wintersteiger plot when it was fit to so. The harvest samples were cleaned and weighed with yields expressed in kg ha^{-1} and corrected to 10% seed moisture content.

All data was subjected to statistical analysis, but actual statistical procedures differed between sites depending on capabilities at each. No attempt was made to perform a combined statistical analysis across sites. All treatment effects and differences between means were considered significant at $P \leq 0.05$. Growing season weather data were monitored and recorded using online data from the nearest Environment Canada weather station which was always located within approximately 5 km of the trial sites.

Results:

Weather:

Mean monthly temperatures and precipitation amounts for the 2013-15 growing seasons at Indian Head are presented relative to the long-term averages in Table 2. In general, 2013 was an excellent growing season for flax with adequate but not excessive moisture and slightly below normal temperatures. The 2014 growing season was more challenging with wet conditions in May and especially June which delayed herbicide applications and resulted in significant crop stress. In 2015, there was adequate moisture at seeding for both dates but no significant precipitation until late June, at which point moisture conditions improved and stayed adequate for the remainder of the season. Overall, the weather conditions were conducive to flax yields which were considered above-average in 2013, below-average in 2014 and approximately average in 2015.

At Melfort, temperatures were near normal during both 2014 and 2015 except that June of 2014 was quite cool. Precipitation during 2014 was above normal from June through August with very wet conditions delaying weed control in June and likely causing damage from saturated soil conditions. The 2015 growing season was very dry in May and dry conditions prevailed until late June. Dry conditions at seeding coupled with drying due to intensive pre-seeding tillage reduced emergence and resulted in somewhat variable crop stands that filled in later. On July 27, more than 100 mm of rain fell in 6 hours, causing flooding which persisted briefly at this trial site and likely caused some variable damage.

At Yorkton in 2015, temperatures were more than 1 degree above normal during June and July and near normal for May and August. Precipitation was much below normal during May and June at Yorkton, and these dry conditions likely adversely impacted crop emergence. Above normal precipitation during July followed by somewhat below normal for August improved the moisture situation for this site, but did not restore precipitation for the growing season to normal levels. Frost in late May at this site appeared to cause more damage to early seeded flax than late seeded which was just at the cotyledon stage when this occurred.

There were several statistically significant interaction between the three factors being evaluated. While some of these interactions were of scientific value, none appeared to have much practical significance, and are therefore not presented in this report.

Seeding date affected plant density at 5 of 6 location years (Table 3). Densities increased as seeding was delayed at 3 location years and increased with delayed seeding at 2 location years. Plant density was not affected by seeding date at Indian Head in 2014.

At Indian Head in 2013, plant populations were 148 plants m^{-2} lower with early seeding (342 vs 490 plants m^{-2}) while in 2015 plant populations were much higher overall but emergence was better with early seeding (574 vs 505 plants m^{-}2). The response in 2013 was typical for a late, cool spring whereby, with early seeding, soils can be cold resulting in reduced or delayed emergence relative to later seeding under such conditions. In contrast, the weather was dry after seeding in 2015 and the slight reduction in emergence detected with late planting may have been due to drier soils at this time. While there was a seeding date effect, flax was seeded into adequate moisture at both dates in 2015 and precipitation later in June ensured excellent emergence for the later seeded plots as well. At Melfort, higher plant densities with early seeding likely reflected better seedbed moisture conditions compared with later seeding; a situation that may have also been related to the impacts of pre-seeding tillage. This same explanation would not account for the differences in emergence associated with seeding date in 2015. Conditions were quite dry at both seeding dates, however seed was likely placed somewhat deeper at the later date, ensuring that a greater proportion of seeds were placed into moist soil. Very dry conditions at Yorkton in 2015 played a role in the overall low emergence noted at this site. Increased plant density with late vs early seeding may have reflected differences in soil temperatures or seed placement between seeding dates. When averaged across all location years, differences in plant densities between seeding dates were relatively small. The observation that overall differences due to seeding date were small while individual site year differences were large and variable reflects the conflicting effects of differences in soil temperature, seedbed moisture and depth of seed placement. All of these factors are known to affect plant densities. Successful crop establishment is often determined by the ability of growers to understand how these factors can be managed by selecting appropriate seeding dates or depths that reflect conditions in the field in any given year.

Table 2. Mean monthly temperatures and precipitation amounts along with long-term (1981-2010) normals for the 2013, 2014 and 2015 growing seasons at Indian Head, Saskatchewan and for 2014 and 2015 at Melfort, Saskatchewan.

Location	**Year**	**May**	**June**	**July**	**August**	**Avg. / Total**
		-----------------------------*Mean Temperature (°C)* -----------------------------				
Indian Head	2013	11.9	15.3	16.3	17.1	15.2
	2014	10.2	14.4	17.3	17.4	14.8
	2015	10.3	16.2	18.1	17.0	15.4
	Long-term	***10.8***	***15.8***	***18.2***	***17.4***	***15.6***
Melfort	2014	10.0	14.0	17.5	17.6	14.8
	2015	9.9	16.4	17.9	17.0	15.3
	Long-term	***10.7***	***15.9***	***17.5***	***16.8***	***15.2***
Yorkton	2015	10.5	16.7	19.3	17.5	16.0
	Long-term	***10.4***	***15.5***	***17.9***	***17.1***	***15.2***
		-------------------------------- *Precipitation (mm)* ------------------------------				
Indian Head	2013	17	104	50	6	177
	2014	36	199	7.8	142	385
	2015	16	38	95	59	207
	Long-term	***52***	***77***	***64***	***51***	***244***
Melfort	2014	24	170	95	60	349
	2015	7	55	150	57	269
	Long -term	***43***	***52***	***77***	***52***	***226***
Yorkton	2013	8	28	123	46	205
	Long-term	***51***	***80***	***78***	***62***	***272***

Variety affected plant density at 4 of 5 location years (Table 3). The traditional variety resulted in significantly higher plant densities than the northern adapted variety in 2014, but in 2015 the reverse occurred at 2 locations and tended to occur at the third location. This suggests that differences associated with variety were most probably due to seed quality differences in the seed lots used each year. Seed size may have also contributed to the observed differences as the rates were based on mass per unit area as opposed to viable seeds per unit area. Thus seed of the traditional variety had better quality than the northern adapted variety in 2014, and the reverse occurred in 2015. When averaged across all location years, differences in plant density between varieties were relatively small and likely not significant.

As expected, the effect of SR on plant densities was significant at all location years with incremental increases in actual plant populations at each seeding date. Averaged across seeding dates (and varieties in

2014-15), plant populations at the LOW seeding rate were above the recommended minimum in all but 1 location year (Yorkton 2015). However for individual variety by date by location year combination densities did fall below this threshold in several more cases (data not shown). This suggested that yield might be affected adversely in these cases due to inadequate plant density.

Table 3. Main effect means for flax plant density (plants/m^2) at Indian Head, Melfort And Yorkton SK during 2013-2015.

	Indian Head			Melfort		Yorkton	ALL
Main effect	2013	2014	2015	2014	2015	2015	
Seeding date							
Early	342b*	484a	574a	627a	313b	284b	437
Late	490a	458a	505b	325b	416a	345a	423
Variety							
Traditional	na	497a	496b	513a	345a	301b	430
Northern adapted	na	446b	583a	440b	384a	325a	436
Seed Rate							
Low	336c	364c	393b	348c	331c	221c	320
Medium	411b	482b	na	466b	353b	318b	406
High	501a	567a	686a	614a	408a	445a	507

* means followed by the same letter do not differ significantly at P=0.05
**averages are for 6 location years for seed date, and 5 location years for variety and seed rate.

Treatment means for days to maturity are presented in Table 4. While maturity was affected by all factors (seeding date, seeding rate and variety), only the seeding date effects were large enough to be of agronomic importance. In all cases, delayed seeding greatly reduced the length of time required for flax to reach maturity; however, it must be noted that the early seeded flax was still always mature and ready to harvest ahead of the late seeded treatments. This effect is common for all crops and is a result of warmer soil and air temperatures later in the spring and early summer. Crops seeded later typically emerge more quickly and progress through the early growth stages much more quickly than crops seeded early into cool soils; however, this does not necessarily translate into higher yields.

At Yorkton, maturity was recorded as the percentage of bolls that had turned brown on 4 occasions as the crop neared maturity. While this data is very accurately measured progression of maturity it was difficult to convert to days to mature. It did indicate very clearly that the early seeded treatments matured earlier than the late seeded ones but did require more days from seeding to maturity. As well the northern adapted variety was later maturing when seeded early but not when seeded late. There was a very clear trend for maturity to be hastened as seeding rate increased (data not shown).

Table 4. Main effect means for flax plant maturity (days from seeding to maturity) at Indian Head, Melfort and Yorkton SK during 2013-2015.

	Indian Head			Melfort		Yorkton	ALL
Main effect	2013	2014	2015	2014	2015	2015	
Seeding date							
Early	107.9a	109.4a	104.0a	98a	102a	114a	106.4
Late	100.4b	104.7b	97.2b	95b	101b	99b	100.1
Variety							
Traditional	na	107.2a	100.5b	97a	102a	107a	102.7
Northern adapted	na	106.9b	100.7a	97a	101a	107a	102.5
Seed Rate	na						
Low	104.7a	107.7a	101.5a	97a	103a	109a	104.3
Medium	104.1b	107.1a	na	97a	102b	107b	103.4
High	103.8b	106.4b	99.7b	97a	101c	105c	102.6

* means followed by the same letter do not differ significantly at P=0.05
**averages are for 6 location years for seed date, and 5 location years for variety and seed rate.

One important interaction was that between seed date and cultivar (Table 5). This interaction was statistically significant at Indian head in both 2014 and 2015, as well as at Yorkton in 2015. However the trend was not consistent at all location years. At Indian Head in 2014 and at Yorkton in 2015, the northern adapted variety was later maturing than the traditional variety. When they were late seeded the northern adapted variety was earlier maturing than the traditional variety at the same location years. However this trend was not consistent since at Indian Head in 2015, both varieties matured at the same time when seeded early, but the northern adapted variety was slightly later maturing when seeded late. At Melfort there was no indication that this interaction was significant. This would suggest that under at least some conditions the northern adapted variety was able to compensate for late seeding by maturing somewhat earlier than a variety that was not selected for adaptation to northerly conditions.

Table 5. Interaction effect of seed date and variety in maturity (days from seeding) of flax at Indian Head (2014 1nd 2015), and Yorkton (2015).

	IH 2014	IH 2015	Yorkton 2015
Early seeded traditional variety	109.2b	104.1a	113.0b
Early seeded Northern adapted variety	109.6a	104.0a	115.6a
Late seeded traditional variety	105.3c	96.9c	100.5c
Late seeded northern adapted variety	104.2d	97.4b	98.1d

* means followed by the same letter do not differ significantly at P=0.05

Overall, flax yields were very high at Indian Head in 2013, high at Melfort in 2014 and Indian Head in 2015, moderate at both Melfort and Yorkton in 2015 and lowest at Indian Head in 2014 (Table 6). This provided a clear indication that climate has a greater influence on flax yield than geographic location. Early seeding significantly increased yield at 1 location year, and decreased it significantly at 2 other location years, while having minimal impact in 2 at 2 other location years. Overall, late seeding tended to provide higher yield than early seeding when averaged across all location years (although we did not test this statistically). Dry conditions early in 2015 at all locations followed by ample rain in July likely contributed to enhanced yield with late seeding. Later seeded crop would be less likely to be affected by early drought stress, and better able to more fully utilize moisture later in the growing season. By contrast, moisture conditions were quite favorable throughout the 2013 growing season at Indian Head, allowing the crop to develop very high yield potential. Under these conditions earlier seeding may have allowed the crop to accumulate more assimilates needed to set additional seed compared with later seeding. The major yield limiting factors at Indian Head in 2014 were flooding in June and heavy weed pressure due to Group 1 resistant wild oats which could not be controlled with in-crop herbicide applications. Seeding date did not significantly affect flax yields in any of the three years; however, based on the overall averages, early seeding tended to produce higher yields in 2013 ($P = 0.150$) while later seeding had a slight advantage in 2015 ($P = 0.075$). In 2014, mean yields were virtually identical for the two dates.

Variety significantly affected yield at three of six location years, with the northern adapted variety being higher yielding in all three cases. When averaged over all location years, the northern adapted variety was almost 5% higher yielding. Because this variety was selected for being well adapted to northern climatic conditions, it would be expected to fare well at the most northerly location, Melfort. In these trials the northern adapted variety was significantly higher yielding in one year at each location, suggesting that it may be inherently higher yielding across a broader range of climatic conditions.

Seeding rate had a highly variable impact on yield, increasing with seeding rate increases in one case, peaking at the lowest rate in another case, or being largely unaffected in several cases. When averaged across all location years, differences in yield between seeding rates were surprisingly small. Most surprising was that at Yorkton in 2015, yield was highest at the low seeding rate where plant population was below 300 plants per square meter.

Table 6. Main effect means for flax grain yield (kg/ha) at Indian Head, Melfort and Yorkton SK during 2013-2015.

	Indian Head			Melfort		Yorkton	
Main effect	2013	2014	2015	2014	2015	2015	ALL
Seeding date							
Early	3012a	1262a	2121a	2310a	1671b	1509b	1980
Late	2846b	1309a	2457a	2282a	1836a	1935a	2111
Variety							
Traditional	na	1287a	2286b	2230b	1699a	1658b	1832
Northern adapted	na	1284a	2341a	2362a	1805a	1790a	1916
Seed Rate							
Low	2874b	1226b	2294a	2333a	1732a	1823a	1998
Medium	2923b	1325a	na	2296a	1750a	1640b	1987
High	2998a	1305ab	2284a	2258a	1779a	1704ab	2009

* means followed by the same letter do not differ significantly at P=0.05
**averages are for 6 location years for seed date, and 5 location years for variety and seed rate.

Conclusions and Recommendations

This project has demonstrated the response of two flax varieties to varying seeding dates and seeding rates at 3 locations in the Black soil zone of Saskatchewan over a total of 6 location years. The overall performance of this crop was relatively insensitive to the specific seeding dates and rates that were evaluated. Seeding date affected plant density at 5 of 6 location years. Densities increased as seeding was delayed at 3 location years and increased with delayed seeding at 2 location years. In all cases, delayed seeding greatly reduced the length of time required for flax to reach maturity; however, it must be noted that the early seeded flax was still always mature and ready to harvest ahead of the late seeded treatments. Overall, late seeding tended to provide somewhat higher yield than early seeding when averaged across all location years. While seeding early is usually recommended, preferably not later than the 15th of May, this demonstration showed that postponing seeding to the end of May will not typically result in lower yields or maturity issues. The variety grown had a variable effect on plant density that more likely reflected seed quality differences between seed lots than genetic potential. Maturity differences between varieties tended to be small and somewhat inconsistent. The northern adapted variety did tend to show a small yield advantage over the traditional variety, but this was not always consistent, and did not occur only at the most northerly location. Increasing seeding rate consistently increased plant density and decreased days to maturity. However seeding rate had only a small and inconsistent effect on yield. This suggested that across the range of seeding rates used in the trial, plant populations were sufficient so as not to greatly limit yield potential. If plant population and it's interaction with other factors like seed dates or varieties is a concern, future studies need to use a broader range of seeding rates to ensure that such relationships can be investigated.

Acknowledgements:
The project was initiated by SaskFlax and financially supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward 2 bi-lateral agreement. Acknowledgement of the Saskatchewan Ministry of Agriculture's support for this demonstration and that of SaskFlax will be included as part of all written reports and oral presentations that arise from this work. Seed for northern adapted flax variety used in the project was provided in-kind by Crop Production Services and crop protection products used over the years were provided in-kind by BASF, Bayer Cropscience, FMC and Syngenta.

Early Defoliation of **Forage Cereals** to Delay Maturity for Swath Grazing.

M. Hall[1], A. Foster[2], B. Nybo[3], D. Sluth[3], J. Pratchler[4], S. Brandt[4]

[1]East Central Research Foundation/Parkland College, Yorkton, SK
[2]Saskatchewan Agriculture, Tisdale, SK
[3]Wheatland Conservation Area, Swift Current, SK
[4]Northeast Agricultural Research Foundation, Melfort, SK

Abstract

The use of early defoliation and delayed seeding to delay maturity of cereals for swath grazing was evaluated at Yorkton, Swift Current and Melfort. The cereals compared in this study were CDC Maverick barley, Haymaker Oats and Bunker triticale. Late seeding (~June 20) delayed crop maturity sufficiently for a swath grazing scenario for all cereals. This approach reduced yields of all cereals at Yorkton and for barley at Melfort. Yield of oats and triticale were unaffected by late seeding at Melfort. Yields of all cereals were increased by late seeding at Swift Current which was likely related to a dry spring followed by late season rain. Defoliation at early jointing delayed maturity sufficiently for a swath grazing scenario at Swift Current and Melfort but not at Yorkton. Defoliation may have been a little earlier at Yorkton which may explain this difference. Compared to late seeding, defoliation at early jointing resulted in similar or better cereal yields at Yorkton and Melfort but poorer yields at Swift Current. In terms of forage quality there were some statistical differences between crop species but differences were not consistent between locations. All forages had a good level of total digestible nutrients and were comparable ranging from 61 to 65% which is adequate for beef cows in late

pregnancy. Protein levels were much higher at Swift Current and Melfort (~12%) compared to Yorkton (~9%).

It would appear that defoliating at early jointing can be used to delay maturity for swath grazing without loss of yield or forage quality. However, this study shows the results can be variable. Late defoliation did not always delay maturity sufficiently. Late defoliation often resulted in a yield loss. More work is required using actual grazing for defoliation before recommendations can be made to producers.

<u>Description</u>

In the U.S. it is a common practice to graze winter wheat in the spring prior to stem elongation and then harvest the grain with little impact on yield. This study set out to evaluate this strategy on spring cereals grown for swath grazing.

The first objective of this study was to demonstrate the use of early defoliation (simulated grazing) and delayed seeding to delay maturity of cereal crops for swath grazing. The second objective was to assess the impact of the differing management on yield and forage quality. To this end, a split-plot trial with 4 replicates was established near Yorkton, Swift Current and Melfort. The main plot factors were composed of the following treatments:

1. Seeded early (~May 20) then harvested at soft dough
2. Seeded late (~June 20) then harvested at soft dough
3. Seeded early (~May 20), defoliated at late vegetative, harvested at soft dough
4. Seeded early (~May 20), defoliated at early jointing, harvested at soft dough

The subplot factor was the following crop species:

1. Barley (CDC Maverick)
2. Oats (Haymaker)
3. Triticale (Bunker)

The early seeding dates varied from May 20 to 27, while late seeding was done between June 17 and 27, depending on location (Table 1). Plant densities were estimated at each location by counting emerged plants from a fixed row length in each plot within 10 days of emergence. Above ground foliage was removed by mowing at either the late vegetatinve or early jointing growh stages as required by the treatments. Forage yield was determined by harvesting and weighing entire plots followed by drying a weighed sub-sample to correct for moisture content. Dried subsamples were submitted to a feed testing lab for quality analyses.

Table 1. Dates of Operations for Yorkton, Swift Current and Melfort in 2015

Operation	Yorkton	Swift Current	Melfort
Seeded early seeded treatments (109 lbs/ac urea +39 lbs/ac Map)	May 20	May 27	May 20
Emergence counts for early seeded treatments	June 10	June 16	June 10
Prestige on early seeded treatments	June 15	None	
Cut late vegetative treatments	June 16	June 22	June 23
Preseed burnoff with Roundup Transorb (0.67 l/ac) for late seeded treatments	June 18	June 12	?
Cut early jointing treatments	June 23	July 2	July 3
Seeded late seeded treatments (109 lbs/ac urea +39 lbs/ac Map)	June 24	June 17	June 20
Emergence counts for late seeded treatment	Not done	July 3	?
Harvested Barley from trt 1- early seeded	August 11	July 29	August 18
Harvested Barley from trt 2 – late seeded	Sept 8	August 17	August 28
Harvested Barley from trt 3 - early seeded + defoliation @ late vegetative	August 11	July 29	August 18
Harvested Barley from trt 4 - early seeded + defoliation @ early jointing	August 11	August 17	August 28
Harvested Oats from trt 1- early seeded	August 11	August 4	August 28
Harvested Oats from trt 2 – late seeded	Sept 8	August 24	Sept 23
Harvested Oats from trt 3 - early seeded + defoliation @ late vegetative	August 11	August 4	August 28
Harvested Oats from trt 4 - early seeded + defoliation @ early jointing	August 11	August 24	Sept 23
Harvested Triticale from trt 1- early seeded	August 11	August 4	August 20
Harvested Triticale from trt 2 – late seeded	Sept 8	August 24	Sept 23

Table 1. Continued			
Operation	Yorkton	Swift Current	Melfort
Harvested Triticale from trt 3 - early seeded + defoliation @ late vegetative	August 11	August 4	August 20
Harvested Triticale from trt 4 - early seeded + defoliation @ early jointing	August 11	August 24	Sept 23

Results

Weather

Mean monthly temperatures and precipitation amounts for the 2015 growing season at Swift Current, Melfort and Yorkon are presented in table 2. Rainfall in May and June was well below average at all sites. Rainfall was then above average for the rest of the season. Melfort suffered a large rain event on July 27th of 139.7 mm within 6 hours. Soil saturated conditions persisted for a number of days after this event. Melfort aand Swift Current were a little cooler than normal in May but was above average for the remainder of the season. Yorkton was above seasonal norms for every month. However, Yorkton suffered a killing frost of minus 2 to 4 ^{o}C on May 30 but emerging cereals were not badly affected as their growing points were below ground.

Table 3. Mean monthly temperatures and precipitation amounts along with long-term (1981-2010) normals for the 2015 growing seasons at Indian Head, Melfort and Yorkton in Saskatchewan.

Location	**Year**	**May**	**June**	**July**	**August**	**Avg. / Total**
		-----------------------------*Mean Temperature (°C)* ------------------------------				
Swift Current	2015	10.1	17.1	19.0	18.2	16.1
	Long-term	***10.9***	***15.4***	***18.5***	***18.2***	***15.7***
Melfort	2015	9.9	16.4	17.9	17.0	15.3
	Long-term	***10.7***	***15.9***	***17.5***	***16.8***	***15.2***
Yorkton	2015	10.5	16.7	19.3	17.5	16.0
	Long-term	***10.4***	***15.5***	***17.9***	***17.1***	***15.2***

Table 3. Continued

Location	Year	May	June	July	August	Avg./Total
		---------------------------------- *Precipitation (mm)* ----------------------------------				
Swift Current	2015	2.3	16.1	96.1	49.2	163.7
	Long-term	***43.8***	***72.8***	***52.6***	***41.5***	***210.7***
Melfort	2015	7	55	150	57	269
	Long -term	***43***	***52***	***77***	***52***	***226***
Yorkton	2015	8	28	123	46	205
	Long-term	***51***	***80***	***78***	***62***	***272***

Plant density did not significantly differ between early and late seedings at Melfort and Swift Current. density counts for the late seeding at Yorkton were missed. Density between crop species did not vary at Melfort (Table 3). Densities were much lower at Yorkton and Swift Current. At Swift Current greater crop density was associated with triticale followed by barley and then followed by Oats. At Yorkton, density of triticale was significantly greater than either barley or oats.

Table 3. Crop species emergence (plants/ft2), averaged over management**

Crop	Yorkton	Swift Current	Melfort
Maverick Barley	12.3 b	14.9 b	23.5 a
Haymaker Oats	13.6 b	10.5 c	24 a
Bunker Triticale	18.1 a	16.8 a	23.6 a

**Means within a site followed by the same letter are not significantly different p=0.05

The original protocol was to harvest the forage species within a management practice on the same day based on the middle maturing specie being at soft dough. This was followed at Yorkton but the other two sites harvested barley earlier than oats and triticale as it matures earlier. The first defoliation was to occur at the late vegetative stage. Defoliation at early jointing may have occurred a little earlier at Yorkton compared to the other sites. From seeding to defoliation at jointing took 34, 36 and 44 days at Yorkton, Swift Current and Melfort, respectively. One would expect the days from seeding to late defoliation to be shorter for Swift Current as it was seeded 7 days later than Yorkton and Melfort. However, Yorkton and Melfort were seeded on the same day but defoliation occurred 10 days earlier at Yorkton. It was somewhat warmer at Yorkton than Melfort but defoliation at Yorkton still may have occurred at an earlier growth stage compared to the other sites which would explain why little difference in maturity with the early jointing defoliation was observed at Yorkton (Figure 1). So to summarize, defoliation at early jointing prolonged maturity similarly to delayed seeding to make it suitable for a swath grazing scenario at Swift Current and Melfort but late defoliation did not delay maturity for a swath grazing scenario at Yorkton (Table 1).

Figure 1. Maverick barley treatments on July 22

At Yorkton, no significant interactions between crop species and management were detected for yield. Thus yield data for crop species has been presented averaged over management (Figure 2) and yield data for management has been averaged over crop species (Figure 3). Significant interactions were detected for yield data at Swift Current and Melfort, thus all treatment means have been presented (Figures 4 and 5). At Yorkton, Haymaker oats yielded significantly more that Maverick barley which yielded significantly more than bunker triticale (Figure 2). At Melfort and Swift Current the relative yield between crop species depended on mangement.

Figure 2.

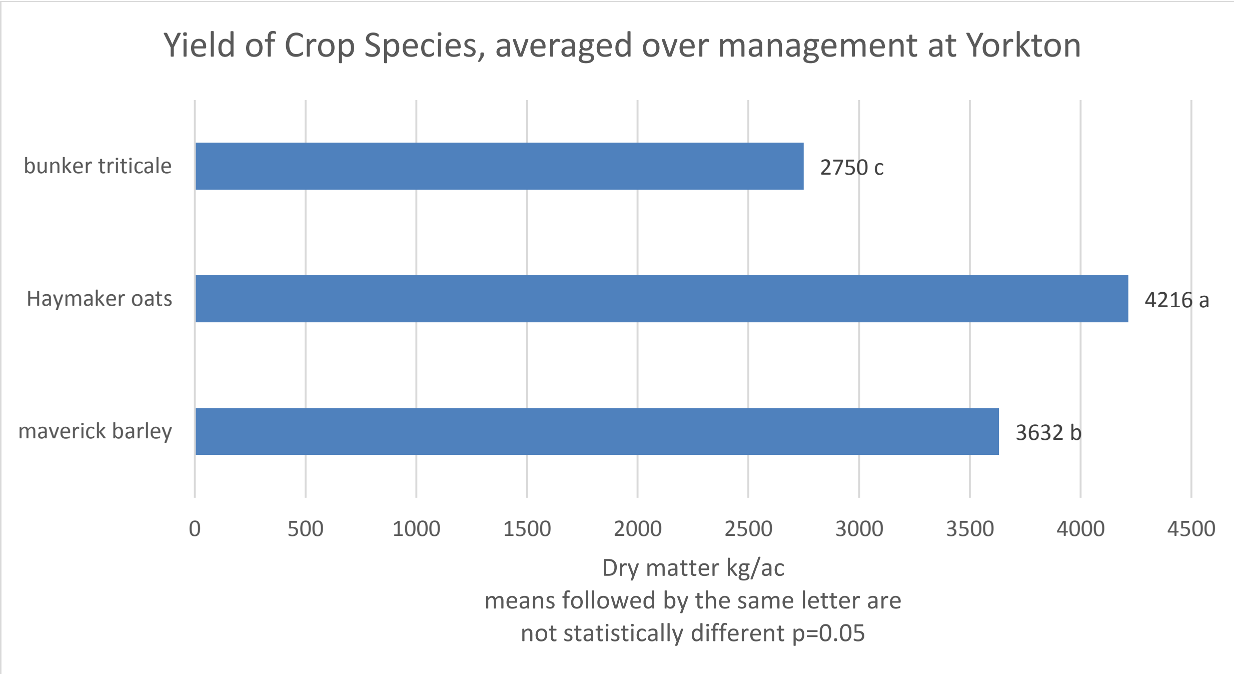
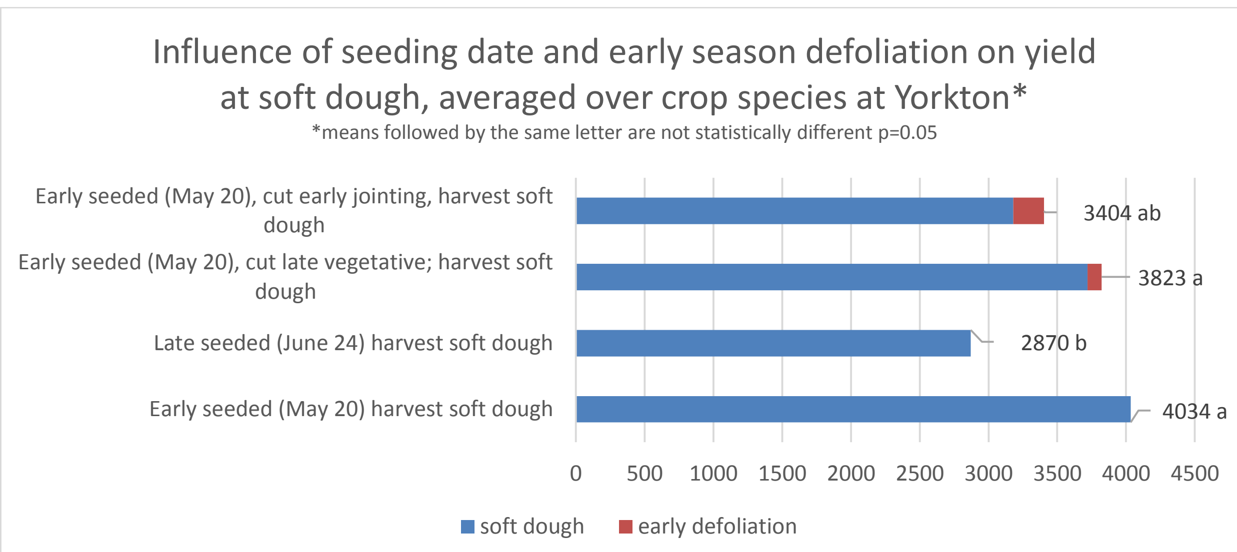


Figure 3.



Seeding late resulted in substantial yield loss for all cereals at Yorkton (Figure 3) and for barley at Melfort (Figure 5). This is what would be typically expected. However, seeding late did not affect yield for oats or triticale at Melfort. Moreover, seeding late actually increased the yields of all cereals at Swift Current (Figure 4). Spring moisture conditions at Swift Current were extremely dry. The authors from Swift Current believe the yield for early seeded treatments were low because crops were past the point of recovery by the time late season rains arrived. Similar but less severe conditions at Melfort may have accounted for good yield of late seeded oats and triticale.

Figure 4

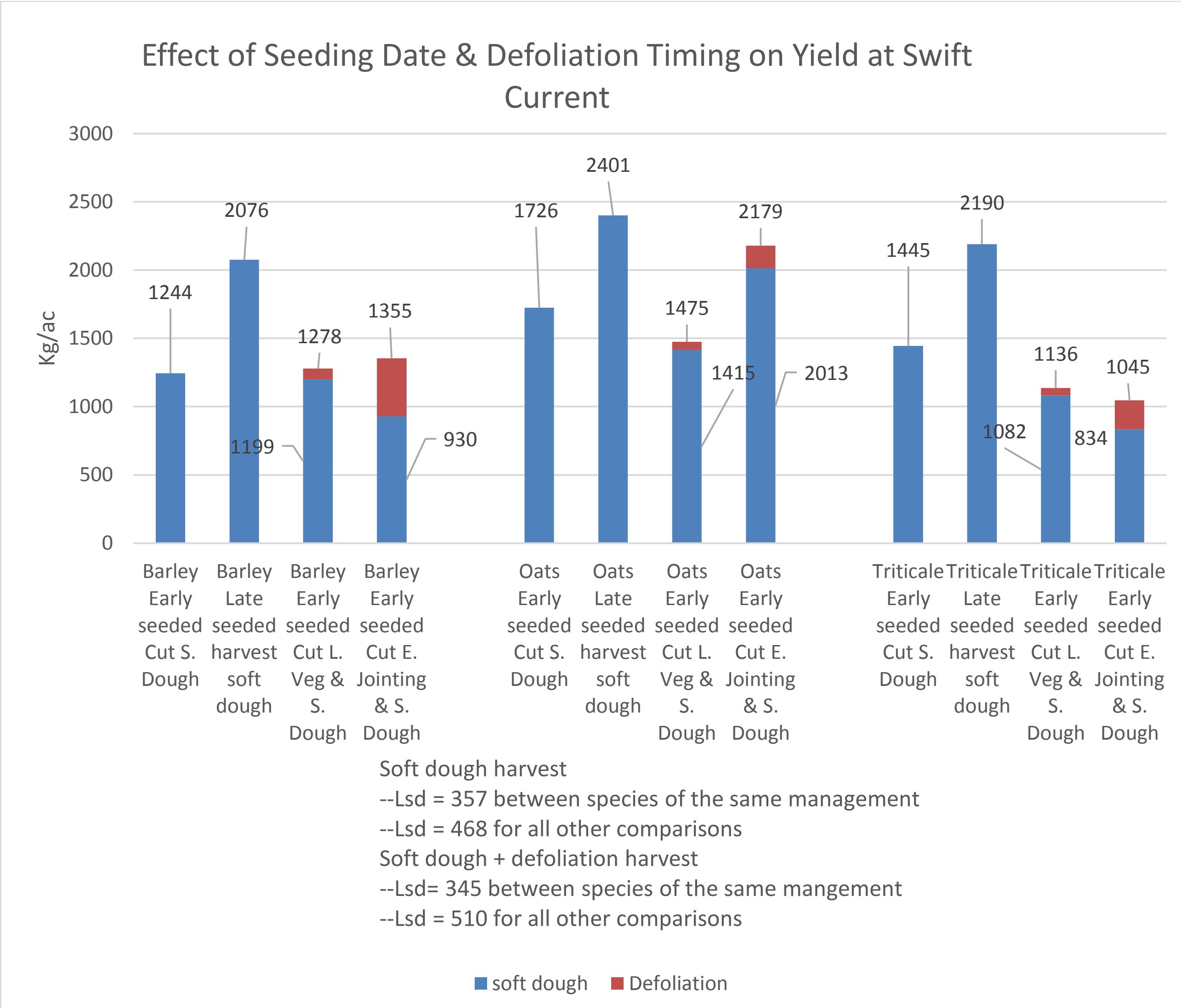
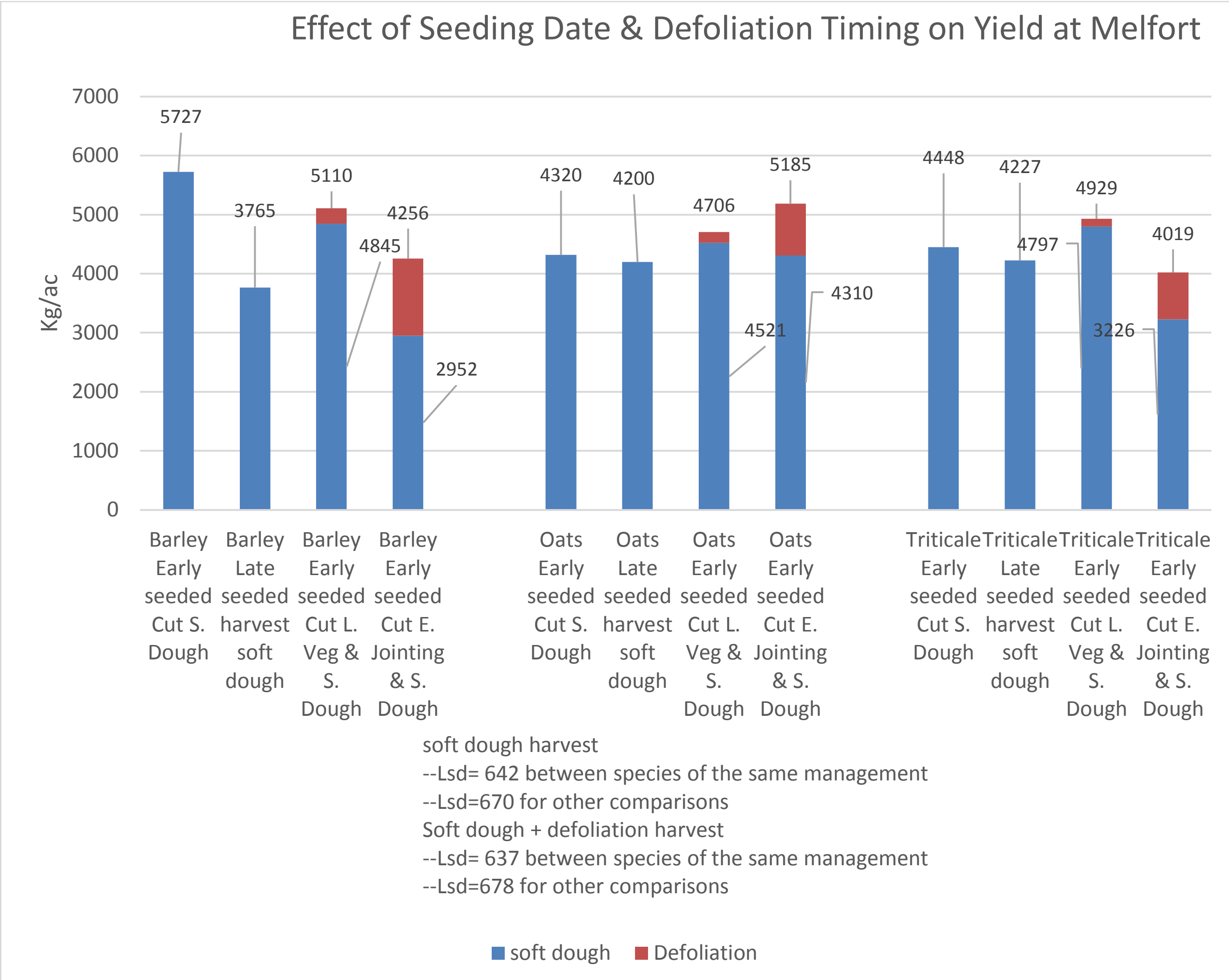

Effect of Seeding Date & Defoliation Timing on Yield at Swift Current
Kg/ac
3000
2500
2000
1500
1000
500
0
1244
2076
1278
1199
1355
930
1726
2401
1475
1415
2179
2013
1445
2190
1136
1082
1045
834
Barley Early seeded Cut S. Dough
Barley Late seeded harvest soft dough
Barley Early seeded Cut L. Veg & S. Dough
Barley Early seeded Cut E. Jointing & S. Dough
Oats Early seeded Cut S. Dough
Oats Late seeded harvest soft dough
Oats Early seeded Cut L. Veg & S. Dough
Oats Early seeded Cut E. Jointing & S. Dough
Triticale Early seeded Cut S. Dough
Triticale Late seeded harvest soft dough
Triticale Early seeded Cut L. Veg & S. Dough
Triticale Early seeded Cut E. Jointing & S. Dough
Soft dough harvest
--Lsd = 357 between species of the same management
--Lsd = 468 for all other comparisons
Soft dough + defoliation harvest
--Lsd= 345 between species of the same mangement
--Lsd = 510 for all other comparisons
soft dough
Defoliation

Figure 5. Yield (Kg/ha Dry Matter) of three cereal crops seeded early or late with early seeded treatments cut a either late vegetative or early jointing to delay maturity



For the most part, defoliation at soft dough reduced forage yield with the latter defoliation at early jointing resulting in the greatest yield loss (Figures 3, 4 and 5). Even when including the yield from defoliation, defoliation usually resulted in less yield. The barley at Swift Current was an exception to this where the yield obtained from defoliation at early jointing made up for the yield loss at the soft dough stage. Another exception was for oats, where late defoliation at early jointing either resulted in more yield at Swift Current (Figure 4) or did not affect oat yield at Melfort (Figure 5) at soft dough. When the yield from late defoliation is included in the total Oat yield, this treatment resulted in significantly more yield at Swift Current and Melfort. The author is at a loss to explain why late defoliation resulted in more yield for oats at Swift Current and Melfort.

Melfort took height measurements and found triticale to be significantly taller (127 cm) than barley (101 cm) which was significantly taller than oats (96 cm). Differences in height between management were not quite significantly different and did not relate well to yield.

Compared to late seeding, defoliation at early jointing resulted in similar or better cereal yields at Yorkton and Melfort but poorer yields Swift Current.

Forage quality results are only based on 2 replicates of data making it more difficult to separate means. However, a few differences were detected.

No effects from seeding date or defoliation on total digestible nutrients (TDN) or protein could be detected at any location. Statistical differences in TDN between crop species were not detected at Yorkton (Table 3). There were statistical differences between crop species for TDN and Protein for the rest of the comparisons. TDN was lowest for oats at both Swift Current and Melfort. However, TDN levels for all crop species are adequate for beef cows in late pregnancy. Protein levels were higest for triticale at Yorkton but the lowest at Swift Current and Melfort. Overall, protein levels were highest at Swift Current which is likely related to low percipitation and yield experienced at this location.

Table 3. Site values for Protein* and TDN** values for cereals, averaged over management

	Barley		**Oats**		**Trticale**	
	TDN (%)	**Protein (%)**	**TDN (%)**	**Protein (%)**	**TDN (%)**	**Protein (%)**
Yorkton	63.2 a	8.6 b	60.2 a	8.4 b	61.7 a	10.1 a
Swift Current	65.6 a	15 a	61 b	14.9 a	65.9 a	12.8 b
Melfort	64.4 a	12.8 a	60.5 b	11.3 b	62.2 b	10.8 b

*Protein means followed by the same letter within a location are not significantly different
**TDN means followed by the same letter within a location are not significantly different

Summary and Conclusions

Delaying seeding enables producers to swath cereals latter in the season for swath grazing. Delaying seeding usually results in less yield and this was the case for all cereals at Yorkton and for barley at Melfort. In contrast, delaying seeding did not affect yields of oats and triticale at Melfort and increased the yield of all cereals at Swift Current. These finding are likely related to a dry spring followed by late season rains which longer season cereals in the case for Melfort or late seeded cereals in the case for Swift Current were better able to utilize.

Defoliation at the late vegetative stage had very little effect on maturity at each site. Later defoliation at the early jointing stage prolonged maturity at Swift Current and Melfort making the swath timing similar to delayed seeding and suitable for swath grazing. In contrast, defoliation at early jointing had little effect on maturity at Yorkton. It is possible the defoliation at Yorkton was a little too early compared to the other sites and this may be the reason for the difference.

For the most part, yields were reduced by defoliation at the soft dough stage, particularly when done at early jointing. Including the yield from defoliation compensated for the yield loss with barley at Melfort.

The yield of oats was increased at both Swift Current and Melfort when yield from the early defoliation is included.

Compared to late seeding, defoliation at early jointing resulted in similar or better cereal yields at Yorkton and Melfort but poorer yields Swift Current.

In terms of forage quality there were some statistical differences between crop species but differences were not consistent between locations. All forages had a good level of total digestible nutrients and were comparable ranging from 61 to 65% which is adequate for beef cows in late pregnancy. Protein levels were much higher at Swift Current and Melfort (~12%) compared to Yorkton (~9%).

It would appear that defoliating at early jointing can be used to delay maturity for swath grazing without loss of yield or forage quality. However, this study shows the results can be variable. Late defoliation did not always delay maturity sufficiently. Late defoliation often resulted in a yield loss. More work is required using actual grazing for defoliation before recommendations can be made to producers.

Acknowledgements

This project was supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward bi-lateral agreement.

Demonstration of **Forage Peas** in Mixture with Cereals for Green feed Production

M. Hall[1], G. Issah[2], J. Weber[2], S. Brandt[3], J. Pratchler[3], B. Nybo[4], D. Sluth[4]

[1]East Central Research Foundation/Parkland College, Yorkton, SK; [2]Western Applied Research Corporation, Scott, SK; [3]Northeast Agriculture Research Foundation, Melfort, SK;[4]Wheatland Conservation Area, Swift Current, SK

Abstract

This project was undertaken in 2015 at four regional locations (Swift Current, Scott, Melfort and Yorkton, SK) to demonstrate the yield and forage value of pea/cereal mixtures in comparison to monocultures of oats, barley and peas. Thirteen treatments at each site included pea, barley and oat monocultures as well as pea/barley and pea/oat mixtures at two different seeding rates. The highest overall yielding mixture was Haymaker oats at 30% of full seeding rate and CDC Horizon pea at 100% of full seeding rate. In contrast the lowest yielding forage treatment was CDC Horizon pea seeded without a cereal crop. Regional differences in yield were noted. Soil zone, growing conditions, protein requirements of livestock and cost should all be considered when selecting forages for greenfeed production.

Objectives and Rationale

1. Project Objectives

The project was designed to assess and demonstrate the yield and forage value of pea/cereal mixtures in comparison to monocultures of oats, barley and peas across the soil zones in Saskatchewan.

2. Project Rationale

Regional Forage Specialists frequently receive calls from producers on the performance of pea/cereal mixtures when used for greenfeed. Producers also have questions on what seeding rates to use when planting pea/cereal mixtures, and how to stage the crop for harvest. There is some speculation that including peas in a greenfeed mixture can actually improve the forage quality. A potential benefit to including peas in a mixture is that they can reduce the reliance on commercial fertilizer, and help reduce input costs.

By demonstrating pea/cereal mixtures in side-by-side comparisons with monocultures of barley, oats and peas, producers will be able to see how these mixtures perform in their geographical area. This demonstration will increase the comfort level that producers have with seeding and managing annual forages on their farm and will provide more information on what species to choose when growing annual forages.

Methodology and Results

3. Methodology

Four research farms in varying soil zones were selected as sites for this demonstration project. Sites were located at Swift Current, SK (Wheatland Conservation Group); Melfort, SK (Northeast Agriculture Research Foundation); Yorkton, SK (East Central Research Foundation) and Scott, SK (Western Applied Research Corp). Saskatchewan Agriculture Regional Forage Specialists supervised and assisted at each of the four sites.

Seed was obtained in the spring of 2015 and distributed to the sites. Plots were sown in the spring of 2015 in randomized small plots with four (4) replicates. The annual forages were evaluated using thirteen (13) treatments (seeding rate is 100% of targeted seeding rate unless noted otherwise in brackets):

1. CDC Horizon Forage Pea*
2. CDC Maverick Barley
3. CDC Cowboy Barley (check)
4. CDC Haymaker Oats
5. CDC Baler Oats
6. CDC Haymaker Oats (30% rate) and CDC Horizon Peas (100% rate)
7. CDC Haymaker Oats (50% rate) and CDC Horizon Peas (50% rate)
8. CDC Maverick Barley (30% rate) and CDC Horizon Peas (100% rate)
9. CDC Maverick Barley (50% rate) and CDC Horizon Peas (50% rate)
10. CDC Haymaker Oats (30% rate) and 40-10 Peas (100% rate)
11. CDC Haymaker Oats (50% rate) and 40-10 Peas (50% rate)
12. CDC Maverick Barley (30% rate) and 40-10 Peas (100% rate)
13. CDC Maverick Barley (50% rate) and 40-10 Peas (50% rate)

**Due to lack of availability of CDC Tucker Forage Pea seed, CDC Horizon Forage Pea was substituted for the demonstration.*

Table 1, on the following page, shows the targeted seeding rate for the forages in this demonstration. Actual seeding rates for the sites are located in the results section of the report.

Table 1. Targeted Seeding Rate for ADOPT Pea/Cereal Greenfeed Demo

Annual Forage	Plants/ft^2
Peas	7-8
Oats	25
Barley	25

Pre-seeding burnoff with glyphosate was performed for weed control and Express® SG herbicide was utilized if required to control difficult weeds or Roundup Ready Canola. A low rate of nitrogen-phosphorus fertilizer (30 lbs N and 15 lbs P) was applied across all plots at seeding. Granular inoculant was also applied for the peas.

Data Collection

Plots were harvested based on appropriate stage for greenfeed harvest of each crop:

- Pea plots were cut when the bottom half of the pods are full and thick, while the upper pods were still developing
- Oat plots were cut at mid-late milk stage
- Barley plots were cut at mid-dough stage
- Cereal/Pea mixtures were cut based upon the appropriate stage for the cereal in the mixture

Table 2. ADOPT Pea/Cereal Mixtures for Greenfeed Important Dates in 2015

Site	Seeding Date	Harvest Date				
		Peas	Oats	Barley	Peas/Oats	Peas/Barley
Swift Current	May 27	July 29	Aug 4	July 29	July 29	July 29
Melfort	June 3	Aug 18	Aug 27	Aug 14	Aug 27	Aug 14
Yorkton	May 20	Aug 3-10*	Aug 3-10	Aug 3-10	Aug 3-10	Aug 3-10
Scott	May 19	July 24	July 24	July 24	July 24	July 24

**All plots were ready for harvest on August 3, however the plot harvester broke down twice and this resulted in a range of harvest dates from August 3 to 10th*
Please note: Dates that samples were sent to lab for analysis are listed in individual site descriptions

Establishment data was collected to determine whether targeted seeding rates were achieved. Seedling counts were done for 2 meters of row in total (1 meter for one row, and then 1 meter for another row) per plot. Counts were done at the 1-2 leaf stage, about 3 weeks after seeding.

Yield data was collected and reported on a dry matter basis. A portion of each plot was hand clipped or the entire plot was harvested with a mechanical harvester, pending equipment availability. Combined yield data for the four sites is displayed in Table 4, on page 7 of the report.

Forage nutritional quality was analyzed. Samples were collected from the two replicate plots that best represented each treatment at each site, which resulted in 26 samples per site. These samples were analyzed at Central Testing Labs by wet chemistry. Forage quality results for selected parameters are listed in Tables 7 to 10 in Appendix B.

4. Final Results

Swift Current Site:

Wheatland Conservation Area carried out the Swift Current demonstration which was located at NW 32-15-13 W3. The plots were in the brown soil zone on clay loam soils which had been summer-fallowed in 2014. Seeding was done with a Fabro-built plot drill with atomjet knife openers at nine inch (9”) row spacing on May 27, 2015. Fertilizer was side-banded at seeding to provide the equivalent of fifteen (15) pounds of phosphorus and thirty (30) pounds of nitrogen.

Harvest took place on July 29, 2015 for the majority of the treatments and on August 4, 2015 for the baler oats and haymaker oats.

100% seeding rates at the Swift Current site were:
Peas: 133 lbs/ac
Barley: Maverick 155 lbs/ac and Cowboy 149 lbs/ac
Oats: Haymaker 112.2 lbs/ac and Baler 114.8 lbs/ac
Rates were calculated by weighing 1000 kernels of each seed type. Ten percent additional seed was added to compensate for mortality.

Establishment was evaluated three weeks after seeding and the site supervisor noted that seedling emergence was good and all stands appeared healthy at that time.

Samples were collected from the drying ovens and sent away for nutritional analysis on August 13 and 14, 2015. Yield and quality results for the Swift Current site are listed in Table 4 (page 7) and Table 9 (Appendix B).

Melfort Site:

The Melfort Research Farm at SE-31-44-18-W2 was the location of the Melfort demonstration. The site is located in the moist black soil zone on loam/clay-loam soils. The peas, oats and barley were sown into soil that had previously been summer fallowed and one litre per acre of Roundup transorb was used for pre-seeding weed control. Thirty (30) pounds of nitrogen fertilizer was broadcast and worked in prior to seeding and fifteen (15) pounds of phosphorus was seed-placed at seeding.

Seeding took place on June 3, 2015 and establishment was observed on June 18, 2015, with successful establishment observed at all plots. Harvest dates (based on recommended harvest stage) were:
Peas: August 18, 2015
Barley: August 14, 2015
Oats: August 27, 2015
Pea/Barley mixtures: August 14, 2015
Pea/Oat mixtures: August 27, 2015

100% seeding rates for the Melfort site were:
Peas: Horizon: 101.6 lbs/ac 40-10: 93.6 lbs/ac

Barley: Maverick: 199.5 lbs/ac   Cowboy: 128.6 lbs/ac
Oats: Haymaker: 113.7 lbs/ac Baler: 109.7 lbs/ac

The site supervisor noted that lodging became a problem for some of the greenfeed mixtures. As the oats and barley lodged, the peas grew up to fill the canopy and the cereals started to decay under the canopy. Lodging was observed and degree of lodging was scored on August 6, 2015 at the Melfort site as it appears that this may be a problem to successful production of pea/cereal greenfeed mixtures in the moist black soil zone. The results are shown in the table below on a scale of 1-8, where 1 indicates little-to-no lodging and 8 indicates the highest level of lodging. Note that all plots showed some degree of lodging.

Table 3. Pea and Cereal Lodging Scores at Melfort Research Farm Demonstration 2015

Treatment	Average Pea Lodging Score	Average Cereal Lodging Score
CDC Horizon Forage Pea	2.50	-
CDC Maverick Barley	-	6.50
CDC Cowboy Barley	-	5.25
CDC Haymaker Oats	-	4.75
CDC Baler Oats	-	5.50
Haymaker 30% Horizon 100%	4.25	4.50
Haymaker 50% Horizon 50%	4.00	5.50
Maverick 30% Horizon 100%	2.00	5.25
Maverick 50% Horizon 50%	3.50	5.50
Haymaker 30% 40-10 100%	1.50	7.00
Haymaker 50% 40-10 50%	1.50	6.50
Maverick 30% 40-10 100%	2.25	6.25
Maverick 50% 40-10 50%	1.50	7.00

Yield and quality results for the Melfort site are listed in Table 4 (page 7) and Table 7 (Appendix B).

Yorkton Site:

The Yorkton demonstration site was at the East Central Research Foundation (ECRF), located at SW 26-25-4 W2 in the black soil zone on clay-loam soil. The plots were sown to annual crops in 2014 and glyphosate and Express herbicide were used for weed control prior to seeding in 2015. Seeding took place on May 20, 2015 using a 10 foot Seedhawk, with fertilizer (30lbs N and 15 lbs P) side-banded.

100% seeding rates at the Yorkton site were:
Peas: 130 lbs/ac
Barley: Maverick 138 lbs/ac and Cowboy 133.5 lbs/ac
Oats: Haymaker 126 lbs/ac and Baler 112 lbs/ac

One June 8, 2015, establishment was assessed and seedlings appeared vigorous and healthy.
Plots were intended to have been harvested on August 3, 2015; however due to mechanical breakdowns of the forage harvester, harvest took place over three separate dates. Plots 101-103 and 301-302 took place on August 3; plots 104 to 202 and 303 to 401 were harvested August 4 and plots 203 to 213 and 402 to 413 were harvested on August 10 (see Appendix C for plot diagram). Forage samples for nutritional analysis were all taken on August 10, 2015. Yield and quality results for the Yorkton site are listed in Table 4 (page 7) and Table 10 (Appendix B).

Scott Site:
The demonstration plots at the Western Applied Research Corporation (WARC) in Scott, SK were located on south half of 17-39-20 W3rd. The soil type is moist dark-brown loam and the plots were sown to a wheat crop in 2014. Herbicide for pre-seeding control of volunteer wheat and weeds included Roundup and Pardner applied on May 15th, 2015.

Plots were sown May 19, 2015 with an R-tech seeder with 10' row spacing. Fertilizer was applied as monammonium phosphate (11-51-0) and seed placed with peas while urea was applied mid-row to meet the project's targeted fertilizer application rates. Peas were put in the seed row and barley/oats were side-banded in the combination treatments.

100% seeding rates at the Scott site were:
Peas: 146 lbs/acre*
Barley: Maverick 170.58 lbs/acre and Cowboy 164.29 lbs/acre
Oats: Haymaker 133.2 lbs/acre and Baler 128.46 lbs/acre
**Pea seeding rate was increased to include a 20% mortality rate*

Emergence of the cereals was observed on May 26, 2015 and pea emergence was observed on May 28, 2015. Emergence counts were completed on June 3, 2015. Harvest for forage quality and biomass took place on July 24, 2015. All crop stages were based on protocols for both peas and cereals. Samples were sent to the lab for forage quality analysis on July 27, 2015. Yield and quality results for the Scott site are listed in Table 4 (page 7) and Table 8 (Appendix B).

Yield
Significant regional differences in yields were observed in this demonstration. Table 4 (next page) illustrates average yield as well as yields for each treatment at each of the four locations. As this was a one-year demonstration, please note that some variations in yield by region are likely due to rainfall and temperature conditions in 2015 and may not present an accurate picture of typical results for that area. The Scott site reported that 2015 was a dry year and thus resulted in low yields compared to expectations.

Although scale of yields varied by region, some mixtures tended to be more or less successful overall in this demonstration. The highest-yielding mixture on average across all sites (3.06 metric tonnes/acre) was Haymaker oat at 30% and Horizon pea at 100% seeding rates. This mixture yielded highest at the Melfort, Yorkton and Swift Current sites. At the Scott site, the Maverick barley at 50% and Horizon pea at 50% blend produced a slightly higher but similar yield. At 50% seeding rates, the blends containing Maverick barley or Haymaker oats with Horizon peas were comparable in terms of yield and generally out-performed mixtures containing 40-10 peas. The lowest-yielding mixture at all four sites and on average (2.04 metric tonnes/acre) was Haymaker oats at 30% and 40-10 peas at 100% seeding rates.

Some mixtures produced higher yields on average than the monoculture cereal and pea crops, while others resulted in similar or slightly lower yields. For example: Haymaker oats alone yielded 4.85 metric tonnes/acre at Melfort; mixtures ranged from 3.14 tonnes/acre (in combination with 40-10 peas at 30%/100% rate) to 5.44 tonnes/acre (in combination with Horizon peas at 30%/100% rate). This indicates that selection of forage variety may be important to the ultimate success of the greenfeed crop in term of yield.

Table 4. Forage yield (metric tonnes/acre) at Melfort, Scott, Swift Current, and Yorkton in Summer 2015

#	Treatment	Average across locations MT/ac	Melfort MT/ac	Scott MT/ac	Swift Current MT/ac	Yorkton MT/ac
1	Horizon pea	1.96	2.28	0.86	1.25	3.44
2	Maverick barley	2.64	5.26	1.21	1.61	2.50
3	Cowboy barley (check)	2.36	5.03	1.01	1.42	1.97
4	Haymaker oats	2.61	4.85	1.02	1.75	2.81
5	Baler oats	2.94	5.17	1.00	1.90	3.69
6	Haymaker oats (30) Horizon pea (100)	3.06	5.44	1.20	1.99	3.59
7	Haymaker oats (50) Horizon pea (50)	2.77	4.79	1.22	1.60	3.48
8	Maverick Barley (30) Horizon pea (100)	2.64	4.62	1.03	1.61	3.31
9	Maverick Barley (50) Horizon peas (50)	2.74	4.57	1.23	1.71	3.45
10	Haymaker oats (30) 40-10 peas (100)	2.04	3.14	0.92	1.33	2.76
11	Haymaker oats (50) 40-10 peas (50)	2.35	3.45	1.04	1.51	3.38
12	Maverick Barley (30) 40-10 peas (100)	2.37	3.52	1.04	1.65	3.25
13	Maverick Barley (50) 40-10 peas (50)	2.40	4.05	1.12	1.58	2.84
P-value		0.15	<.0001	0.08	0.10	0.36
CV %		61.61	12.50	13.82	19.50	30.25
Mean		6246	10677	2640	3977	7691
LSD		5504	1909	612	1109	3328

Note: if P-value is lesser than 0.05, the treatments will be considered significantly different.
CV, coeffecient of variation; LSD, least significant difference at P =0.05
Data were analyzed for each location, and also for all locations.

Average cost per tonne of forage

In order to arrive at a cost per tonne for the 13 treatments, a calculation was made using total seed costs in comparison to average yield for each of the treatments (Table 5). The actual seed costs at time of purchase were: $20/bushel for forage peas, $10/bushel for forage oats, and $15.15 for forage barley. Total seed cost is based on the average seeding rates of all sites used, with a target of 7-8 plants per square foot for the peas and 25 plants per square foot for the cereals.

Table 5 calculations represent the seed cost (based on average seeding rates) as compared to the yield that each site reported in 2015. For example, the 50/50 Haymaker oats/Horizon peas blend cost $38.50 in seed and the Swift Current site yielded 1.60 tonnes/acre. At this yield, the cost was $24.02 per tonne of forage yield. Individual producers would need to compare other costs of production as well as consider their own seed costs and seeding rates when making this calculation, but this gives an indication of the importance of considering potential yield when making seed mixture decisions.

These calculations are for 2015 only and some of the differences in cost are likely due to environmental conditions. For example, Scott reported drier than normal conditions and poor yields as compared to an "average" year. This resulted in the costs at Scott being highest overall when calculated per tonne of forage produced, which may not be the case in future year, depending on seasonal conditions.

From a nutritional perspective, a producer might consider adding forage peas to a greenfeed mixture in an effort to increase protein in the forage. Total protein harvested per acre was compared for each of the 13 treatments and the results are listed in Table 6, in Appendix B.

Table 5. Average Seed Cost per Acre and Average Forage Cost per Tonne of Yield for Annual Forages at Four Sites

Treatment name	Total Seed Cost ($/ac)	Average Forage Cost ($/tonne yielded)			
		Melfort	Scott	Swift Current	Yorkton
CDC Horizon pea	$42.00	$18.44	$46.67	$33.62	$12.35
Maverick barley	$48.83	$9.28	$40.69	$30.25	$19.53
Cowboy barley (check)	$48.83	$9.70	$48.83	$34.33	$24.41
Haymaker oats	$35.00	$7.21	$35.00	$20.01	$12.50
Baler oats	$35.00	$6.77	$35.00	$18.39	$9.46
Haymaker oats (30) Horizon pea (100)	$52.50	$9.65	$43.75	$26.42	$14.58
Haymaker oats (50) Horizon pea (50)	$38.50	$8.03	$32.08	$24.02	$11.00
Maverick Barley (30) Horizon pea (100)	$56.65	$12.24	$56.65	$35.10	$17.17
Maverick Barley (50) horizon peas (50)	$45.41	$9.92	$45.41	$26.48	$12.27
Haymaker oats (30) 40-10 peas (100)	$52.50	$16.69	$58.33	$39.41	$18.75
Haymaker oats (50) 40-10 peas (50)	$38.50	$11.14	$38.50	$25.45	$11.32
Maverick Barley (30) 40-10 peas (100)	$56.65	$16.08	$56.65	$34.23	$17.17
Maverick Barley (50) 40-10 peas (50)	$45.41	$11.20	$41.28	$28.74	$16.22
Average of all treatments	**$45.83**	**$11.26**	**$44.53**	**$28.96**	**$15.13**

Calculation is based on average seeding rate of both varieties used for each forage species

5. **Conclusions/Recommendations**

This demonstration project was carried out to increase the uptake and acceptance of pea/cereal mixtures for greenfeed. Part of the challenge in the past has been a lack of agronomic information available to producers when growing pea/cereal mixtures for greenfeed. This study demonstrated what happens when you use different seeding rate combinations of peas and cereals, and also how to stage a mixture for greenfeed harvest.

From the demonstration, the highest overall yielding mixture was Haymaker oats at 30% of full seeding rate and CDC Horizon pea at 100% of full seeding rate. In contrast the lowest yielding forage treatment was when CDC Horizon was seeded alone without a cereal crop. This demonstration showed that there is a synergistic effect to including a cereal such as oats or barley when growing peas for greenfeed. Oat and barley varieties tended to produce similar yields when seeded alone. Looking at the differences in using a 50/50 (cereal/pea) seeding rate versus a 30/100 (cereal/pea) seeding rate, this did not have a consistent impact upon yield. The Haymaker oat and CDC Horizon pea mixture produced a higher yield on average at the 30/100 rate, while the Maverick barley and Horizon, and the Haymaker oat and 40-10 pea mixtures showed higher yields at the 50/50 rate on average. These results varied by site and it appears that soil zone and growing conditions had more impact on yield than seeding rate had in this demonstration.

Another way to evaluate the treatments is shown in Table 6 looking at total pounds of protein produced per acre, and this is where the full benefit of the pea/cereal mixtures can be shown. The highest protein yield was harvested from the plots containing the pea/cereal mixtures. In particular, the two highest protein yielding treatments were the Haymaker (30) and Horizon pea (100), and Maverick barley (30) and Horizon pea (100) mixtures.

One of the challenges when using peas is the larger seed size associated with them, which results in increased seed cost. This higher seed cost makes pea mixtures a pricier option than straight cereal mixtures when evaluated simply on a cost-per-tonne of feed basis. Adding peas to the mixtures increased the cost per tonne of the greenfeed in all mixtures, except when the peas and cereals were both sown at a 50% seeding rate. Due in part to its smaller seed size Baler oats was the lowest cost option when evaluating greenfeed options on a cost-per-tonne basis. However, from a nutritional perspective there were added benefits of having peas in a mixtures rather than growing a cereal monoculture. In general the peas tended to increase the protein value of the feed. The actual protein increase with peas varied from site to site, with the Melfort site showing the greatest overall protein increase of three-to-six percentage points, while the 100 percent pea treatment (CDC Horizon) had a seven percent increase over a cereal monoculture.

This project pointed out the difference between the two pea varieties. The CDC Horizon pea yielded higher than 40-10 across all the pea/cereal mixtures. This difference in part might be due to the different growth pattern of the ‘newer’ semi-leafless forage pea types which have a more ‘determinate’ growth pattern causing them to mature earlier and be more in sync with the cereal maturity stage. The semi-leafless types such as CDC Horizon also tend to be more upright in growth habit, whereas the 40-10 peas is more ‘viney’ and tended to spread more horizontally.

The results of this demonstration are based on one year of data only and additional years of data would be useful in determining the significance of the variations in yield and quality for these greenfeed mixtures. For example, the Scott site experiences abnormally dry conditions which likely contributed to the low yields reported. These lower yields resulted in increased cost per tonne of forage yielded. As lodging was a problem at the northeast site, this issue may also warrant further investigation. This demonstration used the same fertilizer treatment across all plots and it would be valuable for future projects to fine-tune fertilizer application to ensure maximum yield potential.

Appendix B – Charts and Tables

Table 6: Protein harvested per acre from each forage treatment (averaged across all 4 sites)

Treatment name	Protein Harvested (lbs/ac)
CDC Horizon pea	687
Maverick barley	638
Cowboy barley (check)	598
Haymaker oats	642
Baler oats	729
Haymaker oats (30) Horizon pea (100)	**930**
Haymaker oats (50) Horizon pea (50)	769
Maverick Barley (30) Horizon pea (100)	**828**
Maverick Barley (50) horizon peas (50)	774
Haymaker oats (30) 40-10 peas (100)	682
Haymaker oats (50) 40-10 peas (50)	712
Maverick Barley (30) 40-10 peas (100)	798
Maverick Barley (50) 40-10 peas (50)	709
Average of all treatments	730

Bold lettering indicates highest protein yields

Table 7. Forage Quality in Melfort, SK in summer 2015

#	Treatment	Acid Detergent Fibre (% DM*)	Crude Protein (% DM)	Neutral Detergent Fibre (% DM)	Relative Feed Value (DM)*	Total Digestible Nutrients (% AS FED)**
1	Baler oats	35.26	13.64	56.87	102.63	57.17
2	Cowboy barley (check)	28.80	13.04	47.84	121.13	62.09
3	Haymaker oats	36.33	13.84	57.19	103.38	56.32
4	Haymaker oats (30) 40-10 peas (100)	33.68	18.54	42.17	129.88	58.22
5	Haymaker oats (30) Horizon pea (100)	37.80	16.33	53.44	112.00	54.66
6	Haymaker oats (50) 40-10 peas (50)	34.88	17.32	47.62	116.50	57.50
7	Haymaker oats (50) Horizon pea (50)	35.82	14.92	52.33	105.88	56.65
8	Horizon pea	36.59	20.47	44.10	123.75	53.87
9	Maverick barley	31.72	15.40	48.83	128.00	59.27
10	Maverick Barley (30) 40-10 peas (100)	35.97	19.97	45.72	126.00	54.40
11	Maverick Barley (30) Horizon pea (100)	33.19	17.54	47.72	131.25	57.37
12	Maverick Barley (50) 40-10 peas (50)	35.72	16.20	48.22	124.38	55.24
13	Maverick Barley (50) horizon peas (50)	33.36	16.75	48.16	131.13	57.57
P-value		0.007	0.006	<.0001	<.0001	0.010
CV %		4.67	9.52	3.83	10.28	2.75
Mean		34.55	16.46	49.24	119.68	56.95
LSD		3.49	3.38	4.07	12.02	3.38

**DM=Dry Matter Basis*
***Melfort feed samples were submitted to lab at 8-10% moisture*

Note: if P-value is lesser than 0.05, the treatments will be considered significantly different.
CV, coeffecient of variation; LSD, least significant difference at P =0.05
Data were analyzed for each location

Table 8. Forage Quality in Scott, SK in summer 2015

#	Treatment	Acid Detergent Fibre (% DM*)	Crude Protein (% DM)	Neutral Detergent Fibre (% DM)	Relative Feed Value (DM)*	Total Digestible Nutrients (% As Fed)**
1	Baler oats	34.06	10.36	61.82	94.00	35.59
2	Cowboy barley (check)	29.86	9.94	54.19	113.50	38.50
3	Haymaker oats	34.98	9.96	60.97	94.00	35.82
4	Haymaker oats (30) 40-10 peas (100)	30.95	12.90	46.55	130.00	36.45
5	Haymaker oats (30) Horizon pea (100)	33.04	12.16	54.69	107.50	38.10
6	Haymaker oats (50) 40-10 peas (50)	34.12	11.60	55.92	103.50	36.54
7	Haymaker oats (50) Horizon pea (50)	34.69	11.22	58.82	98.00	35.49
8	Horizon pea	34.22	12.69	45.42	127.50	26.28
9	Maverick barley	26.21	9.27	48.83	130.50	40.71
10	Maverick Barley (30) 40-10 peas (100)	31.85	11.66	44.73	134.00	33.38
11	Maverick Barley (30) Horizon pea (100)	31.17	12.17	48.62	124.00	35.04
12	Maverick Barley (50) 40-10 peas (50)	29.50	10.72	47.15	130.00	36.92
13	Maverick Barley (50) horizon peas (50)	28.64	10.91	49.05	126.50	37.92
P-value		0.001	<.0001	<.0001	0.0004	0.035
CV %		4.75	4.46	4.59	6.53	7.94
Mean		31.79	11.20	52.06	116.38	35.90
LSD		3.26	1.08	5.16	16.42	6.16

**DM=Dry Matter Basis*

***Scott feed samples were submitted to lab at higher moisture content than the other samples. Peas were submitted at 57% moisture, Barley was submitted at 43% moisture, oats were submitted at 42% moisture, and pea/cereal mixtures had an average moisture content of 41%.*

Note: if P-value is lesser than 0.05, the treatments will be considered significantly different.
CV, coeffecient of variation; LSD, least significant difference at P =0.05
Data were analyzed for each location

Table 9. Forage Quality in Swift Current, SK in summer 2015

#	Treatment	Acid Detergent Fibre (% DM*)	Crude Protein (% DM)	Neutral Detergent Fibre (% DM)	Relative Feed Value (DM)*	Total Digestible Nutrients (% As Fed)**
1	Baler oats	31.04	15.41	57.33	105.50	59.84
2	Cowboy barley (check)	27.05	15.82	55.15	114.50	62.67
3	Haymaker oats	33.72	14.65	56.90	102.50	56.94
4	Haymaker oats (30) 40-10 peas (100)	32.28	16.72	45.37	131.50	58.94
5	Haymaker oats (30) Horizon pea (100)	29.39	16.37	46.84	132.50	62.54
6	Haymaker oats (50) 40-10 peas (50)	29.72	16.61	50.72	121.50	61.10
7	Haymaker oats (50) Horizon pea (50)	30.89	16.16	50.90	118.50	59.81
8	Horizon pea	36.98	14.69	47.09	119.00	54.84
9	Maverick barley	24.86	12.92	47.19	138.50	66.07
10	Maverick Barley (30) 40-10 peas (100)	27.84	15.62	45.67	137.00	63.49
11	Maverick Barley (30) Horizon pea (100)	22.97	14.13	44.27	149.00	68.51
12	Maverick Barley (50) 40-10 peas (50)	29.07	13.92	52.86	117.00	62.29
13	Maverick Barley (50) horizon peas (50)	22.49	14.62	45.40	147.00	68.47
P-value		0.005	0.352	0.023	0.057	0.012
CV %		9.28	9.67	7.34	10.51	4.78
Mean		29.10	15.20	49.67	125.69	61.96
LSD		5.83	3.18	7.88	28.55	6.39

**DM=Dry Matter Basis*
***Swift Current feed samples were submitted to lab at 8-10% moisture*

Note: if P-value is lesser than 0.05, the treatments will be considered significantly different.
CV, coeffecient of variation; LSD, least significant difference at P =0.05
Data were analyzed for each location

Table 10. Forage Quality in Yorkton, SK in summer 2015

#	Treatment	Acid Detergent Fibre (% DM*)	Crude Protein (% DM)	Neutral Detergent Fibre (% DM)	Relative Feed Value (DM)*	Total Digestible Nutrients (% As Fed)**
1	Baler oats	32.08	6.21	54.05	110.50	56.41
2	Cowboy barley (check)	28.95	6.44	48.78	127.00	60.69
3	Haymaker oats	32.49	6.37	50.29	118.00	56.42
4	Haymaker oats (30) 40-10 peas (100)	37.08	13.71	47.07	120.00	52.57
5	Haymaker oats (30) Horizon pea (100)	37.58	9.58	53.09	104.50	51.75
6	Haymaker oats (50) 40-10 peas (50)	34.66	10.65	47.85	120.50	51.56
7	Haymaker oats (50) Horizon pea (50)	37.60	7.53	56.86	98.50	51.64
8	Horizon pea	39.45	14.52	45.93	121.00	50.49
9	Maverick barley	30.67	6.97	50.41	120.50	58.98
10	Maverick Barley (30) 40-10 peas (100)	39.42	13.06	49.72	109.00	50.43
11	Maverick Barley (30) Horizon pea (100)	34.55	13.98	45.01	129.00	55.35
12	Maverick Barley (50) 40-10 peas (50)	34.82	12.80	43.60	132.50	54.65
13	Maverick Barley (50) horizon peas (50)	32.93	9.73	45.65	129.00	56.98
P-value		0.103	0.007	0.224	0.565	0.144
CV %		9.34	21.62	8.95	12.83	6.38
Mean		34.79	10.12	49.10	118.46	54.45
LSD		7.02	4.72	9.50	32.85	7.50

**DM=Dry Matter Basis*
***Yorkton feed samples were submitted to lab at 8-10% moisture*
Note: if P-value lesser than 0.05, the treatments will be considered significantly different.
CV, coeffecient of variation; LSD, least significant difference at P =0.05
Data were analyzed for each location

Phosphorus Fertilization and Fungicide Effects on **Faba bean** Establishment and Yield.

M. Hall[1]

[1]East Central Research Foundation/Parkland College, Yorkton, SK

Abstract

The effect of fungicide, phosphorus rate and phosphorus placement on the yield of faba bean was evaluated near Yorkton. No response to a split application of Headline at early flowering followed by Priaxor a 11 days later could be detected. This was not surprising as disease levels were extremely low. Faba bean yield was not responsive to added phosphorus despite soil P levels being classified as marginal.

Description

The objective of this trial were to demonstrate: 1) P fertilizer rate and placement effect on faba bean establishment and yield and 2) faba bean yield response to registered foliar fungicides. To accomplish these objective a small split-plot design experiment was established on the main farm site just south of Yorkton. The main plot factor contrasted no fungicide versus the application of headling @ early flower followed by Priaxor 11 days later. The subplot factor compared no phosphorus versus 25 and 50 kg/ha of P_2O_5 either seed placed or side banded.

Table 1. shows the dates of all the operations for 2015.

Table 1. Dates of Operations for 2015

Operation	Date 2015
Trial seeded	May 15
Emergence counts	June 5
In crop Odyssey + Centurion	June 8
In crop Centurion	June 18
Headline 1.6 l/ac at early flower on specific treatments	June 30
Priaxor 1.6 l/ac on specific treatments	July 10
Disease ratings	July 24
Harvested	Oct 10

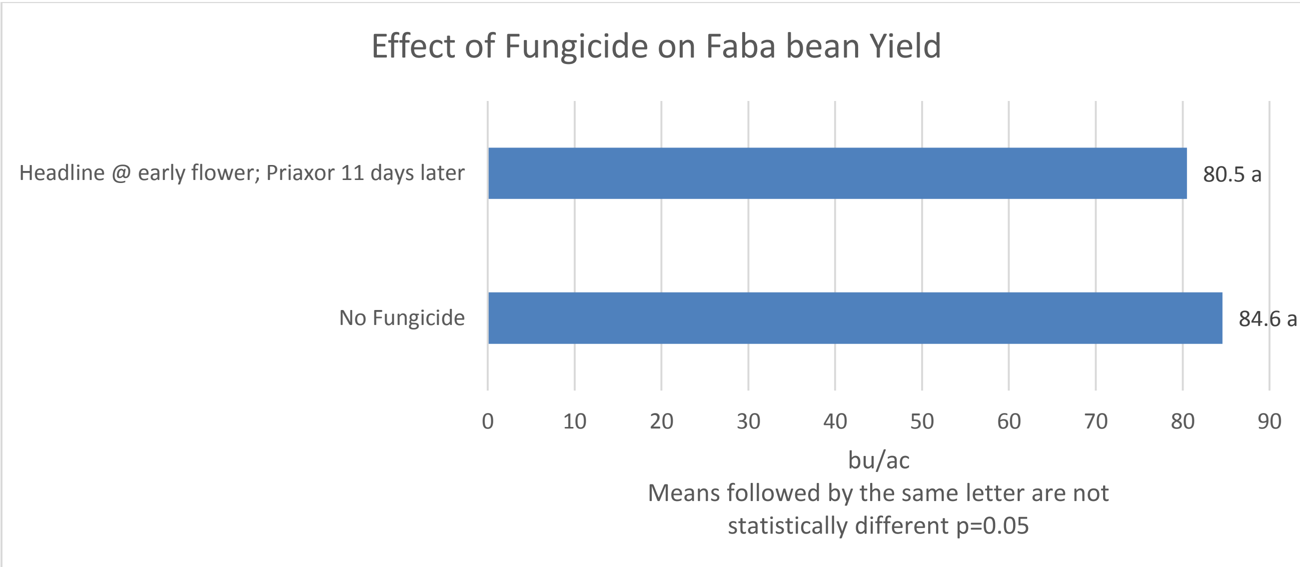
Results

The emergence of the faba bean within the trial averaged 4.3 plants/ft2 and did not statistically differ between treatments. Unfortunately, the timing of emergence was somewhat variable within some plots at elevated landscape positions as spring soil conditions were very dry. This surely added some unwanted variability to the trial making it difficult to separate means.

Leaf disease development was very low and did not differ between plots sprayed and unsprayed with fungicide (Figure 1). As a result no significant yield benefit from the application of fungicide could be detected (Figure 2).

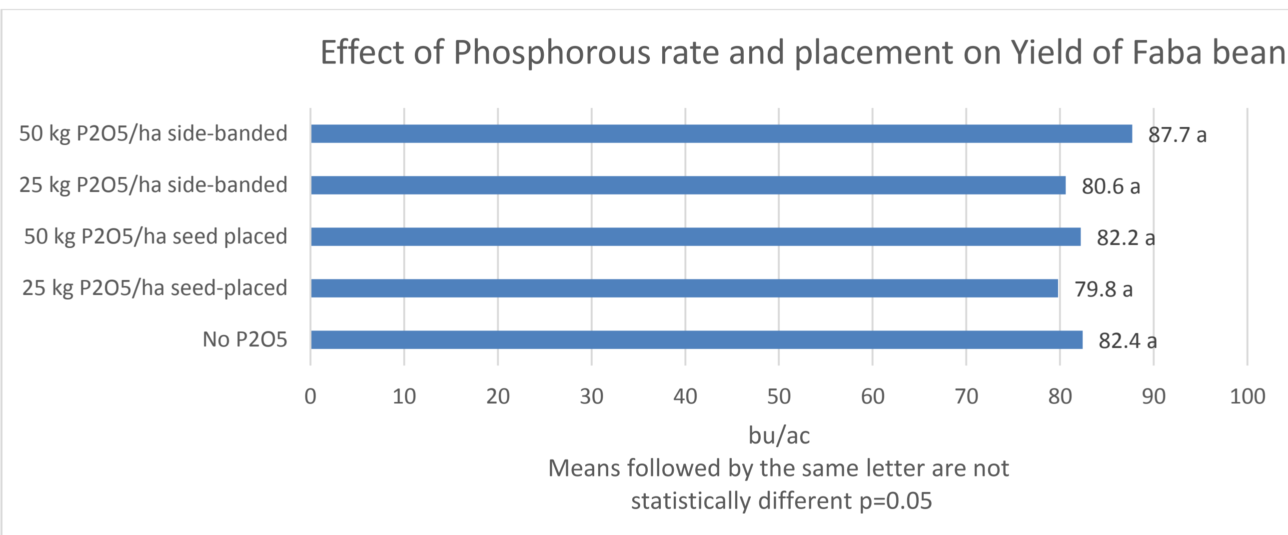
Figure 1. No Leaf Disease Present on Faba beans July 24, 2015

Figure 2.



While there was a tendency for yields to increase with increasing rate of phosphorus no significant differences between treatment means could be detected. Based on soil tests the phosphorus level in this trial could be considered marginal at 38 lbs/ac of P located in the top 12 inches of soil.

Figure 3



Conclusions

Disease pressure was very low in this trial and no response to fungicide could be detected. No response to added phosphorus could be detected despite soil phosphorus levels being marginal. Variability in the timing of crop emergence (due to dry conditions) may have added unwanted variability to the trial data.

Acknowledgements

This project was supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward bi-lateral agreement.

Evaluating Inoculant Options for **Faba beans**

M. Hall[1], C. Holzapfel[2], C. Catellier[2], G. Issah[3], J. Weber[3], G. Hnatowich[4], B. Nybo[5], L. Shaw[6]

[1]East Central Research Foundation/Parkland College, Yorkton, SK; [2]Indian Head Agricultural Research Foundation, Indian Head, SK; [3]Western Applied Research Corporation, Scott, SK; [4]Irrigation Crop Diversification Corp, Outlook, SK;[5]Wheatland Conservation Area, Swift Current, SK;[6]Southeast Agricultural Research Foundation, Redvers, SK

Abstract

Only results from the Yorkton trial are currently available. Results from the other sites will be included when they come available.

A 2 level factorial trial was established near Yorkton. The first factor contrasted the faba bean varieties FB9-4 and Snowdrop. The second factor compared various rates and combinations of Nodulator and TagTeam against an un-inoculated check. Faba beans from all inoculant treatments were well nodulated including the un-inoculated check. This would suggest the faba beans were capable of utilizing indigenous rhizobia that may have been present at the site. No differences in height, seed yield or tissue nitrogen could be detected between any inoculant treatments. Nodulator peat and the 1X TagTeam rate significantly improved emergence of the un-inoculated check however, the combination of the two inoculants did not. The results from this trial are a little odd and more study is required before recommendations can be made.

Description

Interest in growing faba beans has been increasing. Faba beans grow well under moist conditions and are not as susceptible to aphanomyces root rot disease as are peas or lentils. Producers could potentially reintroduce a legume into their rotations by growing faba beans. There are a number of inoculants available specifically for faba bean but few comparisons have been made between products. The objective of this study was to evaluate different rates and combinations of Nodulator peat and TagTean granular on the faba bean varieties snowdrop and FB9-4. FB9-4 has a very large seed and is intended for human consumption. Not all seeders can accommodate the large seed size. Snowdrop has a much smaller seed size and is a low tannin variety intended for livestock feed. Trials were established Yorkton, Indian Head, Scott, Outlook, Swift Current and Redvers. However, only results from Yorkton are available at this time. The trials were established as a 2 level factorial with 4 replicates. The first factor contrasted faba bean compared the faba bean varieties FB9-4 and Snowdrop. The second factor contrasted the following 8 inoculant comparisons:

1. Un-inoculated check
2. Nodulator peat for Faba Beans
3. 0.5x rate TagTeam Granular for Faba bean

4. 1x rate TagTeam Granular for Faba bean
5. 2x rate TagTeam Granular for Faba bean
6. Nodulator peat for Faba Beans + TagTeam granular for Faba Beans at 0.5x
7. Nodulator peat for Faba Beans + TagTeam granular for Faba Beans at 1x
8. Nodulator peat for Faba Beans + TagTeam granular for Faba Beans at 2x

Table 1. lists the dates of operation.

Table 1. Dates of Operations for 2015

Operation	Date 2015
Trial seeded	May 15
Emergence counts	June 1
Odyssey + Centurion	June 8
Centurion	June 18
Plant tissue samples	July 30
Plant heights	?
Harvest	Oct 11

Results

No interaction between variety and inoculant was detected for any of the measures. In other words, the effect of inoculant did not differ between varieties. Thus only treatment means for main effects have been presented (Table 2).

The plant density of Snow drop was significantly more than FB9-4 (Table 2). However, emergence at the time of assessment for both varieties was about half of the targeted rate. Emergence was particularly low for higher landscape positions where the soil was dryer. Rains by mid-June spurred on more germination of seed and plots filled in however, this resulted in variable crop staging particularly in high landscape position plots. There were significant differences in plant density between inoculant treatments. Nodulator peat or 1X rate of TagTeam significantly increased emergence of faba bean relative to the Un-inoculated check. However, the combination of the two products did not significantly affect emergence. The author is at a loss to explain these effects.

Table 2. Least squares means for main effects of variety and inoculant on plant density, height, Tissue N and seed yield of faba bean at Yorkton in 2015.

Main effect	Plant Density	Height	Seed Yield	Tissue-N
Variety	---Plants/m^2---	----cm----	-----Bu/ac----	------%-----
Snow drop	32.8 a	133.5 a	77.5 a	4.1 a
FB9-4	26.4 b	99.3 b	75.9 a	3.9 a
Inoculants				
Un-inoculated	27.9 bc	108.6 a	75.5 a	4.1 a
Nodulator peat	34.4 a	118.9 a	78.9 a	4.0 a
0.5X TagTeam	32.5 ab	118.4 a	76.8 a	4.1 a
1X TagTeam	35 a	118.5 a	80.3 a	4.1 a
2X TagTeam	27.8 bc	114.6 a	79.7 a	3.9 a
Nodulator peat + 0.5X TagTeam	25.7 c	111.8 a	69.6 a	4.3 a
Nodulator peat + 1X TagTeam	25.3 c	113.4 a	76.8 a	3.8 a
Nodulator peat + 2X TagTeam	28.3 bc	127.1 a	76 a	3.8 a

Snow drop was a significantly taller variety than FB9-4. Inoculant did not have a significant effect on crop height.

Yield and level of Tissue N did not significantly differ between varieties or between any of the inoculant treatments. Casual observation found excellent nodulation on all treatments including the Un-inoculated treatments. It would appear that native levels of rhizobia were sufficient. Faba beans can utilize the same rhizobia species utilized by peas. However, the author is unaware if the trial site has ever had a history of peas. Peas have certainly not been grown on the site for at least 5 years.

Conclusions

All treatments were well inoculated including the un-inoculated check suggesting indigenous rhizobia were well utilized by the faba beans. No differences could be detected between inoculants in terms of plant height, seed yield and tissue-N. Nodulator peat and the 1X rate of TagTeam increased plant emergence but did not affect emergence when used together. The results from this trial seem odd and more experimentation is required before recommendations can be made. Results from the other sites will be included in this report when they come available.

Acknowledgements

This project was supported by the Saskatchewan Pulse Growers

Effect of Macro and Micro Nutrients on **Canaryseed** Development and Yield

W. May[1] , M. Hall[2], S. Brandt[3], L. Grenkow[4], B. Nybo[5], L. Shaw[6]

[1]Agriculture & Agri-Food Canada, Indian Head, SK
[2]East Central Research Foundation/Parkland College, Yorkton, SK
[3]Northeast Agriculture Research Foundation, Melfort, SK
[4]Western Applied Research Corporation, Scott, SK
[5]Wheatland Conservation Association, Swift Current, SK
[6]South East Research Farm, Redvers, SK

Abstract

The yield response of canary seed to nitrogen, phosphorus, potassium chloride, sulphur, copper and zinc was evaluated at various locations across the province in 2014 and 2015. The only 2015 results currently available are from Yorkton. The response of nitrogen varied from 15 to 90 kg/ha. There were significant responses to chloride at 3 out 7 location years.

Description

Canary seed producers are becoming aware that chloride is an import nutrient to apply and that large amounts of nitrogen are not required for canary seed production. This project will help to demonstrate to canary seed growers the importance of a complete nutrient management package in canary seed.

The objective of the study was to demonstrate the effect of macro and micro nutrients on canary seed and provide professionals with up to date information on the benefits of macro and micro nutrients for canary seed.

Trials were setup as RCBD with four replicates. Table 1 below lists the treatments:

Table 1 Nutrients applied in each treatment

Treatment	N	P_2O_5	K_2O	Cl	S	Copper	Zinc	Combination of Micro's
------------------------------------ kg/ha ------------------------------------								
1	0							
2	15		20	18.1				
3	30		20	18.1				
4	30	30	20	18.1				
5	30	30	20	18.1	15			
6	60	30	20	18.1	15			
7	60	30			15			
8	60	30	20	18.1	15	3		
9	60	30	20	18.1	15		3	
10	60	30	20	18.1	15			Yes
11	90	30	20	18.1	15			Yes
12*	60	30		**	15	**KCl broadcast before seeding		
13*	60	30		***	15	***CaCl broadcast before seeding		

*Treatments only applied in 2015

Results

2014

The nutrients applied in each treatment are laid out in Table 1. At Indian Head the differences in grain yield from the treatments could not be separated statistically (Fig1). After examining the data it became apparent that the Cl response varied depending on the elevation. When the low elevation was separated from the high elevation there appears to be a chloride response at the higher elevation but not the lower elevations. This makes sense since chloride is mobile and will flow with the water. In the spring the elevation of each plot will be used to improve the statistical analysis of the site.

At Swift Current, the application of 15 kg N ha^{-1} combined with 18 kg Cl ha^{-1} increased the grain yield and removing Cl, treatment 7, reduced grain yield below the unfertilized check, treatment 1 (Figure 2).

At Melfort the addition of N fertilizer up to 30 kg ha^{-1} increased yield and N levels above 30 kg ha^{-1} did not increase yield and may have actually been slightly negative (Figure 3).

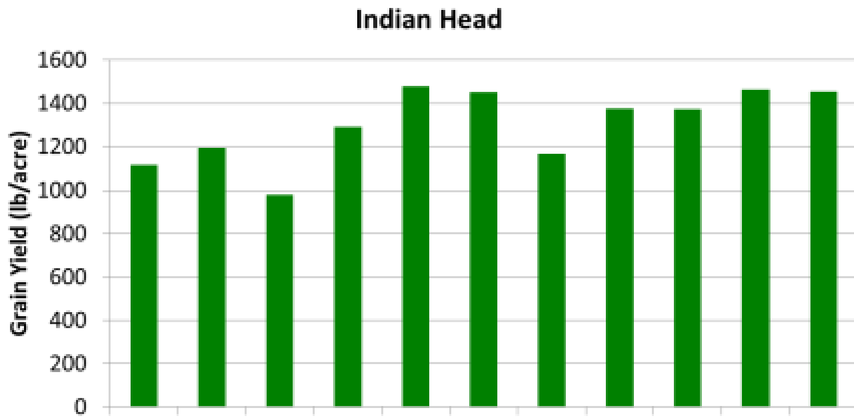
At Scott there was a strong yield response to N up to the highest rate of 90 kg ha^{-1} (Figure 4). In addition there appears to be a grain yield response to Zinc at Scott in 2014.

At Yorkton, the addition of 15 kg N ha^{-1} combined with 18 kg Cl ha^{-1} increased the grain yield and removing Cl, treatment 7, reduced grain yield back to the level of the unfertilized check (Figure 5). The application of N above 15 kg N ha^{-1}had little effect on grain yield.

2015

Only results from Yorkton are currently available. This report will be updated once the data from the other sites is made available. In 2015, canary seed yield continued to increase up to 90 Kg/ha of actual nitrogen.

Figure 1. The grain yield response of canary seed at Indian Head in 2014.



N	0	15	30	30	30	60	60	60	60	60	90
P	0	0	0	30	30	30	30	30	30	30	30
CL		18	18	18	18	18	0	18	18	18	18
S					15	15	15	15	15	15	15
Cu								3			
Zinc									3		
Cu, Z, Mg, B										Yes	Yes

Figure 2. The grain yield response of canary seed at Swift Current in 2014.

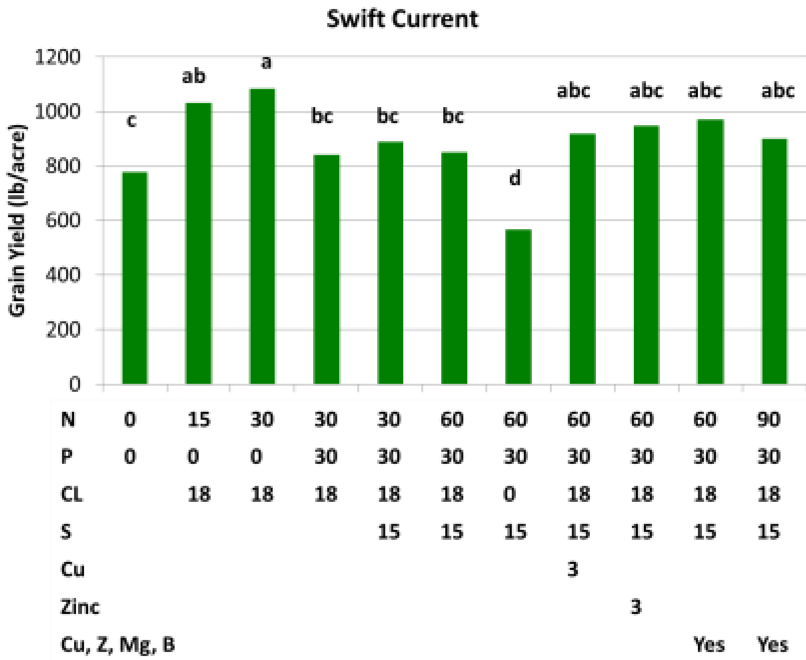


Figure 3. The grain yield response of canary seed at Melfort in 2014

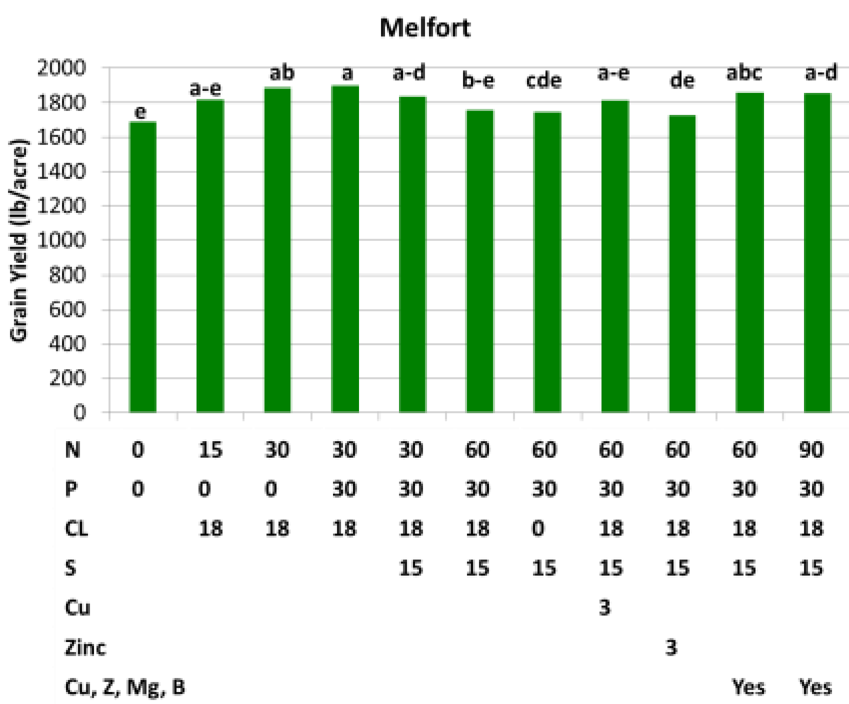


Figure 4. The grain yield response of canary seed at Scott in 2014

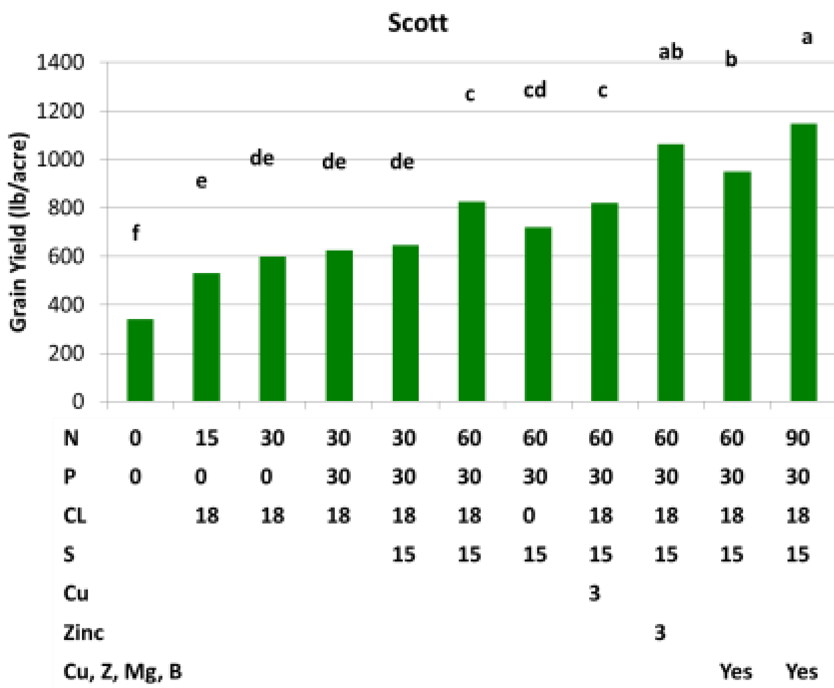


Figure 5. The grain yield response of canary seed at Yorkton in 2014

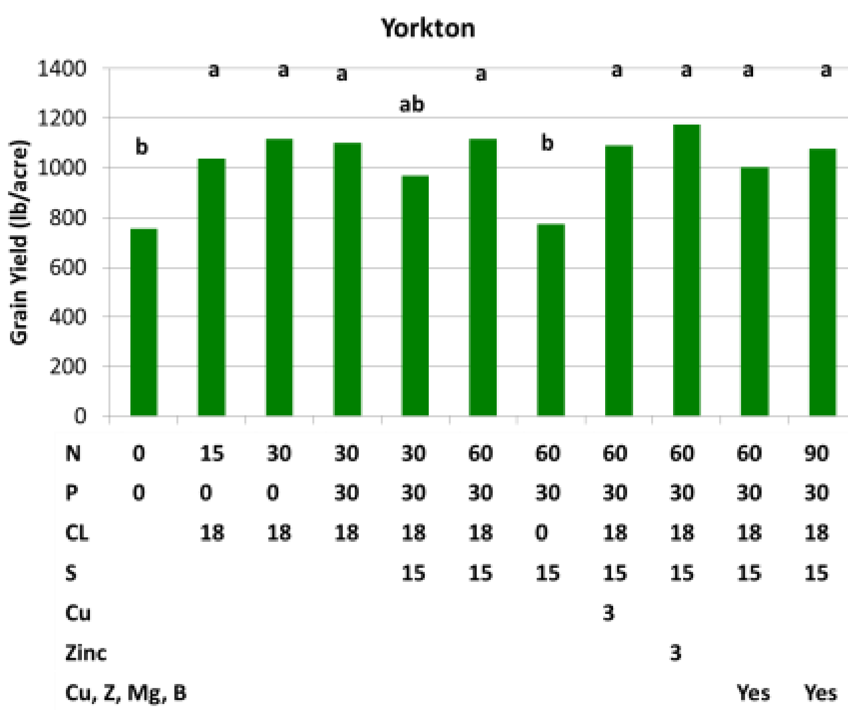
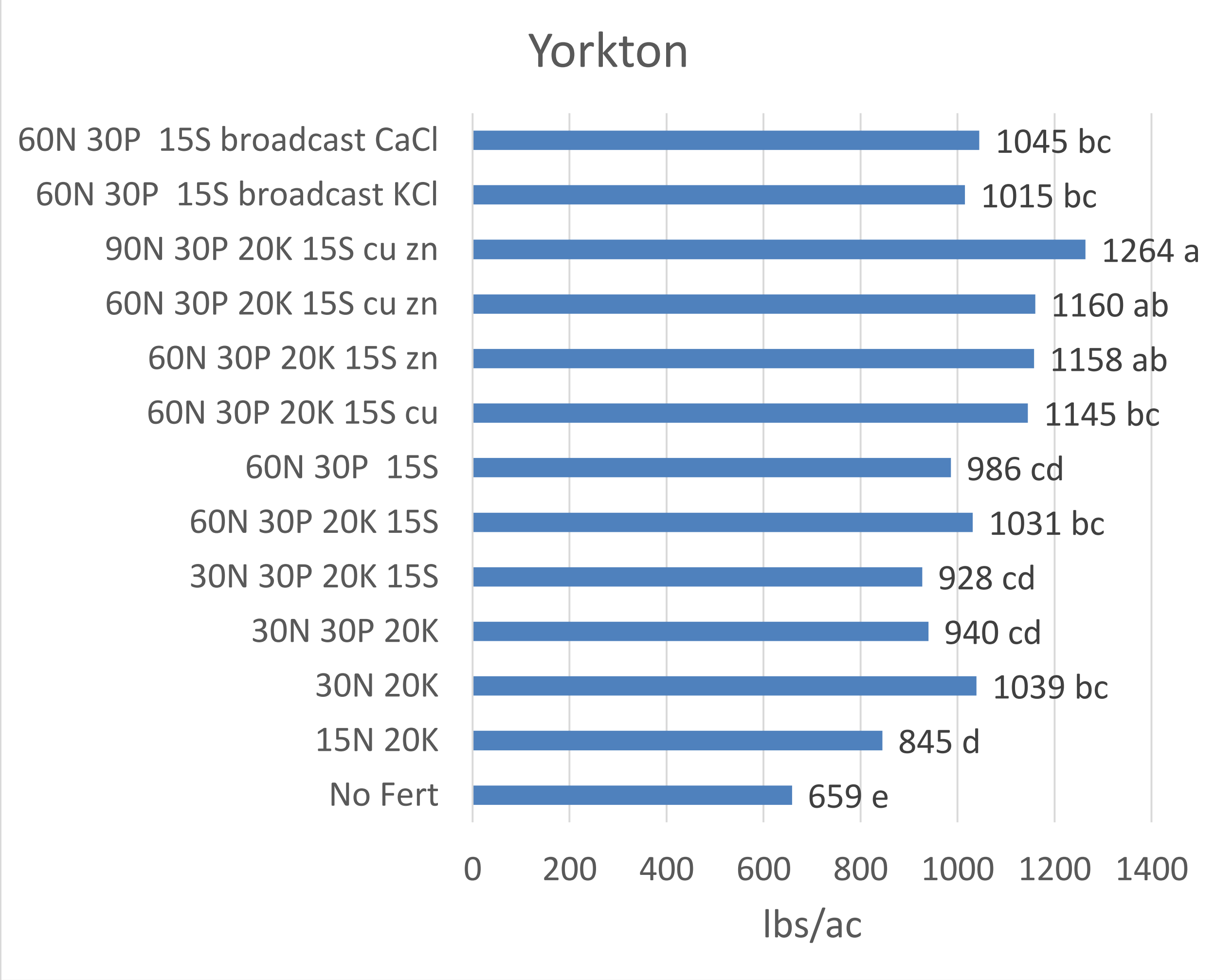


Figure 6. The grain yield response of canary seed at Yorkton in 2015



Conclusion

- N Fertilizer: response at all 7 location years
  - Optimum amount ranged from 15 to 90 kg/ha
- Chloride: response at 3 of 7 location years
- Test weight appears to be affected by a lack of Chloride
- Zinc: response at 1 out of 7 location years
- Still need to incorporate soil test results

Acknowledgements

This project was supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward bi-lateral agreement, and the Canaryseed Development Commission of Saskatchewan.

Yield Response and Test Weight Stability of **Oat** to Increasing Nitrogen

M. Hall[1], W. May[2], S. Brandt[3]

[1]East Central Research Foundation/Parkland College, Yorkton, SK
[2]Agriculture & Agri-Food Canada, Indian Head, SK
[3]Northeast Agriculture Research Foundation, Melfort, SK

Abstract

Growers can increase oat yields by increasing nitrogen rates. However, increasing nitrogen rates can also reduce oat test weights below the milling standard of 250 g/0.5L. Earlier studies have indicated that the test weights for some oat varieties may be more resilient to increasing nitrogen. The yield and test weight response of various oat varieties to increasing nitrogen was evaluated at Yorkton, Indian Head and Melfort in 2014 and 2015 and at Redvers in 2015. In these studies, increasing nitrogen rate increased oat yield. Oat yield was maximized at 120 kg/ha of actual nitrogen both years at Yorkton and Melfort. In contrast, Oat yield was maximized between 60 to 80 kg/ha of nitrogen at Indian Head and Redvers. Not surprisingly, increasing nitrogen rate increased lodging and decreased test weights. Test weight is also a function of environment and variety. Unfortunately, there doesn't seem to be a "silver bullet" variety that is the highest yielder and maintains an adequate test weight above 250 g/0.5L. Stride was a check at every location and appears to be a good variety at maintaining an adequate test weight. It produced the highest test weight in 5/7 site years but it also produced the lowest yields in 6/7 site years. Triactor was the highest yielding variety at Yorkton two years running but was not able to achieve an acceptable test weight of 250 g/0.5L at any nitrogen rate even though the CDC Dancer, Stride and Summit all achieved acceptable test weights at the highest rate of nitrogen at that location. AC Morgan was the highest yielding variety two years running at Melfort. . All varieties in 2014 (AC Morgan , CDC Minstrel, CDC Seabiscuit and Stride) easily achieved an acceptable test weight even at the highest nitrogen rate. However, this was not the case in 2015 where only Stride achieved an acceptable test weight. Again, Stride was the lowest yielding variety. At Redvers, neither CDC Morrison, Leggett, Souris or Stride maintained an acceptable test weight at nitrogen rates above 60 kg/ha. Souris had a particularly low test weights even at the lowest nitrogen rate. At Indian head the varieties CDC Big Brown and Stride maintained adequate test weights at the highest nitrogen rate two years running but they were also lower yielding at the high N rate compared to the other varieties.

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. Research indicates that some cultivars have a more stable test weight than other cultivars as the nitrogen fertilizer rate is increased. In addition, new cultivars are available that growers have not had a chance to see evaluated in their own area. This demonstration will help producers choose the appropriate nitrogen rate and cultivar when growing oats.

Objectives:

1) to validate under local conditions, recent research results showing that oat requires moderate amounts of N and that test weight declines as N rate is increased.

2) to expose growers to new oat cultivars that may be better than cultivars currently grown in the area of the trial.

3) to determine if the test weight of current oat cultivars vary in the stability of their test weight as the nitrogen rate is increased.

The trials were established as a 2 order factorial. First factor was Oat cultivar. Cultivars varied between locations. Cultivars picked for each location were based on two popular and two new cultivars with potential. Each oat cultivar was then evaluated at 40, 60, 80 and 120 Kg N ha-1 of actual nitrogen.

Results

The experiment was successfully carried out at Indian Head, Yorkton and Melfort in 2014 and 2015 and at Redvers in 2015.

Yorkton

At Yorkton the varieties Stride, CDC Dancer, Summit and Triactor were compared in 2014 and 2015 (Tables 1 and 2). No significantly interactions between variety and nitrogen rate were detected for either yield or test weight in either 2014 or 2015. There was no interaction for lodging in 2014 and lodging increased with increasing nitrogen for all varieties. There was an interaction for lodging in 2015. Lodging increased with increasing nitrogen for Triactor but decreased for all other varieties (Table 4). Obviously an unexpected result and the author is at a loss for an explanation. Oat yield significantly increased with increasing nitrogen up to 120 kg/ha in both years (Tables 1 and 2). In 2014 test weight significantly decreased with increasing nitrogen in 2014 but were not significantly affected in 2015. The test weight of Stride, CDC Dancer and Summit were all above the milling oat requirement of 250 g/0.5L regardless of nitrogen rate in either year (Tables 3 and 4). However, the test weight of Triactor was significantly less that the other varieties and was below the milling requirement in both years. This is unfortunate as Triactor yielded significantly more than the other varieties two years in a row. The yield standings for the rest of the varieties were not consistent between the years. In 2014, CDC Dancer significantly out yielded Stride and Summit. In 2015, CDC Dancer significantly yielded less than all the other varieties.

Table 1: Effect of Cultivar and Nitrogen Rate on Oat Yield and Development at Yorkton in 2014

	Plant Density Plants/m^2		Lodging 1-10		Yield Kg/ha		Test weight g/0.5L		Plump seed %		Thin Seed %		Groat Yield %	
Cultivar														
Stride	272.7	a	4.2	b	5960.9	c	266.0	a	96	ab	0.5	b	72.9	c
CDC Dancer	271.4	a	5.6	a	6512.6	b	257.0	c	96	bc	0.7	b	75.6	a
Summit	269.0	a	2.6	c	6194.8	c	260.8	b	96	a	0.6	b	74.5	b
Triactor	253.8	a	2.9	c	7049.3	a	242.4	d	95	c	1.3	a	72.4	c
Nitrogen Rate (kg/ha)														
40	268.5	a	3.5	b	5741.6	c	259.2	a	97	a	0.6	a	73.9	a
60	268.2	a	3.4	b	6309.8	b	257.6	ab	96	b	0.8	a	73.9	a
80	268.8	a	3.7	b	6642.0	b	256.6	b	96	bc	0.8	a	73.9	a
120	261.3	a	4.8	a	7024.2	a	252.8	c	95	c	0.9	a	73.8	a

Table 2. Yield response and test weight stability of oat to fertilizer N at Yorkton in 2015

	Plant Density /m2		Lodging 0-10		Grain yield kg/ha		Grain yield bu/ac		Test Wt g/0.5 L		Plump %		Thin %		Groat Yield %	
Cultivar																
Stride	184.9	c	4.3	b	4446.1	b	115.6	b	259.1	b	89.9	b	1.8	bc	73.6	c
CDC Dancer	212.0	ab	3.8	b	4165.5	c	108.3	c	268.3	a	91.7	a	1.6	c	82.4	a
Summit	219.6	a	5.2	a	4362.1	b	113.4	b	261.5	ab	91.4	a	1.9	ab	80.2	b
Triactor	199.6	bc	2.8	c	5168.6	a	134.4	a	241.0	c	89.4	b	2.1	a	72.6	d
Nitrogen Rate																
40 kg/ha	218.0	a	4.2	ab	3744.7	d	97.4	d	257.9	a	91.1	a	1.7	a	76.9	b
60 kg/ha	215.1	a	4.6	a	4273.9	c	111.1	c	256.5	a	91.2	a	1.8	a	77.0	b
80 kg/ha	196.8	b	3.8	bc	4686.4	b	121.9	b	262.6	a	90.2	b	2.0	a	77.2	b
120 kg/ha	186.3	b	3.4	c	5437.1	a	141.4	a	252.9	a	89.8	b	1.8	a	77.8	a
Interaction p value	0.0183		0.0008													

Table 3: N rate and cultivar interactions on Oat Yield at Yorkton in 2014

Description		Plant Density		Lodging		Yield		Test Wt		Wild Oat		Plump Seed		Thin Seed		Groat Yield	
Rating Unit		/m2		1-10		Kg/ha		g/0.5L		g/50g		%		%		%	
Cultivar	N Rate																
CDC Dancer	40 kg/ha	252.95	a	5.3	b	6244.1	bc	258.40	de	0.00	a	96	abc	0.7	c	75.7	ab
CDC Dancer	60 kg/ha	277.56	a	4.0	bc	6387.4	bc	261.09	cde	0.04	a	96	abc	0.6	c	75.8	ab
CDC Dancer	80 kg/ha	275.84	a	5.3	b	6565.7	bc	257.37	e	0.00	a	96	bc	0.5	c	76.3	a
CDC Dancer	120 kg/ha	279.28	a	8.0	a	6853.3	b	251.07	f	0.00	a	95	c	0.9	bc	74.7	b
Stride	40 kg/ha	283.46	a	3.3	bc	5027.0	d	268.87	a	0.00	a	97	a	0.4	c	73.2	cd
Stride	60 kg/ha	274.11	a	4.3	bc	5908.1	c	266.60	ab	0.00	a	96	abc	0.5	c	73.1	d
Stride	80 kg/ha	275.84	a	4.0	bc	6238.0	bc	265.15	abc	0.00	a	96	bc	0.6	c	72.3	d
Stride	120 kg/ha	257.38	a	5.3	b	6670.3	bc	263.35	bcd	0.00	a	95	bc	0.5	c	72.9	d
Summit	40 kg/ha	285.19	a	2.5	c	5301.4	d	263.67	bcd	0.01	a	97	ab	0.4	c	74.3	bc
Summit	60 kg/ha	266.49	a	2.3	c	5956.1	c	261.18	cde	0.01	a	96	abc	0.6	c	74.4	bc
Summit	80 kg/ha	274.11	a	3.0	bc	6702.1	bc	260.97	cde	0.00	a	96	abc	0.7	c	74.5	b
Summit	120 kg/ha	250.25	a	2.8	bc	6819.5	b	257.46	e	0.00	a	96	abc	0.7	c	74.9	b
Triactor	40 kg/ha	252.46	a	3.0	bc	6393.7	bc	245.72	g	0.00	a	96	abc	0.8	bc	72.3	d
Triactor	60 kg/ha	254.68	a	3.3	bc	6987.5	b	241.57	gh	0.01	a	95	bc	1.5	a	72.3	d
Triactor	80 kg/ha	249.51	a	2.5	c	7062.2	b	242.94	gh	0.00	a	95	c	1.3	ab	72.5	d
Triactor	120 kg/ha	258.37	a	3.0	bc	7753.6	a	239.26	h	0.00	a	95	c	1.7	a	72.6	d
LSD P=.05		34.02		1.50		534.98		3.653		0.030		1.0		0.4		0.98	
CV		8.92		27.34		5.82		1.0		0.69		0.71		36.66		0.92	
Treatment Prob(F)		0.3481		0.0001		0.0001		0.0001		0.5521		0.0001		0.0001		0.0001	

Table 4: N rate and cultivar interactions on Oat Yield at Yorkton in 2015

Description		Plant Density		Lodging		Yield		Yield		Test Wt		Plump Seed		Thin Seed		Groat Yield	
Rating Unit		/m2		1-10		Kg/ha		Bu/ac		g/0.5L		%		%		%	
Cultivar	N Rate																
CDC Dancer	40 kg/ha	214.0	bcd	4.5	b-e	3484.5	h	90.6	h	262.7	b	92.8	a	1.7	b-e	82.1	ab
CDC Dancer	60 kg/ha	229.8	abc	4.9	a-d	4021.6	fg	104.6	fg	264.7	b	92.4	ab	1.6	de	82.5	a
CDC Dancer	80 kg/ha	210.3	b-e	3.5	efg	4254.1	ef	110.6	ef	286.1	a	91.6	abc	1.5	de	82.8	a
CDC Dancer	120 kg/ha	194.0	d-g	2.4	gh	4901.9	c	127.5	c	259.8	bc	89.8	de	1.5	e	82.2	ab
Stride	40 kg/ha	200.3	c-f	4.9	a-d	3763.2	gh	97.8	gh	262.3	b	90.4	cde	1.6	b-e	73.5	ef
Stride	60 kg/ha	193.0	d-g	5.1	abc	4204.3	ef	109.3	ef	259.2	bc	90.1	cde	1.7	a-e	73.5	ef
Stride	80 kg/ha	175.8	fg	3.5	efg	4527.3	de	117.7	de	259.5	bc	89.1	e	2.2	a	73.2	fg
Stride	120 kg/ha	170.8	fg	3.6	d-g	5289.5	b	137.5	b	255.6	bcd	89.8	de	1.6	b-e	74.4	e
Summit	40 kg/ha	247.5	a	5.8	ab	3473.4	h	90.3	h	264.6	b	92.3	ab	1.6	cde	80.0	d
Summit	60 kg/ha	238.5	ab	6.0	a	4091.7	fg	106.4	fg	260.8	bc	92.0	ab	1.9	a-e	79.7	d
Summit	80 kg/ha	182.0	efg	5.1	abc	4473.7	de	116.3	de	261.9	b	90.9	bcd	2.0	a-e	80.0	cd
Summit	120 kg/ha	210.5	b-e	3.8	def	5409.5	b	140.7	b	258.7	bc	90.3	cde	2.0	a-e	81.2	bc
Triactor	40 kg/ha	210.1	b-e	1.7	h	4257.6	ef	110.7	ef	242.2	cde	89.1	e	2.0	a-d	72.2	g
Triactor	60 kg/ha	199.3	d-g	2.4	gh	4778.3	cd	124.2	cd	241.2	de	90.1	cde	2.1	ab	72.2	g
Triactor	80 kg/ha	219.0	a-d	3.1	fgh	5490.7	b	142.8	b	243.0	cde	89.2	e	2.2	a	72.7	fg
Triactor	120 kg/ha	170.0	g	3.9	c-f	6147.7	a	159.8	a	237.6	e	89.2	e	2.1	abc	73.5	ef
LSD P=.05		29.88		1.358		354.772		9.224		17.2365		1.558		0.503		1.15	
CV		10.44		23.82		5.57		5.57		4.77		1.23		19.67		1.06	
Treatment Prob(F)		0.0001		0.0001		0.0001		0.0001		0.0002		0.0001		0.03		0.0001	

Melfort

At Melfort the varieties Stride, CDC Minstrel, AC Morgan and CDC Seabiscuit were compared in 2014 and 2015 (Tables 5 and 6). No interaction for lodging was detected in 2014 and lodging increased significantly (albeit modestly) with increasing nitrogen rate. In 2015, there was a significant interaction with lodging and only Stride and Sea biscuit started to lodge at the 120 kg/ha nitrogen rate (Table 8). No significant interactions were detected for yield either year. Increasing nitrogen rate all the way to 120 kg/ha significantly increased oat yield in 2014 and 2015. In 2014, increasing nitrogen rate did not affect the test weight of any oat variety and test weights were well above the 250 g/0.5L requirement (Tables 5 and 7). In 2015, increasing nitrogen rate reduced the test weight of all varieties but to varying degrees. Test weights of AC Morgan and CDC Minstrel were not significantly reduced by increasing nitrogen whereas, the test weight of CDC Seabiscuit and Stride were significantly reduced (Table 8). It should be noted however, that test weights for AC Morgan, CDC Minstrel and CDC Seabiscuit were all below 250 g/0.5L regardless of nitrogen rate. Only Stride made the grade. Yield wise, AC Morgan significantly yielded more than all other varieties in 2014 and 2015. It is unfortunate that the AC Morgan the highest yielding variety could not meet test weight requirements in 2015 but it did in 2014. It is also unfortunate that Stride which was able to maintain an adequate test weight in 2015 was the lowest yielding variety.

Table 5. Yield response and test weight stability of oat to fertilizer N at Melfort in 2014

	Plant Density /m2		Lodge Belgian 0-5		Grain yield kg/ha		Grain yield bu/ac		Test Wt g/0.5 L		Plump %		Thin %		TKW g/1000 k	
Cultivar																
Stride	284.8	b	0.2	a	6714.3	b	175.8	b	282.89	a	88.216	a	2.288	a	32.7	d
CDC Minstrel	328.3	a	0	a	6874.6	b	180	b	276.31	ab	90.388	a	2.368	a	36.11	c
AC Morgan	295.6	b	0	a	7496.6	a	196.3	a	273.86	b	90.244	a	1.203	b	37.36	b
CDC Seabiscuit	277.8	b	0.3	a	6819.1	b	178.6	b	264.92	c	90.475	a	1.611	b	39.48	a
Nitrogen Rate																
40 kg/ha	294.7	a	0.05	b	6575.5	d	172.2	d	276.29	a	90.716	a	1.834	a	36.83	a
60 kg/ha	293.4	a	0.05	b	6850.6	c	179.4	c	275.44	a	90.635	a	1.936	a	36.93	a
80 kg/ha	305.3	a	0.05	b	7103.9	b	186	b	272.04	a	89.113	b	1.866	a	36	b
120 kg/ha	292.9	a	0.35	a	7374.6	a	193.1	a	274.2	a	88.859	b	1.833	a	35.9	b

Table 6. Yield response and test weight stability of oat to fertilizer N at Melfort in 2015

	Plant Density /m2		Lodging 0-10		Grain yield kg/ha		Grain yield bu/ac		Test Wt g/0.5 L		Plump %		Thin %		Groat Yield %	
Cultivar																
Stride	205.3	c	1.1	a	4923.4	d	128.0	d	254.2	a	89.3	C	1.8	a	71.4	c
CDC Minstrel	233.8	ab	1.0	a	5252.5	c	136.6	c	241.1	c	97.8	A	1.1	b	73.0	b
AC Morgan	245.1	a	1.0	a	5831.4	a	151.6	a	246.7	b	95.2	B	0.9	b	70.4	d
CDC Seabiscuit	214.3	bc	1.3	a	5544.2	b	144.2	b	232.1	d	95.3	B	1.5	a	74.0	a
Nitrogen Rate																
40 kg/ha	224.6	a	1.0	b	4549.9	d	118.3	d	246.9	a	95.4	A	1.1	a	71.9	a
60 kg/ha	220.6	a	1.0	b	5111.9	c	132.9	c	245.0	ab	94.7	ab	1.2	a	72.0	a
80 kg/ha	230.7	a	1.0	b	5631.2	b	146.4	b	242.8	b	94.1	B	1.5	a	72.2	a
120 kg/ha	222.5	a	1.4	a	6258.4	a	162.7	a	239.3	c	94.9	ab	1.3	a	72.6	a
Interaction p value			0.051						0.012							

Table 7: N rate and cultivar interaction on Oat Yield at Melfort in 2014																	
Description		Plant Density		Lodge Belgian		Grain Yield		Grain Yield		Test Wt		Plump		Thin		TKW	
Rating Unit		/m2		0-5		Kg/ha		Bu/ac		g/0.5L		%		%		g/1000g	
Cultivar	N Rate																
AC Morgan	40 kg/ha	292	a	0	b	7100.5	b-e	185.9	b-e	280.0	abc	90.4	abc	1.31	bc	36.9	cde
AC Morgan	60 kg/ha	298	a	0	b	7204.3	bcd	188.7	bcd	277.0	abc	90.7	abc	1.26	bc	37.9	bc
AC Morgan	80 kg/ha	291	a	0	b	7654.3	ab	200.4	ab	269.8	abc	89.7	abc	1.05	c	37.2	cde
AC Morgan	120 kg/ha	301	a	0	b	8027.3	a	210.2	a	268.6	abc	90.1	abc	1.19	bc	37.5	cd
CDC Minstrel	40 kg/ha	317	a	0	b	6404.0	f	167.7	f	282.0	a	91.9	a	2.23	abc	37.0	cde
CDC Minstrel	60 kg/ha	342	a	0	b	6713.3	c-f	175.8	c-f	279.4	a	90.2	abc	2.99	a	37.0	cde
CDC Minstrel	80 kg/ha	340	a	0	b	7024.0	c-f	183.9	c-f	266.2	a	90.5	abc	2.36	abc	35.0	e
CDC Minstrel	120 kg/ha	314	a	0	b	7357.0	bc	192.7	bc	264.0	a	89.0	abc	1.9	abc	35.5	de
CDC Seabiscuit	40 kg/ha	297	a	0.2	ab	6443.8	ef	168.7	ef	262.1	bc	91.6	ab	1.37	bc	40.7	a
CDC Seabiscuit	60 kg/ha	256	a	0.2	ab	6653.8	def	174.2	def	270.1	abc	90.7	abc	1.71	abc	39.9	a
CDC Seabiscuit	80 kg/ha	280	a	0.2	ab	6995.8	c-f	183.2	c-f	260.6	c	90.3	abc	1.53	bc	39.5	ab
CDC Seabiscuit	120 kg/ha	276.8	a	0.6	ab	7183.3	bcd	188.1	bcd	266.8	abc	89.3	abc	1.83	abc	37.8	bc
Stride	40 kg/ha	272	a	0	b	6353.8	f	166.4	f	285.0	a	88.9	abc	2.43	ab	32.8	f
Stride	60 kg/ha	277	a	0	b	6831.0	c-f	178.9	c-f	280.2	abc	90.9	ab	1.79	abc	32.9	f
Stride	80 kg/ha	309	a	0	b	6741.8	c-f	176.5	c-f	284.4	ab	86.1	c	2.53	ab	32.4	f
Stride	120 kg/ha	280	a	0.8	a	6930.8	c-f	181.5	c-f	281.9	abc	87.0	bc	2.40	abc	32.8	f
LSD P=.05		49.77		0.444		417.7		10.9		12.7		2.7		0.78		1.5	
CV		11.74		248.3		4.19		4.19		3.25		2.09		29.38		2.84	
Treatment Prob(F)		0.0577		0.0117		0.0001		0.0001		0.0032		0.0056		0.0001		0.0001	

Table 8: N rate and cultivar interaction on Oat Yield at Melfort in 2015

Description		Plant Density		Lodge Belgian		Grain Yield		Grain Yield		Test Wt		Plump		Thin		Groat Yield	
Rating Unit		/m2		0-5		Kg/ha		Bu/ac		g/0.5L		%		%		%	
Cultivar	N Rate																
AC Morgan	40 kg/ha	245.8	a	1.0	c	5007.9	fg	130.2	fg	248.2	c	95.3	bc	0.8	fg	70.2	e
AC Morgan	60 kg/ha	243.8	a	1.0	c	5591.8	de	145.4	de	247.2	cd	95.0	bc	0.7	g	70.3	e
AC Morgan	80 kg/ha	251.3	a	1.0	c	6107.5	bc	158.8	bc	246.9	cde	94.8	bc	1.0	d-g	70.4	e
AC Morgan	120 kg/ha	239.5	a	1.0	c	6618.4	a	172.1	a	244.4	cde	95.8	bc	0.9	efg	70.6	de
CDC Minstrel	40 kg/ha	235.8	a	1.0	c	4520.7	h	117.5	h	244.1	cde	98.0	a	1.0	d-g	72.3	bc
CDC Minstrel	60 kg/ha	215.0	a	1.0	c	4760.9	gh	123.8	gh	241.3	ef	97.5	a	1.2	c-g	72.3	bc
CDC Minstrel	80 kg/ha	255.0	a	1.0	c	5556.2	de	144.5	de	237.0	fg	97.4	a	1.4	a-e	73.2	ab
CDC Minstrel	120 kg/ha	229.5	a	1.0	c	6172.3	abc	160.5	abc	241.9	def	98.4	a	0.7	g	74.0	a
CDC Seabiscuit	40 kg/ha	199.5	a	1.0	c	4666.8	gh	121.3	gh	237.9	fg	96.0	b	1.2	c-g	73.8	a
CDC Seabiscuit	60 kg/ha	212.0	a	1.0	c	5467.9	def	142.2	def	236.4	fg	95.9	bc	1.3	b-f	74.2	a
CDC Seabiscuit	80 kg/ha	220.3	a	1.0	c	5614.1	de	146.0	de	232.3	g	94.3	c	1.9	a	73.9	a
CDC Seabiscuit	120 kg/ha	225.3	a	2.0	a	6427.9	ab	167.1	ab	221.8	h	95.0	bc	1.8	abc	74.1	a
Stride	40 kg/ha	217.5	a	1.0	c	4004.3	i	104.1	i	257.5	a	91.5	d	1.5	a-d	71.2	cde
Stride	60 kg/ha	211.5	a	1.0	c	4627.1	gh	120.3	gh	255.0	ab	88.7	e	1.9	ab	71.2	cde
Stride	80 kg/ha	196.3	a	1.0	c	5247.2	ef	136.4	ef	254.9	ab	88.4	e	1.8	ab	71.4	cde
Stride	120 kg/ha	195.8	a	1.5	b	5814.9	cd	151.2	cd	249.3	bc	88.2	e	1.9	ab	71.7	cd
LSD P=.05		47.0		0.5		470.0		12.2		5.8						1.3	
CV		14.7		30.3		6.1		6.1		1.7		1.99t		21.85t		1.3	
Treatment Prob(F)		0.2063		0.0052		0.0001		0.0001		0.0001		0.0001		0.0001		0.0001	

Indian Head

At Indian Head, the varieties Stride, Pinnacle, CDC Orrrin, and CDC Big Brown were compared in 2014 (Table 9). In 2015 the varieties compared were Stride, CDC Ruffian, CS Camden and CDC Big Brown (Table 10). No significant interactions were detected for lodging, yield or test weight in either year. In 2014, lodging did not differ between varieties but significantly increased with increasing nitrogen (Table 9). At higher rates of nitrogen the lodging was severe and it is likely the reason yield was maximized at only 60 kg/ha. In 2015, lodging was not a significant issue and did not significantly increasing with increasing nitrogen and yield was maximized at 80 kg/ha of actual N (Table 10). Lodging was significantly highest with Stride but was still fairly low. In 2014, there were no significant yield differences between varieties (Table 9). In 2015, Stride yielded significantly less than CDC Ruffian, CS Camden and CDC Big Brown (Table 10). Across varieties test weights were reduced by increasing nitrogen in 2014 and 2015. However, the effect was more pronounced in 2014. In 2014, Stride and CDC Big Brown had the highest test weights. Both these varieties managed to maintain test weights above 250 g/0.5L even at 120 kg/ha of nitrogen (Table 11). In contrast, the test weight of CDC Orrin and Pinnacle were reduced below 250 g/0.5L at 120 and 80 kg/ha of actual nitrogen, respectively. In fact, the test weight of Pinnacle was reduced all the way down to 233 g/0.5L at 120 kg/ha of nitrogen. In 2015, Stride and CDC Big Brown again had the highest test weights and were able to maintain an acceptable test weight above 250g/0.05L all the way up to 120 kg/ha (Table 12). In contrast, CDC Ruffian and CS Camden did not produce an acceptable test weight at any rate of applied nitrogen. Based on yield and test weight CDC Big Brown looks like a good variety. In both years it was high yielding and maintained an acceptable test weight. While Stride also maintained an acceptable test weight it was the lowest yielding variety two years running.

Table 9. Yield response and test weight stability of oat to fertilizer N at Indian Head in 2014

	Plant Density /m2		Lodging 1-10		Grain yield kg/ha		Groat yield %		Test Wt g/0.5 L		Plump %		Thin %		Wild Oat g/50g	
Cultivar																
Stride	241	a	6.8	a	3727	a	70	bc	262	a	80	b	2.2	a	0.252	a
Pinnacle	222	a	6.6	a	4028	a	71	b	248	c	93	a	1.2	b	0.264	a
CDC Orrin	229	a	6.6	a	4125	a	70	c	256	b	93	a	1.4	b	0.250	a
CDC Big Brown	229	a	5.8	a	4038	a	73	a	261	ab	91	a	2.6	a	0.216	a
Nitrogen Rate																
40 kg/ha	229	a	3.8	d	3426	b	72	a	264	a	92	a	1.5	b	0.260	a
60 kg/ha	231	a	5.8	c	4144	a	71	b	261	a	91	a	1.5	b	0.191	a
80 kg/ha	234	a	7.4	b	4051	a	71	c	256	b	90	a	1.8	b	0.313	a
120 kg/ha	227	a	8.8	a	4296	a	70	d	246	c	85	b	2.6	a	0.219	a

Table 10. Yield response and test weight stability of oat to fertilizer N at Indian Head in 2015

	Plant Density /m2		Lodging 1-10		Grain yield kg/ha		Grain yield bu/ac	Test Wt g/0.5 L		Plump %		Thin %		Groat Yield %	
Cultivar															
Stride	201.26	b	1.9	a	3649.6	b	96	254.614	b	87.6	c	1.42	a	72.13	b
CDC Ruffian	213.56	b	1.3	b	4253.19	a	111	248.414	c	96.53	a	0.54	c	74.77	a
CS Camden	209.77	b	1	b	4520.38	a	118	246.309	c	93.84	b	0.86	b	71.94	b
CDC Big Brown	250.47	a	1.3	b	4400.69	a	115	260.498	a	96.94	a	0.86	b	75.12	a
Nitrogen Rate															
40 kg/ha	227.3	a	1.1	a	3651.41	c	96	253.24	a	93.35	a	0.95	a	72.75	b
60 kg/ha	234.58	a	1.4	a	4118.68	b	108	253.991	a	93.08	a	0.96	a	73.17	b
80 kg/ha	219.3	a	1.3	a	4503.69	a	118	252.338	ab	93.94	a	1.01	a	73.94	a
120 kg/ha	193.88	a	1.6	a	4550.08	a	119	250.266	b	94.54	a	0.76	a	74.11	a

Table 11: N rate and cultivar interactions on Oat Yield at Indian Head in 2014

Description		Plant Density		Lodge		Grain Yield		Test Wt		Wild Oat		Plump Seed		Thin Seed		Groat Yield	
Rating Unit		/m2		1-10		Kg/ha		g/0.5L		g/50g		%		%		%	
Cultivar	N Rate																
CDC Big Brown	40 kg/ha	243.60	a	2.3	f	3330.3	b	268.3	ab	0.19	a	93	a	2.2	bc	75.2	a
CDC Big Brown	60 kg/ha	233.76	a	5.5	b-f	4165.0	ab	262.8	abc	0.29	a	92	a	2.2	bc	72.5	b
CDC Big Brown	80 kg/ha	228.84	a	7.3	a-d	4486.8	ab	260.7	a-d	0.11	a	92	a	2.3	bc	72.3	bc
CDC Big Brown	120 kg/ha	209.56	a	8.0	abc	4172.8	ab	250.3	de	0.13	a	87	ab	3.6	a	70.8	b-f
CDC Orrin	40 kg/ha	237.04	a	5.0	c-f	3355.2	b	261.1	abc	0.34	a	94	a	1.2	cd	70.2	c-f
CDC Orrin	60 kg/ha	229.25	a	5.5	b-f	4224.8	ab	260.3	a-d	0.16	a	95	a	0.9	cd	69.9	def
CDC Orrin	80 kg/ha	225.15	a	6.8	a-e	4133.9	ab	256.0	cde	0.20	a	93	a	1.5	cd	70.1	c-f
CDC Orrin	120 kg/ha	223.51	a	9.0	ab	4787.5	a	246.9	e	0.04	a	92	a	2.0	bcd	69.0	f
Pinnacle	40 kg/ha	210.79	a	3.5	ef	3614.8	ab	258.8	a-d	0.10	a	94	a	0.9	cd	72.1	bcd
Pinnacle	60 kg/ha	218.59	a	5.5	b-f	4440.1	ab	253.3	cde	0.08	a	95	a	0.7	d	71.5	b-e
Pinnacle	80 kg/ha	232.94	a	7.5	a-d	3808.8	ab	247.9	e	0.49	a	92	a	1.2	cd	69.5	ef
Pinnacle	120 kg/ha	225.15	a	10.0	a	4251.3	ab	233.2	f	0.16	a	89	a	2.0	bcd	69.0	f
Stride	40 kg/ha	222.69	a	4.3	def	3405.4	b	269.1	a	0.15	a	87	ab	1.6	cd	71.2	b-f
Stride	60 kg/ha	241.96	a	6.8	a-e	3749.1	ab	267.8	ab	0.08	a	81	b	2.0	bcd	71.0	b-f
Stride	80 kg/ha	248.93	a	8.0	abc	3777.7	ab	257.9	bcd	0.22	a	81	b	2.3	bc	70.2	c-f
Stride	120 kg/ha	251.39	a	8.3	abc	3974.9	ab	252.8	cde	0.31	a	72	c	3.0	ab	69.4	ef
LSD P=.05		13.9		2.2		760.3		6.6		1.61		5		0.8		1.4	
CV		9.81		23.46		13.37		1.81		46.96		4.0		31.89		1.37	
Prob(F)		0.3123		0.0001		0.0070		0.0001		0.0818		0.0001		0.0001		0.0001	

Table 12: N rate and cultivar interactions on Oat Yield at Indian Head in 2015

Description		Plant Density		Lodge		Grain Yield		Test Wt		Plump Seed		Thin Seed		Groat Yield	
Rating Unit		/m2		1-10		Kg/ha		g/0.5L		%		%		%	
Cultivar	N Rate														
CDC Big Brown	40 kg/ha	244.0	a	1.3	b	3796.6	e-h	259.7	ab	95.7	abc	1.1	a-d	74.4	b
CDC Big Brown	60 kg/ha	255.1	a	1.0	b	4639.3	ab	261.9	a	97.2	ab	0.7	c-f	75.1	ab
CDC Big Brown	80 kg/ha	261.2	a	1.5	b	4891.4	ab	259.5	ab	97.2	ab	1.1	a-e	75.7	a
CDC Big Brown	120 kg/ha	241.6	a	1.5	b	4275.4	b-f	260.9	ab	97.8	a	0.5	ef	75.3	ab
CDC Ruffian	40 kg/ha	234.2	ab	1.0	b	3904.8	d-g	248.7	def	95.8	abc	0.6	c-f	74.4	b
CDC Ruffian	60 kg/ha	239.1	a	1.5	b	4006.9	c-f	249.5	def	96.8	ab	0.5	def	74.5	b
CDC Ruffian	80 kg/ha	223.1	abc	1.3	b	4620.4	abc	250.8	de	96.5	ab	0.6	def	75.3	ab
CDC Ruffian	120 kg/ha	157.9	d	1.3	b	4480.7	bcd	244.7	fg	97.0	ab	0.4	f	75.0	ab
CS Camden	40 kg/ha	202.6	a-d	1.0	b	3695.5	fgh	248.3	d-g	95.0	abc	0.7	c-f	70.9	f
CS Camden	60 kg/ha	207.9	a-d	1.0	b	4498.0	a-d	247.6	d-g	92.9	cd	1.0	b-f	71.7	def
CS Camden	80 kg/ha	220.2	a-d	1.0	b	4770.8	ab	246.1	efg	93.7	bc	0.9	b-f	72.2	cde
CS Camden	120 kg/ha	208.3	a-d	1.0	b	5117.2	a	243.2	g	93.7	bc	0.9	b-f	73.0	c
Stride	40 kg/ha	228.4	abc	1.3	b	3208.7	h	256.3	bc	87.0	ef	1.4	ab	71.4	ef
Stride	60 kg/ha	236.2	a	2.3	a	3330.5	gh	257.0	abc	85.4	f	1.6	a	71.4	ef
Stride	80 kg/ha	172.7	bcd	1.5	b	3732.2	e-h	252.9	cd	88.3	ef	1.5	ab	72.6	cd
Stride	120 kg/ha	167.7	cd	2.5	a	4327.0	b-e	252.3	cd	89.6	de	1.2	abc	73.2	c
LSD P=.05		62.6		0.7		629.7		5.4		3.6		0.6		1.0	
CV		20.1		37.7		10.5		1.5		2.7		47.5		1.0	
Prob(F)		0.0406		0.002		0.0001		0.0001		0.0001		0.004		0.0001	

Redvers

At Redver in 2015, comparisons between the oat varieties Stride, Leggett, Souris and CDC Morrison were made (Table 13). There was an interaction for lodging. Lodging increased significantly with increasing nitrogen for all varieties except CDC Morrison which was not significantly affected (Table 14). No interactions with grain yield were detected and yield significantly increased up to 60-80 kg/ha of actual nitrogen (Table 13). There were no significant yield differences between varieties. There was a significant interaction for test weight. Excepting Souris, the test weight of varieties significantly declined with increasing nitrogen. None of the varieties maintained an acceptable test weight of 250g/0.5L at nitrogen rates of 80 kg/ha or higher (Table 14). Acceptable test weight were achieved by CDC Morrison, Leggett and Stride but only at the lowest nitrogen rate of 40 kg/ha. Souris did not have an acceptable test weight at any nitrogen rate.

Conclusions

Increasing nitrogen rate increased oat yield. Oat yield was maximized at 120 kg/ha of actual nitrogen both years at Yorkton and Melfort. In contrast, Oat yield was maximized between 60 to 80 kg/ha of nitrogen at Indian Head and Redvers. Not surprisingly, increasing nitrogen rate increased lodging and decreased test weights. Test weight is also a function of environment and variety. Unfortunately, there doesn't seem to be a "silver bullet" variety that is the highest yielder and maintains an adequate test weight of 250 g/0.5L. Stride was a check at every location and appears to be a good variety at maintaining an adequate test weight. It produced the highest test weight in 5/7 site years but it also produced the lowest yields in 6/7 site years. Triactor was the highest yielding variety at Yorkton two years running but was not able to achieve an acceptable test weight of 250 g/0.5L at any nitrogen rate even though the CDC Dancer, Stride and Summit all achieved acceptable test weights at the highest rate of nitrogen. AC Morgan was the highest yielding variety two years running at Melfort. . All varieties in 2014 (AC Morgan , CDC Minstrel, CDC Seabiscuit and Stride) easily achieved an acceptable test weight even at the highest nitrogen rate. However, this was not the cast in 2015 where only Stride achieved an acceptable test weight. Again, Stride was the lowest yielding variety. At Redvers, neither CDC Morrison, Leggett, Souris or Stride maintained an acceptable test weight at nitrogen rates above 60 kg/ha. Souris had a particularly low test weights even at the lowest nitrogen rate. At Indian head the varieties CDC Big Brown and Stride maintained adequate test weights at the highest nitrogen rate two years running but they were also lower yielding at the high N rate compared to the other varieties.

Table 13. Yield response and test weight stability of oat to fertilizer N at Redvers in 2015

	Plant Density /m2		Lodging 1-10		Grain yield kg/ha		Grain yield bu/ac	Test Wt g/0.5 L		Plump %		Thin %		Groat Yield %	
Cultivar															
Stride	163	c	1.6	b	4416.6	a	115.7	248.5	a	64.1	b	4.7	b	68.9	c
Leggett	247	b	2	b	4542.3	a	118.9	244.6	b	77.1	a	3.9	b	70.1	ab
Souris	278	a	4.7	a	4490.5	a	117.6	236.0	c	64.2	b	8.6	a	70.7	a
CDC Morrison	261	ab	1.1	c	4602.8	a	120.5	247.5	a	72.3	a	4.0	b	69.5	bc
Nitrogen Rate															
40 kg/ha	231.8	a	1.4	c	4154.4	b	108.8	248.9	a	77.4	a	3.4	b	69.7	a
60 kg/ha	237.8	a	1.7	bc	4466.0	a	116.9	244.6	b	67.2	b	6.0	a	69.4	a
80 kg/ha	238.1	a	2.2	b	4667.6	a	122.2	243.9	b	66.0	b	5.9	a	70.0	a
120 kg/ha	241.4	a	3.3	a	4764.2	a	124.8	239.2	c	67.3	b	5.3	a	70.1	a
Interaction p value			0.006					0.09							

Table 14: N rate and cultivar interactions on Oat Yield at Redvers in 2015															
Description		Plant Density		Lodge		Grain Yield		Test Wt		Plump Seed		Thin Seed		Groat Yield	
Rating Unit		/m2		1-10		Kg/ha		g/0.5L		%		%		%	
Cultivar	N Rate														
CDC Morrison	40 kg/ha	249.5	abc	1.0	e	4177.1	bc	250.8	abc	74.9	abc	3.8	bcd	69.3	a-d
CDC Morrison	60 kg/ha	258.4	abc	1.0	e	4407.5	bc	246.9	bcd	68.6	a-e	5.0	bcd	68.5	cd
CDC Morrison	80 kg/ha	283.5	ab	1.0	e	4771.7	ab	247.5	bcd	71.0	a-d	4.0	bcd	69.9	abc
CDC Morrison	120 kg/ha	253.9	abc	1.2	e	5054.8	a	244.8	de	74.8	abc	3.3	cd	70.3	ab
Leggett	40 kg/ha	241.6	bc	1.4	de	4119.3	c	251.8	ab	82.4	a	2.5	d	70.0	abc
Leggett	60 kg/ha	245.1	abc	1.4	de	4458.7	abc	245.3	cd	74.7	abc	4.5	bcd	69.3	a-d
Leggett	80 kg/ha	228.3	c	1.6	de	4535.1	abc	243.3	def	72.8	a-d	5.2	bc	69.8	abc
Leggett	120 kg/ha	273.1	ab	3.9	b	5056.1	a	238.2	fg	78.6	ab	3.6	bcd	71.1	a
Souris	40 kg/ha	280.0	ab	2.3	cd	4227.2	bc	239.0	fg	77.9	ab	4.3	bcd	70.3	abc
Souris	60 kg/ha	285.4	a	4.6	ab	4579.6	abc	234.2	g	60.9	cde	11.1	a	70.5	ab
Souris	80 kg/ha	266.2	abc	7.1	a	4632.4	abc	236.2	g	58.6	de	11.0	a	71.0	a
Souris	120 kg/ha	280.5	ab	5.8	ab	4522.9	abc	234.5	g	59.5	de	9.9	a	70.9	ab
Stride	40 kg/ha	156.0	d	1.0	e	4094.1	c	254.2	a	74.3	abc	3.1	cd	69.1	bcd
Stride	60 kg/ha	162.4	d	1.0	e	4418.4	bc	251.8	ab	64.4	b-e	4.8	bcd	69.4	a-d
Stride	80 kg/ha	174.2	d	1.4	de	4731.1	ab	248.6	a-d	61.6	cde	4.9	bcd	69.3	a-d
Stride	120 kg/ha	158.0	d	3.8	bc	4422.9	bc	239.3	efg	56.1	e	6.6	ab	67.9	d
LSD P=.05															
CV															
Prob(F)															

Acknowledgements

This project was supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward bi-lateral agreement, and the Prairie Oat Growers Association.