



# IHARF

INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

## 2023 Annual Report



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## Introduction

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

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

## IHARF Mandate

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

## IHARF Board of Directors

IHARF is led by a nine member Board of Directors consisting of producers and industry stakeholders who volunteer their time and provide guidance to the organization. Residing all across southeastern Saskatchewan, IHARF Directors are dedicated to the betterment of the agricultural community as a whole. The 2023 IHARF Directors included:

- Cameron Gibson - President (*Kendal*)
- Justin Ritco - Vice President (*Regina*)
- Jennifer Kreway - Secretary / Treasurer (*Regina*)
- Curtis Russell (*Indian Head*)
- Thom Weir (*Yorkton*)
- Dean Douhaniuk (*Killaly*)
- Heather Haus (*Glenavon*)
- Curtis Kuchinka (*Regina*)
- Bryce Thompson (*Regina*)

## Ex-Officio

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

- Bruce McArthur - Associate Director, RDT
- Bill May - Research Scientist
- Chris Omoth - Research Assistant
- Sherri Roberts - Crops Extension Specialist

## IHARF Staff

The 2023 team of IHARF staff included:

- Danny Petty - Executive Manager
- Chris Holzapfel - Research Manager
- Christiane Catellier - Research Associate
- Zak Woidyla - Research Technician
- Doug Stewart - Farm Technician

## Dr. Guy Lafond Memorial Award

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

The recipient of the Dr. Guy Lafond Memorial Award in 2023 was Michelle Ross. Michelle was pursuing her Master's degree in Agricultural and Research Economics at the University of Saskatchewan, looking at optimal rate and nitrous oxide (N<sub>2</sub>O) mitigation policy for nitrogen application in Saskatchewan Canola.

## Extension Events

### Indian Head Crop Management Field Day

On July 19, 2023, IHARF and AAFC hosted the annual Indian Head Crop Management Field Day. 159 producers and agronomists from across the prairies came for tours led by IHARF, AAFC researchers, and industry specialists.

### AgriARM Research Update

IHARF, along with Agriculture Applied Research Management (AgriARM) sites from across the province, jointly hosted the virtual AgriARM Research Update on March 26, 2024. The event highlighted components of each organizations applied research and demonstration programs.

## **IHARF Soil and Crop Management Seminar**

On February 7, 2024, IHARF hosted its annual winter seminar at Balgonie, SK. 134 producers and agronomists attended for the IHARF Soil & Crop Management Seminar. Presentations were delivered by:

- Bill May (AAFC Indian Head)
- Chris Holzapfel (IHARF)
- Christiane Catellier (IHARF)
- Alireza Akhavan (Saskatchewan Ministry of Agriculture)
- Michelle Ross (University of Saskatchewan)
- Ember Simpson (Water Security Agency)

Presentations from each speaker are available for download at [www.iharf.ca](http://www.iharf.ca).

## **2023 IHARF Partners**

Every year, IHARF works with many organizations dedicated to advancing agriculture into the future. IHARF would like to thank all of our partners for their outstanding support of our efforts in 2023:

### **Platinum**

- Agriculture & Agri-Food Canada - Indian Head Research Farm
- BASF
- Bayer CropScience
- Canada/Saskatchewan ADOPT Program
- Saskatchewan AgriARM Program
- Saskatchewan Canola Development Commission
- Saskatchewan Ministry of Agriculture
- Saskatchewan Pulse Growers
- Saskatchewan Strategic Field Program
- Saskatchewan Wheat Development Commission
- Syngenta

### **Gold**

- Alberta Agriculture Funding Consortium
- Alberta Wheat & Barley Commission
- Koch Agronomic Services
- Lucent BioSciences
- Saskatchewan Barley Development Commission
- Western Grains Research Foundation

## Silver

- Anuvia
- BrettYoung
- CanMar Farms Indian Head
- Canola Council of Canada
- Equinom
- NorthStar Genetics
- Novozymes BioAg
- Saskatchewan Farm Stewardship Association
- Sulvaris

## Bronze

- Corteva AgriSciences
- Delage Farms
- GrainShark.com
- Manitoba Crop Alliance
- Mazergroup
- Nutrien Ag Solutions
- Saskatchewan Flax Development Commission
- Saskatchewan Mustard Development Commission
- Town of Indian Head

## AgriARM

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

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

The eight AgriARM organizations found throughout Saskatchewan include:

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

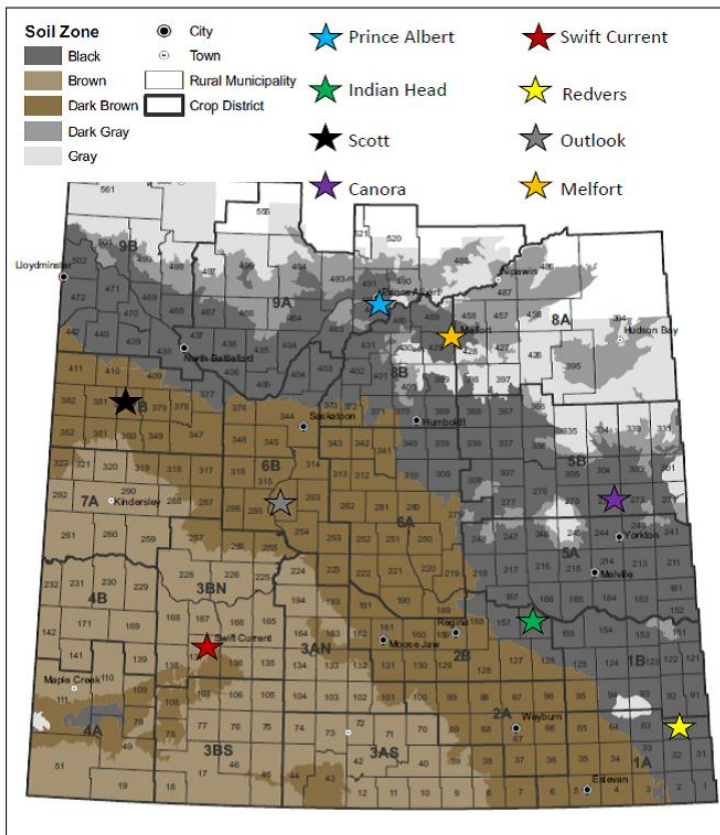


Figure 1. Locations of organizations comprising the Saskatchewan AgriARM Network.

## Environmental Data

Weather data for Indian Head, Melfort, Scott, and Swift Current, Saskatchewan are provided, as many of the studies were conducted at these locations and the data were combined for analyses. Data were obtained from an Environment Canada weather station found at each site, and accessed online [[http://climate.weather.gc.ca/historical\\_data/search\\_historic\\_data\\_e.html](http://climate.weather.gc.ca/historical_data/search_historic_data_e.html)].

Mean temperatures and total precipitation amounts for May through August are presented with the long-term averages for each location in Tables 1 and 2, respectively. In 2023, all locations were considerably warmer than average, with May and June being particularly hot. Swift Current was the wettest relative to its average annual precipitation. Unfortunately, some of its precipitation came in the form of hail resulting in an estimated yield loss of 50%. The remaining locations received 49-70% of the long-term average precipitation amounts with Indian Head and Melfort being the driest in absolute terms and as a percentage of their long-term averages.

Table 1. Mean monthly temperatures for the 2023 growing season and long-term normals (1981-2010).

|               |        | May  | June | July | August | Average |
|---------------|--------|------|------|------|--------|---------|
|               |        | °C   |      |      |        |         |
| Indian Head   | 2023   | 14.0 | 19.4 | 16.7 | 17.7   | 17.0    |
|               | Normal | 10.8 | 15.8 | 18.2 | 17.4   | 15.6    |
| Melfort       | 2023   | 14.1 | 19.2 | 16.9 | 17.3   | 16.9    |
|               | Normal | 10.7 | 15.9 | 17.5 | 16.8   | 15.2    |
| Scott         | 2023   | 14.9 | 17.2 | 17.1 | 17.4   | 16.7    |
|               | Normal | 10.8 | 14.8 | 17.3 | 16.3   | 14.8    |
| Swift Current | 2023   | 14.8 | 17.7 | 18.4 | 18.8   | 17.4    |
|               | Normal | 11.0 | 15.7 | 18.4 | 17.9   | 15.8    |

Table 2. Total monthly precipitation for the 2023 growing season and long-term normals (1981-2010).

|               |        | May  | June | July | August | Total |
|---------------|--------|------|------|------|--------|-------|
|               |        | mm   |      |      |        |       |
| Indian Head   | 2023   | 12.9 | 49.6 | 15.9 | 40.8   | 119   |
|               | Normal | 51.8 | 77.4 | 63.8 | 51.2   | 244   |
| Melfort       | 2023   | 17.9 | 26.4 | 16.4 | 50.0   | 111   |
|               | Normal | 42.9 | 54.3 | 76.7 | 52.4   | 226   |
| Scott         | 2023   | 16.6 | 81.8 | 29.7 | 31.7   | 159   |
|               | Normal | 38.9 | 69.7 | 69.4 | 48.7   | 227   |
| Swift Current | 2023   | 41.0 | 32.9 | 63.3 | 42.1   | 179   |
|               | Normal | 42.1 | 66.1 | 44.0 | 35.4   | 188   |

## Research

IHARF trials were situated at various locations in the Indian Head area, with the majority of projects located on NW28-18-12 W2 and NE27-18-12 W2. Each trial consisted of numerous plots, each representing a specific treatment being evaluated in that particular project (eg. rates, seed treatments, varieties, etc.). Apart from the specific treatments being evaluated, plots were generally cared for using best management practices and in a manner which was consistent with normal or typical practices in the Indian Head area. Deviations in agronomy and crop management have been specified where required as a result of the study objectives or treatments being evaluated and are indicated in the description of each trial. In general, plots were seeded as early as possible in mid-May to early June, with 8' x 35' plots and 12" row spacing using a SeedMaster air drill, or with 12' x 35' plots and 12" row spacing using a ConservaPak air drill. Cultivars and varieties were representative of those used by producers in the area, and recommended seeding practices (i.e. rate, depth) were typically used. Fertility and insect, weed and disease levels were normally kept non-limiting using commercial fertilizers and registered pesticide products so that yields would not be limited by anything other than the specific treatments being evaluated. Plots were desiccated or swathed when required, and harvested as closely as possible to the appropriate timing using a Wintersteiger plot combine, Kincaid-8 XP plot combine, or modified MF300 combine. Apart from the treatments being evaluated, all agronomy and crop management practices were consistent for every plot within a trial.

## Statistical Analyses

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

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

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

| Treatment   | Plant Density<br><i>(not significantly different)</i> | Yield<br><i>(significantly different)</i> |
|-------------|---|---|
| Treatment 1 | 87 a  | 32 b                                      |
| Treatment 2 | 89 a  | 45 a                                      |

## Units

Some data are reported in metric terms (i.e. yield responses shown in kilograms per hectare), particularly in cases where it was not practical to convert the values to bushels per acre (bu/ac), as in certain figures. For reference, yield values ranging from 1000-6000 kg/ha are shown with the corresponding values in bu/ac for each crop in Table 4. Alternatively, multiplying the kg/ha by 0.8921 will provide the lbs/ac, making for an easy conversion to bu/ac.

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

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

## Disclaimer

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

# Fall Rye Cover Crop Effects on Canola Establishment and Response to Nitrogen

Holzapfel, C. (IHARF)

## Description

The objectives of this project were to demonstrate the effects of a preceding cereal rye cover crop on (1) the overall establishment and yield of canola in addition to early season weed densities relative to canola grown with no cover crop and (2) the nitrogen (N) fertilizer requirements and overall response to N fertilization relative to canola grown with no cover crop. A field trial was first initiated near Indian Head, SK in the fall of 2020 and repeated the following two growing seasons. The treatments were a factorial combination of two cover crop scenarios (either none or a fall rye cover crop) and five N fertilizer rates (25, 60, 105, 140, and 175 kg N/ha). The N fertilizer rates were not adjusted for residual soil NO<sub>3</sub>-N because of the possibility that cover crops might impact soil N levels and subsequent fertilizer requirements. The ten treatments were arranged in a four replicate RCBD.

## Results

Data collection included soil test analyses, canola establishment, weed densities, seed yield, oil, and protein. Cover crop establishment was successful in 2021-2022, the wettest of three seasons, but more challenging in 2021 and 2023 due to drought and delayed harvest. The 2021 and 2023 growing seasons were hot and dry while 2022 was wetter with slightly higher canola yield potential. Soil tests results suggested that any cover crop effects were negligible, and the cover crop never reduced weed populations. In 1/3 years, the cover crop resulted in slightly lower final plant populations. Canola seed yields, oil, and protein concentrations were all affected by N rate both for individual years and when averaged across years; however, no significant cover crop effects, whether beneficial or harmful, were ever detected for these variables (Table 5). There was no evidence of cover crop affecting canola response to N fertilizer rate; however, our results may have differed if establishment of the fall rye had been more successful.

Table 5. Tests of fixed effects for year (Yr), cover crop treatment (CC), nitrogen rate (NR), and their interactions for selected canola response variables across 2021-2023. P-values less than 0.05 are considered significant.

| Effect                       | Spring Plant Density | Fall Plant Density | Broadleaf Weeds | Grassy Weeds | Seed Yield | Seed Oil | Seed Protein |
|------------------------------|----------------------|--------------------|-----------------|--------------|------------|----------|--------------|
| ----- Pr > F (p-value) ----- |                      |                    |                 |              |            |          |              |
| Year (Yr)                    | <0.001               | <0.001             | 0.002           | <0.001       | 0.001      | 0.001    | 0.498        |
| Cover Crop (CC)              | 0.111                | 0.005              | 0.500           | 0.017        | 0.093      | 0.405    | 0.409        |
| Yr × CC                      | 0.743                | <0.001             | 0.202           | 0.196        | 0.593      | 0.261    | 0.214        |
| N Rate (NR)                  | 0.465                | 0.494              | 0.147           | 0.992        | <0.001     | <0.001   | <0.001       |
| Yr × NR                      | 0.011                | 0.023              | 0.278           | 0.974        | <0.001     | <0.001   | <0.003       |
| CC × NR                      | 0.448                | 0.857              | 0.136           | 0.899        | 0.846      | 0.903    | 0.789        |
| Yr × CC × NR                 | 0.190                | 0.727              | 0.098           | 0.846        | 0.999      | 0.827    | 0.389        |

### *Conclusions*

Overall, any negative agronomic effects of fall rye cover cropping on the subsequent canola were small and did not affect yield potential or response to N fertilizer. That said, there were never any positive effects, and this practice would undoubtedly have increased production costs and labour requirements. This, along with the challenges in establishing the cover crop with enough success that it was likely to have any effect on soil quality and/or conservation, suggesting that growers should be selective with respect to where and when they choose to integrate cover crops into their rotations.

### *Acknowledgements*

This project was funded under the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Sustainable Canadian Agricultural Partnership bi-lateral agreement between the federal government and the Saskatchewan Ministry of Agriculture and Fertilizer Canada.

## **Spring Cereal Re-seeding Options for Poor Stands of Winter Wheat**

Holzapfel, C. (IHARF)

### *Description*

The objective of this project was to demonstrate the agronomic and economic performance of a wide range of winter wheat stands relative to a selection of agronomically suitable spring cereal re-seeding options. More specifically, we intended to demonstrate the minimum plant populations where winter wheat yields were likely to be compromised and to look at the economics of re-seeding to either barley, oat, or canary seed. A field demonstration with winter wheat was initiated in the fall of 2021 and repeated in 2022. The treatments were arranged in a four replicate RCBD and were simply six different winter wheat seeding rates (50, 100, 200, 300, 400, and 500 seeds/m<sup>2</sup>). Three additional treatments were seeded at a rate of 100 seeds/m<sup>2</sup> and destined to be terminated and re-seeded to spring cereal options. Winter wheat seeding was completed on September 15 in 2021 and September 30 in 2022, and the variety was AAC Goldrush. In both years, the entire trial sites were sprayed prior to winter wheat emergence and each spring, the three treatments slated for re-seeding were terminated with glyphosate and re-seeded to either barley, oat, or canary seed. The re-seeding operations were completed on May 23 in both years, and termination of the winter wheat occurred on May 21-22. This was thought to be late enough to provide time for a thorough evaluation of winter wheat establishment and winter kill, yet still early enough to re-seed with a high probability of success for the spring seeded crops. The target seeding rates and varieties of the spring seed crops were AAC Synergy barley (300 seeds/m<sup>2</sup>), CDC Arborg oat (350 seeds/m<sup>2</sup>), and Keet canaryseed (45 kg/ha).

### *Results*

Winter wheat establishment was excellent both years with actual densities of 46-333 plants/m<sup>2</sup> in 2022 and 55-362 plants/m<sup>2</sup> in 2023. Our results were broadly consistent with past research in that winter wheat stands of 100 plants/m<sup>2</sup>, or even less, yielded remarkably well. When populations fell below this level, yields in 2022 declined substantially and delayed maturity and weed issues were observed; however, this did not occur to the same extent in 2023. Re-seeding was consistently successful with the

spring cereals establishing and yielding well. Oats were the most profitable option, followed by canary seed, and finally barley (Figures 2 & 3). Re-seeding to barley produced slightly lower returns than the most profitable winter wheat stands. Oats and, to a lesser degree, canary seed were more profitable than all winter wheat treatments, even after re-seeding costs were accounted for.

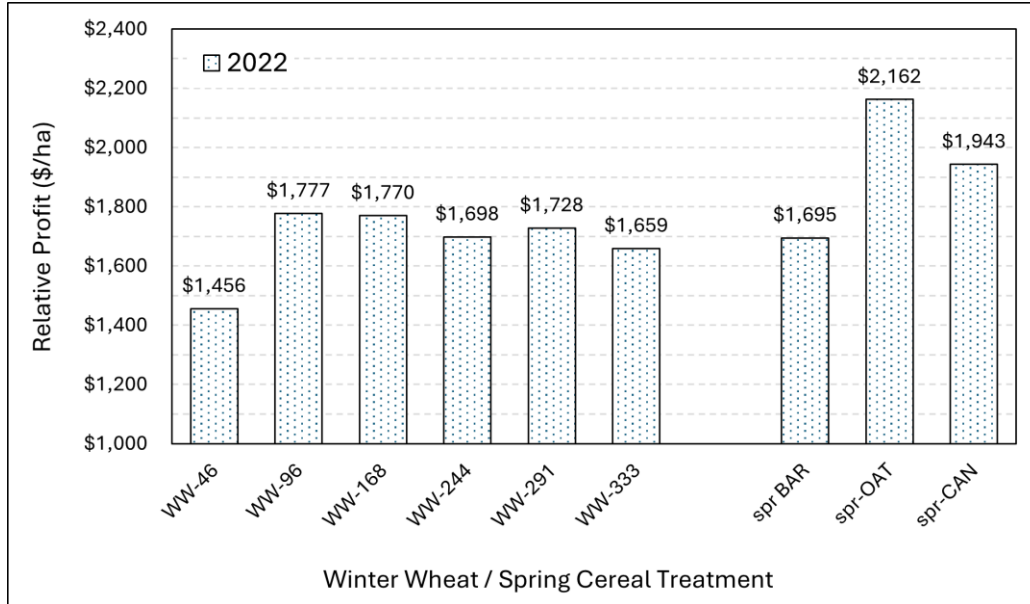


Figure 2. Relative profitability (\$/ha) of winter wheat (WW) growing at a wide range of plant densities (46-333 plants/m<sup>2</sup>) versus with spring (spr) re-seeding to barley (BAR), oat (OAT), or canary seed (CAN) in 2022 at Indian Head.

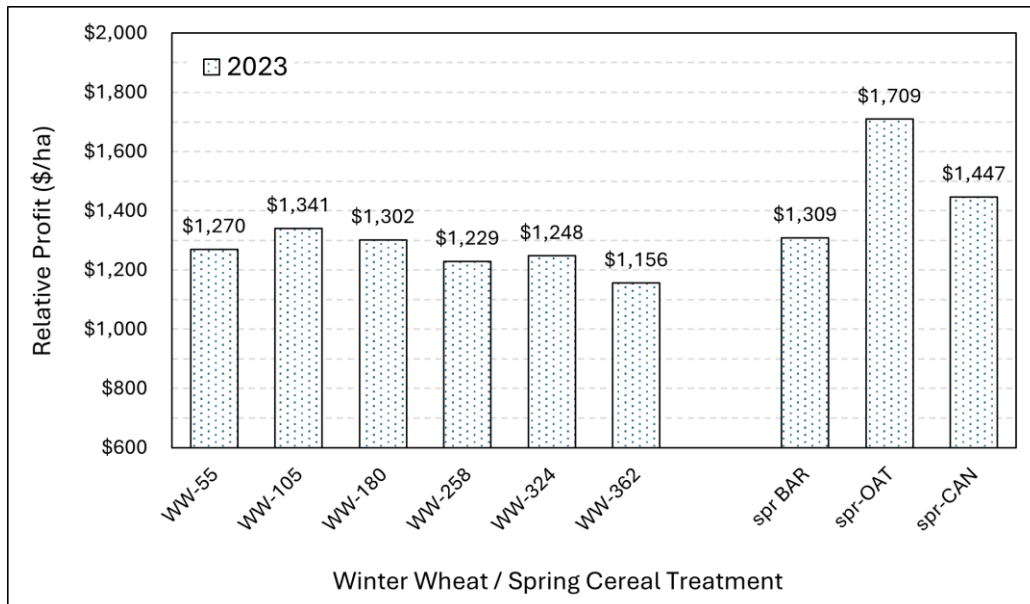


Figure 3. Relative profitability (\$/ha) of winter wheat (WW) growing at a wide range of plant densities (55-62 plants/m<sup>2</sup>) versus with spring (spr) re-seeding to barley (BAR), oat (OAT), or canary seed (CAN) in 2023 at Indian Head.

### Conclusions

In conclusion, growers faced with a sub-optimal stand of winter wheat need to consider the viability of the existing crop, costs associated with terminating and re-seeding, the probability of successfully establishing a spring seeded option, and the likelihood of the re-seeded crop reaching maturity in a timely manner.

### Acknowledgements

This project was funded under the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Sustainable Canadian Agricultural Partnership bi-lateral agreement between the federal government and the Saskatchewan Ministry of Agriculture and Fertilizer Canada.

## Canola Response to Side-banded Enhanced Efficiency Nitrogen Fertilizer Products

Holzapfel, C. (IHARF)

### Description

The objectives of this project were to demonstrate (1) the effects of several side-banded enhanced efficiency nitrogen (N) fertilizer products and blends, relative to untreated urea, on canola establishment, yield, and seed quality, and (2) the agronomic N use-efficiency (ANUE) of side-banded enhanced efficiency fertilizer (EEF) products and blends, relative to untreated urea. A field demonstration with canola was established on canary seed stubble near Indian Head, SK in 2023. The demonstration evaluated ten N fertility treatments (Table 6) which were comprised of several rates of untreated urea and six different EEF N forms applied at an intermediate rate. The treatments were arranged in a RCBD and replicated four times.

Table 6. Nitrogen treatments evaluated in the side-banded enhanced efficiency nitrogen (N) fertilizer demonstration conducted at Indian Head in 2023.

| #  | Formulation           | N Rate <sup>z</sup><br>(soil + fertilizer) | Description                                   |
|----|-----------------------|--|---|
| 1  | n/a                   | 0 N  | - only soil N and N from N & P products       |
| 2  | Urea                  | 75 kg N/ha                                 | - low rate, untreated                         |
| 3  | Urea                  | 125 kg N/ha                                | - medium rate, untreated                      |
| 4  | Urea                  | 175 kg N/ha                                | - high rate, untreated                        |
| 5  | 50% ESN <sup>®</sup>  | 125 kg N/ha                                | - medium rate, low percentage polymer coated  |
| 6  | 75% ESN <sup>®</sup>  | 125 kg N/ha                                | - medium rate, high percentage polymer coated |
| 7  | 100% ESN <sup>®</sup> | 125 kg N/ha                                | - medium rate, pure polymer coated            |
| 8  | ANVOL <sup>®</sup>    | 125 kg N/ha                                | - medium rate, volatilization inhibitor       |
| 9  | eNtrench <sup>™</sup> | 125 kg N/ha                                | - medium rate, nitrification inhibitor        |
| 10 | SUPERU <sup>®</sup>   | 125 kg N/ha                                | - medium rate, dual inhibitors                |

<sup>z</sup> N rates include residual soil NO<sub>3</sub>-N (0-60 cm) and N provided by P and/or S fertilizer products

## Results

Overall, canola emergence was excellent, but the weather was dry and the risk of environmental N losses was low. Neither N fertilizer application rate nor formulation impacted canola emergence; thus, suggesting that the side-band placement provided adequate separation between the seed row and fertilizer. Increasing the rate of side-banded urea from 23 kg N/ha to 175 kg N/ha (soil plus fertilizer) resulted in an 86% (1225 kg/ha) yield increase (Figure 4), an increase in seed protein from 17.3% to 21.2%, a decline in seed oil from 47.1% to 43.4%, and a reduction in ANUE (for N rates 75-175 kg N/ha) from 41% to 33%. However, there were no yield differences between formulations. The protein, oil, and ANUE responses to N rate were all typical; however, again, there were no differences across N formulations. Results may have differed if seeding conditions were poorer, or if extreme wet conditions had persisted at any point during the season.

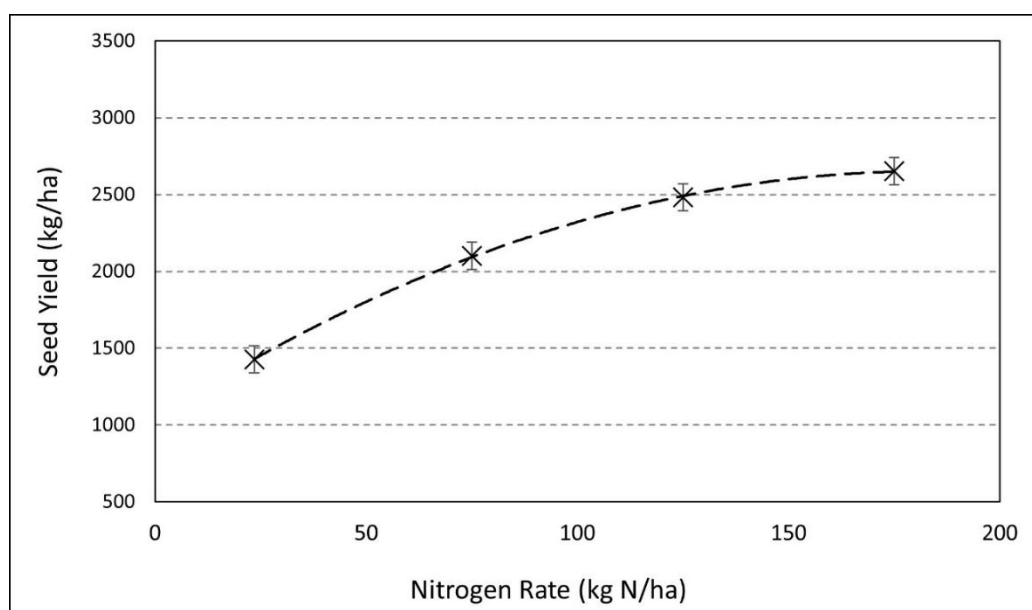


Figure 4. Canola seed yield response to increasing nitrogen (N) rate at Indian Head, 2023. The N rates include soil plus fertilizer N and the fertilizer was specifically side-banded urea. Error bars are standard error of the treatment means and both the linear ( $P < 0.001$ ) and quadratic ( $P = 0.009$ ) orthogonal contrasts were significant.

## Conclusions

We did not see any benefits, or drawbacks, to any of the EEF N products evaluated. This could be explained by the facts that seeding conditions were excellent, therefore the risk of  $\text{NH}_3$  volatilization with side-banding was extremely low, and there were never any periods where the soil was saturated to the extent that denitrification losses might have been expected. There can be a risk of polymer coated urea releasing plant available N too slowly under dry conditions; however, there was no evidence that this was the case in the current project.

## Acknowledgements

This project was funded under the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Sustainable Canadian Agricultural Partnership bi-lateral agreement between the federal government and the Saskatchewan Ministry of Agriculture.

## Demonstrating the Efficacy of Foliar-Applied Nitrogen Fixing Bacteria for Wheat

Holzapfel, C. (IHARF), McInnes, B. (NARF), Singh, G. (ICDC), Lokken, R. (CLC), Shaw, L. (SERF), Enns, J. (WARC), Nybo, B. (WCA), and Hall, M. (ECRF)

### *Description*

Field trials with CWRS wheat were initiated at eight Saskatchewan locations in the spring of 2023 to evaluate the effects of commercially available, foliar-applied nitrogen (N) fixing bacteria products on the yield and seed quality of CWRS wheat grown under a range of N fertility levels and contrasting environmental conditions. The locations were Indian Head, Melfort, Outlook (irrigated), Prince Albert, Redvers, Scott, Swift Current, and Yorkton. The treatments were a factorial combination of three N fertilizer levels and three foliar-applied, N fixing biological products, arranged in a RCBD and replicated four times at each location. The target N levels, adjusted for residual soil NO<sub>3</sub>-N (0-60 cm), were 50 (low), 100 (medium), and 150 kg N/ha (high). The foliar-applied biological treatments were either an untreated control (none applied), Envita® (95 ml/ac plus 0.1% Agrol 90), and Utrisha™-N (135 g/ac). These treatments were applied at the 4-6 leaf stage, in a minimum water volume of 93 l/ha (10 US gal/ac), and we used distilled water to minimize any potential negative impacts of chlorine or other additives on the biological products being demonstrated.

### *Results*

With the exception of 1/8 sites which was excluded from the combined statistical analyses, we observed the expected increases in both seed yield (Figure 5) and protein concentrations with the addition of N fertilizer in the form of the side-banded urea. We did not, however, observe any effects on these variables that could indicate improved N status or biological N<sub>2</sub> fixation associated with the foliar applications of the biological products demonstrated in this project. This was the case, regardless of the environmental conditions encountered (i.e., site) or overall N fertility level (i.e., N fertilizer rate). For some sites, individual treatment means were somewhat variable; however, there were no trends that were consistent enough to suggest positive responses to the biological treatments with any confidence. While we cannot rule out that positive responses might occur with either different crop types or under environmental conditions that were not met in the current project, we did our best to allow the foliar products to succeed. This included careful storage of the products, using distilled water as a carrier, ensuring adequate water volumes, attempting to apply the biological products during cooler conditions, and testing them under N limiting conditions. These results are generally consistent with a similar project conducted with canola, field-scale trials funded by SaskWheat and SaskCanola, and complementary, ongoing research at the University of Saskatchewan.

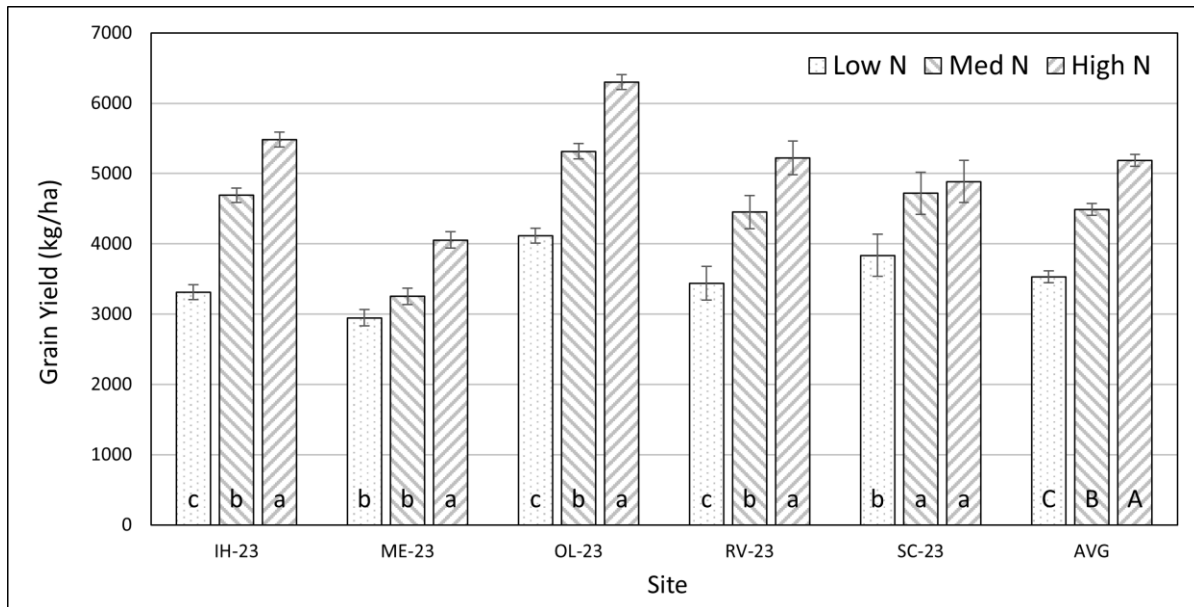


Figure 5. Nitrogen (N) fertility level effects on wheat grain yields for individual sites and averaged across sites. The N fertility levels were Low (50 kg N/ha), medium (100 kg N/ha), and high (150 kg N/ha), including residual soil N. The locations were Indian Head (IH-23), Melfort (ME-23), Outlook (OL-23), Redvers (RV-23), and Scott (SC-23), while AVG denotes the overall, 5-site average. Error bars are S.E.M. and values within a site denoted by the same letter do not significantly differ (Tukey's,  $P \leq 0.05$ ).

### Conclusions

We recommend that farmers avoid reducing their N fertilizer rates when using biological products intended to improve N nutrition in crop production and utilize untreated check strips (preferably replicated) to confirm whether or not they are realizing any benefits on their own farms.

### Acknowledgements

Financial support was provided under the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Sustainable Canadian Agricultural Partnership bi-lateral agreement between the federal government and the Saskatchewan Ministry of Agriculture. The Saskatchewan Wheat Development Commission administered the project in-kind.

## Demonstrating the Response of Hybrid Brown Mustard and Composite Yellow Mustard to Proper Fertility Recommendations

Nybo, B. (WCA), Holzapfel, C. (IHARF), and Shaw, L. (SERF)

### Description

The purpose of this project was to help mustard growers understand the fertility requirements of hybrid and composite mustard varieties. Small-plot demonstrations were initiated near Indian Head, Redvers and Swift Current, SK in 2023. The demonstration was set-up as a split-plot design with four replications. Two varieties of mustard were selected, including AAC Brown 18 (Hybrid) and AAC Yellow 80 (Composite). Both were seeded at 237 seeds/m<sup>2</sup> with all fertilizer side-banded and nutrient rates based

on soil test macronutrient recommendations, plus either zinc (Zn), or boron (B). The treatments are listed in Table 7. Data collection consisted of plant density, lodging, days to maturity, and seed yield.

Table 7. Fertility treatments used in the hybrid brown mustard and composite yellow mustard fertility trials at Indian Head, Redvers, and Swift Current, SK in 2023.

| #  | Mustard Class | Fertility Treatment <sup>z</sup>                             |
|----|---------------|--|
| 1  | AAC Brown 18  | 0% Soil test Rec. NPKS [0% Recommended Fertility Rate (RFR)] |
| 2  | AAC Brown 18  | 50% Soil test Rec. NPKS (50% RFR)                            |
| 3  | AAC Brown 18  | 100% Soil test Rec. NPKS (100% RFR)                          |
| 4  | AAC Brown 18  | 100% Soil test Rec. NPKS + 5.6 kg B/ha (100% RFR + Zn)       |
| 5  | AAC Brown 18  | 100% Soil test Rec. NPKS + 5.6 kg Zn/ha (100% RFR + B)       |
| 6  | AAC Brown 18  | 125% Soil test Rec. NPKS (125% RFR)                          |
| 7  | AAC Yellow 80 | 0% Soil test Rec. NPKS (0% RFR)                              |
| 8  | AAC Yellow 80 | 50% Soil test Rec. NPKS (50% RFR)                            |
| 9  | AAC Yellow 80 | 100% Soil test Rec. NPKS (100% RFR)                          |
| 10 | AAC Yellow 80 | 100% Soil test Rec. NPKS + 5.6 kg B/ha (100% RFR + Zn)       |
| 11 | AAC Yellow 80 | 100% Soil test Rec. NPKS + 5.6 kg Zn/ha (100% RFR + B)       |
| 12 | AAC Yellow 80 | 125% Soil test Rec. NPKS (125% RFR)                          |

<sup>z</sup> Swift Current – Target 35 bu/ac for Brown & 25 bu/ac for Yellow in AGVISOR

<sup>z</sup> Indian Head & Redvers – Target 40 bu/ac for Brown and 30 bu/ac for Yellow in AGVISOR

### Results

There was minimal lodging incidence recorded at all three sites. Maturity ratings were largely affected by drought and high temperatures at each site, averaging 75-76 days compared to the expected 84 days. Overall yield potential was negatively affected by limited moisture and above average temperatures at all three sites. In the combined site analysis, there was no variety effect on yield. AAC Brown 18 yielded 1177 lbs/ac, followed by AAC Yellow 80 at 1169 lbs/ac. Mustard yields increased as fertility rates increased, with the highest yield resulting from 125% RFR (1386 lbs/ac); not significantly different from 100% RFR + Zn (1358 lbs/ac). The addition of boron to the 100% RFR also resulted in a yield increase (1262 lbs/ac) compared to 100% RFR but was not significantly different (1245 lbs/ac). Mustard yields varied across each location with Indian Head averaging 1367 lbs/ac, followed by Redvers (1186 lbs/ac) and Swift Current (963 lbs/ac). The addition of zinc, resulted in more of a yield response than the addition of boron, but at Indian Head the additional macronutrients (125% RFR) resulted in the highest yielding treatment.

### Conclusions

Overall, there was a mustard yield response to zinc in most cases, with the exception of AAC Brown 18 at Indian Head. This study did not demonstrate a strong response to boron, but AAC Yellow 80 did show a small yield response, where soil residual boron was low at Swift Current. As expected, there was a yield response to increased Sulphur and Nitrogen (125% RFR) where residual levels were low. However, in some cases the yield increases from added macronutrients (125% RFR) were not significantly different than added Zinc (100% RFR + Zn) showing that micronutrients should be considered in the overall

picture to avoid over applying macronutrients, such as nitrogen. Like macronutrients, mustard will respond to proper micronutrient management and this study has demonstrated that a composite soil test is very important to optimize yield and economic return.

### Acknowledgements

Financial support was provided under the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Sustainable Canadian Agricultural Partnership bi-lateral agreement between the federal government and the Saskatchewan Ministry of Agriculture .

## Reduction of Cadmium Uptake in Flax Using Agronomic Strategies

Kettenbach, K. (Sask Canola), Shaw, L. (SERF), Holzapfel, C. (IHARF), Enns, J. (WARC), and Hall, M. (ECRF)

### Description

Cadmium (Cd) accumulation in flax is a concern for Saskatchewan producers after the European Union established a limit of 0.5 ppm of Cd for imported flaxseed in 2021. While Cd is naturally present in SK soils, more is added through the application of Monoammonium Phosphate (MAP) fertilizer contaminated with Cd from its parent rock. This demonstration intended to evaluate the efficacy of zinc and calcium fertilization in reducing Cd levels in flax. The project was carried out at four locations in Saskatchewan – Scott, Yorkton, Indian Head, and Redvers in 2022 and 2023. The flax varieties used were Prairie Thunder in 2022 and CDC Rowland in 2023. Seeding rate at all locations was approximately 45 lb/ac. Soil and MAP samples were collected in the beginning of the experiment and sent to the lab for Cd analysis along with harvested flaxseed from the trial. The field trials were set up as RCBD with four replicates and seven treatments. The treatments are listed in Table 8.

Table 8. Treatments and rates used for the project.

| Trt # | Trt Description                        | Rate of Trt       | Rate of product applied*              |
|-------|--|-------------------|---------------------------------------|
| 1     | Untreated control - no zinc, no gypsum | -                 | -                                     |
| 2     | Zn - 1X rate                           | 2.5 kg/ha Zn      | 7.04 kg/ha ZnSO <sub>4</sub> product  |
| 3     | Zn - low rate (0.5X rate)              | 1.25 kg/ha Zn     | 3.52 kg/ha ZnSO <sub>4</sub> product  |
| 4     | Zn - high rate (2X rate)               | 5 kg/ha Zn        | 14.08 kg/ha ZnSO <sub>4</sub> product |
| 5     | Gypsum - 1x rate                       | 107 kg/ha gypsum  | 133.75 kg/ha gypsum product           |
| 6     | Gypsum - low rate (0.5X rate)          | 53.5 kg/ha gypsum | 66.88 kg/ha gypsum product            |
| 7     | Gypsum - high rate (2X rate)           | 214 kg/ha gypsum  | 267.5 kg/ha gypsum product            |

\*Amount of product was calculated based on information from the product suppliers that the zinc sulphate product contained 35.5% zinc and the gypsum product contained 80% gypsum. The gypsum product contained 20% calcium.

### Results

Results showed large variation in MAP Cd levels (ranging from 9-39 ppm), but soil Cd levels were found to be relatively low (<0.1-2 ppm) among all sites. Combined data showed that only the effect of site was statistically significant on plant density, plant height, yield, and flax seed Cd level. ECRF had the highest average plant density (567 plants/m<sup>2</sup>) and ECRF and IHARF had the highest yields (2154-2180 kg/ha) out of all sites. SERF had the lowest yield of 1647 kg/ha averaged across treatments. The average height of

plants was highest at SERF and lowest at IHARF. Cd seed content in harvested flaxseed was highest at IHARF (0.70 ppm) and lowest at ECRF (0.16 ppm). When each site was analyzed separately, none of the treatments of zinc or gypsum had a significant effect on any of the measured parameters at any site.

### *Conclusions*

None of the treatments of zinc or calcium in either year at any of the sites led to a significant reduction in seed Cd levels compared to the untreated control. Findings from two years of this project suggest that at the rates and formulations used in this project, the application of neither zinc nor calcium is effective at reducing Cd accumulation in medium-high to high Cd-accumulating flax varieties.

### *Acknowledgements*

Financial support was provided under the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Sustainable Canadian Agricultural Partnership bi-lateral agreement between the federal government and the Saskatchewan Ministry of Agriculture.

## **Demonstrating the Efficacy of Foliar-Applied Nitrogen Fixing Bacteria for Canola**

Holzappel, C. (IHARF), McInnes, B. (NARF), Singh, G. (ICDC), Lokken, R. (CLC), Shaw, L. (SERF), Enns, J. (WARC), Nybo, B. (WCA), and Hall, M. (ECRF)

### *Description*

In 2023, field trials were conducted at eight Saskatchewan locations to evaluate and demonstrate the potential ability of commercially-available, foliar-applied biological products to aid in nitrogen (N) nutrition and improve yield in canola. The locations were Indian Head, Melfort, Outlook (irrigated), Prince Albert, Redvers, Scott, Swift Current, and Yorkton. The treatments were a factorial combination of three N fertilizer levels and three foliar-applied, N fixing biological products, arranged in a RCBD and replicated four times at each location. The target N levels, adjusted for residual soil NO<sub>3</sub>-N (0-60 cm), were 60 (low), 110 (medium), and 160 kg N/ha (high). It was our expectation for N to be limiting at both the low and medium levels while, at the high level, the N rates would be more typical for canola but still not excessive for most regions. The foliar-applied biological treatments were either an untreated control (none applied), Envita® (95 ml/ac plus 0.1% Agrol 90), and Utrisha™-N (135 g/ac). These treatments were applied at the 4-6 leaf stage, in a minimum water volume of 93 l/ha (10 US gal/ac), and we used distilled water to minimize any potential negative impacts of chlorine or other additives on the biological products being demonstrated.

### *Results*

With the exception of 2/8 sites which were excluded from the combined statistical analyses, we observed the expected increases in seed yield (Figure 6) and protein concentrations along with reductions in seed oil concentrations with the addition of N fertilizer in the form of the side-banded urea. We did not, however, observe any effects on these variables that could indicate improved N status or biological N<sub>2</sub> fixation associated with the foliar applications of the biological products demonstrated

in this project. This was the case, regardless of the environmental conditions encountered (i.e., site) or overall N fertility level (i.e., N fertilizer rate). While we cannot rule out that positive responses might occur with either different crop types or under environmental conditions that were not met in the current project, we did our best to allow the foliar products to succeed. This included careful storage of the products, using distilled water as a carrier, ensuring adequate water volumes, attempting to apply the biological products during cooler conditions, and testing them under N limiting conditions.

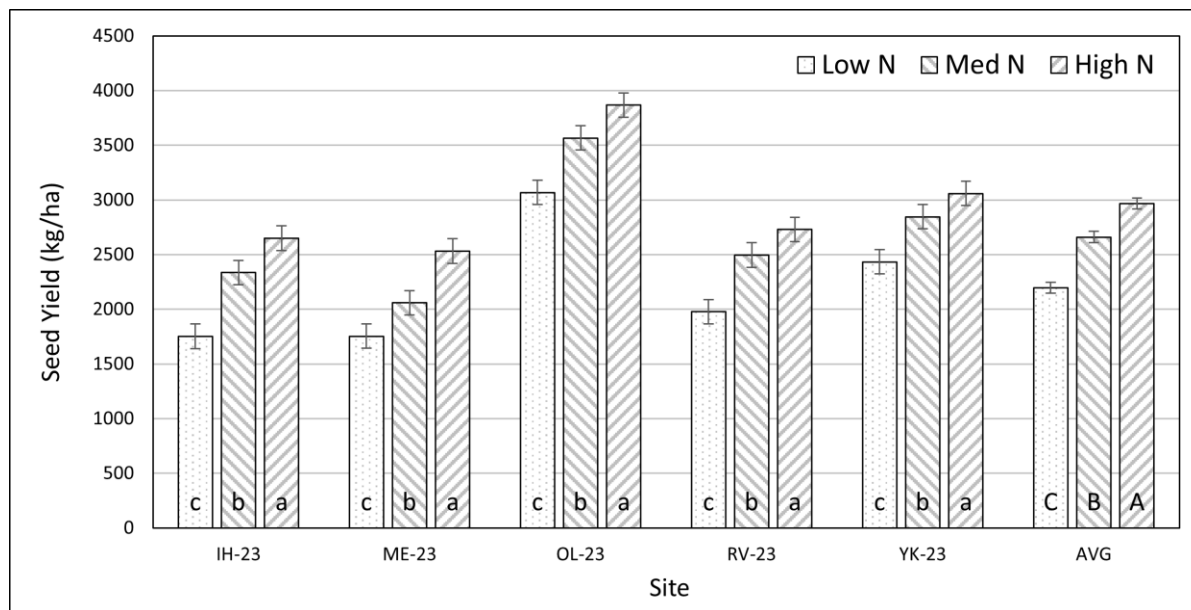


Figure 6. Nitrogen (N) fertility level effects on canola seed yields for individual sites and averaged across sites. The N fertility levels were Low (60 kg N/ha), medium (110 kg N/ha), and high (160 kg N/ha), including residual soil N. The locations were Indian Head (IH-23), Melfort (ME-23), Outlook (OL-23), Redvers (RV-23), and Yorkton (YK-23), while AVG denotes the overall, 5-site average. Error bars are S.E.M. and values within a site denoted by the same letter do not significantly differ (Tukey's,  $P \leq 0.05$ ).

### Conclusions

We recommend that farmers avoid reducing their N fertilizer rates when using biological products intended to improve N nutrition in crop production and utilize untreated check strips (preferably replicated) to confirm whether or not they are realizing any benefits on their own farms.

### Acknowledgements

Financial support was provided under the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Sustainable Canadian Agricultural Partnership bi-lateral agreement between the federal government and the Saskatchewan Ministry of Agriculture. The Saskatchewan Canola Development Commission administered the project in-kind.

## Do Barley Varieties Differ in Response to N Fertility, PGR, and Fungicide?

Japp, M. (Sask Barley), Holzapfel, C. (IHARF), McInnes, B. (NARF), Singh, G. (ICDC), Lokken, R. (CLC), Enns, J. (WARC), Nybo, B. (WCA), and Hall, M. (ECRF)

### Description

The objective of this project was to determine if three malt and three feed barley varieties differ in response to N fertility, PGR, and fungicide. The malt varieties were AAC Synergy, AAC Connect, CDC Fraser, and the feed varieties were CDC Austenson, Claymore, and Oreana. Table 9 lists the treatments established in 2023 at Swift Current, Prince Albert, Indian Head, Scott, Yorkton, Melfort, and Outlook in a split-plot design with four replications. The main-plot factor was “Barley Management” and the sub-plot factor was “Barley Variety”. Standard and Enhanced rates of N varied by location group based on historic yield potential (SCIC data). The groupings were as follows:

- Group 1 = low yield potential: Swift Current: 100 vs 125 lb N/ac of soil + added N
- Group 2 = mid range yield potential: Prince Albert, Indian Head, Scott: 120 vs 150 lb N/ac of soil + added N
- Group 3 = high yield potential: Yorkton, Melfort, Outlook: 130 vs 162 lb N/ac of soil + added N

Table 9. Treatment list for project; Barley Management by Barley Variety

| #  | Barley Management (A-D)  | Barley Variety |
|----|--|----------------|
| 1  | A. Standard <sup>1</sup> N Fertility – No PGR – Fungicide <sup>3</sup> | AAC Synergy    |
| 2  | A. Standard <sup>1</sup> N Fertility – No PGR – Fungicide <sup>3</sup> | AAC Connect    |
| 3  | A. Standard <sup>1</sup> N Fertility – No PGR – Fungicide <sup>3</sup> | CDC Fraser     |
| 4  | A. Standard <sup>1</sup> N Fertility – No PGR – Fungicide <sup>3</sup> | CDC Austenson  |
| 5  | A. Standard <sup>1</sup> N Fertility – No PGR – Fungicide <sup>3</sup> | Claymore       |
| 6  | A. Standard <sup>1</sup> N Fertility – No PGR – Fungicide <sup>3</sup> | Oreana         |
| 7  | B. Enhanced <sup>1</sup> N Fertility – No PGR – Fungicide <sup>3</sup> | AAC Synergy    |
| 8  | B. Enhanced <sup>1</sup> N Fertility – No PGR – Fungicide <sup>3</sup> | AAC Connect    |
| 9  | B. Enhanced <sup>1</sup> N Fertility – No PGR – Fungicide <sup>3</sup> | CDC Fraser     |
| 10 | B. Enhanced <sup>1</sup> N Fertility – No PGR – Fungicide <sup>3</sup> | CDC Austenson  |
| 11 | B. Enhanced <sup>1</sup> N Fertility – No PGR – Fungicide <sup>3</sup> | Claymore       |
| 12 | B. Enhanced <sup>1</sup> N Fertility – No PGR – Fungicide <sup>3</sup> | Oreana         |
| 13 | C. Standard <sup>1</sup> N Fertility – PGR <sup>2</sup> – Fungicide    | AAC Synergy    |
| 14 | C. Standard <sup>1</sup> N Fertility – PGR <sup>2</sup> – Fungicide    | AAC Connect    |
| 15 | C. Standard <sup>1</sup> N Fertility – PGR <sup>2</sup> – Fungicide    | CDC Fraser     |
| 16 | C. Standard <sup>1</sup> N Fertility – PGR <sup>2</sup> – Fungicide    | CDC Austenson  |
| 17 | C. Standard <sup>1</sup> N Fertility – PGR <sup>2</sup> – Fungicide    | Claymore       |
| 18 | C. Standard <sup>1</sup> N Fertility – PGR <sup>2</sup> – Fungicide    | Oreana         |

|    |  |               |
|----|--|---------------|
| 19 | D. Standard <sup>1</sup> N Fertility – No PGR – No Fungicide | AAC Synergy   |
| 20 | D. Standard <sup>1</sup> N Fertility – No PGR – No Fungicide | AAC Connect   |
| 21 | D. Standard <sup>1</sup> N Fertility – No PGR – No Fungicide | CDC Fraser    |
| 22 | D. Standard <sup>1</sup> N Fertility – No PGR – No Fungicide | CDC Austenson |
| 23 | D. Standard <sup>1</sup> N Fertility – No PGR – No Fungicide | Claymore      |
| 24 | D. Standard <sup>1</sup> N Fertility – No PGR – No Fungicide | Oreana        |

<sup>1</sup>All sites were fertilized at P and K levels to be not limiting, even for the high N rate based on soil test recommendations.

<sup>2</sup>PGR was Moddus (trinexapac-ethyl) applied at GS30-32 (stem elongation).

<sup>3</sup>Fungicide was either Trivapro or Nexicor applied at flag leaf.

**Results**

There were no differences in plant density between management treatments. There was a significant variety by management interaction for disease at Yorkton, Outlook, Scott, and Indian Head. At all four sites, disease was significantly reduced with a fungicide application with Oreana but did not differ with fungicide application on any other varieties. Plant height varied with management across all sites in all varieties except Oreana (Figure 7). For all varieties other than Oreana, plants were significantly shorter with Management C (PGR application with standard fertility) than with Management B (no PGR application with enhanced fertility). Across all sites, yield did not differ significantly with management in all varieties except Oreana. Yield of Oreana was significantly higher with Management B (enhanced fertility + fungicide) than with management D (standard fertility, no fungicide). The effect of management on protein was consistent across varieties and sites and was such that protein was significantly higher with Management B (Enhanced fertility) than with A, C, or D (standard fertility).

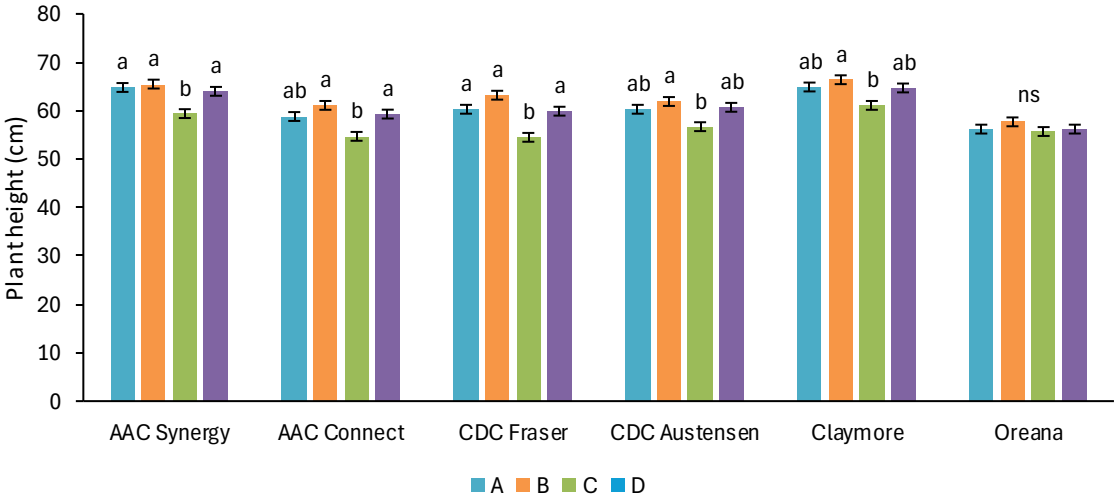


Figure 7. The interactive effect of management (Treatments A, B, C and D) and variety on plant height across all sites. Letters indicate the separation of estimated marginal means by pairwise comparison within variety. Means followed by similar letters within a variety are not significantly different. Error bars indicate the standard error across all sites.

### *Conclusions*

In summary, there was not a lot of evidence to suggest varieties should be managed differently under the dry conditions of this study. Oreana may be more likely to benefit from fungicide than other varieties in this study due to its greater susceptibility to leaf disease. Feed varieties in this study may be less likely to benefit from PGR application since their heights were less affected by PGR and they generally have higher ratings for lodging resistance. However, yield benefits from applying of fungicide to Oreana or PGR to malt varieties vs feed were not observed in this study.

### *Acknowledgements*

Financial support was provided under the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Sustainable Canadian Agricultural Partnership bi-lateral agreement between the federal government and the Saskatchewan Ministry of Agriculture .

## **Lentil Response to Soil Residual Nitrogen and Rhizobial Inoculation**

Holzapfel, C. (IHARF), Enns, J. (WARC), and Nybo, B. (WCA)

### *Description*

In the fall of 2022, field trials with lentil were initiated near Indian Head, Scott, and Swift Current to demonstrate lentil response to high residual soil nitrogen (N) and inoculation . The treatments were a factorial combination of three residual N levels (low, elevated, and extreme), two rhizobial inoculant treatments (none versus label rate of granular inoculant), and two lentil classes (small red versus large green). The residual N treatments were established in the fall. First, a composite soil sample was collected for the entire site to determine the initial levels of residual nitrate ( $\text{NO}_3\text{-N}$ ) to a depth of 60 cm. Next, untreated urea was broadcast in the elevated and extreme residual N treatments to bring the total N levels (residual soil  $\text{NO}_3\text{-N}$  + fertilizer) up to 112 kg N/ha and 225 kg N/ha, respectively. The granular inoculant product was either Nodulator Duo SCG (BASF) at Indian Head and Scott or TagTeam BioniQ at Swift Current. At all sites, the inoculant products were applied in-furrow at the label recommended rates, adjusted for row spacing. At all locations, the small red lentil variety was CDC Impulse CL, and the large green variety was CDC Lima CL. The twelve treatments were replicated four times and arranged in a RCBD.

### *Results*

Across locations, spring soil tests showed a range of 22-89 kg  $\text{NO}_3\text{-N}$ /ha in the residual N treatments. Responses varied across locations. At Indian Head, we did see a slight protein advantage at the lowest residual N level; however, the effect was small and impacts on yield were minimal. The residual N by class interaction for yield at Indian Head suggested that green lentils might be more sensitive to high residual N than red lentils; however, the effect was small. At Scott, there were no negative or positive effects of residual N for any of the variable measured. At Swift Current, despite late-season hail damage, the effects of higher residual N were positive for both seed yield and protein. There were no signs of excessive vegetative growth or delayed maturity associated with the high residual N at Indian Head or Scott and the tendency for higher biomass yields with elevated N at Swift Current was coupled with

significantly higher yield and protein. We did not observe any benefits to granular inoculant in this project.

### Conclusions

While lentils are not an ideal crop to take advantage of high residual soil N, this project suggested that any negative impacts will be minimal and, in some soils, responses could even be positive. While no responses to granular inoculant were observed, we still recommend this input due to the importance of biological N fixation in lentil production.

### Acknowledgements

Financial support was provided under the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Sustainable Canadian Agricultural Partnership bi-lateral agreement between the federal government and the Saskatchewan Ministry of Agriculture. Additional financial support was provided by the Saskatchewan Pulse Growers (SPG).

## Expanding Rotational Options Using New and Novel Pulse Crops 2.0

Nybo, B. (WCA), Holzapfel, C. (IHARF), Enns, J. (WARC), McInnes, B. (NARF), Lokken, R. (CLC), Singh, G. (ICDC), Hall, M. (ECRF), and Shaw, L. (SERF)

### Description

In 2023, field trials were conducted at eight Saskatchewan locations including Swift Current, Indian Head, Melfort, Outlook (irrigated), Prince Albert, Redvers, Scott and Yorkton. The objective of the demonstration was to provide producers with basic economic and agronomic information on non-traditional pulse crops that may be adapted to the various regions in the Agri-ARM network, specifically fenugreek and lupin. Introducing new and novel pulse crops into specific regions is necessary to maintain, diversify, and extend cropping rotations leading to a more robust integrated pest management cropping system. Each crop was replicated four times in a split block design and compared to a pulse 'reference' crop (either peas, or lentils) to ensure a good visual representation and quality data. Treatments and varietal information are listed in Table 10.

Table 10. Crop, seed rate and variety information for novel pulse crops 2.0 trial.

| Crop  | Variety     | TKW (grams) | Distributor                   | Traits  |
|---|-------------|-------------|-------------------------------|---|
| Fenugreek<br>175 plants/m <sup>2</sup><br>250 plants/m <sup>2</sup> | CDC Canafen | 17.9        | Emerald Seed Products Limited | White-flowered  |
| White Lupin<br>40 seeds/m <sup>2</sup><br>56 seeds/m <sup>2</sup>   | Dieta       | 265         | Lupin Platform Inc.           | Purple/blue-flowered, shown resistance to Aphanomyces root rot          |
| Blue Lupin*<br>40 seeds/m <sup>2</sup><br>56 seeds/m <sup>2</sup>   | Boregine    | 190         | Lupin Platform Inc.           | White-flowered, narrow-leaved, shown resistance to Aphanomyces root rot |

|                           |             |     |             |   |
|---------------------------|-------------|-----|-------------|---|
| Small Red Lentil          |             |     |             |   |
| 130 plants/m <sup>2</sup> | CDC Impulse | 45  | SeCan       | Clearfield tolerant                                     |
| 190 plants/m <sup>2</sup> |             |     |             |   |
| Yellow Field pea          |             |     |             |   |
| 85 plants/m <sup>2</sup>  | AAC Profit  | 226 | FP Genetics | White-flowered, semi-leafless, medium seeded yellow pea |
| 95 plants/m <sup>2</sup>  |             |     |             |   |

\*Indian Head, Swift Current, Redvers, Scott and Prince Albert seeded blue lupin at 108 and 129 plants/m<sup>2</sup>

### Results

Pea density increased with seed rate at 2 of the 3 locations and at sites where peas were seeded, no crop out yielded the yellow pea pulse reference crop. Seed rate effect on yield varied by site. Lentil population generally increased with seed rate and had a varied effect on yield. Lentil reference crops were the highest yielding treatments at Prince Albert (no seed rate effect) and Scott (increased seed rate resulted in significantly higher yield). Swift Current lentil yields were not affected by seed rate and did not result in a significantly different yield than white lupin seeded at the recommended rate. White lupin, as well as fenugreek seeded at the increased rate, out yielded the lentil reference crop at Redvers. White and blue lupin plant populations both increased with seed rate. Fenugreek plant population increased with seed rate and percent establishment varied by site. At Indian Head, fenugreek seeded at the recommended rate yielded similar to the lentil reference crop. Lentil seed rate at Indian Head had no effect on lentil yield.

### Conclusions

Having marketing opportunities for these crops is still a challenge. However basic economic information showed a gross revenue per crop at each location. Crop diversity cannot be understated, as we need to mitigate root rots in peas and lentils through new and diversified pulse crop acres. It is already known that it is important to have pulses in your rotations for diversity, but diversity within your pulse crops themselves helps break up cycles of disease, pest, and weed cycles.

### Acknowledgements

Financial support was provided under the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Sustainable Canadian Agricultural Partnership bi-lateral agreement between the federal government and the Saskatchewan Ministry of Agriculture.

## Lentil Response to Varying Rates and Combinations of Potassium and Sulfur Fertility

Holzapfel, C. (IHARF), Slind, K. (WARC), Nybo, B. (WCA), and Wall, A. (WCA)

### Description

The objectives of this project were to demonstrate, for a range of Saskatchewan environments, the yield and quality response of small red lentils to varying rates and combinations of potassium (K) and sulfur (S) fertilizer. Field trials with small red lentils were conducted at Swift Current, Scott, and Indian Head in the 2023 growing season. This project will be repeated in the 2024 growing season. The treatments

were a factorial combination of three K rates and three S rates along with two additional control treatments. One of the control treatments was intended to show the potential losses that might occur when no fertilizer whatsoever is applied (Trt. #1). Since N was not balanced across treatments, the second control was to help ascertain whether responses to ammonium sulphate (AMS) were due to the S or the N that is provided by this product (Trt. #11). The treatments are described in Table 11.

Table 11. Lentil fertility treatments in potassium (K<sub>2</sub>O) and sulfur (S) demonstrations conducted at Indian Head, Scott, and Swift Current in 2023.

| #  | Nitrogen <sup>z</sup><br>(kg N/ha) | Phosphorus<br>(kg P <sub>2</sub> O <sub>5</sub> /ha) | Potassium<br>(kg K <sub>2</sub> O/ha) | Sulfur<br>(kg S/ha) | Description                   |
|----|------------------------------------|--|---------------------------------------|---------------------|-------------------------------|
| 1  | 0                                  | 0  | 0                                     | 0                   | Unfertilized Control          |
| 2  | 10                                 | 45   | 0                                     | 0                   | Phosphorus Only               |
| 3  | 10                                 | 45   | 22                                    | 0                   | Low Potassium                 |
| 4  | 10                                 | 45   | 45                                    | 0                   | High Potassium                |
| 5  | 18                                 | 45   | 0                                     | 10                  | Low Sulphur                   |
| 6  | 27                                 | 45   | 0                                     | 20                  | High Sulphur                  |
| 7  | 18                                 | 45   | 22                                    | 10                  | Low Potassium – Low Sulphur   |
| 8  | 18                                 | 45   | 45                                    | 10                  | High Potassium – Low Sulphur  |
| 9  | 27                                 | 45   | 22                                    | 20                  | Low Potassium – High Sulphur  |
| 10 | 27                                 | 45   | 45                                    | 20                  | High Potassium – High Sulphur |
| 11 | 27                                 | 45   | 0                                     | 0                   | High Nitrogen Control         |

<sup>z</sup> Except for treatment #11 which received supplemental urea, all N was provided by MAP and AMS

### Results

Despite the hail at Swift Current and drier than average weather at Indian Head and Scott, the first year of this project provided valuable information regarding lentil response to K and S fertilizer applications. Overall mean plant densities were higher at Indian Head (196 plants/m<sup>2</sup>) than at Swift Current and Scott (144-155 plants/m<sup>2</sup>). The overall treatment effect on emergence was never significant, indicating that no differences between individual treatment means. Seed yields were lowest at Swift Current (1306 kg/ha), intermediate at Indian Head (2687 kg/ha), and highest at Scott (3772 kg/ha). The overall treatment effects for yield were not significant at any locations. Furthermore, the K and S fertilizer treatment effects for lentil test weight, thousand seed weight, and seed protein concentrations were also not significant at any locations.

### Conclusions

Currently, K and S fertilizer are not commonly specifically recommended for lentil production; however, small, or modest amounts of either nutrient may be frequently applied as part of longer-term or rotation wide nutrient management plans.

### Acknowledgements

Financial support for this project was provided by the Saskatchewan Pulse Growers (SPG).

## Biological Enhancement in Pulses

McInnes, B. (NARF), Holzapfel, C. (IHARF), Nybo, B. (WCA), Wall, A. (WCA), Hall, M. (ECRF), Enns, J. (WARC), Slind, K. (WARC), and Lokken, R. (CLC)

### Description

The objective of this study is to provide a side-by-side comparison of biological treatments that promote an agronomic improvement in the growth of pulse crops. Field trials were established in 2023 at six locations within the major grain producing regions in Saskatchewan. The locations were Swift Current, Outlook (irrigated), Scott, Melfort, Yorkton, Indian Head, and Prince Albert. All trials were established in a RCBD with four replications. Treatment products are shown in Table 12. All inoculant products were applied in-furrow at the time of seeding at the manufacturer’s recommended rate of application. Trials located at Indian Head, Scott, and Swift Current were seeded with CDC Impulse, a small red lentil. Remaining trials were seeded with the yellow field pea variety AAC Profit except at Prince Albert location which was seeded with the yellow pea variety CDC Spectrum.

Table 12. Granular pulse inoculation products evaluated in 2023.

| Trt# | Product               | Company               | Active Microorganism   | Technology*        |
|------|-----------------------|-----------------------|--|--------------------|
| 1    | Control               |                       |  |                    |
| 2    | AgTIV® Thrive         | Premier Tech (Taurus) | <i>R. leguminosarum</i> + <i>Glomus intraradices</i>   | R + MF             |
| 3    | Cell-Tech® Pea/Lentil | Nexus BioAg           | <i>R. leguminosarum</i>  | R                  |
| 4    | AgTIV® Fuel G         | Premier Tech (Taurus) | <i>R. leguminosarum</i>  | R                  |
| 5    | Nodulator® Duo SCG    | BASF                  | <i>R. leguminosarum</i> + <i>Basillus subtilis</i>   | R + GP             |
| 6    | Primo GX2 Pulse       | Verdisian             | <i>R. leguminosarum</i> + <i>Azospirillum</i>  | R + PGPR           |
| 7    | Launcher              | BrettYoung            | <i>R. leguminosarum</i>  | R                  |
| 8    | TagTeam® BioniQ®      | Novozymes             | <i>R. leguminosarum</i> + <i>Penicillium bilaiae</i> + <i>Basillus amyloliquefaciens</i> + <i>Trichoderma virens</i> + lipochitoooligosaccharide | R + P + PGPR + LCO |
| 9    | LALFIX Start          | Lallemand Plant Care  | <i>Rhizobium leguminosarum biovar viciae</i> + <i>Mezorhizobium cicero</i> + <i>Bacillus velezensis</i>  | R + GP             |
| 10   | BOS NutriAg           | NutriAG               | <i>Rhizobium leguminosarum biovar viceae</i> + <i>Pseudomonas</i>  | R + PGPR + GP      |

\*R = rhizobium for nitrogen fixation; GP = growth promotion; PGPR = plant growth promoting rhizobacteria; MF = mycorrhizae fungi; P = phosphate solubilizer; LCO = signal molecule

### Results

No statistical difference occurred for any agronomic measurement gathered at any location. Yields obtained were lower than would be historically obtained at most test locations. This is certainly the case for lentil yields at Swift Current which was impacted by hail damage in early July. Pea yields at Prince Albert, Melfort, Yorkton, and Indian Head were lower than typical, but surprisingly good considering the

extreme drought experienced. Lentil yields at Scott were very good and irrigated pea yields at Outlook, while lower than normal, were certainly acceptable. At no location did treatment granular biological enhancement products provide a yield enhancement.

### Conclusions

Overall, environmental conditions were adverse for pea/lentil production due to widespread drought and heat stress for the majority of trial locations. These conditions certainly contributed to the lack of treatment response obtained.

### Acknowledgements

Financial support for the project was provided by the Saskatchewan Pulse Growers (SPG).

## Minor Use Seed Treatment on Fenugreek

Slind, K. (WARC), Holzapfel, C. (IHARF), Lokken, R. (CLC), Nybo, B. (WCA), and Wall, A. (WCA)

### Description

A field study was conducted at Indian Head, Prince Albert, Scott, and Swift Current in 2023 to demonstrate performance of seed treatment products (Apron XL and Vibrance Maxx RFC) in fenugreek. The objectives of the study were to demonstrate the performance and efficacy of Vibrance Maxx RFC on plant establishment, vigour, root rot symptoms, and yield of fenugreek. The study was arranged as a RCBD with four replications. The fenugreek variety used at all sites was CDC Canafen and was seeded at the rate of 250 seeds/m<sup>2</sup>. Celltech NS inoculant was used at each location. The treatments are listed in Table 13.

Table 13. Treatment list for “Minor Use Seed Treatment on Fenugreek” at Scott, Indian Head, Prince Albert, and Swift Current, SK., 2023.

| # | Treatment                 | Application Rate   |
|---|---------------------------|--------------------|
| 1 | Untreated check           |                    |
| 2 | 1X rate Vibrance Maxx RFC | 100 ml/100 kg seed |
| 3 | 2X rate Vibrance Maxx RFC | 200 ml/100 kg seed |
| 4 | Apron XL <sup>a</sup>     | 10 ml/100 kg seed  |

<sup>a</sup> Delivers the same amount of metalaxyl-m as in Vibrance Maxx RFC and provides control of only Pythium to compare what diseases controlled with Vibrance Maxx RFC

### Results

Seed treatment had a significant effect on plant density at 2-3 WAS, but not at 3-4 WAE (Figure 8). The difference in plant densities between treatments declined over time with the mean plant densities ranging between 170 to 183 plants/m<sup>2</sup> at 3-4 WAS. Plant height was used as an assessment for plant health and the results indicated that the 2X rate of Vibrance Maxx RFC reduced plant height by 8% compared to the untreated check. This is a noteworthy effect as a high seed treatment rate of Vibrance Maxx RFC may in fact hinder plant development rather than provide a boost. Root rot severity was

reduced with application of seed treatment products; however, differences between products were minimal. Greater differences between products may have been observed depending on type of pathogen species present in the soil. Although there was no significant yield difference, the plants were also not abundantly stressed and therefore, a yield difference between treatments did not occur. It would be interesting to see that in cases where the plants are stressed if the 2X rate would improve plant health or hinder it.

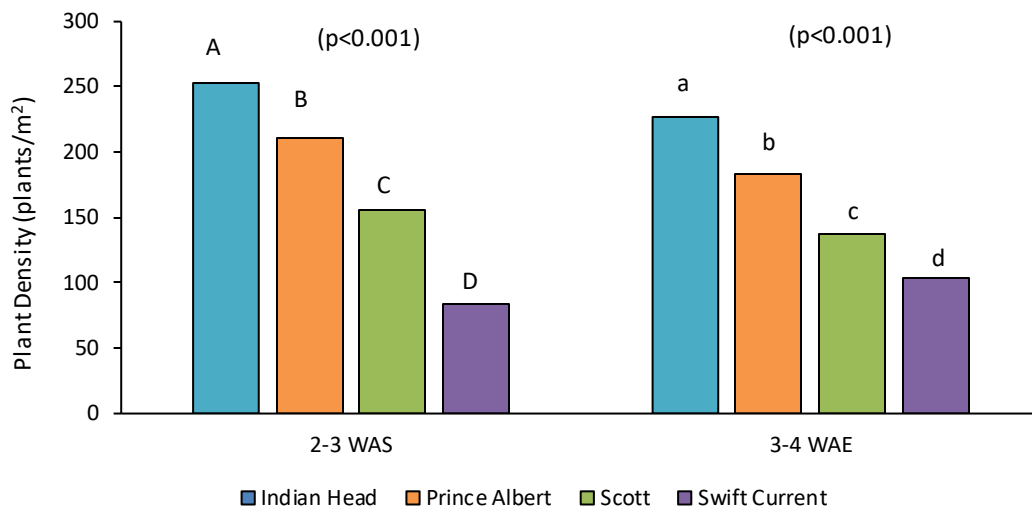


Figure 8. Mean plant density (plants/m<sup>2</sup>) of fenugreek at 2-3 weeks after seeding (WAS) and 3-4 weeks after emergence (WAE) at Indian Head, Prince Albert, Scott, Swift Current in Saskatchewan, 2023. Different upper-case letters (A-C) indicate significance for data recorded at 2-3 WAS. Different lower-case letters (a-c) indicate significance for data recorded at 3-4 WAE. Significance at  $p < 0.05$  using estimated marginal means comparison.

### Conclusions

In conclusion, performance of fenugreek was improved and root rot symptoms lessened with application of seed treatments, although differences between products were minimal.

### Acknowledgements

Financial support for the project was provided by the Saskatchewan Pulse Growers (SPG).

## Faba Bean Agronomy to Enhance Yield, Hasten Maturity, and Reduce Disease

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### Description

The objective of this project was to demonstrate and investigate the overall adaption and yield potential of faba beans throughout all the major soil climatic zones of Saskatchewan, including regions where this crop has not traditionally been grown or recommended. Over the 2021, 2022, and 2023 growing seasons, field trials with faba bean were successfully completed at 16 sites which were representative of

a wide swath of the major grain producing regions of Saskatchewan. The locations were Swift Current, Outlook (irrigated), Indian Head, Yorkton, Melfort, and Prince Albert. The treatments were a factorial combination of two seeding dates (early vs. delayed), two seeding rates (45 vs. 65 viable seeds/m<sup>2</sup>), and two fungicide treatments (untreated vs. treated). Early seeding was targeted for April 25 to May 7 while delayed seeding was targeted for May 20-30; however, seeding was sometimes initiated later than targeted due to delayed snow melt and/or wet spring conditions. The fungicide was either Priaxor® or Dyax®, applied approximately 7-10 days after the initiation of flowering. These products contain the same active ingredients but in different proportions, providing 75-99 g/ha of fluxapyroxad and 99-148 g/ha pyraclostrobin. The eight treatments were arranged in a split-plot design with seeding date as the main plots and seeding rates and fungicide treatments as the sub-plots. Each treatment was replicated four times.

### Results

When averaged across all sites, seeding rate, and fungicide treatments, we saw slightly better establishment with delayed (53.4 plants/m<sup>2</sup>) versus early (50.8 plants/m<sup>2</sup>) seeding (Table 14). Seeding rate effects on faba bean establishment were always as expected with higher populations achieved at the heavier seeding rate (Table 14). Disease pressure was generally quite low in 2021-23, regardless of location. When averaged across sites, only the seeding date effect was large enough to be of much importance for faba bean maturity. Early seeded faba beans took an extra four days, from seeding, to reach maturity (Table 14). That said, there was a 14-27 day spread in the seeding dates for individual sites; therefore, the early seeded crop always reached physiological maturity well before the late seeded crop in terms of the actual calendar date. Faba bean seed yields were affected by seeding date, seeding rate, and fungicide ( $P < 0.001-0.002$ ) with significant site × seeding date and site × seeding rate interactions also detected ( $P < 0.001$ ). The overall, 16 site average seeding date effect was as expected, with early seeded faba beans yielding 17% higher than with delayed seeding (Table 14). The seeding rate effect on yield was smaller and less consistent with, averaged across all 16 sites. Across all 16 sites, seed weights were slightly higher with early seeding date and at the 45 seeds/m<sup>2</sup> seeding rate.

Table 14. Overall main effect means of seeding date, seeding rate, and fungicide treatment for selected faba bean response variables. Means within a column followed by the same letter do not significantly differ ( $P \leq 0.05$ ).

| Main Effect             | Plant Density             | Initial Disease | Final Disease | Days to Maturity <sup>z</sup> | Seed Yield  | Seed Weight  |
|-------------------------|---------------------------|-----------------|---------------|-------------------------------|-------------|--------------|
| <u>Seeding Date</u>     | - plants/m <sup>2</sup> - | --- 0-9 ---     | --- 0-9 ---   | --- days ---                  | -- kg/ha -- | g/1000 seeds |
| Early                   | 50.8 B                    | 0.60 A          | 0.52 A        | 101.3 A                       | 3060 A      | 394.5 A      |
| Delayed                 | 53.4 A                    | 0.29 B          | 0.60 A        | 97.4 B                        | 2621 B      | 388.2 B      |
| <u>Seeding Rate</u>     |                           |                 |               |                               |             |              |
| 45 seeds/m <sup>2</sup> | 44.7 B                    | 0.44 A          | 0.54 A        | 99.4 A                        | 2793 B      | 394.6 A      |
| 65 seeds/m <sup>2</sup> | 59.5 A                    | 0.45 A          | 0.58 A        | 99.2 B                        | 2887 A      | 388.1 B      |
| <u>Fungicide</u>        |                           |                 |               |                               |             |              |
| Control                 | —                         | —               | 0.61 A        | 99.5 A                        | 2803 B      | 390.6 A      |
| Treated                 | —                         | —               | 0.51 B        | 99.2 B                        | 2878 B      | 392.1 A      |

<sup>z</sup> Days to maturity was not reported at YK-22

### Conclusions

Overall, our results are largely in agreement with past research and supportive of current recommendations. Faba beans should be seeded as early as possible and target seeding rates of approximately 45 seeds/m<sup>2</sup> are likely to be sufficient in most cases if seedling mortality is not excessive. In this project, any impacts of fungicide applications on disease symptoms were also low. The project was conducted during a period of relatively low disease pressure, and it is unclear whether the product we used at most sites had much activity on the dominant disease, Chocolate spot (*Botrytis*).

### Acknowledgements

Financial support for the project was provided by the Saskatchewan Pulse Growers (SPG).

## Efficacy of Fungicides Active Ingredient for Fusarium Head Blight (FHB) and Deoxynivalenol (DON) Management in Wheat

Singh, G. (ICDC), Holzapfel, C. (IHARF), Nybo, B. (WCA), Hall, M. (ECRF), McInnes, B. (NARF), and Enns, J. (WARC)

### Description

In 2023, field demonstrations with durum wheat (CWAD) and bread wheat (CWRS) varieties were conducted at six Agri-ARM locations to compare the effectiveness of five fungicides sprayed at the anthesis stage in controlling Fusarium head blight (FHB). The locations were Outlook (irrigated), Indian Head, Swift Current, Yorkton, Melfort, and Scott. The study involved comparison of five fungicides registered for controlling FHB in Saskatchewan (Table 15). Field trials were established using a RCBD with four replicates. Fungicide treatments were applied to target the anthesis stage (BBCH61 to BBCH 69).

Table 15. Fungicides evaluated at fusarium head blight (FHB) and deoxynivalenol (DON) management in wheat trial at Outlook, Indian Head, Swift Current, Yorkton, Melfort, and Scott in 2023.

| Treatment | Active ingredient              | Group | Commercial name                    |
|-----------|--------------------------------|-------|------------------------------------|
| 1         | Control                        |       |                                    |
| 2         | Metconazole                    | 3     | Caramba (BASF Canada)              |
| 3         | Prothioconazole                | 3     | Proline (Bayer)                    |
| 4         | Prothioconazole + Tebuconazole | 3     | Prosaro XTR (Bayer)                |
| 5         | Pyraclostrobin + Metconazole   | 11,3  | Twinline (BASF Canada)             |
| 6         | Pydiflumetofen + Propiconazole | 7,3   | MIRAVIS Ace (Syngenta Canada Inc.) |

### Results

The 2023 growing season experienced notably higher temperatures and below-average precipitation, impacting disease severity. Fusarium head blight (FHB) incidence and severity was notably low at all sites during this study, making it challenging to assess the effectiveness of the five fungicides tested in disease management. Fusarium-damaged kernel (FDK) assessment indicated minimal damage, while significant yield differences were observed at Indian Head and Outlook between control and fungicide-applied treatments.

### Conclusions

Considering environmental conditions and disease pressure, a proactive approach utilizing Group 3 or 7 active ingredients around wheat anthesis is recommended for high FHB risk areas.

### Acknowledgements

Four sites (Outlook, Melfort, Scott, and Yorkton) in this project received funding through the Agriculture Demonstration of Practices and Technologies (ADOPT) program by the Ministry of Agriculture. Additionally, the Saskatchewan Wheat Crop Development Board generously provided financial support for two project sites (Indian Head and Swift Current).

## Standing Up with Your Own Stalk: Do the Plant Growth Regulators Available for Spring Wheat Improve the Productivity of Current CWRS Varieties?

McInnes, B. (NARF), Hall, M. (ECRF), Holzapfel, C. (IHARF), Lokken, R. (CLC), Enns, J. (WARC), and Singh, G. (ICDC)

### Description

The main objective of this project was to demonstrate the response of current and common Canadian Western Red Spring (CWRS) wheat varieties to the plant growth regulators (PGRs) registered for use in spring wheat. The trials were conducted at Melfort, Prince Albert, Outlook (irrigated), Indian Head, Yorkton, and Scott in 2023. The treatments were arranged as a split-plot with four replications at all sites. The main plot was plant growth regulator (PGR), and the sub-plot was CWRS variety. The PGR treatments were an untreated control, Manipulator, and Moddus. Both products were applied at the recommended growth stage of BBCH 30-32 and at the recommended rate of 700mL/ac (Manipulator) and 340mL/ac (Moddus). The treatment factors of PGR and CWRS variety were combined to result in 12 treatments (Table 16).

Table 16. Treatments used in PGRs applications on CWRS wheat varieties at all sites in 2023.

| Treatment # | PGR Product | Variety      | Lodging Resistance* |
|-------------|-------------|--------------|---------------------|
| 1           | No PGR      | AAC Brandon  | G                   |
| 2           |             | AAC Alida    | VG                  |
| 3           |             | AAC Redberry | F                   |
| 4           |             | AAC Starbuck | F                   |
| 5           | Manipulator | AAC Brandon  | G                   |
| 6           |             | AAC Alida    | VG                  |
| 7           |             | AAC Redberry | F                   |
| 8           |             | AAC Starbuck | F                   |
| 9           | Moddus      | AAC Brandon  | G                   |
| 10          |             | AAC Alida    | VG                  |
| 11          |             | AAC Redberry | F                   |
| 12          |             | AAC Starbuck | F                   |

\*Lodging resistance scale: VG-very good, G-good, F-fair

## Results

PGR had no effect on plant density at any site. Application of Moddus and Manipulator significantly reduced crop height at Melfort, Scott, Outlook, and Indian Head as compared to No PGR (Table 17). Depending on site, the significant reduction in crop height ranged from 4-8cm. There was no significant difference in the reduction in crop height between Moddus and Manipulator at any site. As for the variety effect, AAC Alida was the tallest at all sites (Table 17). At Indian Head, Manipulator significantly increased days to maturity as compared to the control; however, the effect was too small to be of any agronomic concern. At both Yorkton and Indian Head, application of Manipulator and Moddus significantly reduced lodging as compared to No PGR however, the degree of lodging at both sites was very small. Grain yield was not affected by PGR application at five of the sites, but at Melfort, Moddus significantly reduced crop yield as compared to No PGR by 15% or 542 kg/ha. At Indian Head, Manipulator reduced test weight and protein and at Melfort, Manipulator reduced test weight, and both Moddus and Manipulator reduced protein. Applying a PGR was often not economical in this demonstration due to the lack of yield response to applying PGRs.

Table 17. Statistical analyses and treatments mean for crop height (cm) for PGRs applications on CWRS Wheat varieties trial in 2023. Means within a column followed by the same letter do not significantly differ ( $P \leq 0.05$ ).

| Main effect                   | NARF      | ECRF      | WARC       | CLC       | ICDC     | IHARF      |
|-------------------------------|-----------|-----------|------------|-----------|----------|------------|
| Crop height (cm) <sup>2</sup> |           |           |            |           |          |            |
| PGR (p-value)                 | 0.0062**  | 0.06      | 0.0006***  | 0.56      | 0.0174*  | 0.0021**   |
| Variety (p-value)             | 0.0001*** | 0.0002*** | <0.0001*** | 0.0005*** | 0.0051** | <0.0001*** |
| Var*PGR (p-value)             | 0.70      | 0.47      | 0.0007***  | 0.52      | 0.34     | 0.0019**   |
| <u>PGR</u>                    |           |           |            |           |          |            |
| Manipulator                   | 65 b      | 68 a      | 69 b       | 71 a      | 86 b     | 69 b       |
| Moddus                        | 66 b      | 71 a      | 67 b       | 71 a      | 86 b     | 72 b       |
| No PGR                        | 72 a      | 77 a      | 74 a       | 73 a      | 90 a     | 77 a       |
| <u>Variety</u>                |           |           |            |           |          |            |
| AAC Alida                     | 72 a      | 76 a      | 72 a       | 74 ab     | 91 a     | 77 a       |
| AAC Brandon                   | 67 b      | 71 b      | 67 c       | 68 c      | 85 b     | 71 b       |
| AAC Redberry                  | 64 b      | 71 b      | 70 ab      | 76 a      | 87 ab    | 72 b       |
| AAC Starbuck                  | 66 b      | 70 b      | 70 b       | 70 bc     | 86 b     | 71 b       |

<sup>2</sup>Significance level of the p-value: \* $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

## Conclusions

There were very few differences in varietal response to PGR at all sites in this demonstration, suggesting that these varieties responded similar to both PGR's in this one-year demonstration.

## Acknowledgements

Four sites (Melfort, Outlook, Yorkton, and Prince Albert) in this project received funding through the Agriculture Demonstration of Practices and Technologies (ADOPT) program by the Ministry of Agriculture. Additionally, the Saskatchewan Wheat Crop Development Board generously provided financial support for two project sites (Indian Head and Scott).

## Evaluation of Seeding Rates of Wheat Under Various Environmental Conditions

Enns, J. (WARC), Slind, K. (WARC), Holzapfel, C. (IHARF), McInnes, B. (NARF), Lokken, R. (CLC), Nybo, B. (WCA), Wall, A. (WCA), and Hall, M. (ECRF)

### Description

The objective of this study was to evaluate the ideal seeding rate for spring wheat under various environmental conditions. Seven seeding rate treatments were arranged in a RCBD with four replications at six sites throughout Saskatchewan in 2023. The sites in this trial included Scott, Indian Head, Melfort, Prince Albert, Swift Current, and Yorkton. Seeding rate treatments are listed in Table 18. At each location a common, high yielding hard red spring wheat (HRSW) variety was chosen.

Table 18. Treatment list for “Evaluation of Seeding Rates of Wheat Under Various Environmental Conditions” in Scott, Indian Head, Melfort, Prince Albert, Swift Current, and Yorkton, SK. 2023.

| Trt# | Seeding Rates        |                        |
|------|----------------------|------------------------|
|      | Seeds/m <sup>2</sup> | Plants/ft <sup>2</sup> |
| 1    | 108                  | 10                     |
| 2    | 163                  | 15                     |
| 3    | 217                  | 20                     |
| 4    | 272                  | 25                     |
| 5    | 326                  | 30                     |
| 6    | 378                  | 35                     |
| 7    | 432                  | 40                     |

### Results

The plant and head densities tended to increase as seeding rates increased at all locations; however, the effect was stronger at high moisture sites than low moisture sites. Furthermore, lodging also tended to increase with increasing seeding rates, but only at high moisture sites. Tiller density, head length, and head size tended to decrease as seeding rates increased for all locations, but to a greater degree at high moisture sites than low moisture sites. The effect of seeding rate on protein and seed weight was minimal for all locations regardless of moisture conditions. The effect of seeding rate on yield varied greatly depending on location. At low moisture sites the yields tended to decrease as seeding rates increased; whereas at high moisture sites the yields tended to increase as seeding rates increased. Head density and tillering were the most significant factors influencing yields compared to other factors evaluated in the study. However, the impact of these factors varied based on moisture conditions. The highest yields for both head density and tillering occurred consistently at seeding rates of 20 seeds/ft<sup>2</sup> in low moisture conditions and 30 seeds/ft<sup>2</sup> in high moisture conditions.

### Conclusions

This study confirms that seeding rates to optimize yield vary based on environmental conditions. Further research to understand these impacts on topography throughout a field would be beneficial to determine whether varying seeding rates based on topography could be used to optimize yields throughout entire fields.

## Acknowledgements

Financial support for this project was provided by the Saskatchewan Wheat Development Commission.

## Response of Canola and Flax to Humic Acid Coated P Fertilizer (MAP) Rates

Singh, G. (ICDC), Holzapfel, C. (IHARF), Hall, M. (ECRF), Lokken, R. (CLC), and Galbraith, Z. (CLC)

### Description

This study aimed to demonstrate if humic acid-coated MAP (Monoammonium phosphate) fertilizer can promote phosphorus absorption by plants and enhance fertilizer utilization rates. Small plot trials were established at Indian Head, Yorkton, Prince Albert, and Outlook (irrigated), SK in 2023. Five treatments (Table 19) were implemented using a RCBD, with four replications for each crop. All P fertilizer was placed in the seed row, and nitrogen, in the form of urea (46-0-0), was uniformly side-banded across all treatments. Response of Canola and flax was evaluated in separate and individual trials.

Table 19. Treatment plan for both canola and flax MAP field trials conducted at Indian Head, Yorkton, Prince Albert, and Outlook, SK in 2023.

| Treatment | Canola/Flax   |
|-----------|---|
| 1         | Control   |
| 2         | 1 × (25 kg/ha P <sub>2</sub> O <sub>5</sub> ) MAP                         |
| 3         | 1 × (25 kg/ha P <sub>2</sub> O <sub>5</sub> ) MAP treated with humic acid |
| 4         | 2 × (50 kg/ha P <sub>2</sub> O <sub>5</sub> ) MAP                         |
| 5         | 2 × (50 kg/ha P <sub>2</sub> O <sub>5</sub> ) MAP treated with humic acid |

### Results

#### Canola Response

Significant impacts on canola emergence were observed in five tested treatments at Indian Head, Prince Albert, and Yorkton, while the effect was nonsignificant at Outlook. Days to maturity were unaffected by MAP treatments at Indian Head, Prince Albert, and Outlook, with the exception of Yorkton, where control plots matured a day earlier than MAP-applied plots. Grain yield remained unaffected by the tested treatments at Indian Head, Prince Albert, and Outlook, except at Yorkton, where a positive trend for MAP application was observed compared to control plots. The results for plant P uptake exhibited a range of 0.16 to 0.55 %, indicating a tendency towards increased tissue P with MAP application compared to the control.

#### Flax Response

Overall, plant counts exhibited no significant variation between treatments (control vs. MAP treatments, MAP vs. Humic acid MAP, 1× and 2× MAP rates) at all sites. Flax dry matter yield and maturity remained unaffected by the tested treatments at all sites. At Prince Albert, flax plots were affected by wildlife damage, resulting in significantly lower yields. A significant impact of tested treatments on flax yield was observed at Indian Head, with check plots (0 P fertilizer) displaying the lowest yield and a yield increase

with adding P fertilizer. Fertilizer rates (1× vs. 2×) also influenced for flax yield, with higher yields observed for 2× rates. No yield advantage was observed in flax due to humic acid treatments. Yorkton and Outlook showed no significant treatment effect on flax yield. Tissue P varied across sites from 0.11 to 0.31 %. A general trend towards increased tissue P with MAP application compared to the control was observed at Indian Head.

### *Conclusions*

The results indicate variability in plant responses across locations and treatments, emphasizing the complexity of factors influencing crop performance. Based on one-year trials, no noticeable plant density and yield improvements were observed by treating MAP fertilizer with humic acid.

### *Acknowledgements*

Financial support for the projects was provided by the Saskatchewan Canola Development Commission (SaskCanola) and Saskatchewan Flax Development Commission (SaskFlax).

## **Contrasting Fungicide Applications and Genetic Fusarium Head Blight Resistance for Enhanced Yield and Quality of Barley**

Holzapfel, C. (IHARF), Turkington, K. (AAFC), Mohr, R. (AAFC), Hall, M. (ECRF), and McInnes, B. (NARF)

### *Description*

The project was initiated in the winter of 2019-2020 to investigate the potential for foliar fungicide applications combined with genetic fusarium head blight (FHB) resistance to enhance yields and/or end-use quality of barley. The first field trials were established at Indian Head, Yorkton, and Melfort in the spring of 2020, with the Brandon site postponed due to COVID-19 restrictions. For the 2021-2023 growing seasons, trials were conducted at all four locations. To date, field trials have been conducted at 15 location-years. The treatments were a factorial combination of three varieties and four fungicide treatments, arranged in a four replicate RCBD. The varieties were selected based on their genetic resistance to FHB and were CDC Bow (moderately susceptible; MS), AAC Synergy (intermediate; I), and AAC Connect (moderately resistant, MR). The target seeding rate at all sites was 300 viable seeds/m<sup>2</sup>. The fungicide treatments were an untreated control, a flag-leaf application targeting leaf disease (Trivapro), an application at 80-100% head emergence targeting FHB (Prosaro XTR), and a dual application which received both the flag-leaf stage and heading fungicide applications. The fungicides were applied as per protocol, using field sprayers and a minimum solution volume of 187 l/ha (20 U.S. gal/ac). The treatments were applied on the same date for each variety, and, to date, no sites have observed enough variance in crop stage to suggest that separate application dates would be warranted.

### *Results*

Differences in plant emergence between varieties was observed at 5/15 sites. Emergence for AAC Synergy was slightly lower than for the other two varieties at IH-20. All four locations in 2021 observed lower plant populations for CDC Bow compared to the other varieties. There were no differences in plant density amongst varieties at any of the 2022 or 2023 sites. At the time of the flag leaf fungicide

applications, leaf disease levels never differed between varieties and were approximately 1% or lower (leaf area affected) at 13/15 sites, the sole exceptions being ME-20 and BR-23 where the overall mean values were still quite low at 2.3-2.4%. At ME-20, the trend was for the most disease in CDC Bow and the least in AAC Connect. The final leaf disease collections were completed as late in the season as possible but before senescence; however, total disease levels (leaf spots disease) at this time were still approximately 1% or less at 7/15 sites. Despite the low disease pressure, variety effects were significant at 9/15 sites and fungicide effects were significant at 8/16 sites, and VAR × FUNG interactions were detected at 3/16 sites. For variety, the trends were not perfectly consistent but showed amongst the highest disease pressure with CDC Bow. Significant fungicide effects were always as expected with the highest overall disease levels consistently occurring in the untreated control plots. The VAR × FUNG interactions occurred at BR-22, BR-23, and ME-21 and were consistent in that they showed the strongest fungicide effects with CDC Bow, intermediate effects with CDC Connect, and essentially no effect with AAC Synergy. Similar to the trends for variety and leaf spot severity, these trends likely reflected the levels of leaf spot resistance each variety. Grain yields were affected by variety at 10/16 sites and fungicide at 2/15 sites, with VAR × FUNG interactions also detected at 2/15 sites. For 9/10 of the sites where variety differences existed, CDC Bow was the lowest yielding variety (Table 20). The sole sites where the overall fungicide effect was significant were BR-22 and IH-22. At BR-22, the highest yields were achieved with the dual application while yields for the single application treatments were intermediate and did not significantly differ from either the control or the dual fungicide treatments (Table 20). At IH-22, all treatments that received a fungicide yielded similarly and significantly higher than the untreated control treatments.

Table 20. Variety and fungicide treatment main effect means for barley yield at Brandon, MB (2021-2023). Main effect means within a column followed by the same letter do not significantly differ (Tukey, P < 0.05).

| Source                          | BR-21  | BR-22   | BR-23  |
|---------------------------------|--------|---------|--------|
| ----- Grain Yield (kg/ha) ----- |        |         |        |
| <u>Variety (VAR)</u>            |        |         |        |
| Bow (MS)                        | 3950 B | 5863 C  | 6857 B |
| Synergy (I)                     | 5653 A | 6601 A  | 7516 A |
| Connect (MR)                    | 5288 A | 6345 B  | 7258 A |
| <u>Fungicide</u>                |        |         |        |
| Untreated                       | 4986 A | 6139 B  | 7112 A |
| Flag                            | 4895 A | 6226 AB | 7143 A |
| Head                            | 4920 A | 6307 AB | 7261 A |
| Dual                            | 5054 A | 6406 A  | 7325 A |

### Conclusions

All aspects of the field trials went well in 2023; however, the data from Yorkton was unusually variable with yields ranging from 698-5886 kg/ha. Yields were well distributed within this range, and the overall average was 2813 kg/ha; therefore, excluded from any combined analyses. Overall average yields at Brandon, Indian Head, and Melfort were 7210 kg/ha, 5881 kg/ha, and 5493 kg/ha, respectively, and the data generally appeared to be of acceptably high quality. However, the low disease pressure observed at all locations was not ideal for the purposes of this project.

### Acknowledgements

Financial support for this project was provided by the Saskatchewan Barley Development Commission, Manitoba Crop Alliance, and Western Grains Research Foundation (WGRF).

## Hemp Seeding Date Demonstration for Grain Production

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### Description

The primary aim of this project was to identify the optimal seeding date for conventional hemp in Saskatchewan. Field trials were established at Outlook (irrigated), Scott, Melfort, and Indian Head, Saskatchewan from 2021-2023. Three hemp varieties—X59, Picolo, and Kantani—were planted at three distinct times: late May, mid-June, and early July in a replicated split-plot design. The main plot was the seeding date, and the sub plot was three hemp varieties. Hemp plots were seeded at 30 lb/ac seed rate (sometimes adjusted for differences in germination and thousand kernel weight), with an estimated target plant density of 100-125 plants/m<sup>2</sup>.

### Results

Throughout the study, all sites faced drier conditions with temperatures exceeding the long-term averages, impacting the yield potential of dryland sites. In the irrigated Outlook trial, the mid-June seeding date exhibited a yield advantage and better plant emergence compared to early and late seeding dates (Table 21). This trend was consistent across all dryland sites, demonstrating promising yields when seeded in mid-June. Among the three tested varieties, X59 consistently outperformed the other varieties at all sites, showcasing higher yield potential in Saskatchewan's growing conditions. Hemp height was influenced by water availability at each site, with irrigated site displaying almost double the height of dryland sites. Assessing maturity proved challenging but was also impacted by the seeding date. Expressed as days from seeding, early seeded hemp took longer to reach physiological maturity than later seeding dates tested in this study.

Table 21. Seeding dates and varieties' effect on plants/m<sup>2</sup> (PPMS), plant height (cm), and mean yield (kg/ha) measured at Outlook in 2021, 2022, and 2023. Main effect means within a column followed by the same letter do not significantly differ (ANOVA, P < 0.05).

| Outlook        | PPMS   |       |       |   | Height (cm) |         |         | Yield (kg/ha) |        |      |
|----------------|--------|-------|-------|---|-------------|---------|---------|---------------|--------|------|
|                | 2021   | 2022  | 2023  |   | 2021        | 2022    | 2023    | 2021          | 2022   | 2023 |
| <i>Date</i>    |        |       |       |   |             |         |         |               |        |      |
| Late May       | 105 b  | 100 a | 162 a | - | 119 b       | 138.3 b | 1247 ab | 584 a         | 1182 b |      |
| Mid-June       | 128 a  | 107 a | 173 a | - | 132 a       | 148.2 a | 1546 a  | 497 a         | 1233 a |      |
| Early July     | 112 ab | 96 a  | 166 a | - | 134 a       | 136.0 b | 1211 b  | 715 a         | 556 c  |      |
| <i>Variety</i> |        |       |       |   |             |         |         |               |        |      |
| Katani         | 110 b  | 91 b  | 163 a | - | 122 b       | 138.3 b | 1278    | 557 b         | 938 b  |      |
| Picolo         | 107 b  | 93 b  | 167 a | - | 122 b       | 137.4 b | 1239    | 540 b         | 892 b  |      |
| X59            | 129 a  | 118 a | 170 a | - | 141 a       | 146.8 a | 1487    | 946 a         | 1141 a |      |

### Conclusions

Among the three seeding dates investigated, the mid-June seeding date consistently delivered the best results, leading to enhanced yield and plant densities. Variety X59 consistently outperformed other varieties tested, establishing itself as the preferred choice for achieving higher yields. However, producers should consider site-specific seeding dates and varieties based on local conditions for optimal hemp cultivation.

### Acknowledgements

This project was funded through the Ministry of Agriculture and the Canadian Agriculture Partnership Strategic Field Program (SFP).

## Establishing Nitrogen and Seeding Rate Recommendations for Composite Yellow Mustard Production in Saskatchewan

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### Description

The project was initiated to define upper limits of nitrogen fertilizer and specify an optimal seeding rate to maximize yield for a composite yellow mustard (AAC Yellow 80). In 2023, small-plot research trials were established in three different soil zones in Saskatchewan. Locations were Swift Current, Indian Head, and Redvers. The project was comprised as two separate trials that included both varieties AAC Yellow 80 (composite yellow) and Andante Yellow (open pollinated) mustard. The first trial evaluated both varieties at increasing nitrogen rates of 0, 60, 80, 100, 120, 140 and 160 lbs/ac of total nitrogen (soil residual + nitrogen applied as urea). The second trial included both varieties and balanced NPKS at increasing seed rates of 108, 150, 194, 237, and 280 seeds/m<sup>2</sup>. The two trials each arranged in a RCBD with 4 replicates. Treatments are listed in Table 22.

Table 22. Nitrogen and seeding rates used in two yellow mustard trials in 2023.

| Trial 1         |                          |                                       |
|-----------------|--------------------------|---------------------------------------|
| Mustard Variety | Seed Rate                | Residual + Applied Nitrogen (lb N/ac) |
| AAC Yellow 80   | 237 seeds/m <sup>2</sup> | Soil N <sup>2</sup>                   |
| AAC Yellow 80   | 237 seeds/m <sup>2</sup> | 60                                    |
| AAC Yellow 80   | 237 seeds/m <sup>2</sup> | 80                                    |
| AAC Yellow 80   | 237 seeds/m <sup>2</sup> | 100                                   |
| AAC Yellow 80   | 237 seeds/m <sup>2</sup> | 120                                   |
| AAC Yellow 80   | 237 seeds/m <sup>2</sup> | 140                                   |
| AAC Yellow 80   | 237 seeds/m <sup>2</sup> | 160                                   |
| Andante         | 237 seeds/m <sup>2</sup> | Soil N <sup>2</sup>                   |
| Andante         | 237 seeds/m <sup>2</sup> | 60                                    |
| Andante         | 237 seeds/m <sup>2</sup> | 80                                    |
| Andante         | 237 seeds/m <sup>2</sup> | 100                                   |
| Andante         | 237 seeds/m <sup>2</sup> | 120                                   |
| Andante         | 237 seeds/m <sup>2</sup> | 140                                   |
| Andante         | 237 seeds/m <sup>2</sup> | 160                                   |

| Trial 2         |                          |  |
|-----------------|--------------------------|--|
| Mustard Variety | Seed Rate                | Residual + Applied Nitrogen (lb N/ac) <sup>Y</sup> |
| AAC Yellow 80   | 108 seeds/m <sup>2</sup> | 100  |
| AAC Yellow 80   | 150 seeds/m <sup>2</sup> | 100  |
| AAC Yellow 80   | 194 seeds/m <sup>2</sup> | 100  |
| AAC Yellow 80   | 237 seeds/m <sup>2</sup> | 100  |
| AAC Yellow 80   | 280 seeds/m <sup>2</sup> | 100  |
| Andante         | 108 seeds/m <sup>2</sup> | 100  |
| Andante         | 150 seeds/m <sup>2</sup> | 100  |
| Andante         | 194 seeds/m <sup>2</sup> | 100  |
| Andante         | 237 seeds/m <sup>2</sup> | 100  |
| Andante         | 280 seeds/m <sup>2</sup> | 100  |

<sup>Z</sup> soil nitrogen varied at each site.

<sup>Y</sup> varied according to location.

### Results

Mustard variety and nitrogen rate effects on establishment were similar at each location. Andante yellow mustard resulted in a higher plant stand than AAC Yellow 80 at each site with nitrogen rate having little to no effect on plant population. Mustard variety and seed rate effects on mustard establishment were also similar at each location. Andante yellow mustard resulted in higher plant stands compared to AAC Yellow 80 at each site, with the exception of Swift Current not being significantly different. Andante was also rated as more vigorous at Swift Current and Redvers. Plant stand and vigor increased with seed rate at all sites. However, seed mortality increased as seeding rate increased, meaning the lower seeding rates had a higher percentage of surviving plants. There was no variety or nitrogen effect on lodging at Swift Current, or Redvers. At Indian Head, AAC Yellow 80 was more prone to lodging (2.1) compared to Andante (1.3) and lodging increased with nitrogen rates from 1.2 to 2.2, on a scale of 1-9. Seeding rate had no effect on lodging (only measured at Indian Head and Swift Current). However, there was a slight trend at Indian Head for lodging to increase with seed rate and ranged from 1.6 to 2.1. Yield potential was negatively affected by limited moisture and above average temperatures at all sites. Despite AAC Yellow 80 establishment rates being significantly lower than Andante, average yields of AAC Yellow 80 were statistically higher compared to Andante at Swift Current and Indian Head for both the nitrogen and seed rate trials.

### Conclusions

In the first year, AAC Yellow 80 indicated a strong nitrogen use efficiency and the ability to compensate with increased branching at a lower target plant stand compared to Andante. The field trials will be repeated for the next two growing seasons; therefore, the project will be completed after the 2025 growing season.

### Acknowledgements

This project was funded through the Ministry of Agriculture and the Canadian Agriculture Partnership Strategic Field Program (SFP).

## Foliar Applied Nitrogen Fixing Biological Products for Canola

Catellier, C. (IHARF)

### Description

The objective of this project was to determine if there are agronomic and economic benefits of applying a commercially available, foliar applied N-fixing bacteria product (Envita®) in canola under varying rates of applied N fertilizer. In 2023, field-scale trials were conducted at nine commercial farms with canola in Saskatchewan. There were two treatments options: Option A and Option B (Table 23). The treatments were replicated and applied in randomized strips. Option A trials were replicated four times (8 plots total) and Option B trials were replicated three times (12 plots total). All plots were managed the same agronomically including seeding date, variety, seeding depth, seed treatment, and pesticide application. The normal N fertilizer rate was determined by the producer and their agronomist as per their management practices. The reduced N rate treatments were 90 % or less of the normal N rate. For Option A, the entire field was seeded at the normal N fertilizer rate and, Envita® treatment strips were established at the recommended timing using the provided randomized field plan. For Option B, N fertility treatments were established at seeding time and Envita® application was completed at the recommended timing using the provided field plan. Envita® was either tank-mixed at herbicide timing or applied as a separate pass. Label recommendations were followed. Data from all sites was combined to assess the overall effect of Envita application and whether the effect differed with nitrogen availability.

Table 23. Treatments used in foliar applied N-fixing bacteria product in canola trial in 2023.

| Option A: Two treatments                  | Option B: Four treatments     |
|---|-------------------------------|
| 1) Untreated check                        | 1) Normal N rate + Untreated  |
| 2) Envita® at recommended rate and timing | 2) Normal N rate + Envita®    |
|   | 3) Reduced N rate + Untreated |
|   | 4) Reduced N rate + Envita®   |

### Results

There was no significant difference in yield between treatments. Therefore, the most economical treatment was the check. Protein increased significantly and oil content decreased significantly with N supply but did not differ significantly with Envita® application.

### Conclusions

Overall, we were unable to detect a difference in yield in response to Envita® application or N rate under the conditions experienced across the trials this growing season.

### Acknowledgements

Financial support for this project was provided by the Saskatchewan Canola Development Commission (SaskCanola).

## Lentil Seeding Rates

Catellier, C. (IHARF)

### *Description*

The objective of this project was to evaluate the seeding rate of small red or large green lentil including comparisons of seedling survivability and yield in response to plant population across various landscape positions. Field-scale trials were established on a total of 17 commercial farms throughout the lentil growing region of Saskatchewan in 2023. The treatments compared three different seeding rates at each trial site, apart from one trial site which only compared two seeding rates. The seeding rate treatments generally corresponded to approximately targeting standard (12 plants per ft<sup>2</sup>), high (18 plants per ft<sup>2</sup>), and very high (24 plants per ft<sup>2</sup>) plant populations. Landscape position (knoll, mid-slope, or depression) was included as an additional sub-plot variable at sites with variable topography and data collected separately within these subplots. Trials were set up in randomized strips with four replicates, for a total of 12 plots. Data from each site was analyzed individually and combined to assess the general response.

### *Results*

Overall, plant density and seedling mortality increased with seeding density but did not differ significantly by landscape position at the five sites where this was assessed. Further, plant density and seedling mortality increased significantly with seeding density overall, and this was fairly consistent across all sites. Overall, yield decreased significantly with higher seeding densities, but this was not consistent across individual sites. Protein and seed size were not affected overall, and this was also fairly consistent across sites.

### *Conclusions*

After the first year of field scale trials, the results suggested that in general, increased seeding rates in lentils were not economically viable due to the increased cost of seed without an associated yield or quality increase. However, as there were some individual sites with significant yield increases at higher seeding densities, it is worth exploring further and identifying the precise management and weather conditions that would be associated with this response.

### *Acknowledgements*

Financial support for this project was provided by the Saskatchewan Pulse Growers.

## Barley Seeding Rates

Catellier, C. (IHARF)

### *Description*

The objective of this project was to optimize seeding rates based on target plant density to balance seed costs, yield, crop competitiveness, and stand management in malt barley. In 2023, field-scale trials were established at two commercial farms with barley at Dodsland and Luseland in Saskatchewan. The

treatments compared three different seeding rates at each trial site approximately targeting 250 seeds/m<sup>2</sup> – Reduced rate, 300 seeds/m<sup>2</sup> – Standard rate, and 350 seeds/m<sup>2</sup> – High rate. Actual seeding rates for each treatment varied depending on the producers' needs and current rates. The treatments were replicated four times and applied in randomized strips. On request, an additional treatment of a variable seeding rate with adjustments for landscape position (knoll, mid-slope, and depression), was applied.

### *Results*

At Dosland, higher barley seeding rate increased plant density. Seedling mortality was significantly higher with variable seeding rate than with the flat rates which had consistent seedling mortality. There were no significant differences in yield, protein, or plumps and thins with increased seeding rates. However, plant height and test weight decreased significantly with seeding rates. At Luseland, higher barley seeding rate did not significantly affect plant height, yield, test weight, or percent thins. However, protein was significantly lower and percent plumps significantly higher in the low seeding rate compared to the standard seeding rate.

### *Conclusions*

The effect of seeding rate on yield was not significant, thus the yield difference between treatments was zero. Net profit declined with seeding rate.

### *Acknowledgements*

Financial support for this project was provided by the Saskatchewan Barley Development Commission.

## **Foliar Applied Nitrogen Fixing Biological Products for Wheat**

Catellier, C. (IHARF)

### *Description*

The objective of this project was to determine if there are agronomic and economic benefits of applying a commercially available, foliar-applied N-fixing bacteria product (Envita<sup>®</sup>) in wheat. In 2023, field-scale trials were conducted at 12 commercial farms with wheat in Saskatchewan. There were two treatment options: Option A and Option B (Table 24). The treatments were replicated and applied in randomized strips. Option A trials were replicated four times (8 plots total) and Option B trials were replicated three times (12 plots total). All plots were managed the same agronomically including seeding date, variety, seeding depth, seed treatment, and pesticide application. The normal N fertilizer rate was determined by the producer and their agronomist as per their management practices. The reduced N rate treatments were 90 % or less of the normal N rate. For Option A, the entire field was seeded at the normal N fertilizer rate and, Envita<sup>®</sup> treatment strips were established at the recommended timing using the provided randomized field plan. For Option B, N fertility treatments were established at seeding time and Envita<sup>®</sup> application was completed at the recommended timing using the provided field plan. Envita<sup>®</sup> was either tank-mixed at herbicide timing or applied as a separate pass. Label recommendations

were followed. Data from all sites was combined to assess the overall effect of Envita application and whether the effect differed with nitrogen availability.

Table 24. Treatments used in foliar applied N-fixing bacteria product in wheat trial in 2023.

| Option A: Two treatments                  | Option B: Four treatments     |
|---|-------------------------------|
| 1) Untreated check                        | 1) Normal N rate + Untreated  |
| 2) Envita® at recommended rate and timing | 2) Normal N rate + Envita®    |
|   | 3) Reduced N rate + Untreated |
|   | 4) Reduced N rate + Envita®   |

### *Results*

There was no significant difference in yield between treatments. Therefore, the most economical treatment was the check. Protein increased significantly with N supply but was not significantly affected by Envita application. The effect of N supply on test weight differed when Envita was applied; test weight was unaffected by N supply when untreated but increased with N supply when Envita was applied. Seed size was not significantly affected by Envita application or N supply overall.

### *Conclusions*

Overall, we were unable to detect a significant difference in yield in response to Envita application under the conditions experienced across the trials this growing season.

### *Acknowledgements*

Financial support for this project was provided by the Saskatchewan Wheat Development Commission.