2025 Project Report

for the

Agricultural Demonstration of Practices and Technologies (ADOPT) Program

Winter Cereal Showcase Demonstrating Winter Wheat, Winter Triticale, and Fall Rye Response to Seed-Applied Fungicides

(Project # 20240951)

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Agriculture Demonstration of Practices and Technologies (ADOPT)

Project Final Report

The final project report should be made available electronically (MS Word). Additional data tables and or graphs may be submitted in spreadsheet format. Due to formatting, printing and distribution requirements, final reports will not be accepted as PDF documents. Completed reports must be returned by email to Evaluation.Coordinator@gov.sk.ca.

Project Title: Winter Cereal Showcase Demonstrating Winter Wheat, Winter Triticale, and Fall Rye Response to Seed-Applied Fungicides

Project Number: 20240951

Producer Group Sponsoring the Project: Indian Head Agricultural Research Foundation

Project Location(s): *Provide the name or number of the rural municipality, nearest town or legal land location if possible. Provide the name of any cooperating landowner(s).* Indian Head, R.M. #156

Project start date *(month & year):* 9/1/2024

Project end date *(month & year):* 3/31/2026

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Abstract *(maximum 200 words)*

Detail key elements from the project objectives, methodology, results and conclusions to provide a short concise summary of the project. List extension activities such as field days or workshops and include the number of people who visited the project.

A winter cereal trial was established near Indian Head in the fall of 2024. The treatments were a factorial combination of crop types (winter wheat, winter triticale, and fall rye), varieties (old versus new), and seed-applied fungicide treatments (untreated versus treated). Data collection included soil temperature/moisture at seeding, spring plant densities, NDVI, grain yield, and test weight. Conditions were excellent for establishment but became drier as the season progressed. Mortality was consistently below 10% and not affected by variety or seed treatment. NDVI, an indicator of early-season biomass, showed an advantage to triticale over the other crops but no variety or seed treatment effects. On average, grain yields were similar for wheat and rye, but slightly less for triticale. Both wheat varieties yielded similarly, but the old triticale variety slightly outyielded its modern counterpart; however, the newer hybrid rye variety yielded nearly 30% higher than the old open-pollinated variety. Yields were not affected by seed

Sustainable Canadian Agricultural Partnership Saskatchewan Canada treatment, likely attributable to the excellent conditions for establishment and lack of effects on emergence. Crop type effects on test weight were as expected while varietal effects varied by crop type. Importantly, this demonstration only comprised a single location-year and both seed treatment effects and the relative performance of the various crop types and varieties may vary.

Project Objectives

Provide a short statement outlining the project objectives. Identify the key concept this project was designed to demonstrate. For example, you might use a statement such as *"This project was intended to demonstrate and compare the benefits of……" or "The objective of this project was to demonstrate the impact of…."*

The primary objective was to promote more widespread adoption of winter cereals in southeast Saskatchewan by showcasing the overall adaptation and relative agronomic performance of winter wheat, winter triticale, and fall rye. Secondary objectives were to demonstrate varietal improvements for each crop type over the past decade along with the ability of seed-applied fungicides to improve the establishment and yield potential of winter cereals.

Project Rationale

Briefly describe why this project is of interest to local producers. Why is it important to have this project? What are the potential beneficial outcomes? What is the perceived need?

Winter cereal crops can be advantageous in that they help to spread out a farmer's workload, as the timing of seeding, spraying, and harvest all generally differ from most spring crops. While actual results often vary with specific environmental conditions, winter cereals often have higher yield potential than their summer counterparts because they can take advantage of a longer growing season (Larsen et al., 2018). For livestock producers, winter cereals can also provide a better-quality forage crop that is ready to be cut or grazed sooner than spring cereals (Government of Saskatchewan, n.d.b). Due to earlier development, winter cereal crops often miss the peak infection windows of several detrimental diseases and pests, such as fusarium head blight and orange blossom wheat midge (Larsen et al., 2018). Winter cereals also provide numerous environmental benefits. Having a crop planted in the field over the winter reduces erosion risk and provides excellent habitat for migrating waterfowl. Winter cereals take better advantage of late fall and early spring moisture than spring cereals, often demonstrating improved water use-efficiency. Compared to spring cereals, winter cereals are often more competitive and can disrupt weed cycles, making them a useful component of integrated weed management strategies. (Larsen et al., 2018).

Recommendations for the timing of seeding winter cereals on the Canadian Prairies are well established but often difficult to achieve. Seedlings should reach the Zadoks 21 growth stage (three leaves, one tiller) prior to winter for the best chance of survival (Larsen *et al.,* 2018). Optimal seeding date is based on several factors but is most closely related to fall soil temperature whereby seeding should be completed when the maximum soil temperature at 5 cm (depth of the crown) in the afternoon is around 18°C (Fowler, 2018; Fowler, 1982). Essentially, 4-6 weeks of growth at temperatures between 0-16°C prior to the onset of freezing fall temperatures, is ideal for vernalization and cold acclimation (Fowler, 2018; Fowler, 1982). Winter triticale and fall rye are typically seeded at the same time as winter wheat (Government of Saskatchewan, n.d.a). Again, while these seeding conditions are ideal, getting the previous crop off early enough to achieve them is frequently challenging. Delayed seeding may increase the risk of winterkill and lead to yield losses, delayed maturity, lower test weight, and weed problems (Fowler, 2018). In addition to seeding delays, dry fall soils can also inhibit winter wheat emergence and, therefore, increase the risk of winter kill and poor overall establishment (i.e., Holzapfel, 2013).

While not a perfect solution, seed treatments can help maintain the viability of winter cereal seeds when conditions for establishment are poor (i.e., Beres et al. 2016; Holzapfel 2013; Holzapfel 2016). Past research has shown seed treatments to provide quite consistent benefits with respect to establishment and early season vigor of winter cereals. In 2012-13 at Indian Head where the fall was extremely dry and there was essentially no emergence until early spring, a seed-applied fungicide (Raxil PRO) nearly doubled plant populations with approximately 86% of the seeds establishing as plants compared to only 38% with untreated seed (Holzapfel 2013). The establishment benefit to seed treatment observed by Beres et al. (2016) was more subtle but still significant, averaging 7% or 11 plants/m^2 over 26 site-years in Alberta, Saskatchewan, and Manitoba. Bere's et al. (2016) reported the greatest benefits with a dual (fungicide plus insecticide) seed treatment; however, Holzapfel (2016) observed small but significant yield benefits to a fungicide only seed treatment in 2/3 years and numerically higher yields with seed-applied fungicide in all three years. Winter triticale and fall rye responses to seed treatments are less well documented than winter wheat; however, similar benefits can be reasonably expected with these crops.

While winter cereals have been a part of the agricultural landscape in Saskatchewan for decades, they remain a novel crop for many producers. Winter wheat made up just over 7% of the total seeded acres of wheat in Canada in 2023 (Statistics Canada, 2023). While many producers are familiar with winter wheat and/or fall rye, they may not have experience with winter triticale. The current project was initiated to benefit producers by demonstrating the relative performance of winter wheat, winter triticale, and fall rye along with varietal improvements and the ability of seed treatments to improve establishment under challenging conditions. The project will provide valuable extension material to encourage more widespread adoption of winter cereals.

Literature Cited

Beres, B. L., Turkington, T. K., Kutcher, H. R., Irvine, B., Johnson, E. N., O'Donovan, J. T., Harker, K. N., Holzapfel, C. B., Mohr, R., Peng, G., and Spaner, D. M. 2016. Winter wheat cropping systems response to seed treatments, seed size, and sowing density. Agron. J. **108:** 1101-111. Online [available]: https://doi.org/10.2134/agronj2015.0497 (Dec. 31, 2025).

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Government of Saskatchewan (n.d.a). Triticale: Production and Use. Available at: https://www.saskatchewan.ca/business/agriculture-natural-resources-and-industry/agribusiness-farmers-and-ranchers/crops-and-irrigation/field-crops/cereals-barley-wheat-oats-triticale/triticale-production-and-use (Dec. 31, 2025).

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Larsen, R.J., Beres, B.L., Blackshaw, R.E. and Graf, R.J. 2018. Extending the growing season: winter cereals in western Canada. Can. J. Plant Sci. **98:** 267-277. Online [available]: https://doi.org/10.1139/cjps-2017-0278 (Dec. 31, 2025).

Methodology

Fully describe how the project was set up and run. You should provide enough information so that any reader can understand what you did, and where and when you did it. From that they can determine if your report has any relevance to their own operation. For example, your description should include all relevant items such as 1) the number and size of any field plots, 2) what was seeded, 3) what treatments were applied to the plots, 4) the schedule or timing of any relevant activities such as seeding, treatment application or harvest, and 5) what was measured to evaluate the success of any treatment. If your project dealt with animals, you should be sure to include 1) the number of animals in each trial group, 2) the treatment or procedure applied to each group, and 3) what was measured to evaluate the success of each treatment.

A field trial was established near Indian Head, Saskatchewan (thin-Black soil zone) in the fall of 2024. The treatments were a factorial combination of three crop types (winter wheat, winter triticale, and fall rye), two varieties (old versus new), and two seed-applied fungicide treatments (untreated versus treated). The varieties were AAC Wildfire (old) versus AAC Coldfront (new) for wheat, Fridge (old) versus AB Snowcat (new) for triticale, and AC Hazlet (old) versus KWS Trebiano (new) for rye. The seed-applied fungicide was 325 ml Raxil Pro/100 kg seed (1 g tebuconazole plus 5 g prothioconazole plus 2 g metalaxyl/100 kg seed). The twelve treatments were arranged in a four replicate randomized complete block design (RCBD).

Pertinent agronomic details and dates of operations appear in Table 6 of the Appendices. The plots were seeded directly into canola stubble on September 23, 2024. The target seeding depth was just over 2 cm (7/8”). Accounting for both seed size and germination, the seed rates were 350 seeds/m^2 for winter wheat and triticale and 300 seeds/m^2 for fall rye. All nutrients were intended to be non-limiting with a total of 145-45-15-15 kg N-P_2O_5-K_2O-S/ha supplied as urea, monoammonium phosphate (MAP), potash (KCl), and ammonium sulphate (AMS). All fertilizer was side-banded except for a portion of the MAP (15 kg P_2O_5/ha) which was placed in-furrow. Weeds were controlled using a combination of pre-emergent (glyphosate plus florasulam) and in-crop (bromoxynil, MCPA ester, plus pyroxsulam) herbicides. To reduce the potential for disease while accounting for differences in crop stage across crop types and varieties, preventative foliar fungicide (metconazole plus prothioconazole) was applied on two separate dates (June 13 and June 24, 2025). Pre-harvest glyphosate was applied on August 5 (2025), after the latest plots had matured, and the centre five rows of each plot were straight combined using a Wintersteiger Classic on August 12 (2025).

Various data were collected throughout the season and from the harvested grain samples. For explanatory purposes, composite soil samples were collected for determination of residual soil nutrients/properties and soil moisture at the time of seeding. Soil temperatures at a depth of ~4 cm were measured for eight locations within the trial area on the afternoon of seeding. Gravimetric soil moisture content was estimated using the wet and dry weights of two separate composite soil samples (0-15 cm and 0-30 cm), comprised of a minimum of eight cores each, collected on the day of seeding. The following spring, final plant densities were estimated by digging up plants in a 1 x 1m section of crop row per plot, separating/counting individual plants, and converting the values to plants/m^2. Destructive counts were necessary because mortality was low and the plants were already well developed and tillered by early May, making accurate in-situ counts extremely difficult. As such, the sampling area was smaller than ideal; however, we attempted to minimize potential variability or biases by counting plants from the same opener in all plots. The average NDVI of each plot was measured using a handheld GreenSeeker sensor on May 27, when most plants were at the flag leaf/early boot stage. Yields, reported in kg/ha, were determined by weighing the harvested grain samples, correcting for dockage (determined using CGC methods), and adjusting to 14.5% and 14% seed moisture content for wheat and triticale/rye respectively. Test weights were estimated from the cleaned seed sub-samples using standard CGC methods/equipment and two measurements per plot.

All response data were analyzed using generalized linear mixed model (GLIMMIX) procedure of SAS Studio. The effects of crop type (CROP), variety (VAR), seed-applied fungicide (FUNG), along with all possible interactions, were considered fixed while replicate effects were random. Treatment means were separated using Fisher’s protected LSD test and all treatment effects / differences between means were considered significant at $P \leq 0.05$.

Results *(you must provide the following information)*

Present and discuss any project results, including any data or measurements taken to evaluate the demonstration. Include things that didn't appear to work. These results are just as important to share. List extension activities such as field days or workshops. List the activity, the date it occurred, and the number of people who attended.

Soil test results are presented in Table 5 of the Appendices and showed that the site was moderately alkaline (pH of 7.7), with 4.8% organic matter, and clay texture (27% sand, 24% silt, and 49% clay). These soil properties were considered reasonably typical for the area. While the field was low in residual NO_3-N and extractable P, fertility was not a focus of this project, and all nutrients were intended to be non-limiting. The average soil temperature at the time of seeding was 16.3 °C and gravimetric soil water content was 33% for the 0-15 cm depth and 31% for 0-30 cm. Growing season weather information is presented in Table 1 below. With reasonably good initial soil moisture, above normal September precipitation, and warm fall weather, conditions were excellent for successful winter cereal establishment. Conditions became increasingly dry, however, with an extremely dry October, approximately 80% of average snowfall (November 2024 through March 2025), and only 65% of average precipitation from April through July. Growing season temperatures were close to average overall but varied throughout the season, being particularly cool in April and July, warm in May, and close to average in June.

Table 1. Mean monthly temperatures and precipitation amounts along with long-term (LT; 1981-2010) averages for the 2025 winter cereal growing season at Indian Head, Saskatchewan.

Year	Sept-24	Oct-24	Apr-25	May-25	Jun-25	Jul-25	Apr-Jul
	---------- Mean Temperature (°C) ----------						
IH-25	15.9 (+4.4)	6.9 (+2.9)	2.8 (-1.4)	12.7 (+1.9)	15.3 (-0.5)	17.0 (-1.2)	12.0 (-0.2)
IH-LT	11.5	4.0	4.2	10.8	15.8	18.2	12.2
	---------- Total Precipitation (mm) ----------						
IH-25	44.4 (126%)	4.9 (20%)	29.2 (129%)	42.6^Z (82%)	39.4 (51%)	27.9 (44%)	139 (65%)
IH-LT	35.3	24.9	22.6	51.7	77.4	63.8	216

^{Z} Includes 27.7 mm precipitation on May 15 (missing from ECCC data) estimated from a nearby private weather station

Results from the overall tests of fixed effects are presented in Table 2 and will be discussed separately for each response variable. Main effect means are presented in Table 3 with those corresponding to the significant interactions appearing in Table 4, and individual treatment means deferred to Table 7 of the Appendices.

Table 2. Overall tests of fixed effects crop type (CROP), variety (VAR), seed treatment (FUNG), and all possible interactions for winter cereal plant densities, NDVI at the flag leaf stage, grain yield, and test weight. All response data were analyzed using the generalized linear mixed model (GLIMMIX) procedure of SAS Studio.

Effect	Plant Density	NDVI	Grain Yield	Test Weight
	---------- Pr > *F* (p-value) ----------			
CROP	0.001	<0.001	0.002	<0.001
VAR	0.794	0.548	0.004	<0.001
CROP*VAR	0.557	0.252	<0.001	<0.001
FUNG	0.741	0.521	0.779	0.032
CROP*FUNG	0.785	0.492	0.836	0.640
FUNG*VAR	0.068	0.884	0.474	0.646
CROP*FUNG*VAR	0.529	0.638	0.811	0.519

Final plant densities were affected by crop type (P = 0.001), but no other main effects (P = 0.741-0.794) or any interactions (P = 0.068-0.785). The difference between crop types was attributed to winter wheat and triticale having higher plant densities than fall rye (331-358 plants/m^2 versus 284 plants/m^2), an expected result given the different seeding rates (350 seeds/m^2 for wheat and triticale versus 300 seeds/m^2 for rye). Overall, these numbers support the previous observation that conditions were excellent for establishment with observed average mortalities falling well below 10%. While we hypothesized that seed-applied fungicides might improve establishment, the lack of any observed advantage was not unexpected given the near ideal conditions for emergence. Previous research has shown and it is generally understood that seed treatments are most likely to be beneficial under stressful conditions when emergence is delayed or slow. The near significant (P = 0.068) VAR*FUNG interaction was due to opposite trends for seed treatment effects on emergence in old versus new varieties; however, the observed differences were small and individual treatment means were variable with inconsistent trends. Again, variability in the final plant population data may have been increased by the smaller than ideal sampling area.

Like plant densities, NDVI was affected by crop type (P < 0.001), but not variety (P = 0.548), seed treatment (P = 0.521), or any interactions (P = 0.252-0.884) (Table 2). The crop type effect was such that NDVI was higher for winter triticale (0.53) than for winter wheat and fall rye (0.40-0.43) (Table 3). Individual treatment means for fall rye and winter wheat were variable, ranging from 0.37-0.45 (Table 7) while, for triticale, NDVI was more consistent (0.52-0.53).

Table 3. Main effect means of crop type (CROP), variety (VAR), and seed treatment (FUNG) for the response variables plant density, NDVI, grain yield, and test weight. Values within a main effect for each variable followed by the same letter do not significantly differ ($P \leq 0.05$; Fisher's protected LSD test).

Main Effect	Plant Density	NDVI	Grain Yield	Test Weight
Crop Type	--- plants/m^2 ---	------- 0-1 -------	----- kg/ha -----	------ g/0.5 L ------
Winter Wheat	330.7 a	0.43 b	4383 a	406.0 a
Winter Triticale	358.0 a	0.53 a	4122 b	366.9 c
Fall Rye	283.8 b	0.40 b	4494 a	375.3 b
S.E.M.	14.99	0.019	179.8	1.07
$LSD_{0.05}$	37.71	0.050	195.2	1.67
Variety				
Old	326.2 a	0.46 a	4212 b	385.5 a
New	322.2 a	0.45 a	4455 a	380.0 b
S.E.M.	12.94	0.016	175.4	1.02
$LSD_{0.05}$	ns	ns	159.4	1.37
Seed Treatment				
Untreated	321.7 a	0.45 a	4322 a	383.5 a
Treated	326.7 a	0.46 a	4344 a	382.0 b
S.E.M.	12.94	0.016	175.4	1.22
$LSD_{0.05}$	ns	ns	ns	1.37

Winter cereal grain yields were affected by crop type (P = 0.002) and variety (P = 0.004); however, the interaction for these two factors was also significant (P < 0.001). Neither seed treatment (P = 0.779) nor any other interactions (P = 0.474-0.836) were significant for grain yield (Table 2). Across varieties and seeding rates, fall rye and winter wheat had similar yields (4383-4494 kg/ha) while winter triticale yields were slightly lower (4122 kg/ha). Across crops and seed-applied fungicide treatments, the modern varieties yielded slightly but significantly higher than the old varieties; however, the interaction showed that this result was inconsistent (Table 4). For the winter wheat, the two varieties yielded similarly while, for winter triticale, the old variety Fridge yielded 10% higher than the modern variety AB

Snowcat. The greatest advantage to choosing a modern variety, by a large margin, occurred with fall rye where the modern hybrid KWS Trebiano yielded 26% higher than the much older, open-pollinated variety AC Hazlet. While hybrid winter triticale and winter wheat varieties exist and are grown in other regions, they have yet to be developed and/or commercialized for western Canada. There were no trends to suggest that seed-applied fungicide was having a positive effect on yield for any individual crop types and/or varieties. Again, this lack of a yield benefit was not unexpected given the favorable conditions for establishment and absence of any impacts on final plant densities.

Test weight was affected by crop type ($P < 0.001$), variety ($P < 0.001$), and seed-applied fungicide ($P = 0.032$), with a significant interaction between crop type and variety ($P < 0.001$) (Table 2). The overall effects of crop type on test weight were as expected with winter wheat being the heaviest (406 g/0.5 L), winter triticale being the lightest (367 g/0.5 L), and fall rye being intermediate (375 g/0.5 L). While the overall variety effect suggested that test weights were lower with the new varieties, the crop by variety interaction ($P < 0.001$) showed that this only occurred with winter triticale and, to a lesser extent, fall rye, while test weights were similar for both winter wheat varieties. A significant overall seed-applied fungicide effect ($P = 0.032$) resulted from a slight reduction in test weight with treated seed; however, the difference was too small to be of any concern or practical importance (Table 4).

Table 4. Significant crop type by variety (CROP x VAR) interactions for grain yield and test weight at Indian Head, 2025.

Crop Type x Variety	Grain Yield	Test Weight
	-------- kg/ha --------	------- g/0.5 L -------
WW-Old (AAC Wildfire)	4259 b	405.4 a
WW-New (AAC Coldfront)	4343 b	406.7 a
WT-Old (Fridge)	4233 b	373.0 c
WT-New (AB Snowcat)	3857 c	360.9 d
FR-Old (AC Hazlet)	3906 c	378.2 b
FR-New (KWS Trebiano)	4914 a	372.4 c
S.E.M.	192.1	1.22
$LSD_{0.05}$	276.0	2.37

Extension Activities

This project was a scheduled stop during the Indian Head Crop Management Field Day, held on July 15, 2025, and attended by nearly 160 farmers, agronomists, and government/industry representatives. Chris Holzapfel explained the project and objectives in addition to presenting more broadly the benefits and challenges associated with winter cereal production. On July 16, 2025, the project was shown to a group of nearly 30 BASF scientists and agronomists from all over the world where the discussion focused primarily on weed management challenges and herbicide resistance. On August 5, 2025, a small group of agronomists, farmer directors, and staff from SaskWheat visited the site and this trial was a key stop where we discussed winter cereal production, challenges, and research priorities. This technical report will be freely available online and we will continue to share the results through oral presentations and extension materials, as opportunities arise.

Conclusions and Recommendations

Describe what was learned from the demonstration. Highlight any significant conclusions and provide recommendations for the application and adoption of the project results. Be sure that you have presented the relevant data to support your conclusions. Identify any further research, development and communication needs, if applicable.

Overall, this project has demonstrated that winter wheat, winter triticale, and fall rye can all be grown quite successfully in the thin-Black soil zone of southeast Saskatchewan, even if seeding is not completed until the latter half of September. Winter wheat and fall rye yielded similarly overall; however, the comparatively low yields of the open-pollinated fall rye variety relative to the modern hybrid biased these means again this crop. For fall rye specifically, there was a strong advantage to choosing the more modern variety. While winter triticale yielded slightly lower than wheat or rye, this crop is largely viewed as dual purpose being an excellent option for either forage/silage or grain production. For wheat, the lack of any yield difference between the old (AAC Wildfire) and new (AAC Coldfront) varieties was not unexpected based on the information provided in the Saskatchewan Seed Guide; however, the newer variety is generally regarded as having slightly better lodging resistance/shorter stature, earlier maturity, and higher protein. While the modern triticale variety (AB Snowcat) yielded slightly less than the older option (Fridge), more information is needed to make confident variety recommendations for this crop. Varietal choices are limited for winter triticale and AB Snowcat is promoted as a good dual purpose (forage or grain) option while Fridge is commonly marketed as a cover crop or for grazing, hay and/or silage production. Neither Fridge nor AB Snowcat winter triticale varieties appear in the 2025 Saskatchewan Guide. The economics of growing each of these crop types were beyond the scope of this project and complicated by the fact that prices can vary widely with grain quality and the specific market to which the crops are sold (i.e., feed versus milling versus distilling).

While we did not demonstrate any benefits to the seed-applied fungicides, this can be at least partly attributed to the near optimal conditions for emergence and establishment with the good soil moisture and temperature conditions at seeding followed by prolonged warm weather through the latter half of September and much of October. Our results may have differed if conditions for emergence and fall growth were less favorable. As such, repeating this work across a broader range of years and/or locations would give us a better sense of whether the benefits to seed treatments differ across winter cereal crop types. Overall, seed-applied fungicides are commonly recommended for winter cereals since conditions for emergence are often less favorable than with spring seeded crops and because overwinter survival is improved when crops are well established and healthy going into winter. Producers looking to save costs might consider dropping this input if conditions for establishment are excellent, as was the case at Indian Head in the fall of 2024; however, seed-treatments are often regarded as a low-cost insurance against seed-borne diseases and stand reductions resulting from delayed or slow germination and emergence.

Again, it would be beneficial to generate more data, ideally under less favorable conditions for establishment, to better demonstrate differences amongst winter cereal types and potential benefits to seed-applied fungicides. With that, it is fortunate that the project is being repeated in 2025-26 with funding from the Saskatchewan Wheat Development Commission. These results, conclusions, and recommendations will be updated upon conclusion of this second season of field trials.

Sustainable Canadian Agricultural Partnership (Sustainable CAP) Performance Indicators

a) List of performance indicators

Sustainable CAP Indicator	Total Number
Scientific publications from this project (List the publications under section b)	
• Published	0

• Accepted for publication	0
Highly Qualified Personnel (HQPs) trained during this project	
• Master's students	0
• PhD students	0
• Post docs	0
Knowledge transfer products developed based on this project (presentations, brochures, factsheets, flyers, guides, extension articles, podcasts, videos)[1]. List the knowledge transfer products under section (c)	4+

[1] Please only include the number of unique knowledge transfer products.

b) List of scientific journal articles published/accepted for publication from this project. Please ensure that each line includes the following: **Title, Author(s), Journal, Date Published or Accepted for Publication and Link to Article (if available).** *Add additional lines as needed*.

1. Not Applicable – no scientific articles associated with this project have been submitted for peer-review or publication.

c) List of knowledge transfer products/activities developed from this project.

Knowledge Transfer Product or Activity	Event/Location Where Knowledge Transfer Was Conducted	Estimated Number of Producers Participated in Knowledge Transfer	Link (if available)
C. Holzapfel (IHARF) plot tour / presentation	Indian Head Crop Management Field Day (Jul-15-2025)	157	https://iharf.ca/indian-head-crop-management-field-day/
C. Holzapfel (IHARF) plot tour	BASF Global Herbicide Group / IHARF Plot Tour (Jul-16-2025)	26	n/a
C. Holzapfel (IHARF) plot tour	SaskWheat / IHARF Plot Tour (Aug-5-2025)	9	n/a
Final project report	IHARF Website (online)	unknown	https://iharf.ca/full-reports/

Acknowledgements

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Financial support for this demonstration was provided under the Sustainable Canadian Agricultural Partnership, a federal-provincial-territorial initiative. Signs were in place for the major crop tours to acknowledge the funding sources and appropriate acknowledgements will be made in all written communications, oral presentations, or other printed materials pertaining to the project. We would like to acknowledge the IHARF Board of Directors in addition to the many technical and support staff who worked on the project. Seed for the project was supplied by Zoe Galbraith of the Conservation Learning Centre and many of the crop inputs utilized were provided in-kind by our industry partners. IHARF has a strong working relationship/framework agreement with Agriculture and Agri-Food Canada and has received funding for infrastructure and basic operating expenses from the Saskatchewan Ministry of Agriculture and several other producer/commodity groups, all of which has helped to make work like this possible.

Appendices

Include any additional materials supporting the previous sections, e.g. detailed data tables, maps, graphs, specifications, literature cited (Use a consistent reference style throughout).

Table 5. Selected soil test results for winter cereal showcase / seed treatment demonstration at Indian Head, 2025. The samples were analyzed at Agvise Laboratories (Northwood, ND) and a particle size analysis showed that the soil texture was 27% sand, 24% silt, and 49% clay.

Depth	pH	O.M.	CEC	CCE	NO_3-N	Olsen-P	K	S
	------------	---- % ----	-- meq --	---- % ----	- kg/ha -	-- ppm --	-- ppm --	-- ppm --
0-15 cm	7.7	4.8	43.8	2.3	2	9	642	20
15-60 cm	8.0	–	–	–	7	–	–	34
0-60 cm	–	–	–	–	9	–	–	54

Table 6. Selected agronomic information and dates of operations at Indian Head in 2025.

Activity	Indian Head - 2024
Previous Crop	Canola
Pre-Emergent Herbicide	894 g glyphosate/ha + 5 g florasulam/ac (Sep-27-2024)
Seeding Date	Sep-23-2024
Row Spacing	31 cm
kg N-P_2O_5-K_2O-S/ha [Z]	145-45-15-15
Destructive Plant Counts	May-23-2025
NDVI Measurements	May-27-2025
In-crop Herbicide	280 g bromoxynil/ha + 280 g MCPA ester/ha + 15 g pyroxsulam/ha (May-12-2025)
Foliar Fungicide	60 g metconazole/ha + 100 g prothioconazole/ha (Jun-13-2025 and again on Jun-24-2025)
Pre-harvest Herbicide	894 g glyphosate/ha (Aug-5-2025)
Harvest Date	Aug-12-2025

Table 7. Individual treatment means (crop type x variety x seed treatment) for response variables plant density, NDVI, grain yield, and test weight. Because the three-way interaction was never significant, these means are presented solely for the sake of transparency and interest.

Treatment	Plant Density	NDVI	Grain Yield	Test Weight
	--- plants/m^2 ---	------- 0-1 -------	----- kg/ha -----	------ g/0.5 L ------
WW-Old-Untr	328	0.38	4199	406.8
WW-Old-Fung	335	0.45	4319	404.0
WW-New-Untr	320	0.43	4333	407.5
WW-New-Fung	340	0.45	4354	405.9
WT-Old-Untr	390	0.52	4155	372.9
WT-Old-Fung	351	0.53	4311	373.0
WT-New-Untr	335	0.52	3899	361.6
WT-New-Fung	355	0.53	3815	360.2
FR-Old-Untr	295	0.45	3928	379.6
FR-Old-Fung	258	0.42	3885	376.8
FR-New-Untr	261	0.37	4933	372.7
FR-New-Fung	322	0.38	4895	372.1
S.E.M.	27.2	0.035	210.7	1.47
$LSD_{0.05}$	75.4	0.099	383.1	3.36

Expenditure Statement

You must provide an expenditure statement showing how ADOPT funds were used. Expenditures must be reported using the budget categories shown in Appendix B of your contract. We recommend that you report your expenditures using the Excel spreadsheet we have developed for this purpose (ADOPT Expenditure Statement.xls). That spreadsheet is available from the research branch project manager or the evaluation coordinator.
Note that the ADOPT contract requires you to retain all receipts and financial records relating to the project for at least six years after the project is completed.

Provided in a separate Excel workbook and available upon request.