

2024 (Year 5) Interim Report

for the

Saskatchewan Barley Development Commission,

Manitoba Crop Alliance,

and Western Grains Research Foundation

Project Title: Contrasting Fungicide Applications and Genetic Fusarium Head Blight Resistance for Enhanced Yield and Quality of Barley

(Project # SBDC 5086; MWBGA 2063; WGRF AGR2008)



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2. Project Numbers:

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6. Summary: Include activities during the project period, status of the project (is it on schedule), and any significant observations in related to the progress of the project.

A project was initiated in the winter of 2019-20 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 2021-23 growing seasons, trials were conducted at all four locations and, in 2024, trials were conducted at Brandon, Indian Head, and Melfort to use up the funding that was originally allocated to conducting field trials at Lacombe. While the originally proposed field trials at Lacombe could not proceed due to COVID restrictions and capacity limitations, Kelly Turkington continued to collaborate as a scientific authority and AAFC-Lacombe staff have completed leaf disease ratings for all sites.

Despite a few minor issues, the field trials went well in 2020 and no specific changes to the field protocols were recommended at that time. The issues encountered were due to human error (i.e., some plots lost

to spray drift at Melfort), minor misunderstandings of data collection requirements (i.e., plant counts not completed for all plots at Yorkton), or environment (i.e., variable yields due to drought at Yorkton). In 2021, the field trials went reasonably well at all locations; however, drought, in some cases severe, resulted in negligible leaf disease levels at all sites and, in some (i.e., Yorkton and Melfort), low and/or extremely variable yields combined with relatively poor grain quality. In 2022, moisture conditions were much better at all sites, but there were still challenges. Yield data were extremely variable at Melfort, potentially due to variable fertility or compaction issues. Residual N was relatively high at Melfort 2022 and, as such, only 22 kg N/ha was applied as fertilizer. However, noticeable irregularities in crop condition were observed during the growing season and grain yields were extremely variable. It is possible that the actual residual N was either lower or more variable than anticipated and the observed yield variability was a result of inconsistent fertility or other soil related issues. At Yorkton in 2022, moisture was abundant and yield potential was high; however, the plots were severely damaged by hail in late June, and, in the end, yields were variable and grain quality was poor. Unfortunately, these challenges will likely result in data from the affected sites having to be excluded from final, combined analyses for certain response variables. In 2023, leaf disease pressure, was low overall in practical terms (i.e., well below 5%), but especially at Indian Head where it remained well below 0.5% at the late milk/early dough stage. At Yorkton in 2023, yield data were extremely variable and, unfortunately, will need to be excluded from any combined analyses. Data from the other three locations appears to be of high quality, even though the low disease pressure was not ideal for the purposes of this project. In 2024, yields were reasonably high but somewhat variable at locations. Despite low to moderate levels of leaf disease at Brandon and Melfort which were reduced by fungicide, no yield benefits to fungicide were observed in 2024.

The data that have been collected for all plots (unless otherwise specified) included plant density, leaf disease ratings, grain yield, test weight, thousand kernel weight, plump seeds, thin seeds, and deoxynivalenol (DON) accumulation. Each collaborator completed the plant density and grain yield measurements for their sites in addition to collecting the leaves required for disease ratings. AAFC staff at Lacombe completed all leaf disease assessments. IHARF staff completed all grain quality assessments except DON, which was completed by Seed Solutions Laboratory (Swift Current). All currently available response data has been statistically analyzed and summarized and the only data that was not available at the time of preparing this report was DON from the 2024 sites. These preliminary analyses are intended to allow some basic initial interpretation of results, identify potential trends or issues, and to potentially help guide future groupings of sites for combined statistical analyses (i.e., low versus high disease pressure). No extension activities were conducted in 2020 due to COVID-19 restrictions. At Indian Head, the trial was shown, and the project was discussed during the Indian Head Crop Management Field Days in 2021, 2022, 2023, and 2024 with a combined attendance of approximately 500 participants. Kelly Turkington (AAFC) and Mitchell Japp (SaskBarley) joined us for the 2024 field day at IHARF where we were able to provide in-depth presentations on disease management in barley and cereals as a whole. In 2022 at Melfort, the project was signed and briefly shown during the AAFC NARF Joint Annual Field Day (July 20, 52 attendees), during a SaskWheat Field Day on August 9, 2022 (21 attendees), during the 2023 AAFC NARF Joint Annual Field Day (July 26, 70 attendees), and during the 2024 AAFC NARF Joint Field Day (July 18, 98 attendees). The trial was shown at Yorkton during the 2023 ECRF Field Day held on July 20 (80 attendees). No extension activities have been reported at Brandon.

Like previous years, this project is still considered to be behind schedule relative to the original timelines; however, things have been progressing as expected since the last report. With AAFC-Brandon postponed and AAFC-Lacombe unable to host a site for the final two years as originally planned, we extended field trials for an additional growing season at three sites in 2024 (Indian Head, Melfort, and Brandon) to make up the shortfall. Further to this, we had requested and received approval for an additional year for final data analyses and report preparation; however, this did not come with any additional funding requirements. At this time, preliminary statistical analyses and summaries are completed for all variables except for DON from 2024. The final step, to be completed in the winter of 2025/26, will be to determine

the most appropriate way to combine data across sites for a combined statistical analyses and general final conclusions and recommendations.

7. Methods: Include approaches, experimental design, methodology, materials, sites, etc. Major changes from original work plan must be indicated and the reason(s) for the change should be specified. Significant changes from the original work plan will require written approval from the Funders.

The specific field protocols and research plan for this project were developed back in 2019 during the letter of intent and full proposal phases, with feedback from both funding organizations and collaborators. The detailed field protocol that was distributed to collaborators in early 2020 was refined early in 2022 to include an extra set of leaf disease assessments (prior to the 2nd fungicide application) but is otherwise identical to what was originally approved. A copy of the most recent field protocol is provided in Schedule 1 of the Appendices. Field trials were conducted at Brandon in 2021, 2022, 2023, and 2024, Indian Head and Melfort in 2020, 2021, 2022, 2023, and 2024, and Yorkton in 2020, 2021, 2022, and 2023 for a total of 18 site-years. A brief description of the methods, along with any further deviations from the original protocols, follows.

The treatments were a factorial combination of three varieties and four fungicide treatments, arranged in a four replicate randomized complete block design (RCBD). The varieties were selected based on their genetic resistance to FHB (according to the Saskatchewan Seed Guide) and were CDC Bow (moderately susceptible; MS), AAC Synergy (intermediate; I), and AAC Connect (moderately resistant, MR). The seeding rates always targeted 300 live seeds/m² and information on seed size and percent germination is provided in Table 1 of the Appendices (Schedule 2). The fungicide treatments were an untreated control, a flag-leaf application targeting leaf disease (Trivapro; 74 g azoxystrobin/ha, 124 g propiconazole/ha, and 30 g benzovindiflupyr/ha), an application at 80-100% head emergence targeting FHB (Prosaro XTR; 100 g prothioconazole/ha and 100 g tebuconazole/ha), 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 no sites reported enough variance in crop stage to suggest that separate application dates would be warranted.

Barley was managed with all (controllable) factors, other than disease, intended to be non-limiting. Detailed agronomic information for all applicable sites is provided in Tables 2, 3, 4, 5, and 6 of the Appendices for 2020, 2021, 2022, 2023, and 2024, respectively. The target seeding rate at all sites was 300 viable seeds/m², adjusted for seed size and percent germination and all locations used the same seed source. Fertilizer applications varied by site but were equal across treatments within each site and all nutrients were intended to be non-limiting. At Indian Head in 2024, an error during seeding resulted in a much higher than targeted nitrogen fertilizer rate; however, we applied a plant growth regulator to help reduce the potential for lodging and there did not appear to be any other adverse effects on data quality resulting from this error. Weed control measures also varied by site, but the intent was to keep the crop reasonably free of weeds throughout the season. The centre rows from each plot were harvested, taking care to avoid potential edge effects (i.e., outside rows or fungicide drift) and areas of the plot affected by wheel tracks. Unfortunately, several plots at Melfort 2020 were damaged by spray drift by AAFC staff working in the area. The affected plots were removed prior to any statistical analyses, as per NARF staff recommendations. This was the only instance where a substantial amount of data was lost; however, not unexpectedly with such a large number of sites, adverse environmental conditions did render data from some sites unusable over the duration of the project.

Various data were collected during the season and from the harvested grain samples. Emergence was assessed by recording the number of plants in 2 x 1 m sections of crop row per plot in late May/early June and converting the values to plants/m². These measurements were not completed for all plots at YK-20; however, data were collected from enough treatments to test for varietal differences which was all that

was originally intended for this variable. Initial leaf disease pressure and subsequent treatment effects on leaf disease were estimated from a minimum of 10 leaves per plot collected from the control treatments at the flag leaf stage (prior to fungicide application) and for all plots at the late milk/early dough stages. Starting in 2022, an additional measurement was completed just prior to the second fungicide applications. This measurement period was missed at Melfort 2022 but was completed by all sites in 2023 and 2024. The third leaf from the head was collected for the first two sets of ratings while the penultimate (2nd leaf from the head) was collected at the final measurement date. At Melfort 2020, where spray drift resulted in some data loss, the leaf disease samples were collected from healthy areas of the affected plots and the values appeared to be consistent and representative of the site; therefore, all leaf disease data for the site was retained. All leaf disease samples were forwarded to AAFC-Lacombe to have the leaves rated for scald (causal agent *Rhynchosporium commune*), net-form blotch (causal agent *Pyrenophora teres f. teres*), and other leaf diseases (spot-form net blotch, causal agent *Pyrenophora teres f. maculata* and spot blotch, causal agent *Cochliobolus sativus*). All leaf disease ratings were completed blind, with the technicians doing the ratings having no knowledge of the specific treatments to which the leaf samples they were evaluating belonged. Grain yields were determined from the mass of harvested grain and are corrected for dockage and to a uniform seed moisture content of 13.5%.

Each year, all locations forwarded 1 kg of cleaned grain from each plot to IHARF for further quality analyses. Test weights were determined from cleaned sub-samples for each plot using standard Canadian Grain Commission methods and equipment. Test weight values are expressed as g/0.5 L and are the average of two measurements per plot. Thousand kernel weights were determined by counting approximately 1000 seeds per plot with an automated seed counter and weighing the counted seeds to the nearest 0.00 g. The number and mass of seeds were used to calculate g/1000 seeds. The proportion of plump and thin kernels were determined from a 200 g cleaned sub-sample and were defined as the proportion of seeds that stayed on top of, or lodged in, a No. 6 slotted sieve (plump) or passed through a No. 5 slotted sieve (thin). At this stage, plump and thin seeds are expressed as g/100 seed; however, this may be revised for the final statistical analyses. Finally, a 250-300 g sub-sample from each plot was forwarded to Seed Solutions Seed Labs (Swift Current, SK) for deoxynivalenol (DON) determination. These data were reported in parts per million (ppm) to the nearest 0.00 ppm. Data for DON in 2024 are not yet available; however, we are not necessarily expecting high levels due to the relatively dry conditions.

At this stage, all available data from all locations has been formatted for consistency and organized into master files with basic screening for quality. To stay current with results to date and to help facilitate future grouping of sites for combined analyses (i.e., low versus high disease pressure), data from each location have been analysed separately and summarized in the Appendices. For the time being, results are organized by location. All response data were analysed using the generalized linear mixed model (GLIMMIX) procedure of SAS Studio with variety (VAR), fungicide (FUNG), and VAR x FUNG effects considered fixed and replicate effects treated as random. Unless there were explicit reasons for doing so (i.e., drift damage at Melfort 2021), no individual data points have been deleted at this stage of the project; however, we anticipate that entire sites will need to be excluded from combined analyses for certain response variables due to the extreme variability and questionable validity of results. Where possible, such decisions will be made on a case-by-case basis for each response variable in order to preserve as much data as possible; however, when yield data is highly variable the quality data was often also similarly questionable.

8. Progress during the reporting period: (e.g., laboratory, growth chamber, greenhouse, and field experiments; chemical analysis; data analysis; model development). Please briefly indicate what has been done during the reporting period in respect to meeting the stated objectives of the project.

This section is specific to the April 2024-March 2025 reporting period.

Seed for the 2024 season was sourced for all sites by IHARF staff and distributed as required. Field trials were initiated and carried through to completion at three of the participating locations (Indian Head, Melfort, and Brandon). Except for an error during seeding that resulted in a much higher than targeted nitrogen rate at Indian Head, all aspects of the field trials went well in 2024. To reduce potential lodging due to the excessive N fertility at Indian Head in 2024, a plant growth regulator (Moddus; 124 g trinexapac-ethyl/ha) was applied at early stem elongation. Overall average yields at Brandon, Indian Head, and Melfort were 5774 kg/ha, 5318 kg/ha, and 5356 kg/ha, respectively, and, while somewhat variable at all sites, the data generally appeared to be of acceptably high quality.

Like previous years, each collaborating site completed the plant counts, leaf collections, and yield measurements for their respective sites, with leaf disease samples forwarded to AAFC Lacombe and grain quality samples forwarded to IHARF at Indian Head. IHARF completed all the grain quality assessments that could be done in-house and coordinated with Seed Solutions Laboratory (Swift Current, SK) for DON determination on behalf of all sites. Although we are still waiting on the DON results, the leaf disease samples were forwarded to Lacombe relatively early this season and all ratings were completed in the early winter months. A minimum of 10 leaves were assessed for each plot in all cases. Scald and net blotch were rated separately, but due to the low overall levels of disease, only the total disease levels (percent leaf area affected) have been reported.

Regardless of data quality or environmental conditions, all available data has been analysed using basic statistical procedures and is summarized and reported to help us identify potential issues as they arise while also better understanding results from individual sites. Again, this information will help us determine how to group locations most effectively for any future combined analyses in addition to allowing data to be scrutinized and excluded from future combined analyses where necessary.

9. Project Progress to date: (e.g., laboratory, growth chamber, greenhouse, and field experiments; chemical analysis; data analysis; model development; results if available). Please indicate overall project progress since its initiation.

To date, field trials have been conducted at 18 location-years with specific details of these trials and the work completed discussed in previous sections. All available results to date, from all five years of the project, are summarized in the Appendices and will be briefly discussed in the current section. Again, seed specifications from each year are provided in Table 1 while selected agronomic information and dates of operations are provided in Tables 2, 3, 4, 5, and 6 of the Appendices for 2020, 2021, 2022, 2023, and 2024, respectively. Tables 7 and 8 include mean monthly temperatures and cumulative precipitation, respectively, along with the long-term averages for each site (location-year). Interim results will be briefly discussed separately for each variable. Overall mean temperatures for the four-month growing seasons have ranged from 0.5 °C below the long-term averages to 1.8 °C above-average with a mean of 0.8 °C above average. Cumulative precipitation has ranged from 46-121% of the long-term average with a mean of 81%. These numbers suggest that, while conditions have varied amongst individual sites, the environmental conditions have been frequently hot and dry over the duration of this project, and generally not conducive to the development of leaf disease and fusarium head blight.

Preliminary results are organized by response variable and location in the Appendices, and we will discuss the results for each variable individually across all site-years, focusing on frequency of responses and broader trends. The results from the overall tests of fixed effects, which will be referred to throughout the following discussion, are presented for Brandon, Indian Head, Melfort, and Yorkton in Tables 9, 10, 11, and 12, respectively.

Establishment (Tables 13-16)

These measurements were completed prior to the application of any fungicide treatments, therefore, only variety effects were included in the statistical model. While seeding rates were adjusted for seed size and percent germination, significant differences between varieties still occurred at 7/18 sites. Emergence for

Synergy was slightly lower than for the other two varieties at IH-20. All four locations in 2021 observed lower plant populations for Bow compared to the other varieties. This was attributed to poorer seed quality and subsequently higher mortality for this specific variety. There were no differences in plant density amongst varieties at any of the 2022 or 2023 sites. In 2024, we saw the lowest densities with Synergy and highest with Bow at Indian Head and Brandon, but similar values for all varieties at Yorkton. At some locations (i.e., IH-21 and BR-21), emergence was poorer than expected, potentially due to poor seedbed conditions and/or deeper than optimal seed placement. In any case, emergence issues or differences in establishment between varieties were never thought to be important yield-limiting factors or problematic for the purposes of this study. This measurement will not likely be reported on in any final reports since, while important for quality assurance purposes, it was not considered necessary to meet the project objectives.

Leaf Disease (Tables 17-24)

At the time of the flag leaf fungicide applications (T1), there were only two instances where leaf disease levels differed between varieties (BR-24 and ME-24; $P = 0.003-0.030$). Despite the significant effect, leaf disease was extremely low at ME-24 ($< 1\%$); however, in both cases, leaf disease was lowest with Synergy and intermediate to highest with Bow and Connect. Varietal differences were never detected at the remaining sites ($P = 0.069-0.947$) and were approximately 1% or lower (leaf area affected) at 14/16 sites, the exceptions being ME-20 and BR-23 where the overall mean values were still quite low at 2.3-2.4%.

In 2022, we introduced an additional leaf disease measurement period prior to the second set of fungicide applications (T2); however, these collections were missed at ME-22. The percent leaf area affected by disease continued to be low at this time; however, variety differences were detected at BR-22, IH-23, and YK-22. These were somewhat inconsistent with BR-22 and YK-22 showing a trend for higher disease in Bow relative to Synergy and Connect (Tables 23). At IH-23, Connect tended to have the highest disease. In all cases where the variety effect on leaf disease was significant at early heading, the values never exceeded 1%. Notably, leaf disease at early heading was no longer affected by variety at BR-24 and ME-24, despite the differences observed previously.

The final leaf disease collections were completed as late in the season as possible but before senescence; however, total disease levels at this time were still approximately 1% or less at 8/18 sites and were always less than 5%. Such low leaf spot disease levels this close to physiological maturity were unlikely to have much impact on yield. Despite the low pressure, variety effects were significant at 12/18 sites, fungicide effects were significant at 11/18 sites, and VAR \times FUNG interactions were detected at 4/18 sites. For variety, the trends were not perfectly consistent, but usually showed amongst the highest disease pressure with Bow. These trends likely reflected the levels of leaf spot resistance each variety had, whereby Bow is susceptible to net-form net blotch, while having intermediate resistance levels for spot blotch (<https://saskseed.ca/wp-content/uploads/2020/12/2024-Varieties-of-Grain-Crops.pdf>). In contrast, AAC Synergy is resistant to spot-form net blotch and spot blotch, and is moderately resistant to net-form net blotch. Finally, Connect has intermediate resistance to net-form net blotch and is moderately resistant to both spot-form net blotch and spot blotch. Significant fungicide effects were always as expected, with the highest overall disease levels consistently occurring in the untreated control plots. Differences amongst the treatments that received a fungicide were less common; however, where they did occur, they tended to show better control with either the flag leaf or dual applications as opposed to a sole application during heading (i.e., ME-23, YK-20). Delaying fungicide application may result in reduced efficacy, but this would only be an issue if the risk of leaf disease was moderate to high prior to head emergence. The VAR \times FUNG interactions that occurred at BR-22, BR-23, and ME-21 were consistent in that they showed the strongest fungicide effects with Bow, intermediate effects with Connect, and essentially no effect with Synergy. At IH-24, a VAR \times FUNG interaction showed a benefit to fungicide (regardless of timing) solely with Connect; however, disease pressure was far too low (0.0-0.3% for individual treatments) for this interaction to be important. Similar to the trends for variety and leaf spot severity, these trends likely reflected the levels of leaf spot resistance for each variety. Importantly,

an intermediate to good leaf disease resistance package may allow producers to focus on a single fungicide application following head emergence to target FHB and DON, while providing leaf spot management during the critical grain filling period. Broadly speaking, early leaf disease ratings were not always consistent with yield responses to fungicide; however, this was likely due to other environmental stresses impacting the disease levels and/or limiting the yield potential of the barley. Fungicide effects on final leaf disease ratings were often, but not always consistent with the observed yield responses to fungicide. For example, at Indian Head and Brandon 2022 we did see significant reductions in leaf disease with fungicide and we will see there were also yield increases with fungicide at these locations. There were, however, cases where we did see leaf disease reductions with fungicide, but no statistically significant yield increase (i.e. BR-23, BR-24, and ME-24); however, the leaf disease pressure in such cases was often low overall and late-season conditions likely became such that factors other than disease were more limiting to yield. Based on previous experience, yield may not be affected by fungicide unless you have moderate to high levels of disease (e.g. untreated plots having 10-40% leaf area affected). In addition, yield may not be affected, but one may see some impacts on TKW, test weight, plumps and thins. Likely this is related to disease impacts on the extent of individual kernel grain filling.

Grain Yield (Tables 25-32)

Grain yields were affected by variety at 12/18 sites and fungicide at 2/18 sites, with VAR × FUNG interactions also detected at 2/18 sites. For 11/12 of the sites where variety differences existed, Bow was the lowest yielding variety. The sole site where this did not occur was YK-21; however, yields at this site were unusually low, highly variable, and will be excluded from any future combined analyses. In two cases (BR-22 and YK-20), Synergy yielded significantly higher than Connect and this was frequently the trend; however, yields for these two varieties were usually statistically similar under the current analyses. The sole sites where the overall fungicide effect was significant were BR-22 and IH-22, two of the wetter and higher yielding sites. 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. At IH-22, all treatments that received a fungicide yielded similarly and significantly higher than the untreated control treatments.

The interactions occurred at ME-21 and YK-22 but were difficult to explain and may not have been genuine responses to the treatments. At ME-21, the interaction was due to there being unusually low yields with the post-heading fungicide application for Bow and for both the flag leaf and dual applications for Synergy. These results cannot be reasonably explained and standard error values for yield at this site were extremely high, but unfortunately, the variability was widespread within the site and cannot be simply attributed to a few outliers. At YK-22, the interaction appeared to be due to there being a relatively strong, positive fungicide response for Bow, relatively little response with Synergy, and an inconsistent, perhaps even negative, response to fungicide with Connect. Again, the barley at this site was severely damaged by hail which reduced the reliability of these results. Like ME-21, however, the variation appeared to be relatively random and there were no outliers that could be confidently identified and removed to improve the data set. Other sites where the quality of the yield data was questionable and may need to be removed included ME-22, YK-20, YK-21, and YK-23. The variability at YK-20, YK-21, YK-23, and ME-21 was primarily attributed to drought and adverse environmental conditions. At ME-22, the causes of the variability were less clear; however, we speculate that they could have been caused by a combination of compaction issues and variable background fertility levels. Fall soil tests showed relatively high residual fertility at ME-22 and, therefore, only 22 kg N/ha was applied as fertilizer. It is possible that the site-specific N levels were either lower or quite variable, and variation in total N fertility across the site resulted in unusually high yield variability. Like the other sites identified as potentially problematic, there were no outliers that could be readily identified and removed in order to improve data quality and our ability to detect meaningful treatment effects.

Test Weight (Tables 33-40)

Test weights were affected by variety at 17/18 sites and fungicide treatment at 3/18 sites, with a VAR × FUNG interaction detected at 1 site. Varietal effects on test weight appeared to vary with environment. Amongst the 17 sites where varietal differences in test weight were detected, Bow, Synergy, and Connect had amongst the highest test weights in 35%, 71%, and 59% of possible cases, respectively. For the three sites where fungicide affected test weight, the values for the untreated control were amongst the lowest; however, beyond that the responses were inconsistent. At IH-22, only the dual fungicide application led to a statistically significant improvement in test weight; however, most of the benefit appeared to come from the flag leaf application. In contrast, at IH-23 the positive effect on test weight was solely attributed to the application at full heading. At YK-22, the test weight benefit was attributed to the application at heading time and, somewhat oddly, test weights with the dual application were significantly lower than what was achieved with the later fungicide application on its own. That said, YK-22 was also the sole site where the VAR × FUNG interaction was significant, and this showed that the benefits were largely due to the heading application, but inconsistencies existed. Again, data from YK-22 were quite variable, likely due in part to the hail, and will likely be removed from any combined analyses. Test weight data from YK-23 were also extremely variable and will be removed from any combined analyses.

Thousand Kernel Weight (Tables 41-48)

According to the overall tests of fixed effects, thousand kernel weight (TKW) was affected by variety at 14/18 sites and fungicide treatment at 4/18 sites. A VAR × FUNG interaction was only detected for this variable at 1 site. Variety effects, when significant, were somewhat inconsistent with Bow, Synergy, and Connect having amongst the highest TKW at 29%, 57%, and 79% of the 14 responsive sites. In the rare cases where fungicide effects occurred, they tended to show slightly higher thousand kernel weights when fungicide was applied post-heading, either alone or in combination with a flag-leaf application (i.e., BR-23, IH-22 and YK-22). The flag leaf fungicide application appeared to have relatively little impact on kernel weight. At YK-22, the sole site where the interaction was significant, there were inconsistencies across varieties, and AAC Connect appeared to be less responsive overall. Again, we cannot rule out that these values may have been affected by hail and data from YK-22 will likely be removed from any combined analyses.

Plump Kernels (Tables 49-56)

Based on the overall tests of fixed effects, percent plump kernels were affected by variety and fungicide at 13/18 and 2/18 sites, respectively. The VAR × FUNG interaction for plump kernels was only significant at one site, ME-24. Of the sites where individual variety differences were significant, Bow had amongst the most plump kernels 85% (11/13) of the time while Synergy and Connect had amongst the highest values in 62% (8/13 sites) and 15% (2/13) of possible cases, respectively. At IH-22, one of the two sites where fungicide affected kernel plumpness, we saw the highest values when the heads were sprayed. For the other responsive site, YK-22, the responses appeared somewhat random, and the sprayed treatments never differed from the control. Again, this site was severely impacted by the late June hail and these data should be removed from any final, combined analyses. At IH-24, the percentage of plump kernels was quite low (73% on average), presumably due to dry conditions and extreme heat during head emergence and filling.

Thin Kernels (Tables 57-64)

Percent thin kernels were affected by variety at 13/18 sites and fungicide at 4/18 sites, with significant VAR × FUNG interactions detected at 3/18 sites. Of the sites where differences between varieties were significant, Bow had amongst the highest proportion of thin kernels 33% of the time (4/12 sites) while this was the case for Synergy 25% of the time (3/12 sites) and for Connect 83% of the time (10/12 sites). Fungicide effects were rare, only occurring at 2/15 sites, and which application had the greatest impact on percent thin kernels was inconsistent; however, the untreated control always had amongst the highest proportion of thin kernels. Prior to the final, combined analyses, one of two changes will be implemented. Either data for percent thin kernels will be rounded to a single decimal place prior to analyses as we frequently picked up treatment effects that were not biologically meaningful and were largely diminished

with rounding. Alternatively, this response variable may be excluded altogether as it is directly related to percent plump kernels and the latter is a more important grading factor which will also conform better to the assumptions of the statistical analyses, especially when data is combined across sites.

Deoxynivalenol – DON (Tables 65-72)

Deoxynivalenol (DON) accumulation was measured for all plots at all sites, but these results are not yet available for any 2024 sites and no DON was detected at any locations in 2021. For context, the Brewing and Malting Barley Research Institute (BMBRI) suggests that barley with DON levels over 0.5 ppm will normally be rejected for malt; however, depending on supply, DON levels of 0.5-1.0 ppm may also be considered acceptable. Of the 11 sites where data is available and DON was detectable, variety effects were significant in two cases (ME-22 and BR-23) and fungicide effects were significant in two cases (IH-22 and YK-22). At ME-22, the VAR x FUNG interaction was also significant ($P = 0.009$). Where the variety effects were significant, the results were subtle but as expected, with the highest levels consistently observed with CDC Bow (MS; 0.29-0.56 ppm) and lowest with AAC Connect (MR; 0.19-0.48 ppm). At BR-23, DON values with Synergy were similar to Connect while, at ME-22, they were intermediate between Bow and Connect. While the main effects of fungicide were not significant at ME-22, there was an interaction which appeared to be due to elevated DON with AAC Synergy when fungicide was applied at the flag leaf stage, but not when followed up by an application after heading. This may be because the flag leaf stage fungicide product contained a strobilurin (Azoxystrobin); however, the difference was so small that it is of limited practical importance. Kelly Turkington observed similar trends in an AAFC trial comparing flag (Twinline, metconazole and pyraclostrobin) and head emergence (Prosaro) fungicide timings in AC Metcalfe. None of the fungicide treatments reduced DON relative to the control at ME-22 when averaged across varieties or for individual varieties. While yield data from ME-22 will likely need to be discarded, we believe that the treatment effects on DON are valid and can provide some meaningful insights. At IH-22, we saw the highest DON levels, by far, with an overall average of 1.33 ppm. Fungicide applications had the expected effect in that both the treatments where fungicide was applied at heading had significantly lower, albeit still rather high, DON levels than the treatments that did not receive this application. This was consistent across varieties, and we saw similar DON levels for all varieties, despite the expected differences in genetic resistance. At YK-22, the DON levels were always low enough that there was no risk of rejection for malt; however, we did detect a fungicide response whereby the post-heading applications substantially reduced DON relative to both the control and the single application at the flag-leaf stage. DON levels at YK-22 were quite consistent across varieties and the fungicide effects were also consistent across varieties. At BR-22 and YK-23, DON levels were relatively high, averaging 0.41-0.55 ppm; however, neither variety nor fungicide treatment had any impact on the values at these sites, and no meaningful trends were observed. Of the 15 sites where DON data are currently available, only three have had average values > 0.5 ppm; thus, indicating that the risk of malt rejection due to DON is relatively low. That said, overall conditions during heading and grain filling have mostly been dry and the subsequent disease pressure has been low; therefore, this observation may not hold true during wetter periods.

10. Extension and Communication Activities: (e.g., extension meetings; papers produced; conference presentations made; photos)

Extension and communication activities specific to this project have been mostly limited to plot tours and broader discussions of cereal disease management. We had intended to introduce the project during the 2020 IHARF Crop Management Field Day; however, this event was cancelled due to COVID-19 restrictions. In 2021, IHARF hosted a scaled back, in-person field day at Indian Head with approximately 80 participants and the plots were shown during a discussion of the project objectives, results to date, and other related projects (i.e., FHB modelling in wheat, durum, and barley led by University of Manitoba). In 2022, we planned to feature the project during the IHARF Crop Management Field Day; however, the field sites

could not be toured due to heavy rain and wet conditions. Nonetheless, the project was briefly discussed during indoor presentations with approximately 120 participants. In 2022 at Melfort, the project was signed and briefly shown during the AAFC NARF Joint Annual Field Day (July 20, 52 attendees) and during a SaskWheat Field Day on August 9 (21 attendees). In 2023 at Indian Head, the project was shown during the annual field day (July 18, 160 attendees) where Chris Holzapfel discussed project results to date and broader considerations for disease management in barley. At Melfort in 2023, Brianne McInnes showed and discussed the project during the NARF AAFC joint field day on July 26 and attended by 70 participants. At the 2023 ECRF Field Day in Yorkton (July 20, 80 attendees), Gursahib Singh discussed fusarium head blight management in both wheat and barley while Mike Hall shared specific details on the current project. In 2024 at Indian Head, Chris Holzapfel was joined by Kelly Turkington (AAFC) and Mitchell Japp (SaskBarley) during the Indian Head Crop Management Field (July 16, 145 participants) and we were able to show the plots and lead in-depth discussions on results to date and cereal disease management with a focus on how best management practices may differ between wheat and barley. At Melfort in 2024, the project was not a main stop during the AAFC NARF Annual Field Day (July 18, 98 attendees); however, it was well signed and briefly discussed/acknowledged in passing. We will continue to promote this project in 2025/26 where opportunities arise, and this technical report will be made available online through the IHARF website (www.iharf.ca/library), where previous interim reports have also been available for download and online viewing.

11. Appendices

Schedule 1 – Example Field Protocol Distributed to All Collaborators for the 2023 Season – Does Not Include Randomization / Field Map

#23-2613: FUNGICIDE APPLICATIONS & GENETIC FUSARIUM HEAD BLIGHT RESISTANCE FOR ENHANCED YIELD AND QUALITY OF BARLEY (YR 4)

Objective: To investigate the potential merits of contrasting foliar fungicide strategies in barley production and the potential for foliar fungicide applications combined with genetic FHB resistance to enhance end-use quality of barley.

Location: Indian Head (lead), Melfort, Brandon, and Yorkton

Design: RCBD with 4 replicates

Treatments: 4 fungicide treatments x 3 varieties = 12 treatments x 4 reps = 48 plots plus guards

#	Variety ^z	Fungicide ^y
1	CDC Bow (MS)	1) Untreated (no foliar fungicide)
2	CDC Bow (MS)	2) Flag (0.4 l/ac Trivapro A + 0.12 l/ac Trivapro B)
3	CDC Bow (MS)	3) Head (0.325 l/ac Prosaro XTR)
4	CDC Bow (MS)	4) Dual (Trt 2 and 3 combined – plots receive both applications)
5	AAC Synergy (I)	1) Untreated (no foliar fungicide)
6	AAC Synergy (I)	2) Flag (0.4 l/ac Trivapro A + 0.12 l/ac Trivapro B)
7	AAC Synergy (I)	3) Head (0.325 l/ac Prosaro XTR)
8	AAC Synergy (I)	4) Dual (Trt 2 and 3 combined – plots receive both applications)
9	AAC Connect (MR)	1) Untreated (no foliar fungicide)
10	AAC Connect (MR)	2) Flag (0.4 l/ac Trivapro A + 0.12 l/ac Trivapro B)
11	AAC Connect (MR)	3) Head (0.325 l/ac Prosaro XTR)
12	AAC Connect (MR)	4) Dual (Trt 2 and 3 combined – plots receive both applications)

^z All locations will use the same seed source on a year-to-year basis. Ratings are for FHB (MS – moderately susceptible; I – intermediate; MR – moderately resistant)

^y Fungicides should be applied in ~20 U.S. gal/ac at either the flag-leaf stage (Trt 2, 4, 6, 8, 10, & 12) or between 80% head emergence and 3 days after heading is complete (Trt 3, 4, 7, 8, 11, & 12). If necessary, application dates may vary with variety.

Crop Management:

- 1) Drill/Plot Size:** Conserva-Pak / 14' x 35', flagged at 15' (plot size may vary across locations)
- 2) Cultivar:** As per protocol
- 3) Seed rate / Date:** 300 viable seeds/m², target early to mid-May seeding
- 4) Fertility:** NPKS balanced across treatments and **non-limiting** (target ~100-35-17-17 kg N-P₂O₅-K₂O-S, consult project lead if uncertain about appropriate fertilizer rates)
- 5) Crop protection:** Registered pesticides as required to keep weeds and insects non-limiting; fungicides applied as per protocol

- 6) **Harvest:** Straight-combine centre rows when mature and dry. Do not harvest outside rows and there should be no wheel-tracks within the harvest area. **Pre-harvest glyphosate not permitted.** If necessary, collaborators may use diquat to assist crop dry-down; however, allowing the crop to mature and dry naturally is the preferred option. Take care during harvest not to cause excessive damage to the barley as this creates challenges for future quality analyses.

Data collection:

- 1) **Plant Density:** Count plants in 2 x 1 m sections of crop row after emergence is complete for all plots (i.e. approximately 14 days after emergence is first noted)
- 2) **Leaf disease ratings:** Leaves are to be collected as per instructions below. Upon collection, the leaves will be placed flat in long envelopes or submarine bags, dried at room temperature, carefully packaged, and forwarded to AAFC-Lacombe (care of Noryne Rauhala/Kelly Turkington) to be rated using established protocols during the fall/winter months. Leaves will be rated for scald, net-form net blotch, and other leaf spots and collections will be completed at three separate times. If possible, collect from rows that are not being harvested for grain yield.
 - a. **T1) Early Flag Leaf stage and T2) just following head emergence:** To assess early season risk and variety differences, initial ratings will be completed at early flag emergence for the **untreated plots only (Trt 1, 5, & 9, and from all replicates)**. These ratings will focus on the **3rd leaf from the head.**
 - i. Please label each bag with Location, Test#, Growth stage, Leaf collected, Plot#, Rep and Crop type
 - ii. - **Growth stage – flag leaf emergence (GS39) and head emergence (GS 59-60)**
 - iii. - Need 20-25 leaves of the Flag -2 (third leaf down from the head) for each sampling date (keep dates and plots separate)
 - iv. - Put in properly labeled sub-shaped bag (DO NOT BEND THE LEAVES).
 - v. - Fold each bag at the top and staple bag for each plot together with only one staple.
 - vi. - Keep the bags (leaves) flat and dry the leaves in the sub bags at room temp.
 - b. **T2) Late-Milk/Early dough stage: All plots are to be rated at this time,** at least 7 days after the 2nd fungicide applications but prior to senescence. These ratings will focus on the penultimate leaf (2nd leaf from the head).
 - i. Please label each bag with Location, Test#, Growth stage, Leaf collected, Plot#, Rep and Crop type
 - ii. - **Growth stage - late milk to early dough (GS77-83; leaves must be green)**
 - iii. - Need 20-25 leaves of the Flag -1 (keep plots separate).
 - iv. - Put in properly labeled sub shaped bag (DO NOT BEND THE LEAVES)
 - v. - Fold each bag at the top and staple bag for each plot with only one staple.
 - vi. - Keep the bags (leaves) flat and dry the leaves in the sub bags at room temp.
 - vii. - IF LEAVES ARE SENESCING AT THIS STAGE, PLEASE CONTACT NORRYNE RAUHALA FOR INSTRUCTIONS
 - c. **Send leaf samples to Noryne Rauhala** in Lacombe for rating. Please email Noryne (noryne.rauhala@agr.gc.ca) prior to shipping so that they know to expect them. At the discretion of individual site-managers, leaf samples may also be forwarded to Chris Holzapfel (IHARF) who will then forward to Lacombe with the leaf samples from Indian Head.
 - i. Noryne Rauhala, Lacombe Research Centre, 6000 C&E Trial, Lacombe, AB T4L 1W1, (ph: 403-302-7329), email: noryne.rauhala@agr.gc.ca

3) Grain Yield: Corrected for dockage and to 13.5% seed moisture content

NOTE: All grain quality measurements are to be completed by IHARF staff. Forward a 1 kg (minimum) cleaned subsample for each plot to: Indian Head Research Farm – IHARF, #1 Government Rd, Indian Head, SK, S0G 2K0, Attn: Chris Holzapfel, Phone: 306-695-7761, Email: cholzapfel@iharf.ca

4) Test Weight: Standard CGC methodology, two measurement per plot, recorded in g/0.5 l**5) Kernel Weight:** Count and weigh (to 0.00 g) a minimum of 500 seeds, convert to g/1000 seeds**6) Percent Plump & Thin Kernels:** Record (to the nearest 0.01 g) the mass of grain from a 200 g cleaned sub-sample that stays on top of (or lodged in) a No. 6 slotted sieve (plump) or passes through a No. 5 slotted sieve (thin)**7) Percent deoxynivalenol (DON):** Retain a commercially cleaned (i.e. dockage removed) sub-sample & forward to an accredited lab for DON determination (tentatively 250 g – confirm with lab)

- a. IHARF to retain any leftover grain (approximately 500 g) as a temporary archive, until the project has concluded

Schedule 2 – Complete Results Tables for the 2020-24 Field Trials

Table 1. Specifications for seed used in 2020-24 field trials. All locations used the same seed source within any given year and the target seeding rate was always 300 viable seeds/m².

Variety - Year	Germination	TKW	Target Seeding Rate
	----- % -----	---- g/1000 seeds ----	----- kg/ha -----
CDC Bow (MS) - 2020	97	51	158
CDC Bow (MS) - 2021	88	52	176
CDC Bow (MS) - 2022	98	47	144
CDC Bow (MS) - 2023	97	52	159
CDC Bow (MS) - 2024	97	52	159
AAC Synergy (I) - 2020	99	52	158
AAC Synergy (I) - 2021	99	47	142
AAC Synergy (I) - 2022	99	47	142
AAC Synergy (I) - 2023	99	49	149
AAC Synergy (I) - 2024	99	46	138
AAC Connect (MR) - 2020	97	52	161
AAC Connect (MR) - 2021	99	56	168
AAC Connect (MR) - 2022	99	48	145
AAC Connect (MR) - 2023	95	55	174
AAC Connect (MR) - 2024	95	53	167

Table 2. Selected agronomic information and dates of operations for barley fusarium head blight management demonstrations completed at three locations in 2020.

Factor/Operation	Indian Head	Yorkton	Melfort
Previous Crop	Canola	Canola	Canola
Pre-Emergent Weed Control	894 g glyphosate/ha (May-14-2020)	None	894 g glyphosate/ha + 50 g saflufenacil/ha (May-24-2020)
Seeding Date	May-14	May-7	May 22
Row Spacing	30 cm	30 cm	30 cm
Fertility (kg N-P ₂ O ₅ -K ₂ O-S/ha)	115-35-18-18	97-34-0-0	31-36-11-6 (high residual N)
Emergence Counts	Jun-4	May-26	Jun-11
In-Crop Herbicides	5 g halauxifen/ha + 77 g fluroxypyr/ha + 371 g MCPA ester/ha + 62 g pinoxaden/ha (Jun-11)	107 g fluroxypyr/ha +74 clopyralid + 415 g MCPA ester/ha (May 29) 62 g pinoxaden/ha (Jun-8)	107 g fluroxypyr/ha +74 clopyralid + 415 g MCPA Ester/ha (Jun-23) 62 g pinoxaden/ha (Jul-3)
Foliar Insecticide	n/a	n/a	n/a
T1 – Leaf Disease	July 3	Jun-29	July 13
Flag Fungicide Date	Jul-3	Jul-1	Jul-11
T2 – Leaf Disease	n/a	n/a	n/a
Head Fungicide Date	Jul-19	Jul-13	Jul-24
T3 – Leaf Disease	Jul-30	Jul-27	Aug-5
Pre-harvest Herb.	n/a	894 g glyphosate/ha ^z (Aug 5)	n/a
Harvest Date	Aug-19	Aug-20	Sep-28

^z The decision to apply pre-harvest glyphosate at Yorkton-2020 was due to initial drought followed by wet conditions leading to late emerging tillers and variable crop stage. Swathing was not an option, and we did not feel that diquat would have been effective under the circumstances.

Table 3. Selected agronomic information and dates of operations for barley fusarium head blight management demonstrations completed at four locations in 2021.

Factor/Operation	Indian Head	Yorkton	Melfort	Brandon
Previous Crop	Canola	Canola	Canola	Canola
Pre-Emergent Weed Control	894 g glyphosate/ha (May-11)	None	894 g glyphosate/ha + 50 g saflufenacil/ha (May-14)	None
Seeding Date	May-8	May-13	May 10	May 3
Row Spacing	30 cm	30 cm	30 cm	23 cm
Fertility (kg N-P ₂ O ₅ -K ₂ O-S/ha)	115-35-18-18	67-34-0-0 (high residual N)	82-45-11-8	110-36-0-0
Emergence Counts	Jun-8	Jun-4	Jun-4	Jun-3
In-Crop Herbicides	129 g fluroxypyr/ha + 90 g clopyralid/ha + 503 g MCPA ester + 62 g pinoxaden/ha (Jun-13)	129 g fluroxypyr/ha + 90 g clopyralid/ha + 503 g MCPA ester (Jun-7) + 62 g pinoxaden/ha (Jun-13)	62 g pinoxaden/ha (Jun-22) + 129 g fluroxypyr/ha + 90 g clopyralid/ha + 503 g MCPA ester (Jun-8)	280 g bromoxynil/ha + 280 g MCPA ester/ha + 198 g tralkoxydim/ha (Jun-2)
Foliar Insecticide	n/a	n/a	n/a	n/a
T1 - Leaf Disease	July 2	Jun-24	Jun-30	Jun-17
Flag Fungicide Date	Jul-2	Jun-28	Jul-5	Jun-17
T2 – Leaf Disease	n/a	n/a	n/a	n/a
Head Fungicide Date	Jul-16	Jul-14	Jul-13	Jul-5
T3 – Leaf Disease	Jul-26	Jul-21	Jul-26	Jul-13
Pre-harvest Herb.	n/a	n/a	n/a	n/a
Harvest Date	Aug-28	Aug-27	Aug-26	Aug-18

Table 4. Selected agronomic information and dates of operations for barley fusarium head blight management demonstrations completed at four locations in 2022.

Factor/Operation	Indian Head	Yorkton	Melfort	Brandon
Previous Crop	Canola	Canola	Canola	Canola
Pre-Emergent Weed Control	894 g glyphosate/ha (May-24)	None	1422 g triallate/ha (May-12) + 894 g glyphosate/ha (May-21)	None
Seeding Date	May-27	May-12-2022	May 23	May 25
Row Spacing	30 cm	30 cm	30 cm	23 cm
Fertility (kg N-P ₂ O ₅ -K ₂ O-S/ha)	115-35-18-18	74-32-0-0 (high residual N)	22-49-19-0 (high residual N)	103-36-0-0
Emergence Counts	Jun-20	Jun-1	Jun-13	Jun-7
In-Crop Herbicides	5 g halauxifen + 77 g fluroxypyr + 348 g MCPA Ester + 62 g pinoxaden/ha (Jun-23)	129 g fluroxypyr/ha + 90 g clopyralid/ha + 503 g MCPA ester (Jun-6) + 62 g pinoxaden/ha (Jun-8)	129 g fluroxypyr/ha + 90 g clopyralid/ha + 503 g MCPA ester (Jun-28) + 62 g pinoxaden/ha (Jun-22)	280 g bromoxynil/ha + 280 g MCPA ester/ha + 198 g tralkoxydim/ha (Jun-10)
Foliar Insecticide	n/a	n/a	n/a	n/a
T1 – Leaf Disease	July 8	Jul-3	Jul-8	Jul-5
Flag Fungicide Date	Jul-10	Jul-4	Jul-8	Jul-6
T2 – Leaf Disease	Jul-21	Jul-19	n/a	July 12
Head Fungicide Date	Jul-22	Jul-20	Jul-18	Jul-12
T3 – Leaf Disease	Aug-8	Aug-3	Aug-2	Jul-28
Pre-harvest Herbicide	n/a	n/a	n/a	n/a
Harvest Date	Sep-17	Aug-30	Sep-8	Aug-23

Table 5. Selected agronomic information and dates of operations for barley fusarium head blight management demonstrations completed at four locations in 2023.

Factor/Operation	Indian Head	Yorkton	Melfort	Brandon
Previous Crop	Canola	Canola	Canola	Canola
Pre-Emergent Weed Control	894 g glyphosate/ha (May-19-2023)	n/a	894 g glyphosate/ha (May-16)	n/a
Seeding Date	May-14	May-15	May-16	May-5
Row Spacing	30 cm	30 cm	30 cm	23 cm
Fertility (kg N-P ₂ O ₅ -K ₂ O-S/ha)	115-35-18-18	107-34-0-0	113-56-17-6	109-36-0-0
Emergence Counts	Jun-12	May-31	Jun-2	Jun-6
In-Crop Herbicides	144 g fluroxypyr + 100 g clopyralid + 560 g MCPA Ester + 62 g pinoxaden/ha (Jun-7)	144 g fluroxypyr + 100 g clopyralid + 560 g MCPA Ester (Jun-5) 62 g pinoxaden/ha (Jun-12)	144 g fluroxypyr + 100 g clopyralid + 560 g MCPA Ester (Jun-7) 62 g pinoxaden/ha (Jun-20)	5 g halauxifen + 77 g fluroxypyr + 420 g MCPA ester + 198 g tralkoxydim/ha (Jun-7)
Foliar Insecticide	50g chlorantraniliprole/ha (Jun-22)	n/a	7.5 g deltamethrin/ha (Jun-23)	n/a
T1 – Leaf Disease	Jun-26	Jun-27	Jun-21	Jun-16
Flag Fungicide Date	Jun-24	Jun-27	Jun-28	Jun-16
T2 – Leaf Disease	Jul-7	Jul-5	Jul-10	Jun-22
Head Fungicide Date	Jul-12	Jul-5	Jul-7	Jun-22
T3 – Leaf Disease	Jul-25	Jul-21	Jul-24	Jul-13
Pre-harvest Herbicide	n/a	n/a	n/a	n/a
Harvest Date	Aug-25	Aug-14	Aug-14	Aug-15

Table 6. Selected agronomic information and dates of operations for barley fusarium head blight management demonstrations completed at four locations in 2024.

Factor/Operation	Indian Head	Melfort	Brandon
Previous Crop	Canola	Canola	Canola
Pre-Emergent Weed Control	894 g glyphosate/ha (May-14) + 894 g glyphosate/ha (May-21)	894 g glyphosate/ha (May-14)	n/a
Seeding Date	May-19	May-14	May-6
Row Spacing	30 cm	30 cm	23 cm
Fertility (kg N-P ₂ O ₅ -K ₂ O-S/ha)	266-35-18-18 ²	101-56-11-6	124-36-0-0
Emergence Counts	Jun-10	Jun-13	Jun-3
In-Crop Herbicides	144 g fluroxypyr + 100 g clopyralid + 560 g MCPA Ester + 62 g pinoxaden/ha (Jun-14)	62 g pinoxaden/ha (Jun-9) 100 g fluroxypyr + 238 g bromoxynil + 300 g 2,4-D Ester (Jun-14)	5 g halauxifen + 77 g fluroxypyr + 420 g MCPA ester + 198 g tralkoxydim/ha (Jun-12)
Plant Growth Regulator	124 g Trinexapac-ethyl/ha (Jun-22)	n/a	n/a
Foliar Insecticide	n/a	n/a	n/a
T1 – Leaf Disease	Jul-9	Jul-5	Jun-25
Flag Fungicide Date	Jul-9	Jul-4	Jun-27
T2 – Leaf Disease	Jul-19	Jul-16	Jul-9
Head Fungicide Date	Jul-23	Jul-15	Jul-8
T3 – Leaf Disease	Aug-1	Jul-30	Jul-19
Pre-harvest Herbicide	n/a	n/a	n/a
Harvest Date	Aug-28	Aug-22	Aug-13

² Unusually high N rate at Indian Head was due to an error during seeding – applied PGR in attempt to minimize lodging.

Table 7. Mean monthly temperatures along with the long-term (1981-2010) averages for the 2020-24 growing seasons at Brandon, Indian Head, Melfort, and Yorkton.

Location	Year	May	June	July	August	Average
----- Mean Temperature (°C) -----						
Brandon	2021	9.9	18.8	20.5	17.5	16.7 (+1.3)
	2022	10.2	16.6	19.5	19.2	16.4 (0.0)
	2023	14.7	19.9	17.4	17.6	17.4 (+1.0)
	2024	10.9	15.1	20.0	17.7	15.9 (-0.5)
	Long-term	11.4	16.6	19.2	18.2	16.4
Indian Head	2020	10.7	15.6	18.4	17.9	15.7 (+0.1)
	2021	9.0	17.7	20.3	17.1	16.0 (+0.4)
	2022	10.9	16.1	18.1	18.3	15.9 (+0.3)
	2023	14.0	19.4	16.7	17.7	17.0 (+1.4)
	2024	10.6	13.6	19.5	17.9	15.4 (-0.2)
	Long-term	10.8	15.8	18.2	17.4	15.6
Melfort	2020	10.1	14.3	18.2	17.6	15.1 (-0.1)
	2021	9.6	18.2	20.1	16.9	16.2 (+1.0)
	2022	9.8	15.2	18.2	18.7	15.5 (+0.3)
	2023	14.1	19.2	16.9	17.3	16.9 (+1.7)
	2024	10.1	13.2	19.4	17.4	15.0 (-0.2)
	Long-term	10.7	15.9	17.5	16.8	15.2
Yorkton	2020	10.5	16.4	19.9	18.3	16.3 (+1.1)
	2021	8.9	19.1	21	17.3	16.6 (+1.4)
	2022	10.6	15.7	18.6	18.9	16.0 (+0.8)
	2023	13.8	19.7	16.7	17.8	17.0 (+1.8)
	Long-term	10.4	15.5	17.9	17.1	15.2

Table 8. Mean monthly precipitation along with the long-term (1981-2010) averages for the 2020-24 growing seasons at Brandon, Indian Head, Melfort, and Yorkton.

Location	Year	May	June	July	August	Total
----- Cumulative Precipitation (mm) -----						
Brandon	2021	25.8	101.2	0.2	156.8	284 (105%)
	2022	102.6	66.2	76.9	27.0	273 (101%)
	2023	25.7	126.5	25.2	29.2	207 (77%)
	2024	112.0	119.6	9.5	34.5	276 (102%)
	Long-term	56.5	79.6	68.2	65.5	270
Indian Head	2020	27.3	23.5	37.7	24.9	113 (46%)
	2021	81.6	62.9	51.2	99.4	295 (121%)
	2022	97.7	27.5	114.5	45.9	286 (117%)
	2023	12.9	49.6	15.9	40.8	119 (49%)
	2024	63.7	74.9	37.4	71.2	248 (102%)
	Long-term	51.7	77.4	63.8	51.2	244
Melfort	2020	26.7	103.7	52.4	18.5	201 (89%)
	2021	31.4	37.6	0.2	69.3	138 (61%)
	2022	90.8	78.1	34.9	37.5	241 (107%)
	2023	17.9	26.4	16.4	50.0	111 (49%)
	2024	73.0	84.0	36.1	16.9	210 (93%)
	Long-term	42.9	54.3	76.7	52.4	226
Yorkton	2020	16.7	33.6	80.1	49.3	180 (66%)
	2021	24.6	18.1	35.2	69.7	148 (54%)
	2022	137.9	57.9	38.4	90.8	325 (120%)
	2023	16.8	67.9	18.0	33.3	136 (50%)
	Long-term	51.3	80.1	78.2	62.2	272

Table 9. Overall tests of fixed effects for variety (VAR), fungicide (FUNG), and VAR x FUNG for selected barley response variables over four-year period at Brandon, MB.

Source	BR-21	BR-22	BR-23	BR-24
----- Emergence (p-values) -----				
Variety (VAR)	0.003	0.775	0.206	0.030
----- Flag Leaf Stage Leaf Disease – T1 (p-values) -----				
Variety (VAR)	–	0.630	0.402	0.033
----- Early Heading Stage Leaf Disease – T2 (p-values) -----				
Variety (VAR)	–	0.027	0.702	0.202
----- Early Dough Stage Leaf Disease – T3 (p-values) -----				
Variety (VAR)	0.027	<0.001	0.045	<0.001
Fungicide (FUNG)	0.087	<0.001	<0.001	<0.001
VAR x FUNG	0.918	<0.001	0.038	0.238
----- Yield (p-values) -----				
Variety (VAR)	<0.001	<0.001	<0.001	<0.001
Fungicide (FUNG)	0.864	0.029	0.489	0.195
VAR x FUNG	0.616	0.088	0.901	0.790
----- Test Weight (p-values) -----				
Variety (VAR)	0.460	<0.001	<0.001	<0.001
Fungicide (FUNG)	0.682	0.206	0.422	0.367
VAR x FUNG	0.560	0.053	0.916	0.734
----- Thousand Kernel Weight (p-values) -----				
Variety (VAR)	0.053	0.617	<0.001	0.033
Fungicide (FUNG)	0.918	0.173	0.041	0.275
VAR x FUNG	0.379	0.769	0.148	0.737
----- Plump Kernels (p-values) -----				
Variety (VAR)	<0.001	<0.001	<0.001	<0.001
Fungicide (FUNG)	0.594	0.283	0.165	0.496
VAR x FUNG	0.329	0.533	0.813	0.949
----- Thin Kernels (p-values) -----				
Variety (VAR)	0.006	<0.001	<0.001	<0.001
Fungicide (FUNG)	0.535	0.035	0.176	0.639
VAR x FUNG	0.240	0.017	0.148	0.940
----- Deoxynivalenol (p-values) ² -----				
Variety (VAR)	–	0.878	0.007	–
Fungicide (FUNG)	–	0.533	0.551	–
VAR x FUNG	–	0.683	0.453	–

² DON was undetectable in all samples at all sites in 2021 and is not yet available for 2024

Table 10. Overall tests of fixed effects for variety (VAR), fungicide (FUNG), and VAR x FUNG for selected barley response variables over five-year period at Indian Head, SK (2020-24).

Source	IH-20	IH-21	IH-22	IH-23	IH-24
----- Emergence (p-values) -----					
Variety (VAR)	<0.001	<0.001	0.091	0.162	0.033
----- Flag Leaf Stage Leaf Disease – T1 (p-values) -----					
Variety (VAR)	0.670	0.388	0.670	0.919	0.244
----- Early Heading Stage Leaf Disease – T2 (p-values) -----					
Variety (VAR)	–	–	0.739	0.026	0.630
----- Early Dough Stage Leaf Disease – T3 (p-values) -----					
Variety (VAR)	<0.001	0.962	0.003	0.973	0.021
Fungicide (FUNG)	0.893	<0.001	<0.001	0.971	0.030
VAR x FUNG	0.397	0.824	0.159	0.739	0.023
----- Yield (p-values) -----					
Variety (VAR)	<0.001	<0.001	0.058	<0.001	0.069
Fungicide (FUNG)	0.144	0.373	<0.001	0.444	0.409
VAR x FUNG	0.746	0.512	0.147	0.567	0.715
----- Test Weight (p-values) -----					
Variety (VAR)	<0.001	<0.001	<0.001	<0.001	0.026
Fungicide (FUNG)	0.258	0.003	<0.001	0.081	0.112
VAR x FUNG	0.657	0.212	0.416	0.570	0.453
----- Thousand Kernel Weight (p-values) -----					
Variety (VAR)	<0.001	0.775	<0.001	<0.001	0.011
Fungicide (FUNG)	0.099	0.131	<0.001	0.709	0.432
VAR x FUNG	0.258	0.889	0.547	0.830	0.507
----- Plump Kernels (p-values) -----					
Variety (VAR)	0.113	0.357	<0.001	<0.001	0.049
Fungicide (FUNG)	0.626	0.178	<0.001	0.662	0.216
VAR x FUNG	0.487	0.851	0.099	0.306	0.831
----- Thin Kernels (p-values) -----					
Variety (VAR)	0.034	0.001	<0.001	0.007	0.051
Fungicide (FUNG)	0.339	0.972	0.010	0.996	0.466
VAR x FUNG	0.831	0.805	0.008	0.018	0.977
----- Deoxynivalenol (p-values) ² -----					
Variety (VAR)	0.559	–	0.394	0.418	–
Fungicide (FUNG)	0.642	–	<0.001	0.808	–
VAR x FUNG	0.082	–	0.427	0.465	–

² DON was undetectable in all samples at all sites in 2021 and is not yet available for 2024

Table 11. Overall tests of fixed effects for variety (VAR), fungicide (FUNG), and VAR x FUNG for selected barley response variables over a five-year period at Melfort, SK (2020-24).

Source	ME-20	ME-21	ME-22	ME-23	ME-24
----- Emergence (p-values) -----					
Variety (VAR)	0.239	0.003	0.401	0.367	0.264
----- Flag Leaf Stage Leaf Disease – T1 (p-values) -----					
Variety (VAR)	0.069	0.880	0.516	0.947	0.003
----- Early Heading Stage Leaf Disease – T2 (p-values) -----					
Variety (VAR)	–	–	–	0.064	0.210
----- Early Dough Stage Leaf Disease – T3 (p-values) -----					
Variety (VAR)	0.017	0.362	0.022	0.370	<0.001
Fungicide (FUNG)	0.298	0.152	<0.001	0.005	<0.001
VAR x FUNG	0.983	0.021	0.161	0.754	0.101
----- Yield (p-values) -----					
Variety (VAR)	0.214	0.001	0.624	<0.001	0.001
Fungicide (FUNG)	0.759	0.715	0.156	0.317	0.162
VAR x FUNG	0.964	0.020	0.206	0.095	0.236
----- Test Weight (p-values) -----					
Variety (VAR)	0.002	0.001	0.001	<0.001	<0.001
Fungicide (FUNG)	0.957	0.307	0.158	0.942	0.106
VAR x FUNG	0.974	0.894	0.712	0.928	0.147
----- Thousand Kernel Weight (p-values) -----					
Variety (VAR)	0.005	0.115	<0.001	0.001	0.012
Fungicide (FUNG)	0.436	0.585	0.312	0.516	0.768
VAR x FUNG	0.841	0.757	0.655	0.673	0.508
----- Plump Kernels (p-values) -----					
Variety (VAR)	0.976	0.210	0.006	<0.001	<0.001
Fungicide (FUNG)	0.413	0.214	0.300	0.512	0.255
VAR x FUNG	0.805	0.762	0.115	0.164	<0.001
----- Thin Kernels (p-values) -----					
Variety (VAR)	0.355	0.754	0.085	0.218	<0.001
Fungicide (FUNG)	0.689	0.265	0.362	0.943	0.936
VAR x FUNG	0.409	0.592	0.358	0.201	0.508
----- Deoxynivalenol (p-values) ² -----					
Variety (VAR)	0.819	–	0.047	0.297	–
Fungicide (FUNG)	0.343	–	0.275	0.588	–
VAR x FUNG	0.802	–	0.009	0.397	–

² DON was undetectable in all samples at all sites in 2021 and is not yet available for 2024

Table 12. Overall tests of fixed effects for variety (VAR), fungicide (FUNG), and VAR x FUNG for selected barley response variables over four-year period at Yorkton, SK.

Source	YK-20	YK-21	YK-22	YK-23
----- Emergence (p-values) -----				
Variety (VAR)	0.830	<0.001	0.155	0.511
----- Flag Leaf Stage Leaf Disease – T1 (p-values) -----				
Variety (VAR)	0.518	0.933	0.620	0.947
----- Early Heading Stage – T2 (% leaf area affected by disease) -----				
Variety (VAR)	–	–	0.055	0.857
----- Early Dough Stage – T3 (% leaf area affected by disease) -----				
Variety (VAR)	0.026	0.723	<0.001	0.370
Fungicide (FUNG)	<0.001	0.095	<0.001	0.069
VAR x FUNG	0.567	0.130	0.171	0.973
----- Yield (p-values) -----				
Variety (VAR)	0.010	0.036	0.109	0.051
Fungicide (FUNG)	0.250	0.945	0.448	0.266
VAR x FUNG	0.504	0.655	0.015	0.373
----- Test Weight (p-values) -----				
Variety (VAR)	0.005	<0.001	0.019	<0.001
Fungicide (FUNG)	0.187	0.625	<0.001	0.612
VAR x FUNG	0.387	0.257	0.004	0.083
----- Thousand Kernel Weight (p-values) -----				
Variety (VAR)	<0.001	0.040	<0.001	0.019
Fungicide (FUNG)	0.045	0.581	<0.001	0.345
VAR x FUNG	0.483	0.596	0.022	0.093
----- Plump Kernels (p-values) -----				
Variety (VAR)	0.136	0.002	<0.001	<0.001
Fungicide (FUNG)	0.841	0.139	0.019	0.476
VAR x FUNG	0.725	0.482	0.162	0.272
----- Thin Kernels (p-values) -----				
Variety (VAR)	0.594	0.026	<0.002	<0.001
Fungicide (FUNG)	0.733	0.050	0.004	0.458
VAR x FUNG	0.862	0.333	0.094	0.371
----- Deoxynivalenol (p-values) ² -----				
Variety (VAR)	0.650	–	0.274	0.415
Fungicide (FUNG)	0.483	–	<0.001	0.565
VAR x FUNG	0.046	–	0.826	0.104

² DON was undetectable in all samples at all sites in 2021 and is not yet available for 2024

Table 13. Variety main effect means for barley plant density at Brandon, MB (2021-24). Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	BR-21	BR-22	BR-23	BR-24
Variety (VAR)	----- Emergence (plants/m ²) -----			
Bow (MS)	127 B	183 A	229 A	215 A
Synergy (I)	159 A	187 A	227 A	187 B
Connect (MR)	149 A	184 A	215 A	199 AB
S.E.M.	6.2	5.4	9.4	7.1

Table 14. Variety main effect means for barley plant density at Indian Head, SK (2020-24). Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	IH-20	IH-21	IH-22	IH-23	IH-24
Variety (VAR)	----- Emergence (plants/m ²) -----				
Bow (MS)	222 A	134 B	192 A	261 A	255 A
Synergy (I)	195 B	161 A	215 A	247 A	239 B
Connect (MR)	218 A	184 A	204 A	260 A	242 AB
S.E.M.	6.7	7.5	7.2	7.2	4.3

Table 15. Variety main effect means for barley plant density at Melfort, SK (2020-24). Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	ME-20	ME-21	ME-22	ME-23	ME-24
Variety (VAR)	----- Emergence (plants/m ²) -----				
Bow (MS)	231 A	199 B	191 A	241 A	235 A
Synergy (I)	214 A	221 AB	212 A	253 A	245 A
Connect (MR)	217 A	234 A	203 A	252 A	227 A
S.E.M.	10.1	7.8 ^z	11.6	8.8	7.4

Table 16. Variety main effect means for barley plant density at Yorkton, SK (2020-23). Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	YK-20	YK-21	YK-22	YK-23
Variety (VAR)	----- Emergence (plants/m ²) -----			
Bow (MS)	274 A	207 B	244 A	291 A
Synergy (I)	278 A	239 A	240 A	285 A
Connect (MR)	278 A	253 A	226 A	300 A
S.E.M.	9.0	5.1	8.8	13.4

Table 17. Variety and fungicide (T3 only) main effect means for percent leaf area affected by disease (total) at Brandon, MB (2021-24) . Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$). The 3rd leaf from the head was rated for T1 and T2 while the 2nd leaf from the head (penultimate) was rated at T3. Only the control plots for each variety were rated at the T1 and T2 stages.

Source	BR-21	BR-22	BR-23	BR-24
Variety (VAR)	----- Flag Leaf Stage – T1 (% leaf area affected by disease) -----			
Bow (MS)	0.0	0.3 A	2.2 A	4.7 A
Synergy (I)	0.0	0.3 A	2.7 A	0.8 B
Connect (MR)	0.0	0.3 A	2.3 A	1.2 AB
S.E.M.	–	0.02	0.26	0.84
Variety (VAR)	----- Early Heading Stage – T2 (% leaf area affected by disease) -----			
Bow (MS)	–	1.0 A	2.2 A	1.5 A
Synergy (I)	–	0.6 B	2.2 A	0.7 A
Connect (MR)	–	0.7 B	2.0 A	1.1 A
S.E.M.	–	0.07	0.28	0.32
Variety (VAR)	----- Early Dough Stage – T3 (% leaf area affected by disease) -----			
Bow (MS)	0.2 A	1.6 A	1.9 A	8.1 A
Synergy (I)	0.0 B	0.7 B	1.6 A	2.3 B
Connect (MR)	0.1 AB	0.9 B	1.7 A	3.4 B
S.E.M.	0.04	0.12	0.11	0.96
<u>Fungicide</u>				
Untreated	0.2 A	1.8 A	2.3 A	7.8 A
Flag	0.1 A	0.8 B	1.5 B	3.0 B
Head	0.1 A	0.8 B	1.6 B	4.0 B
Dual	0.1 A	0.8 B	1.5 B	3.6 B
S.E.M.	0.04	0.14	0.12	1.01

Table 18. Individual variety by fungicide treatment means for percent leaf area affected by disease (total) at Brandon, MB (2021-24). Ratings are for the 2nd leaf from the head (penultimate) and means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	BR-21	BR-22	BR-23	BR-24
<u>Variety - Fung</u>	----- Early Dough Stage – T3 (% leaf area affected by disease) -----			
MS – untr	0.3 a	3.3 a	2.8 a	10.8 a
MS – flag	0.1 a	1.0 b	1.6 bc	5.8 abc
MS – head	0.1 a	1.1 b	1.7 bc	8.2 ab
MS – dual	0.2 a	1.1 b	1.5 c	7.7 ab
I – untr	0.1 a	0.7 b	1.9 bc	3.9 c
I – flag	0.0 a	0.7 b	1.6 bc	1.5 c
I – head	0.0 a	0.7 b	1.5 bc	2.0 c
I – dual	0.0 a	0.6 b	1.6 bc	1.6 c
MR – untr	0.2 a	1.3 b	2.2 ab	8.8 ab
MR – flag	0.1 a	0.7 b	1.5 c	1.7 c
MR – head	0.1 a	0.7 b	1.6 bc	1.8 c
MR – dual	0.1 a	0.8 b	1.4 c	1.5 c
S.E.M.	0.08	0.23	0.17	1.35

Table 19. Variety and fungicide (T3 only) main effect means for percent leaf area affected by disease (total) at Indian Head, SK (2020-24) . Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$). The 3rd leaf from the head was rated for T1 and T2 while the 2nd leaf from the head (penultimate) was rated at T3. Only the control plots for each variety were rated at the T1 and T2 stages.

Source	IH-20	IH-21	IH-22	IH-23	IH-24
Variety (VAR)	----- Flag Leaf Stage – T1 (% leaf area affected by disease) -----				
Bow (MS)	0.1 A	0.1 A	0.1 A	0.1 A	0.0 A
Synergy (I)	0.2 A	0.1 A	0.1 A	0.1 A	0.0 A
Connect (MR)	0.1 A	0.2 A	0.0 A	0.1 A	0.1 A
S.E.M.	0.08	0.05	0.03	0.05	0.02
Variety (VAR)	----- Early Heading Stage – T2 (% leaf area affected by disease) -----				
Bow (MS)	–	–	0.2 A	0.1 B	0.0 A
Synergy (I)	–	–	0.2 A	0.2 AB	0.0 A
Connect (MR)	–	–	0.2 A	0.5 A	0.0 A
S.E.M.	–	–	0.07	0.026	0.02
Variety (VAR)	----- Early Dough Stage – T3 (% leaf area affected by disease) -----				
Bow (MS)	1.9 B	0.3 A	0.7 A	0.1 A	0.1 AB
Synergy (I)	3.1 A	0.3 A	0.3 B	0.1 A	0.0 B
Connect (MR)	4.0 A	0.3 A	0.4 B	0.2 A	0.1 A
S.E.M.	0.30	0.05	0.10	0.06	0.03
<u>Fungicide</u>					
Untreated	2.9 A	0.5 A	0.8 A	0.2 A	0.1 A
Flag	3.0 A	0.2 B	0.4 B	0.1 A	0.1 AB
Head	3.0 A	0.2 B	0.2 B	0.1 A	0.1 AB
Dual	3.2 A	0.2 B	0.3 B	0.2 A	0.0 B
S.E.M.	0.35	0.06	0.11	0.07	0.03

Table 20. Individual variety by fungicide treatment means for percent leaf area affected by disease (total) at Indian Head, SK (2020-24). Ratings are for the 2nd leaf from the head (penultimate) and means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	IH-20	IH-21	IH-22	IH-23	IH-24
<u>Variety - Fung</u>	----- Early Dough Stage – T3 (% leaf area affected by disease) -----				
MS – untr	1.6 b	0.6 a	1.4 a	0.1 a	0.1 ab
MS – flag	1.6 b	0.2 ab	0.7 ab	0.2 a	0.1 b
MS – head	1.7 b	0.2 ab	0.3 b	0.2 a	0.1 b
MS – dual	2.8 ab	0.1 b	0.4 b	0.1 a	0.1 ab
I – untr	3.2 ab	0.4 ab	0.5 b	0.1 a	0.0 b
I – flag	3.8 ab	0.3 ab	0.3 b	0.1 a	0.0 b
I – head	2.7 ab	0.2 ab	0.1 b	0.1 a	0.0 b
I – dual	2.9 ab	0.2 ab	0.2 b	0.3 a	0.0 b
MR – untr	4.1 ab	0.5 ab	0.6 ab	0.2 a	0.3 a
MR – flag	3.5 ab	0.2 ab	0.3 b	0.1 a	0.1 b
MR – head	4.6 a	0.2 ab	0.3 b	0.1 a	0.1 b
MR – dual	4.1 ab	0.2 ab	0.4 b	0.2 a	0.0 b
S.E.M.	0.59	0.10	0.17	0.10	0.05

Table 21. Variety and fungicide (T3 only) main effect means for percent leaf area affected by disease (total) at Melfort, SK (2020-24) . Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$). The 3rd leaf from the head was rated for T1 and T2 while the 2nd leaf from the head (penultimate) was rated at T3. Only the control plots for each variety were rated at the T1 and T2 stages.

Source	ME-20	ME-21	ME-22	ME-23	ME-24
Variety (VAR)	----- Flag Leaf Stage – T1 (% leaf area affected by disease) -----				
Bow (MS)	3.4 A	0.2 A	0.3 A	0.4 A	0.8 A
Synergy (I)	2.2 A	0.2 A	0.4 A	0.4 A	0.2 B
Connect (MR)	1.3 A	0.2 A	0.4 A	0.4 A	0.8 A
S.E.M.	0.68	0.04	0.10	0.07	0.08
Variety (VAR)	----- Early Heading Stage – T2 (% leaf area affected by disease) -----				
Bow (MS)	–	–	–	0.4 A	0.6 A
Synergy (I)	–	–	–	0.4 A	0.4 A
Connect (MR)	–	–	–	0.3 A	0.8 A
S.E.M.	–	–	–	0.029	0.15
Variety (VAR)	----- Early Dough Stage – T3 (% leaf area affected by disease) -----				
Bow (MS)	5.2 A	0.4 A	1.8 AB	2.7 A	1.9 A
Synergy (I)	3.8 AB	0.5 A	1.2 B	2.4 A	0.8 B
Connect (MR)	3.2 B	0.6 A	2.0 A	2.9 A	1.1 B
S.E.M.	0.65	0.09	0.25	0.32	0.14
<u>Fungicide</u>					
Untreated	4.8 A	0.6 A	3.1 A	3.5 A	2.3 A
Flag	4.3 A	0.4 A	1.1 B	2.3 B	0.9 B
Head	3.6 A	0.5 A	1.4 B	2.6 AB	1.1 B
Dual	3.5 A	0.4 A	1.0 B	2.2 B	0.8 B
S.E.M.	0.70	0.100	0.28	0.34	0.15

Table 22. Individual variety by fungicide treatment means for percent leaf area affected by disease (total) at Melfort, SK (2020-24). Ratings are for the 2nd leaf from the head (penultimate) and means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	ME-20	ME-21	ME-22	ME-23	ME-24
<u>Variety - Fung</u>	----- Early Dough Stage – T3 (% leaf area affected by disease) -----				
MS – untr	5.8 a	0.5 ab	2.9 ab	3.7 a	3.3 a
MS – flag	5.5 a	0.5 ab	1.3 bc	2.4 a	1.7 bcd
MS – head	4.4 a	0.3 ab	1.6 bc	2.3 a	1.7 bc
MS – dual	5.0 a	0.5 ab	1.2 bc	2.3 a	1.2 bcd
I – untr	4.9 a	0.5 ab	2.1 bc	2.9 a	1.4 bcd
I – flag	4.0 a	0.4 ab	0.9 bc	2.1 a	0.6 cd
I – head	3.6 a	0.5 ab	1.1 bc	2.4 a	0.5 d
I – dual	2.7 a	0.5 ab	0.6 c	2.2 a	0.7 cd
MR – untr	3.7 a	1.0 a	4.4 a	3.9 a	2.2 ab
MR – flag	3.5 a	0.3 b	1.1 bc	2.4 a	0.5 d
MR – head	2.9 a	0.9 ab	1.4 bc	3.2 a	1.2 bcd
MR – dual	2.8 a	0.3 b	1.2 bc	2.0 a	0.5 d
S.E.M.	1.03	0.15	0.44	0.50	0.25

Table 23. Variety and fungicide (T3 only) main effect means for percent leaf area affected by disease (total) at Yorkton, SK (2020-23) . Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$). The 3rd leaf from the head was rated for T1 and T2 while the 2nd leaf from the head (penultimate) was rated at T3. Only the control plots for each variety were rated at the T1 and T2 stages.

Source	YK-20	YK-21	YK-22	YK-23
Variety (VAR)	----- Flag Leaf Stage – T1 (% leaf area affected by disease) -----			
Bow (MS)	1.1 A	0.1 A	0.9 A	1.2 A
Synergy (I)	1.1 A	0.1 A	0.7 A	1.4 A
Connect (MR)	1.0 A	0.1 A	0.5 A	1.3 A
S.E.M.	0.06	0.05	0.23	0.43
Variety (VAR)	----- Early Heading Stage – T2 (% leaf area affected by disease) -----			
Bow (MS)	–	–	1.4 A	1.4 A
Synergy (I)	–	–	1.0 AB	1.2 A
Connect (MR)	–	–	0.8 B	1.2 A
S.E.M.	–	–	0.18	0.36
Variety (VAR)	----- Early Dough Stage – T3 (% leaf area affected by disease) -----			
Bow (MS)	2.2 A	0.1 A	3.0 A	1.2 A
Synergy (I)	1.7 B	0.1 A	1.8 B	0.9 A
Connect (MR)	1.9 AB	0.2 A	2.0 B	1.0 A
S.E.M.	0.15	0.03	0.26	0.14
<u>Fungicide</u>				
Untreated	3.3 A	0.1 A	3.5 A	1.4 A
Flag	1.3 BC	0.1 A	2.2 B	0.9 A
Head	1.8 B	0.2 A	2.0 B	1.0 A
Dual	1.2 C	0.1 A	1.4 B	0.8 A
S.E.M.	0.17	0.04	0.28	0.17

Table 24. Individual variety by fungicide treatment means for percent leaf area affected by disease (total) at Yorkton, SK (2020-23). Ratings are for the 2nd leaf from the head (penultimate) and means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	YK-20	YK-21	YK-22	YK-23
<u>Variety - Fung</u>	----- Early Dough Stage – T3 (% leaf area affected by disease) -----			
MS – untr	4.0 a	0.2 a	4.8 a	1.7 a
MS – flag	1.5 cd	0.1 a	3.4 ab	1.0 a
MS – head	2.1 bcd	0.2 a	2.3 bcd	1.1 a
MS – dual	1.3 d	0.1 a	1.6 bcd	0.9 a
I – untr	2.8 abc	0.2 a	2.8 bcd	1.1 a
I – flag	1.2 d	0.0 a	1.5 cd	0.8 a
I – head	1.7 cd	0.2 a	1.9 bcd	0.9 a
I – dual	1.1 d	0.1 a	1.1 d	0.8 a
MR – untr	3.3 ab	0.1 a	3.0 abc	1.4 a
MR – flag	1.3 d	0.2 a	1.8 bcd	0.8 a
MR – head	1.7 cd	0.3 a	1.8 bcd	0.9 a
MR – dual	1.3 d	0.1 a	1.5 cd	0.7 a
S.E.M.	0.27	0.07	0.42	0.29

Table 25. Variety and fungicide treatment main effect means for barley yield at Brandon, MB (2021-24). 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	BR-24
Variety (VAR)	----- Grain Yield (kg/ha) -----			
Bow (MS)	3950 B	5863 C	6857 B	5476 B
Synergy (I)	5653 A	6601 A	7516 A	6000 A
Connect (MR)	5288 A	6345 B	7258 A	5845 A
S.E.M.	141.7	80.7 ^z	98.8	92.2
<u>Fungicide</u>				
Untreated	4986 A	6139 B	7112 A	5727 A
Flag	4895 A	6226 AB	7143 A	5896 A
Head	4920 A	6307 AB	7261 A	5661 A
Dual	5054 A	6406 A	7325 A	5808 A
S.E.M.	158.8	86.3 ^z	113.0	100.4

Table 26. Individual variety by fungicide treatment means for barley yield at Brandon, MB (2021-24). Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	BR-21	BR-22	BR-23	BR-24
<u>Variety - Fung</u>	----- Grain Yield (kg/ha) -----			
MS – untr	3960 cd	5848 de	6845 a	5308 b
MS – flag	3749 d	5907 cde	6853 a	5631 ab
MS – head	4235 bcd	5690 e	6846 a	5373 b
MS – dual	3855 cd	6008 cde	6884 a	5592 ab
I – untr	5767 a	6330 a-d	7468 a	5958 ab
I – flag	5575 a	6470 ab	7336 a	6135 a
I – head	5490 a	6769 a	7647 a	5835 ab
I – dual	5780 a	6834 a	7615 a	6072 a
MR – untr	5231 a	6240 bcd	7024 a	5916 ab
MR – flag	5362 a	6300 a-d	7242 a	5922 ab
MR – head	5035 abc	6463 abc	7290 a	5776 ab
MR – dual	5525 a	6377 abc	7477 a	5764 ab
S.E.M.	257.5	122.5 ^z	191.9	150.1

Table 27. Variety and fungicide treatment main effect means for barley yield at Indian Head, SK (2020-24). Main effect means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	IH-20	IH-21	IH-22	IH-23	IH-24
Variety (VAR)	----- Grain Yield (kg/ha) -----				
Bow (MS)	4986 B	3156 B	6968 A	5432 B	5174 A
Synergy (I)	5609 A	3965 A	6917 A	6141 A	5247 A
Connect (MR)	5429 A	3954 A	6751 A	6071 A	5534 A
S.E.M.	123.9	120.6	84.1	55.7	219.9
<u>Fungicide</u>					
Untreated	5378 A	3635 A	6584 B	5895 A	5433 A
Flag	5444 A	3720 A	6925 A	5867 A	5382 A
Head	5258 A	3735 A	6997 A	5844 A	5317 A
Dual	5286 A	3677 A	7009 A	5919 A	5139 A
S.E.M.	127.7	122.6	92.0	58.2	229.1

Table 28. Individual variety by fungicide treatment means for barley yield at Indian Head, SK (2020-24). Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	IH-20	IH-21	IH-22	IH-23	IH-24
<u>Variety - Fung</u>	----- Grain Yield (kg/ha) -----				
MS – untr	4989 bcd	3015 b	6459 c	5454 b	5168 a
MS – flag	5188 a-d	3194 b	6964 abc	5450 b	5295 a
MS – head	4830 d	3251 b	7108 ab	5432 b	5250 a
MS – dual	4938 cd	3165 b	7342 a	5392 b	4982 a
I – untr	5682 a	3984 a	6741 abc	6166 a	5542 a
I – flag	5662 a	3979 a	6936 abc	6132 a	5405 a
I – head	5611 a	4025 a	7036 abc	6049 a	4999 a
I – dual	5481 ab	3871 a	6954 abc	6216 a	5043 a
MR – untr	5464 abc	3906 a	6552 bc	6065 a	5590 a
MR – flag	5483 ab	3987 a	6875 abc	6018 a	5447 a
MR – head	5333 a-d	3930 a	6847 abc	6052 a	5705 a
MR – dual	5439 abc	3994 a	6729 abc	6148 a	5393 a
S.E.M.	154.7	137.2	139.6	75.5	292.7

Table 29. Variety and fungicide treatment main effect means for barley yield at Melfort, SK over a four-year period (2020-24). Main effect means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	ME-20	ME-21	ME-22	ME-23	ME-24
Variety (VAR)	----- Grain Yield (kg/ha) -----				
Bow (MS)	3394 A	2000 B	4166 A	5292 B	4661 B
Synergy (I)	3691 A	2728 A	4402 A	5669 A	5835 A
Connect (MR)	3630 A	2484 A	4368 A	5518 A	5572 A
S.E.M.	138.0 ^z	226.8 ^z	239.8	123.1	213.1
<u>Fungicide</u>					
Untreated	3487 A	2553 A	4094 A	5391 A	5258 A
Flag	3691 A	2340 A	4728 A	5511 A	5813 A
Head	3604 A	2382 A	4131 A	5574 A	5332 A
Dual	3505 A	2340 A	4294 A	5496 A	5020 A
S.E.M.	155.0 ^z	239.1 ^z	262.4	127.8	246.0

^zOverall average S.E.M. (values for individual treatments varied due to missing plots)

Table 30. Individual variety by fungicide treatment means for barley yield at Melfort, SK (2020-24). Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	ME-20	ME-21	ME-22	ME-23	ME-24
<u>Variety - Fung</u>	----- Grain Yield (kg/ha) -----				
MS – untr	3203 a	2252 ab	4119 a	5227 ab	4293 a
MS – flag	3569 a	2112 ab	4241 a	5308 ab	5713 a
MS – head	3438 a	1463 b	4115 a	5502 ab	4483 a
MS – dual	3365 a	2172 ab	4187 a	5133 b	4154 a
I – untr	3772 a	3183 a	4175 a	5694 ab	6203 a
I – flag	3625 a	2484 ab	5399 a	5740 a	5518 a
I – head	3749 a	3123 a	3595 a	5521 ab	6142 a
I – dual	3618 a	2121 ab	4436 a	5722 ab	5474 a
MR – untr	3484 a	2225 ab	3988 a	5253 ab	5278 a
MR – flag	3879 a	2425 ab	4543 a	5486 ab	6208 a
MR – head	3624 a	2559 ab	4682 a	5699 ab	5370 a
MR – dual	3532 a	2727 ab	4260 a	5633 ab	5434 a
S.E.M.	250.4 ^z	320.9 ^z	399.6	160.4	426.1

^zOverall average S.E.M. (values for individual treatments varied due to missing plots)

Table 31. Variety and fungicide treatment main effect means for barley test weight at Brandon, MB (2021-24). 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	BR-24
Variety (VAR)	----- Test Weight (g 0.5/l) -----			
Bow (MS)	302.1 A	320.4 A	313.1 A	321.1 A
Synergy (I)	303.8 A	320.1 A	309.6 B	314.9 B
Connect (MR)	302.7 A	315.6 B	308.4 B	313.7 B
S.E.M.	1.00	0.84	0.80	1.25
<u>Fungicide</u>				
Untreated	302.0 A	317.7 A	309.4 A	314.9 A
Flag	302.2 A	319.9 A	310.9 A	316.2 A
Head	303.7 A	317.5 A	311.1 A	316.6 A
Dual	303.3 A	319.6 A	310.0 A	318.6 A
S.E.M.	1.16	0.97	0.89	1.44

Table 32. Individual variety by fungicide treatment means for barley yield at Brandon, MB (2021-24). Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	BR-21	BR-22	BR-23	BR-24
<u>Variety - Fung</u>	----- Test Weight (g 0.5/l) -----			
MS – untr	301.6 a	319.3 ab	312.9 ab	320.6 a
MS – flag	298.9 a	323.1 a	313.7 ab	319.5 a
MS – head	304.7 a	318.4 ab	314.3 a	322.3 a
MS – dual	303.0 a	320.7 a	311.5 ab	322.2 a
I – untr	303.8 a	318.4 ab	308.1 ab	310.9 a
I – flag	303.8 a	318.4 ab	310.4 ab	316.4 a
I – head	302.9 a	322.8 a	310.1 ab	315.7 a
I – dual	304.7 a	320.8 a	309.9 ab	316.5 a
MR – untr	300.7 a	315.6 ab	307.3 b	313.3 a
MR – flag	304.0 a	318.0 ab	308.6 ab	312.6 a
MR – head	303.6 a	311.4 b	309.0 ab	311.9 a
MR – dual	302.3 a	317.3 ab	308.7 ab	317.1 a
S.E.M.	2.00	1.68	1.44	2.50

Table 33. Variety and fungicide treatment main effect means for barley test weight at Indian Head, SK (2020-24). Main effect means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	IH-20	IH-21	IH-22	IH-23	IH-24
Variety (VAR)	----- Test Weight (g 0.5/l) -----				
Bow (MS)	324.6 B	287.9 B	318.5 A	303.0 C	289.9 AB
Synergy (I)	328.5 A	296.6 A	319.9 A	306.4 B	287.8 B
Connect (MR)	326.4 A	289.1 B	315.6 B	308.5 A	294.2 A
S.E.M.	0.50	0.61	0.93	0.65	4.07
<u>Fungicide</u>					
Untreated	325.8 A	290.0 B	316.2 B	306.4 A	293.7 A
Flag	326.7 A	291.5 AB	316.7 B	305.6 A	290.6 A
Head	326.7 A	290.8 B	319.9 A	305.0 A	291.2 A
Dual	327.5 A	292.5 A	319.2 A	306.9 A	287.1 A
S.E.M.	0.58	0.65	0.97	0.70	4.18

Table 34. Individual variety by fungicide treatment means for barley test weight at Indian Head, SK (2020-24). Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	IH-20	IH-21	IH-22	IH-23	IH-24
<u>Variety - Fung</u>	----- Test Weight (g 0.5/l) -----				
MS – untr	323.5 b	287.7 c	315.8 bcd	303.7 cde	291.2 a
MS – flag	325.7 ab	287.8 c	316.1 bcd	302.6 de	291.1 a
MS – head	324.4 b	287.8 c	321.3 a	301.3 e	290.4 a
MS – dual	324.9 ab	288.3 c	320.7 ab	304.4 b-e	287.0 a
I – untr	328.3 ab	294.4 b	318.7 a-d	307.5 abc	291.9 a
I – flag	328.4 ab	297.3 ab	319.3 abc	306.5 a-d	290.4 a
I – head	328.1 ab	295.6 ab	321.2 a	304.9 a-e	284.5 a
I – dual	329.4 a	299.1 a	320.3 ab	306.7 a-d	284.4 a
MR – untr	325.5 ab	287.8 c	314.0 d	308.1 abc	297.8 a
MR – flag	326.0 ab	289.6 c	314.7 cd	307.6 abc	290.2 a
MR – head	327.8 ab	289.0 c	317.2 a-d	308.7 ab	298.7 a
MR – dual	328.1 ab	290.1 c	316.5 a-d	309.5 a	289.9 a
S.E.M.	1.01	0.91	1.26	1.05	4.93

Table 35. Variety and fungicide treatment main effect means for barley test weight at Melfort, SK (2020-24). Main effect means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	ME-20	ME-21	ME-22	ME-23	ME-24
Variety (VAR)	----- Test Weight (g 0.5/l) -----				
Bow (MS)	334.2 B	310.8 B	316.6 B	337.8 AB	317.9 B
Synergy (I)	336.2 A	315.7 A	320.0 A	336.4 B	324.3 A
Connect (MR)	333.4 B	313.1 AB	318.7 A	339.0 A	321.4 A
S.E.M.	0.62 ^z	0.88 ^z	1.06	0.40	0.94
<u>Fungicide</u>					
Untreated	334.3 A	312.2 A	317.5 A	337.7 A	320.2 A
Flag	334.8 A	314.6 A	319.7 A	337.6 A	323.5 A
Head	334.7 A	312.4 A	318.1 A	338.0 A	321.0 A
Dual	334.6 A	313.5 A	318.4	337.7 A	320.0 A
S.E.M.	0.68 ^z	1.01 ^z	1.11	0.46	1.08

^zOverall average S.E.M. (values for individual treatments varied due to missing plots)

Table 36. Individual variety by fungicide treatment means for barley test weight at Melfort, SK (2020-24). Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	ME-20	ME-21	ME-22	ME-23	ME-24
<u>Variety - Fung</u>	----- Test Weight (g 0.5/l) -----				
MS – untr	334.3 a	310.8 a	315.7 b	338.2 a	317.1 ab
MS – flag	334.6 a	311.7 a	317.4 ab	336.9 a	322.4 ab
MS – head	334.2 a	310.1 a	316.1 ab	338.2 a	317.5 ab
MS – dual	333.8 a	310.5 a	317.1 ab	337.8 a	314.4 b
I – untr	335.6 a	314.5 a	319.6 ab	336.2 a	324.9 a
I – flag	336.7 a	317.7 a	321.7 a	336.5 a	323.3 ab
I – head	336.4 a	315.6 a	318.5 ab	336.4 a	325.6 a
I – dual	336.0 a	315.1 a	320.3 ab	336.6 a	323.3 ab
MR – untr	333.0 a	311.3 a	317.2 ab	338.8 a	318.5 ab
MR – flag	333.0 a	314.4 a	320.0 ab	339.3 a	324.7 a
MR – head	333.5 a	311.6 a	319.7 ab	339.3 a	320.0 ab
MR – dual	333.9 a	314.4 a	317.8 ab	338.7 a	322.3 ab
S.E.M.	1.03 ^z	1.75 ^z	1.47	0.80	1.87

^zOverall average S.E.M. (values for individual treatments varied due to missing plots)

Table 37. Variety and fungicide treatment main effect means for barley test weight at Yorkton, SK (2020-23). Main effect means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	YK-20	YK-21	YK-22	YK-23
Variety (VAR)	----- Test Weight (g 0.5/l) -----			
Bow (MS)	326.7 B	271.5 B	297.8 B	305.1 B
Synergy (I)	329.1 A	280.0 A	299.1 AB	312.2 A
Connect (MR)	327.9 AB	273.3 B	302.4 A	306.7 B
S.E.M.	0.50	0.94 ^z	1.73	1.61
<u>Fungicide</u>				
Untreated	326.9 A	275.8 A	296.7 B	308.4 A
Flag	328.3 A	274.0 A	296.7 B	309.3 A
Head	327.9 A	274.9 A	305.9 A	306.6 A
Dual	328.6 A	275.0 A	299.7 B	307.9 A
S.E.M.	0.58	1.05 ^z	1.84	1.76

^zOverall average S.E.M. (values for individual treatments varied due to missing plots)

Table 38. Individual variety by fungicide treatment means for barley yield at Yorkton, SK (2020-23). Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	YK-20	YK-21	YK-22	YK-23
<u>Variety - Fung</u>	----- Test Weight (g 0.5/l) -----			
MS – untr	326.9 a	273.1 bcd	291.4 d	309.6 ab
MS – flag	325.8 a	271.7 cd	299.8 a-d	306.9 ab
MS – head	326.1 a	269.7 d	303.4 abc	302.5 ab
MS – dual	327.7 a	271.6 d	296.6 bcd	301.5 b
I – untr	327.4 a	279.3 abc	294.0 bcd	307.3 ab
I – flag	330.7 a	281.3 a	293.7 cd	313.5 ab
I – head	328.8 a	280.1 ab	305.0 ab	313.8 ab
I – dual	329.7 a	279.6 ab	304.0 abc	314.3 a
MR – untr	326.3 a	275.2 a-d	304.7 abc	308.2 ab
MR – flag	328.5 a	269.2 d	296.7 bcd	307.5 ab
MR – head	328.6 a	274.9 a-d	309.5 a	303.5 ab
MR – dual	328.3 a	274.0 a-d	298.6 a-d	307.8 ab
S.E.M.	0.99	1.67 ^z	2.60	2.71

^zOverall average S.E.M. (values for individual treatments varied due to missing plots)

Table 39. Variety and fungicide treatment main effect means for barley thousand seed weight at Brandon, MB (2021-24). 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	BR-24
Variety (VAR)	----- Seed Weight (g 1000/seeds) -----			
Bow (MS)	47.0 A	47.1 A	49.8 A	41.5 A
Synergy (I)	45.6 A	46.6 A	47.6 B	40.0 AB
Connect (MR)	46.7 A	46.8 A	49.6 A	39.9 B
S.E.M.	0.39	0.40	0.48	0.51
<u>Fungicide</u>				
Untreated	46.3 A	46.1 A	48.1 A	39.8 A
Flag	46.3 A	47.6 A	48.7 A	41.1 A
Head	46.4 A	46.8 A	49.5 A	40.1 A
Dual	46.7 A	46.7 A	49.8 A	40.9 A
S.E.M.	0.45	0.46	0.53	0.58

Table 40. Individual variety by fungicide treatment means for barley thousand seed weight at Brandon, MB (2021-24). Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	BR-21	BR-22	BR-23	BR-24
<u>Variety - Fung</u>	----- Seed Weight (g 1000/seeds) -----			
MS – untr	47.0 a	46.8 a	47.9 abc	41.0 a
MS – flag	46.0 a	47.7 a	50.4 ab	42.0 a
MS – head	47.6 a	46.4 a	51.2 a	41.5 a
MS – dual	47.4 a	47.5 a	49.7 bc	41.7 a
I – untr	45.6 a	46.0 a	47.1 bc	39.0 a
I – flag	45.5 a	47.1 a	46.4 c	41.7 a
I – head	44.7 a	47.1 a	47.8 abc	38.8 a
I – dual	46.7 a	46.0 a	49.3 abc	40.5 a
MR – untr	46.4 a	45.6 a	49.3 abc	39.6 a
MR – flag	47.5 a	48.0 a	49.4 abc	39.7 a
MR – head	46.8 a	47.0 a	49.7 abc	39.9 a
MR – dual	46.1 a	46.6 a	50.3 ab	40.5 a
S.E.M.	0.79	0.80	49.28	0.97

Table 41. Variety and fungicide treatment main effect means for barley thousand seed weight at Indian Head, SK (2020-24). Main effect means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	IH-20	IH-21	IH-22	IH-23	IH-24
Variety (VAR)	----- Seed Weight (g/1000 seeds) -----				
Bow (MS)	47.8 B	45.1 A	45.7 A	47.4 B	37.9 B
Synergy (I)	49.1 A	45.0 A	47.3 A	47.7 B	37.6 B
Connect (MR)	49.3 A	45.1 A	47.6 A	48.7 A	39.8 A
S.E.M.	0.16	0.17	0.25	0.16	1.13
<u>Fungicide</u>					
Untreated	48.4 A	44.8 A	46.3 B	48.1 A	39.2 A
Flag	49.1 A	45.1 A	46.6 B	47.9 A	38.0 A
Head	48.7 A	44.9 A	47.6 A	47.9 A	38.5 A
Dual	48.8 A	45.4 A	47.0 AB	47.9 A	37.9 A
S.E.M.	0.18	0.19	0.27	0.18	1.17

Table 42. Individual variety by fungicide treatment means for barley thousand seed weight at Indian Head, SK (2020-24). Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	IH-20	IH-21	IH-22	IH-23	IH-24
<u>Variety - Fung</u>	----- Seed Weight (g/1000 seeds) -----				
MS – untr	47.3 c	44.8 a	44.8 d	47.4 de	38.3 a
MS – flag	48.1 bc	44.9 a	45.2 cd	47.5 de	37.4 a
MS – head	48.1 bc	45.1 a	46.6 a-d	47.6 b-e	38.3 a
MS – dual	47.9 bc	45.4 a	46.3 bcd	47.3 e	37.7 a
I – untr	48.9 ab	44.6 a	46.8 abc	48.1 a-e	38.1 a
I – flag	49.7 a	45.0 a	47.3 ab	47.5 cde	38.0 a
I – head	48.5 abc	44.7 a	47.8 ab	47.6 b-e	36.4 a
I – dual	49.2 ab	45.6 a	47.5 ab	47.7 a-e	37.7 a
MR – untr	48.9 ab	44.9 a	47.2 ab	48.8 a	41.3 a
MR – flag	49.4 ab	45.4 a	47.4 ab	48.7 ab	38.7 a
MR – head	49.6 ab	45.0 a	48.4 a	48.7 abc	40.9 a
MR – dual	49.2 ab	45.3 a	47.4 ab	48.6 a-d	38.3 a
S.E.M.	0.31	0.33	0.40	0.27	1.46

Table 43. Variety and fungicide treatment main effect means for barley thousand seed weight at Melfort, SK (2020-24). Main effect means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	ME-20	ME-21	ME-22	ME-23	ME-24
Variety (VAR)	----- Seed Weight (g/1000 seeds) -----				
Bow (MS)	44.8 B	45.5 A	47.0 B	47.9 B	46.3 B
Synergy (I)	46.3 A	45.2 A	47.0 B	48.9 A	47.1 AB
Connect (MR)	46.1 A	46.2 A	49.3 A	48.9 A	47.4 A
S.E.M.	0.41 ^z	0.35 ^z	0.38	0.19	0.24
<u>Fungicide</u>					
Untreated	45.9 A	45.3 A	47.3 A	48.5 A	46.7 A
Flag	45.7 A	45.9 A	48.1 A	48.9 A	47.0 A
Head	46.0 A	45.6 A	47.8 A	48.6 A	47.2 A
Dual	45.9 A	45.9 A	47.8 A	48.4 A	46.9 A
S.E.M.	0.45 ^z	0.40 ^z	0.39	0.22	0.28

^zOverall average S.E.M. (values for individual treatments varied due to missing plots)

Table 44. Individual variety by fungicide treatment means for barley thousand seed weight at Melfort, SK (2020-24). Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	ME-20	ME-21	ME-22	ME-23	ME-24
Variety - Fung	----- Seed Weight (g/1000 seeds) -----				
MS – untr	44.7 a	45.2 a	46.4 c	47.8 a	46.0 a
MS – flag	44.5 a	45.0 a	47.1 bc	47.9 a	47.0 a
MS – head	44.9 a	45.4 a	47.1 bc	48.3 a	46.5 a
MS – dual	45.3 a	46.3 a	47.2 abc	47.8 a	45.9 a
I – untr	45.4 a	44.8 a	46.6 c	49.1 a	47.3 a
I – flag	46.6 a	45.8 a	47.8 abc	49.3 a	46.5 a
I – head	46.6 a	45.3 a	46.4 c	48.6 a	47.3 a
I – dual	46.5 a	45.0 a	47.2 abc	48.7 a	47.3 a
MR – untr	45.8 a	45.8 a	48.9 abc	48.5 a	47.0 a
MR – flag	46.7 a	46.8 a	49.5 ab	49.4 a	47.4 a
MR – head	45.7 a	45.7 a	49.8 a	48.8 a	47.7 a
MR – dual	46.3 a	46.3 a	49.0 abc	48.9 a	47.6 a
S.E.M.	0.66 ^z	0.66 ^z	0.59	0.39	0.48

^zOverall average S.E.M. (values for individual treatments varied due to missing plots)

Table 45. Variety and fungicide treatment main effect means for barley thousand seed weight at Yorkton, SK (2020-23). Main effect means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	YK-20	YK-21	YK-22	YK-23
Variety (VAR)	----- Seed Weight (g/1000 seeds) -----			
Bow (MS)	48.7 B	42.1 A	42.2 A	42.2 B
Synergy (I)	49.7 A	40.6 AB	40.6 B	44.4 A
Connect (MR)	49.9 A	39.2 B	42.8 A	42.7 AB
S.E.M.	0.19	1.19	0.38	1.20
<u>Fungicide</u>				
Untreated	49.0 A	40.9 A	41.0 B	43.6 A
Flag	49.8 A	40.6 A	40.9 B	43.7 A
Head	49.2 A	41.4 A	43.4 A	42.7 A
Dual	49.7 A	39.7 A	42.2 AB	42.3 A
S.E.M.	0.22	1.28	0.43	1.24

Table 46. Individual variety by fungicide treatment means for barley thousand seed weight at Yorkton, SK (2020-23). Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	YK-20	YK-21	YK-22	YK-23
<u>Variety - Fung</u>	----- Seed Weight (g/1000 seeds) -----			
MS – untr	48.6 b	41.4 a	40.3 bcd	44.9 a
MS – flag	49.0 ab	43.3 a	42.2 abc	42.1 a
MS – head	48.6 b	41.8 a	43.8 a	41.1 a
MS – dual	48.8 ab	41.9 a	42.4 abc	40.7 a
I – untr	49.0 ab	40.6 a	39.6 cd	42.7 a
I – flag	50.5 a	41.4 a	38.6 d	45.5 a
I – head	49.2 ab	41.7 a	42.1 abc	45.6 a
I – dual	49.9 ab	38.8 a	42.2 abc	44.0 a
MR – untr	49.3 ab	40.6 a	43.2 ab	43.4 a
MR – flag	49.9 ab	37.7 a	41.9 a-d	43.5 a
MR – head	49.9 ab	40.7 a	44.3 a	41.3 a
MR – dual	50.3 ab	38.2 a	42.0 abc	42.4 a
S.E.M.	0.38	1.80	0.69	1.54

Table 47. Variety and fungicide treatment main effect means for plump barley kernels at Brandon, MB (2021-24). 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	BR-24
Variety (VAR)	----- Plump Kernels (g/100 g) -----			
Bow (MS)	97.0 A	96.0 A	97.5 A	90.1 A
Synergy (I)	95.1 B	96.5 A	97.0 A	87.6 A
Connect (MR)	93.3 C	94.3 B	96.1 B	80.5 B
S.E.M.	0.45	0.36	0.18	1.52
<u>Fungicide</u>				
Untreated	95.2 A	95.1 A	96.7 A	85.1 A
Flag	95.5 A	96.0 A	97.2 A	86.3 A
Head	94.5 A	95.6 A	96.8 A	85.1 A
Dual	95.3 A	95.8 A	96.8 A	87.8 A
S.E.M.	0.52	0.40	0.20	1.68

Table 48. Individual variety by fungicide treatment means for plump barley kernels at Brandon, MB (2021-24). Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	BR-21	BR-22	BR-23	BR-24
<u>Variety - Fung</u>	----- Plump Kernels (g/100 g) -----			
MS – untr	96.8 ab	95.5 ab	97.3 a-d	89.8 a
MS – flag	96.7 ab	96.8 a	98.0 a	89.4 a
MS – head	97.4 a	95.3 ab	97.6 ab	90.2 a
MS – dual	96.9 ab	96.2 a	97.4 abc	91.1 a
I – untr	95.8 ab	96.5 a	96.7 a-d	85.6 a
I – flag	95.4 ab	96.5 a	97.2 a-d	89.7 a
I – head	93.1 ab	96.7 a	97.0 a-d	85.6 a
I – dual	96.1 ab	96.4 a	97.3 a-d	89.6 a
MR – untr	92.9 b	93.3 b	96.1 bcd	79.9 a
MR – flag	94.4 ab	94.7 ab	96.6 a-d	79.9 a
MR – head	93.0 ab	94.7 ab	95.9 cd	79.4 a
MR – dual	92.8 b	94.7 ab	95.8 d	82.8 a
S.E.M.	0.91	0.60	0.33	2.62

Table 49. Variety and fungicide treatment main effect means for plump barley kernels at Indian Head, SK (2020-24). Main effect means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	IH-20	IH-21	IH-22	IH-23	IH-24
Variety (VAR)	----- Plump Kernels (g/100 g) -----				
Bow (MS)	97.0 A	98.5 A	95.3 A	98.3 A	76.6 A
Synergy (I)	97.5 A	98.6 A	93.5 B	98.1 A	70.1 B
Connect (MR)	96.7 A	98.4 A	92.4 C	97.5 B	71.8 AB
S.E.M.	0.27	0.14	0.23	0.09	3.37
<u>Fungicide</u>					
Untreated	96.8 A	98.3 A	92.9 B	98.0 A	75.4 A
Flag	97.1 A	98.5 A	93.5 AB	97.9 A	75.0 A
Head	97.2 A	98.6 A	94.3 A	98.0 A	70.8 A
Dual	97.3 A	98.6 A	94.1 A	97.9 A	70.2 A
S.E.M.	0.31	0.15	0.26	0.10	3.54

Table 50. Individual variety by fungicide treatment means for plump barley kernels at Indian Head, SK (2020-24). Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	IH-20	IH-21	IH-22	IH-23	IH-24
<u>Variety - Fung</u>	----- Plump Kernels (g/100 g) -----				
MS – untr	96.6 a	98.2 a	90.9 e	98.3 ab	78.2 a
MS – flag	96.4 a	98.4 a	91.8 de	98.3 a	80.3 a
MS – head	97.0 a	98.7 a	93.6 a-d	98.3 a	75.8 a
MS – dual	98.0 a	98.6 a	93.4 abc	98.3 ab	72.3 a
I – untr	97.2 a	98.5 a	94.7 abc	98.2 abc	74.3 a
I – flag	97.9 a	98.6 a	95.6 a	97.9 a-e	72.4 a
I – head	97.8 a	98.6 a	95.4 ab	98.1 a-d	64.2 a
I – dual	97.2 a	98.6 a	95.4 cd	98.3 a	69.3 a
MR – untr	96.5 a	98.2 a	93.0 cd	97.6 b-e	73.4 a
MR – flag	96.9 a	98.5 a	93.2 cd	97.5 de	72.4 a
MR – head	96.8 a	98.4 a	94.0 abc	97.6 cde	72.4 a
MR – dual	96.8 a	98.5 a	93.7 a-d	97.2 e	69.1 a
S.E.M.	0.54	0.20	0.43	0.15	4.68

Table 51. Variety and fungicide treatment main effect means for plump barley kernels at Melfort, SK (2020-24). Main effect means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	ME-20	ME-21	ME-22	ME-23	ME-24
Variety (VAR)	----- Plump Kernels (g/100 g) -----				
Bow (MS)	97.8 A	98.3 A	95.4 B	98.3 A	95.9 B
Synergy (I)	97.8 A	98.0 A	96.4 A	98.4 A	96.9 A
Connect (MR)	97.9 A	98.0 A	96.2 A	97.6 B	95.6 B
S.E.M.	0.30 ^z	0.22 ^z	0.22	0.10	0.12
<u>Fungicide</u>					
Untreated	97.4 A	98.1 A	95.9 A	98.1 A	96.0 A
Flag	98.2 A	98.3 A	96.4 A	98.1 A	96.1 A
Head	97.9 A	97.8 A	95.7 A	98.2 A	96.3 A
Dual	97.9 A	98.8 A	95.9 A	98.0 A	96.0 A
S.E.M.	0.33 ^z	0.24 ^z	0.30	0.11	0.13

^zOverall average S.E.M. (values for individual treatments varied due to missing plots)

Table 52. Individual variety by fungicide treatment means for plump barley kernels at Melfort, SK (2020-24). Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	ME-20	ME-21	ME-22	ME-23	ME-24
Variety - Fung	----- Plump Kernels (g/100 g) -----				
MS – untr	97.6 a	98.6 a	95.1 a	98.4 ab	95.9 bcd
MS – flag	98.2 a	98.7 a	95.4 a	98.1 abc	96.6 abc
MS – head	97.8 a	97.8 a	95.9 a	98.3 ab	96.1 bcd
MS – dual	97.7 a	98.7 a	95.2 a	98.3 ab	95.1 d
I – untr	96.9 a	97.9 a	96.7 a	98.6 a	96.8 abc
I – flag	97.8 a	98.1 a	96.8 a	98.4 ab	96.6 abc
I – head	98.2 a	97.9 a	95.4 a	98.7 a	96.9 ab
I – dual	98.2 a	97.9 a	96.8 a	98.1 abc	97.3 a
MR – untr	97.6 a	97.9 a	96.0 a	97.3 c	95.3 d
MR – flag	98.4 a	98.3 a	97.1 a	97.8 abc	95.2 d
MR – head	97.7 a	97.6 a	95.9 a	97.7 bc	96.0 bcd
MR – dual	97.8 a	98.2 a	95.8 a	97.6 bc	95.8 cd
S.E.M.	0.53 ^z	0.36 ^z	0.47	0.19	0.23

^zOverall average S.E.M. (values for individual treatments varied due to missing plots)

Table 53. Variety and fungicide treatment main effect means for plump barley kernels at Yorkton, SK (2020-23). Main effect means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	YK-20	YK-21	YK-22	YK-23
Variety (VAR)	----- Plump Kernels (g/100 g) -----			
Bow (MS)	99.0 A	98.2 A	91.0 A	90.5 A
Synergy (I)	99.2 A	95.3 A	85.6 B	91.4 A
Connect (MR)	98.9 A	94.9 A	84.7 B	82.2 B
S.E.M.	0.16	0.94	1.06	2.17
<u>Fungicide</u>				
Untreated	98.9 A	96.9 A	86.0 AB	88.0 A
Flag	99.0 A	95.4 A	84.9 B	89.8 A
Head	99.0 A	97.2 A	89.9 A	87.0 A
Dual	99.1 A	95.1 A	87.4 AB	87.5 A
S.E.M.	0.16	1.02	1.19	2.27

Table 54. Individual variety by fungicide treatment means for plump barley kernels content at Yorkton, SK (2020-23). Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	YK-20	YK-21	YK-22	YK-23
<u>Variety - Fung</u>	----- Plump Kernels (g/100 g) -----			
MS – untr	98.8 a	97.7 a	89.7 abc	92.4 a
MS – flag	99.1 a	98.2 a	90.4 ab	90.4 ab
MS – head	99.0 a	98.7 a	93.3 a	89.8 abc
MS – dual	98.9 a	98.2 a	90.5 ab	89.4 abc
I – untr	99.1 a	96.4 a	83.5 bc	87.7 abc
I – flag	99.2 a	95.6 a	80.9 c	93.2 a
I – head	99.3 a	96.1 a	88.3 abc	92.7 a
I – dual	99.1 a	93.3 a	89.6 abc	92.3 a
MR – untr	98.9 a	96.7 a	85.0 abc	83.8 abc
MR – flag	98.8 a	92.6 a	83.6 bc	85.8 abc
MR – head	98.8 a	96.6 a	88.2 abc	78.6 c
MR – dual	99.1 a	93.7 a	82.2 bc	80.7 bc
S.E.M.	0.22	1.47	1.96	2.94

Table 55. Variety and fungicide treatment main effect means for thin barley kernels at Brandon, MB (2021-24). 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	BR-24
Variety (VAR)	----- Thin Kernels (g/100 g) -----			
Bow (MS)	0.3 B	0.6 B	0.3 B	1.3 B
Synergy (I)	0.3 B	0.4 C	0.3 B	1.4 B
Connect (MR)	0.5 A	0.8 A	0.5 A	2.9 A
S.E.M.	0.04	0.06	0.03	0.26
<u>Fungicide</u>				
Untreated	0.4 A	0.7 A	0.4 A	1.9 A
Flag	0.3 A	0.5 B	0.3 A	1.9 A
Head	0.3 A	0.6 AB	0.3 A	2.0 A
Dual	0.4 A	0.6 AB	0.3 A	1.6 A
S.E.M.	0.05	0.07	0.03	0.29

Table 56. Individual variety by fungicide treatment means for plump barley kernels at Brandon, MB (2021-24). Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	BR-21	BR-22	BR-23	BR-24
<u>Variety - Fung</u>	----- Thin Kernels (g/100 g) -----			
MS – untr	0.4 a	0.9 ab	0.4 abc	1.2 ab
MS – flag	0.3 a	0.4 de	0.3 bc	1.5 ab
MS – head	0.2 a	0.7 a-e	0.3 abc	1.4 ab
MS – dual	0.4 a	0.5 b-e	0.2 c	1.2 ab
I – untr	0.2 a	0.4 de	0.3 abc	1.7 ab
I – flag	0.3 a	0.5 cde	0.3 bc	1.2 ab
I – head	0.4 a	0.3 e	0.3 abc	1.6 ab
I – dual	0.3 a	0.5 b-e	0.3 abc	1.0 b
MR – untr	0.6 a	0.8 abc	0.5 ab	2.8 ab
MR – flag	0.4 a	0.7 a-d	0.5 ab	3.1 a
MR – head	0.3 a	0.9 a	0.4 abc	3.1 a
MR – dual	0.6 a	0.7 a-d	0.5 a	2.6 ab
S.E.M.	0.09	0.10	0.05	0.43

Table 57. Variety and fungicide treatment main effect means for thin barley kernels at Indian Head, SK (2020-24). Main effect means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	IH-20	IH-21	IH-22	IH-23	IH-24
Variety (VAR)	----- Thin Kernels (g/100 g) -----				
Bow (MS)	0.3 AB	0.1 A	0.7 A	0.1 B	3.2 A
Synergy (I)	0.2 B	0.1 B	0.4 B	0.2 AB	4.0 A
Connect (MR)	0.3 A	0.1 B	0.6 A	0.2 A	4.1 A
S.E.M.	0.03	0.01	0.05	0.01	0.49
<u>Fungicide</u>					
Untreated	0.3 A	0.1 A	0.7 A	0.2 A	3.5 A
Flag	0.3 A	0.1 A	0.6 AB	0.2 A	3.5 A
Head	0.2 A	0.1 A	0.5 AB	0.2 A	3.9 A
Dual	0.3 A	0.1 A	0.5 B	0.2 A	4.0 A
S.E.M.	0.030	0.02	0.05	0.01	0.51

Table 58. Individual variety by fungicide treatment means for thin barley kernels at Indian Head, SK (2020-24). Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	IH-20	IH-21	IH-22	IH-23	IH-24
<u>Variety - Fung</u>	----- Thin Kernels (g/100 g) -----				
MS – untr	0.3 a	0.1 a	1.0 a	0.1 a	3.1 a
MS – flag	0.3 a	0.1 a	0.7 ab	0.1 a	2.7 a
MS – head	0.2 a	0.1 a	0.4 b	0.1 a	3.4 a
MS – dual	0.2 a	0.1 a	0.5 b	0.2 a	3.6 a
I – untr	0.2 a	0.1 a	0.4 b	0.2 a	3.6 a
I – flag	0.2 a	0.1 a	0.4 b	0.2 a	3.8 a
I – head	0.2 a	0.1 a	0.4 b	0.2 a	4.3 a
I – dual	0.2 a	0.1 a	0.4 b	0.1 a	4.3 a
MR – untr	0.4 a	0.1 a	0.6 b	0.2 a	3.7 a
MR – flag	0.3 a	0.1 a	0.6 b	0.2 a	4.2 a
MR – head	0.3 a	0.1 a	0.6 b	0.2 a	4.1 a
MR – dual	0.3 a	0.1 a	0.6 b	0.2 a	4.3 a
S.E.M.	0.05	0.02	0.08	0.02	0.67

Table 59. Variety and fungicide treatment main effect means for thin barley kernels at Melfort, SK (2020-24). Main effect means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	ME-20	ME-21	ME-22	ME-23	ME-24
Variety (VAR)	----- Thin Kernels (g/100 g) -----				
Bow (MS)	0.3 A	0.2 A	0.5 A	0.1 A	0.4 A
Synergy (I)	0.3 A	0.2 A	0.4 A	0.1 A	0.2 C
Connect (MR)	0.3 A	0.2 A	0.4 A	0.1 A	0.3 B
S.E.M.	0.06 ^z	0.03 ^z	0.04	0.02	0.02
<u>Fungicide</u>					
Untreated	0.3 A	0.2 A	0.5 A	0.1 A	0.3 A
Flag	0.3 A	0.2 A	0.4 A	0.1 A	0.3 A
Head	0.3 A	0.2 A	0.4 A	0.1 A	0.3 A
Dual	0.3 A	0.1 A	0.4 A	0.1 A	0.3 A
S.E.M.	0.07 ^z	0.03 ^z	0.05	0.02	0.02

^zOverall average S.E.M. (values for individual treatments varied due to missing plots)

Table 60. Individual variety by fungicide treatment means for thin barley kernels at Melfort, SK (2020-24). Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	ME-20	ME-21	ME-22	ME-23	ME-24
<u>Variety - Fung</u>	----- Thin Kernels (g/100 g) -----				
MS – untr	0.2 a	0.2 a	0.6 a	0.1 a	0.4 a
MS – flag	0.2 a	0.2 a	0.5 a	0.1 a	0.3 ab
MS – head	0.3 a	0.3 a	0.4 a	0.2 a	0.4 a
MS – dual	0.3 a	0.1 a	0.5 a	0.1 a	0.4 a
I – untr	0.5 a	0.2 a	0.3 a	0.1 a	0.2 b
I – flag	0.4 a	0.2 a	0.3 a	0.2 a	0.2 ab
I – head	0.3 a	0.1 a	0.4 a	0.2 a	0.2 ab
I – dual	0.2 a	0.2 a	0.3 a	0.2 a	0.2 ab
MR – untr	0.3 a	0.2 a	0.5 a	0.2 a	0.3 ab
MR – flag	0.2 a	0.1 a	0.3 a	0.1 a	0.3 ab
MR – head	0.3 a	0.2 a	0.5 a	0.1 a	0.3 ab
MR – dual	0.3 a	0.2 a	0.4 a	0.1 a	0.3 ab
S.E.M.	0.09 ^z	0.05 ^z	0.08	0.03	0.04

^zOverall average S.E.M. (values for individual treatments varied due to missing plots)

Table 61. Variety and fungicide treatment main effect means for thin barley kernels at Yorkton, SK (2020-23). Main effect means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	YK-20	YK-21	YK-22	YK-23
Variety (VAR)	----- Thin Kernels (g/100 g) -----			
Bow (MS)	0.1 A	0.2 B	1.0 B	0.6 B
Synergy (I)	0.1 A	0.3 AB	1.6 A	0.7 B
Connect (MR)	0.1 A	0.3 A	1.7 A	1.0 A
S.E.M.	0.01	0.04	0.12	0.08
<u>Fungicide</u>				
Untreated	0.1 A	0.2 A	1.5 A	0.9 A
Flag	0.1 A	0.3 A	1.8 A	0.7 A
Head	0.1 A	0.2 A	1.0 B	0.8 A
Dual	0.1 A	0.3 A	1.4 AB	0.8 A
S.E.M.	0.01	0.04	0.14	0.10

Table 62. Individual variety by fungicide treatment means for thin barley kernels at Yorkton, SK (2020-23). Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	YK-20	YK-21	YK-22	YK-23
<u>Variety - Fung</u>	----- Thin Kernels (g/100 g) -----			
MS – untr	0.1 a	0.2 a	1.1 bc	0.6 a
MS – flag	0.1 a	0.2 a	1.0 bc	0.5 a
MS – head	0.1 a	0.2 a	0.8 c	0.6 a
MS – dual	0.1 a	0.2 a	1.0 bc	0.7 a
I – untr	0.1 a	0.2 a	1.9 abc	1.0 a
I – flag	0.1 a	0.3 a	2.3 a	0.6 a
I – head	0.1 a	0.2 a	1.1 bc	0.5 a
I – dual	0.1 a	0.4 a	1.1 bc	0.6 a
MR – untr	0.1 a	0.2 a	1.7 abc	0.9 a
MR – flag	0.1 a	0.4 a	2.0 ab	0.9 a
MR – head	0.1 a	0.2 a	1.2 abc	1.2 a
MR – dual	0.1 a	0.3 a	2.0 ab	1.1 a
S.E.M.	0.02	0.06	0.24	0.16

Table 63. Variety and fungicide treatment main effect means for barley deoxynivalenol (DON) content at Brandon, MB (2021-24). 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	BR-24
Variety (VAR)	----- Deoxynivalenol - DON (ppm) -----			
Bow (MS)	Nil	0.40 A	0.29 A	—
Synergy (I)	Nil	0.41 A	0.19 B	—
Connect (MR)	Nil	0.41 A	0.19 B	—
S.E.M.	—	0.023	0.025	—
<u>Fungicide</u>				
Untreated	Nil	0.40 A	0.25 A	—
Flag	Nil	0.42 A	0.23 A	—
Head	Nil	0.41 A	0.20 A	—
Dual	Nil	0.38 A	0.20 A	—
S.E.M.	—	0.025	0.029	—

Table 64. Individual variety by fungicide treatment means for barley deoxynivalenol (DON) content at Brandon, MB (2021-24). Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	BR-21	BR-22	BR-23	BR-24
<u>Variety - Fung</u>	----- Deoxynivalenol - DON (ppm) -----			
MS – untr	Nil	0.40 a	0.35 a	—
MS – flag	Nil	0.43 a	0.23 a	—
MS – head	Nil	0.38 a	0.27 a	—
MS – dual	Nil	0.39 a	0.32 a	—
I – untr	Nil	0.43 a	0.21 a	—
I – flag	Nil	0.39 a	0.23 a	—
I – head	Nil	0.43 a	0.18 a	—
I – dual	Nil	0.39 a	0.14 a	—
MR – untr	Nil	0.39 a	0.19 a	—
MR – flag	Nil	0.45 a	0.25 a	—
MR – head	Nil	0.44 a	0.15 a	—
MR – dual	Nil	0.36	0.15 a	—
S.E.M.	—	0.039	0.051	—

Table 65. Variety and fungicide treatment main effect means for barley deoxynivalenol (DON) content at Indian Head, SK (2020-24). Main effect means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	IH-20	IH-21	IH-22	IH-23	IH-24
Variety (VAR)	----- Deoxynivalenol - DON (ppm) -----				
Bow (MS)	0.06 A	Nil	1.27 A	0.10 A	—
Synergy (I)	0.06 A	Nil	1.42 A	0.09 A	—
Connect (MR)	0.03 A	Nil	1.30 A	0.08 A	—
S.E.M.	0.026	—	0.113	0.018	—
<u>Fungicide</u>					
Untreated	0.06 A	Nil	1.64 A	0.08 A	—
Flag	0.06 A	Nil	1.62 A	0.09 A	—
Head	0.02 A	Nil	1.06 B	0.08 A	—
Dual	0.05 A	Nil	1.01 B	0.10 A	—
S.E.M.	0.028	—	0.122	0.020	—

Table 66. Individual variety by fungicide treatment means for barley deoxynivalenol (DON) content at Indian Head, SK (2020-24). Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	IH-20	IH-21	IH-22	IH-23	IH-24
<u>Variety - Fung</u>	----- Deoxynivalenol - DON (ppm) -----				
MS – untr	0.14 a	Nil	1.59 ab	0.09 a	—
MS – flag	0.04 a	Nil	1.46 ab	0.09 a	—
MS – head	0.03 a	Nil	1.03 ab	0.08 a	—
MS – dual	0.01 a	Nil	1.03 ab	0.14 a	—
I – untr	0.04 a	Nil	1.82 a	0.08 a	—
I – flag	0.03 a	Nil	1.64 ab	0.12 a	—
I – head	0.03 a	Nil	1.30 ab	0.08 a	—
I – dual	0.13 a	Nil	0.93 b	0.07 a	—
MR – untr	0.00 a	Nil	1.52 ab	0.08 a	—
MR – flag	0.11 a	Nil	1.76 a	0.07 a	—
MR – head	0.00 a	Nil	0.84 b	0.09 a	—
MR – dual	0.00 a	Nil	1.08 ab	0.08 a	—
S.E.M.	0.045	—	0.181	0.028	—

Table 67. Variety and fungicide treatment main effect means for barley deoxynivalenol (DON) content Melfort, SK (2020-24). Main effect means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	ME-20	ME-21	ME-22	ME-23	ME-24
Variety (VAR)	----- Deoxynivalenol - DON (ppm) -----				
Bow (MS)	0.11 A	Nil	0.56 A	0.18 A	—
Synergy (I)	0.10 A	Nil	0.53 AB	0.16 A	—
Connect (MR)	0.08 A	Nil	0.48 B	0.20 A	—
S.E.M.	0.031	—	0.030	0.036	—
<u>Fungicide</u>					
Untreated	0.12 A	Nil	0.49 A	0.19 A	—
Flag	0.08 A	Nil	0.56 A	0.18 A	—
Head	0.13 A	Nil	0.53 A	0.16 A	—
Dual	0.05 A	Nil	0.51 A	0.20 A	—
S.E.M.	0.035 ^z	—	0.032	0.037	—

^zOverall average S.E.M. (values for individual treatments varied due to missing plots)

Table 68. Individual variety by fungicide treatment means for barley deoxynivalenol (DON) content at Melfort, SK (2020-24). Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	ME-20	ME-21	ME-22	ME-23	ME-24
<u>Variety - Fung</u>	----- Deoxynivalenol - DON (ppm) -----				
MS – untr	0.09 a	Nil	0.51 ab	0.17 a	—
MS – flag	0.10 a	Nil	0.54 ab	0.19 a	—
MS – head	0.16 a	Nil	0.60 ab	0.14 a	—
MS – dual	0.09 a	Nil	0.57 ab	0.24 a	—
I – untr	0.18 a	Nil	0.49 ab	0.15 a	—
I – flag	0.07 a	Nil	0.69 a	0.14 a	—
I – head	0.14 a	Nil	0.46 b	0.20 a	—
I – dual	0.01 a	Nil	0.47 b	0.16 a	—
MR – untr	0.11 a	Nil	0.47 b	0.24 a	—
MR – flag	0.07 a	Nil	0.44 b	0.21 a	—
MR – head	0.08 a	Nil	0.53 ab	0.15 a	—
MR – dual	0.07 a	Nil	0.49 ab	0.21 a	—
S.E.M.	0.061 ^z	—	0.047	0.047	—

^zOverall average S.E.M. (values for individual treatments varied due to missing plots)

Table 69. Variety and fungicide treatment main effect means for barley deoxynivalenol (DON) content at Yorkton, SK (2020-23). Main effect means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	YK-20	YK-21	YK-22	YK-23
Variety (VAR)	----- Deoxynivalenol - DON (ppm) -----			
Bow (MS)	0.01 A	Nil	0.14 A	0.54 A
Synergy (I)	0.00 A	Nil	0.14 A	0.54 A
Connect (MR)	0.00 A	Nil	0.08 A	0.57 A
S.E.M.	0.004	–	0.037	0.025
<u>Fungicide</u>				
Untreated	0.01 A	Nil	0.19 A	0.53 A
Flag	0.01 A	Nil	0.18 A	0.54 A
Head	0.00 A	Nil	0.04 B	0.57 A
Dual	0.00 A	Nil	0.07 B	0.55 A
S.E.M.	0.005	–	0.040	0.028

Table 70. Individual variety by fungicide treatment means for barley deoxynivalenol (DON) content at Yorkton, SK (2020-23). Means within a column followed by the same letter do not significantly differ (Tukey, $P < 0.05$).

Source	YK-20	YK-21	YK-22	YK-23
<u>Variety - Fung</u>	----- Deoxynivalenol - DON (ppm) -----			
MS – untr	0.03 a	Nil	0.20 a	0.54 a
MS – flag	0.00 a	Nil	0.18 a	0.48 a
MS – head	0.00 a	Nil	0.07 a	0.59 a
MS – dual	0.00 a	Nil	0.10 a	0.54 a
I – untr	0.00 a	Nil	0.22 a	0.49 a
I – flag	0.00 a	Nil	0.25 a	0.51 a
I – head	0.01 a	Nil	0.01 a	0.54 a
I – dual	0.01 a	Nil	0.07 a	0.60 a
MR – untr	0.00 a	Nil	0.15 a	0.56 a
MR – flag	0.02 a	Nil	0.13 a	0.62 a
MR – head	0.00 a	Nil	0.03 a	0.58 a
MR – dual	0.00 a	Nil	0.03 a	0.51 a
S.E.M.	0.008	–	0.059	0.041