

2023 (Year 4) 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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1. Project Title: Contrasting Fungicide Applications and Genetic Fusarium Head Blight Resistance for Enhanced Yield and Quality of Barley

2. Project Numbers:

Saskatchewan Barley Development Commission: SBDC 5086
Manitoba Crop Alliance: MWBGA 2063
Western Grains Research Foundation: WGRF AGR2008

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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. While the originally proposed field trials at Lacombe could not proceed due to COVID restrictions and capacity limitations, Kelly Turkington continues 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. Results for the DON analyses in 2023 are not yet available for any locations; however, all samples were submitted to the lab back in early February.

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 2023 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, and 2023 with a combined attendance of approximately 350 participants. 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), and during the 2023 AAFC NARF Joint Annual Field Day (July 26, 70 attendees). The trial was shown at Yorkton during the 2023 ECRF Field Day held on July 20 (80 attendees). To date, 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 are extending 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. As discussed during the previous reporting period, the challenge with respect to the original reporting timelines is that much of the grain quality and disease data is not available until quite late in the winter and it is difficult for us to dedicate sufficient time to data analyses and report preparation during the field season.

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 approved and has previously been reported. A copy of the most recent field protocol is provided in Schedule 1 of the Appendices. To date, field trials have been conducted at Brandon in 2021, 2022, and 2023 and Indian Head, Melfort, and Yorkton in 2020, 2021, 2022, and 2023 for a total of 15 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 Appendices (Schedule 2). The fungicide treatments were an untreated control, a flag-leaf application targeting leaf disease (Trivapro), an application at 80-100% head emergence targeting FHB (Prosaro XTR), and a dual application which received both the flag-leaf stage and heading fungicide applications. The fungicides were applied as per protocol, using field sprayers and a minimum solution volume of 187 l/ha (20 U.S. gal/ac). The treatments were applied on the same date for each variety, and, to date, no sites have observed enough variance in crop stage to suggest that separate application dates would be warranted.

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, and 5 of the Appendices for 2020, 2021, 2022, and 2023, 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. 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. NARF staff assessed the damage and recommended that data from 10 plots would be affected and that these should be removed prior to any analyses. This was unfortunate but not due to any wrongdoing of NARF staff and the affected plots were removed prior to any statistical analyses, as per their recommendations. This was the only instance where a substantial amount of data was lost; however, as previously discussed, adverse environmental conditions have rendered data from some sites.

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 is planned to be included in the 2024 data collection activities. 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 this 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%.

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 2023 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 2023-March 2024 reporting period.

Seed for the 2023 season was sourced for all sites by IHARF staff and distributed as required. Field trials were initiated and carried through to completion at all four of the locations (Indian Head, Yorkton, Melfort, and Brandon). All aspects of the field trials went well in 2023; however, the data from Yorkton was unusually variable with yields ranging from 698-5886 kg/ha. Yields were well distributed within this range and the overall average was 2813 kg/ha; therefore, we were not able to attribute the variability to a

few outliers which could easily be removed. Overall average yields at Brandon, Indian Head, and Melfort were 7210 kg/ha, 5881 kg/ha, and 5493 kg/ha, respectively, and the data generally appeared to be of acceptably high quality.

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 statistically analysed and 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 15 location-years with specific details of these trials and the work completed discussed in previous sections. All available results to date, from all four 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, and 5 of the Appendices for 2020, 2021, 2022, and 2023 respectively. Tables 6 and 7 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 0.1 °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 46-120% 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 unusually hot and dry throughout the duration of this project.

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, focussing 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 8, 9, 10, and 11, respectively.

Establishment (Tables 12-15)

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, differences between varieties still occurred at 5/15 sites. Emergence for AAC Synergy (I) was slightly lower than for the other two varieties at IH-20. All four locations in 2021 observed lower plant populations for CDC Bow (MS) 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. At some locations (i.e., IH-21 and BR-21), emergence was somewhat poorer than expected, potentially due to poor seedbed conditions and/or deeper than optimal seed placement. While plant populations at these sites may have increased as the

season progressed and ultimately been higher than what is reported, emergence counts with cereals must generally be done early, prior to tillering, or they become increasingly difficult to accurately complete. 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.

Leaf Disease (Tables 16-23)

At the time of the flag leaf fungicide applications (T1), leaf disease levels never differed between varieties ($P = 0.069-0.947$) and were approximately 1% or lower (leaf area affected) at 13/15 sites, the sole exceptions being ME-20 and BR-23 where the overall mean values were still quite low at 2.3-2.4%. At ME-20, the trend was for the most disease in CDC Bow and the least in AAC Connect ($P = 0.069$; Table 20).

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 CDC Bow relative to Synergy and AAC Connect (Tables 23). At IH-23, CDC Connect tended to have the highest disease; however, the values never exceed 0.5% and, as such, these differences were not important.

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 7/15 sites and, at their worst, averaged only 4.1%. 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 9/15 sites, fungicide effects were significant at 8/16 sites, and VAR \times FUNG interactions were detected at 3/16 sites. For variety, the trends were not perfectly consistent, but showed amongst the highest disease pressure with CDC Bow. These trends likely reflected the levels of leaf spot resistance each variety had, whereby CDC 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, AAC Connect has intermediate resistance to net-form net and is moderately resistant to both spot-form net blotch and spot blotch. These trends likely reflected the levels of leaf spot resistance each variety had, whereby CDC 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, AAC Connect has intermediate resistance to net-form net 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 less efficacy at later stages, 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 occurred at BR-22, BR-23, and ME-21 and were consistent in that they showed the strongest fungicide effects with CDC Bow, intermediate effects with CDC Connect, and essentially no effect with Synergy. Similar to the trends for variety and leaf spot severity, these trends likely reflected the levels of leaf spot resistance each variety. In addition, a 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. Brandon 2023); however, the leaf disease pressure in such cases was low overall and the trends were often for slightly higher yield with fungicide.

Grain Yield (Tables 24-31)

Grain yields were affected by variety at 10/16 sites and fungicide at 2/15 sites, with VAR × FUNG interactions also detected at 2/15 sites. For 9/10 of the sites where variety differences existed, CDC Bow was the lowest yielding variety. 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 one case (BR-22), Synergy yielded significantly higher than CDC Connect and this was frequently the trend; however, yields for these two varieties were usually statistically similar when the data were analysed for each site individually. Combining the sites where yield data is considered reliable for more power analyses may improve our ability to detect differences between means. 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 CDC Bow (MS) and for both the flag leaf and dual applications for AAC 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 CDC Bow (MS), relatively little response with AAC Synergy (I), and an inconsistent, perhaps even negative, response to fungicide with AAC Connect (MR). 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 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 32-39)

Test weights were affected by variety at 14/15 sites and fungicide treatment at 3/15 sites, with a VAR × FUNG interaction detected at 1 site. Varietal effects on test weight appeared to vary with environment. CDC Bow had amongst the highest test weights at 5/15 sites, Synergy had amongst the highest test weights at 12/15 sites, and CDC Connect had amongst the highest test weights at 8/15 sites. 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 40-47)

Thousand kernel weight was affected by variety at 11/15 sites, fungicide treatment at 4/11 sites, and a VAR × FUNG interaction was detected for this variable at 1 site. Variety effects, when significant, were somewhat inconsistent with CDC Bow having amongst the highest TKW at 8/15 sites, Synergy having amongst the highest TKW at 11/15 sites, and CDC Connect having amongst the highest TKW at 14/15 sites. In the rare cases where fungicide effects occurred, they showed slightly higher thousand kernel weights when fungicide was applied post-heading, either alone or in combination with a flag-leaf application. 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 48-55)

Percent plump kernels were affected by variety and fungicide at 10/15 and 2/15 sites, respectively. The VAR × FUNG interaction was never significant for this variable. CDC Bow had amongst the highest proportion of plump kernels at 14/15 sites while AAC Synergy and AAC Connect had amongst the highest values at 12/15 sites and 7/15 sites, respectively. At IH-22, one of the two sites where fungicide affected kernel plumpness, we saw the highest values when the heads were sprayed. The other responsive site, YK-22, had far fewer plump kernels than any other sites and, while the overall F-test was significant, 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.

Thin Kernels (Tables 56-63)

Percent thin kernels were affected by variety at 10/15 sites and fungicide at 4/15 sites, with significant VAR × FUNG interactions detected at 3/15 sites. Of the responsive sites, CDC Bow had amongst the highest proportion of thin kernels at 3/10 sites while AAC Synergy had amongst the highest proportion at 3/10 sites and AAC Connect had amongst the highest values at 9/10 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, 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.

Deoxynivalenol – DON (Tables 64-71)

Deoxynivalenol (DON) accumulation was measured for all plots at all sites, but these results are not yet available for any 2023 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 seven sites where data is available and DON was detectable, variety effects were significant in one case (ME-22) while fungicide effects were significant in two cases (IH-22 and YK-22). At ME-22, where the variety effect was significant, the results were subtle but as expected with the highest levels observed with CDC Bow (MS; 0.56 ppm) and the lowest with AAC Connect (MR; 0.48 ppm) and intermediate values with AAC Synergy (I; 0.53 ppm). 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 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. 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, DON levels were relatively high, averaging 0.41 ppm; however, neither variety nor fungicide treatment had any impact on the values, and no meaningful trends were observed.

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 limited. 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, Brianne McInnes showed and discussed the project during the NARF AAFC joint field day on July 26 and attended by 70 participants. At the 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. We will continue to promote this project in 2024 where opportunities arise, and this technical report will be made available online through the IHARF website (www.iharf.ca).

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 NORZYNE 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	–	–	–
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	–	–	–
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	–	–	–

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-14-20)	None	894 g glyphosate/ha + 50 g saflufenacil/ha (May-24-20)
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-11-21)	None	894 g glyphosate/ha + 50 g saflufenacil/ha (May-14-21)	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-7-2021) + 62 g pinoxaden/ha (Jun-13)	62 g pinoxaden/ha (Jun-22-2022) + 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-24-22)	None	1422 g triallate/ha (May-12-22) + 894 g glyphosate/ha (May-21-22)	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-6-2022) + 62 g pinoxaden/ha (Jun-8)	129 g fluroxypyr/ha + 90 g clopyralid/ha + 503 g MCPA ester (Jun-28-2022) + 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-19-23)	n/a	894 g glyphosate/ha (May-16-23)	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	109-36-0-02
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. Mean monthly temperatures along with the long-term (1981-2010) averages for the 2020-23 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)
	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)
	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)
	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 7. Mean monthly precipitation along with the long-term (1981-2010) averages for the 2020-23 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%)
	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%)
	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%)
	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 8. 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	—
----- Flag Leaf Stage Leaf Disease – T1 (p-values) -----				
Variety (VAR)	—	0.630	0.402	—
----- Early Heading Stage Leaf Disease – T2 (p-values) -----				
Variety (VAR)	—	0.027	0.702	—
----- Early Dough Stage Leaf Disease – T3 (p-values) -----				
Variety (VAR)	0.027	<0.001	0.045	—
Fungicide (FUNG)	0.087	<0.001	<0.001	—
VAR x FUNG	0.918	<0.001	0.038	—
----- Yield (p-values) -----				
Variety (VAR)	<0.001	<0.001	<0.001	—
Fungicide (FUNG)	0.864	0.029	0.489	—
VAR x FUNG	0.616	0.088	0.901	—
----- Test Weight (p-values) -----				
Variety (VAR)	0.460	<0.001	<0.001	—
Fungicide (FUNG)	0.682	0.206	0.422	—
VAR x FUNG	0.560	0.053	0.916	—
----- Thousand Kernel Weight (p-values) -----				
Variety (VAR)	0.053	0.617	<0.001	—
Fungicide (FUNG)	0.918	0.173	0.041	—
VAR x FUNG	0.379	0.769	0.148	—
----- Plump Kernels (p-values) -----				
Variety (VAR)	<0.001	<0.001	<0.001	—
Fungicide (FUNG)	0.594	0.283	0.165	—
VAR x FUNG	0.329	0.533	0.813	—
----- Thin Kernels (p-values) -----				
Variety (VAR)	0.006	<0.001	<0.001	—
Fungicide (FUNG)	0.535	0.035	0.176	—
VAR x FUNG	0.240	0.017	0.148	—
----- Deoxynivalenol (p-values) ^z -----				
Variety (VAR)	—	0.878	—	—
Fungicide (FUNG)	—	0.533	—	—
VAR x FUNG	—	0.683	—	—

^z DON was undetectable in all samples at all sites in 2021 and is not yet available for 2023

Table 9. Overall tests of fixed effects for variety (VAR), fungicide (FUNG), and VAR x FUNG for selected barley response variables 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	—
----- Flag Leaf Stage Leaf Disease – T1 (p-values) -----					
Variety (VAR)	0.670	0.388	0.670	0.919	—
----- Early Heading Stage Leaf Disease – T2 (p-values) -----					
Variety (VAR)	—	—	0.739	0.026	—
----- Early Dough Stage Leaf Disease – T3 (p-values) -----					
Variety (VAR)	<0.001	0.962	0.003	0.973	—
Fungicide (FUNG)	0.893	<0.001	<0.001	0.971	—
VAR x FUNG	0.397	0.824	0.159	0.739	—
----- Yield (p-values) -----					
Variety (VAR)	<0.001	<0.001	0.058	<0.001	—
Fungicide (FUNG)	0.144	0.373	<0.001	0.444	—
VAR x FUNG	0.746	0.512	0.147	0.567	—
----- Test Weight (p-values) -----					
Variety (VAR)	<0.001	<0.001	<0.001	<0.001	—
Fungicide (FUNG)	0.258	0.003	<0.001	0.081	—
VAR x FUNG	0.657	0.212	0.416	0.570	—
----- Thousand Kernel Weight (p-values) -----					
Variety (VAR)	<0.001	0.775	<0.001	<0.001	—
Fungicide (FUNG)	0.099	0.131	<0.001	0.709	—
VAR x FUNG	0.258	0.889	0.547	0.830	—
----- Plump Kernels (p-values) -----					
Variety (VAR)	0.113	0.357	<0.001	<0.001	—
Fungicide (FUNG)	0.626	0.178	<0.001	0.662	—
VAR x FUNG	0.487	0.851	0.099	0.306	—
----- Thin Kernels (p-values) -----					
Variety (VAR)	0.034	0.001	<0.001	0.007	—
Fungicide (FUNG)	0.339	0.972	0.010	0.996	—
VAR x FUNG	0.831	0.805	0.008	0.018	—
----- Deoxynivalenol (p-values) ^x -----					
Variety (VAR)	0.559	—	0.394	—	—
Fungicide (FUNG)	0.642	—	<0.001	—	—
VAR x FUNG	0.082	—	0.427	—	—

^x DON was undetectable in all samples at all sites in 2021 and is not yet available for 2023

Table 10. Overall tests of fixed effects for variety (VAR), fungicide (FUNG), and VAR x FUNG for selected barley response variables 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	–
----- Flag Leaf Stage Leaf Disease – T1 (p-values) -----					
Variety (VAR)	0.069	0.880	0.516	0.947	–
----- Early Heading Stage Leaf Disease – T2 (p-values) -----					
Variety (VAR)	–	–	–	0.064	–
----- Early Dough Stage Leaf Disease – T3 (p-values) -----					
Variety (VAR)	0.017	0.362	0.022	0.370	–
Fungicide (FUNG)	0.298	0.152	<0.001	0.005	–
VAR x FUNG	0.983	0.021	0.161	0.754	–
----- Yield (p-values) -----					
Variety (VAR)	0.214	0.001	0.624	<0.001	–
Fungicide (FUNG)	0.759	0.715	0.156	0.317	–
VAR x FUNG	0.964	0.020	0.206	0.095	–
----- Test Weight (p-values) -----					
Variety (VAR)	0.002	0.001	0.001	<0.001	–
Fungicide (FUNG)	0.957	0.307	0.158	0.942	–
VAR x FUNG	0.974	0.894	0.712	0.928	–
----- Thousand Kernel Weight (p-values) -----					
Variety (VAR)	0.005	0.115	<0.001	0.001	–
Fungicide (FUNG)	0.436	0.585	0.312	0.516	–
VAR x FUNG	0.841	0.757	0.655	0.673	–
----- Plump Kernels (p-values) -----					
Variety (VAR)	0.976	0.210	0.006	<0.001	–
Fungicide (FUNG)	0.413	0.214	0.300	0.512	–
VAR x FUNG	0.805	0.762	0.115	0.164	–
----- Thin Kernels (p-values) -----					
Variety (VAR)	0.355	0.754	0.085	0.218	–
Fungicide (FUNG)	0.689	0.265	0.362	0.943	–
VAR x FUNG	0.409	0.592	0.358	0.201	–
----- Deoxynivalenol (p-values) ^x -----					
Variety (VAR)	0.819	–	0.047	–	–
Fungicide (FUNG)	0.343	–	0.275	–	–
VAR x FUNG	0.802	–	0.009	–	–

^x DON was undetectable in all samples at all sites in 2021 and is not yet available for 2023

Table 11. 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) ^x -----				
Variety (VAR)	0.650	–	0.274	–
Fungicide (FUNG)	0.483	–	<0.001	–
VAR x FUNG	0.046	–	0.826	–

^x DON was undetectable in all samples at all sites in 2021 and is not yet available for 2023

Table 12. 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	—
Synergy (I)	159 A	187 A	227 A	—
Connect (MR)	149 A	184 A	215 A	—
S.E.M.	6.2	5.4	9.4	—

Table 13. Variety main effect means for barley plant density at Indian Head, SK (2021-24). 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	—
Synergy (I)	195 B	161 A	215 A	247 A	—
Connect (MR)	218 A	184 A	204 A	260 A	—
S.E.M.	6.7	7.5	7.2	7.2	—

Table 14. Variety main effect means for barley plant density at Melfort, SK (2021-24). 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	—
Synergy (I)	214 A	221 AB	212 A	253 A	—
Connect (MR)	217 A	234 A	203 A	252 A	—
S.E.M.	10.1	7.8 ^z	11.6	8.8	—

Table 15. Variety main effect means for barley plant density at Yorkton, SK (2021-24). 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 16. 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	—
Synergy (I)	0.0	0.3 A	2.7 A	—
Connect (MR)	0.0	0.3 A	2.3 A	—
S.E.M.	—	0.02	0.26	—
Variety (VAR)	----- Early Heading Stage – T2 (% leaf area affected by disease) -----			
Bow (MS)	—	1.0 A	2.2 A	—
Synergy (I)	—	0.6 B	2.2 A	—
Connect (MR)	—	0.7 B	2.0 A	—
S.E.M.	—	0.07	0.28	—
Variety (VAR)	----- Early Dough Stage – T3 (% leaf area affected by disease) -----			
Bow (MS)	0.2 A	1.6 A	1.9 A	—
Synergy (I)	0.0 B	0.7 B	1.6 A	—
Connect (MR)	0.1 AB	0.9 B	1.7 A	—
S.E.M.	0.04	0.12	0.11	—
<u>Fungicide</u>				
Untreated	0.2 A	1.8 A	2.3 A	—
Flag	0.1 A	0.8 B	1.5 B	—
Head	0.1 A	0.8 B	1.6 B	—
Dual	0.1 A	0.8 B	1.5 B	—
S.E.M.	0.04	0.14	0.12	—

Table 17. 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
Variety - Fung	----- Early Dough Stage – T3 (% leaf area affected by disease) -----			
MS – untr	0.3 a	3.3 a	2.8 a	—
MS – flag	0.1 a	1.0 b	1.6 bc	—
MS – head	0.1 a	1.1 b	1.7 bc	—
MS – dual	0.2 a	1.1 b	1.5 c	—
I – untr	0.1 a	0.7 b	1.9 bc	—
I – flag	0.0 a	0.7 b	1.6 bc	—
I – head	0.0 a	0.7 b	1.5 bc	—
I – dual	0.0 a	0.6 b	1.6 bc	—
MR – untr	0.2 a	1.3 b	2.2 ab	—
MR – flag	0.1 a	0.7 b	1.5 c	—
MR – head	0.1 a	0.7 b	1.6 bc	—
MR – dual	0.1 a	0.8 b	1.4 c	—
S.E.M.	0.08	0.23	0.17	—

Table 18. 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	—
Synergy (I)	0.2 A	0.1 A	0.1 A	0.1 A	—
Connect (MR)	0.1 A	0.2 A	0.0 A	0.1 A	—
S.E.M.	0.08	0.05	0.03	0.05	—
Variety (VAR)	----- Early Heading Stage – T2 (% leaf area affected by disease) -----				
Bow (MS)	—	—	0.2 A	0.1 B	—
Synergy (I)	—	—	0.2 A	0.2 AB	—
Connect (MR)	—	—	0.2 A	0.5 A	—
S.E.M.	—	—	0.07	0.026	—
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	—
Synergy (I)	3.1 A	0.3 A	0.3 B	0.1 A	—
Connect (MR)	4.0 A	0.3 A	0.4 B	0.2 A	—
S.E.M.	0.30	0.05	0.10	0.06	—
<u>Fungicide</u>					
Untreated	2.9 A	0.5 A	0.8 A	0.2 A	—
Flag	3.0 A	0.2 B	0.4 B	0.1 A	—
Head	3.0 A	0.2 B	0.2 B	0.1 A	—
Dual	3.2 A	0.2 B	0.3 B	0.2 A	—
S.E.M.	0.35	0.06	0.11	0.07	—

Table 19. Individual variety by fungicide treatment means for percent leaf area affected by disease (total) at Indian Head, SK (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	IH-20	IH-21	IH-22	IH-23	IH-24
Variety - Fung	----- Early Dough Stage – T3 (% leaf area affected by disease) -----				
MS – untr	1.6 b	0.6 a	1.4 a	0.1 a	—
MS – flag	1.6 b	0.2 ab	0.7 ab	0.2 a	—
MS – head	1.7 b	0.2 ab	0.3 b	0.2 a	—
MS – dual	2.8 ab	0.1 b	0.4 b	0.1 a	—
I – untr	3.2 ab	0.4 ab	0.5 b	0.1 a	—
I – flag	3.8 ab	0.3 ab	0.3 b	0.1 a	—
I – head	2.7 ab	0.2 ab	0.1 b	0.1 a	—
I – dual	2.9 ab	0.2 ab	0.2 b	0.3 a	—
MR – untr	4.1 ab	0.5 ab	0.6 ab	0.2 a	—
MR – flag	3.5 ab	0.2 ab	0.3 b	0.1 a	—
MR – head	4.6 a	0.2 ab	0.3 b	0.1 a	—
MR – dual	4.1 ab	0.2 ab	0.4 b	0.2 a	—
S.E.M.	0.59	0.10	0.17	0.10	—

Table 20. 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	—
Synergy (I)	2.2 A	0.2 A	0.4 A	0.4 A	—
Connect (MR)	1.3 A	0.2 A	0.4 A	0.4 A	—
S.E.M.	0.68	0.04	0.10	0.07	—
Variety (VAR)	----- Early Heading Stage – T2 (% leaf area affected by disease) -----				
Bow (MS)	—	—	—	0.4 A	—
Synergy (I)	—	—	—	0.4 A	—
Connect (MR)	—	—	—	0.3 A	—
S.E.M.	—	—	—	0.029	—
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	—
Synergy (I)	3.8 AB	0.5 A	1.2 B	2.4 A	—
Connect (MR)	3.2 B	0.6 A	2.0 A	2.9 A	—
S.E.M.	0.65	0.09	0.25	0.32	—
<u>Fungicide</u>					
Untreated	4.8 A	0.6 A	3.1 A	3.5 A	—
Flag	4.3 A	0.4 A	1.1 B	2.3 B	—
Head	3.6 A	0.5 A	1.4 B	2.6 AB	—
Dual	3.5 A	0.4 A	1.0 B	2.2 B	—
S.E.M.	0.70	0.100	0.28	0.34	—

Table 21. Individual variety by fungicide treatment means for percent leaf area affected by disease (total) at Melfort, SK (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	ME-20	ME-21	ME-22	ME-23	ME-24
Variety - Fung	----- Early Dough Stage – T3 (% leaf area affected by disease) -----				
MS – untr	5.8 a	0.5 ab	2.9 ab	3.7 a	—
MS – flag	5.5 a	0.5 ab	1.3 bc	2.4 a	—
MS – head	4.4 a	0.3 ab	1.6 bc	2.3 a	—
MS – dual	5.0 a	0.5 ab	1.2 bc	2.3 a	—
I – untr	4.9 a	0.5 ab	2.1 bc	2.9 a	—
I – flag	4.0 a	0.4 ab	0.9 bc	2.1 a	—
I – head	3.6 a	0.5 ab	1.1 bc	2.4 a	—
I – dual	2.7 a	0.5 ab	0.6 c	2.2 a	—
MR – untr	3.7 a	1.0 a	4.4 a	3.9 a	—
MR – flag	3.5 a	0.3 b	1.1 bc	2.4 a	—
MR – head	2.9 a	0.9 ab	1.4 bc	3.2 a	—
MR – dual	2.8 a	0.3 b	1.2 bc	2.0 a	—
S.E.M.	1.03	0.15	0.44	0.50	—

Table 22. 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 23. Individual variety by fungicide treatment means for percent leaf area affected by disease (total) at Yorkton, SK (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	YK-20	YK-21	YK-22	YK-23
Variety - Fung	----- 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 24. 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	—
Synergy (I)	5653 A	6601 A	7516 A	—
Connect (MR)	5288 A	6345 B	7258 A	—
S.E.M.	141.7	80.7 ^z	98.8	—
<u>Fungicide</u>				
Untreated	4986 A	6139 B	7112 A	—
Flag	4895 A	6226 AB	7143 A	—
Head	4920 A	6307 AB	7261 A	—
Dual	5054 A	6406 A	7325 A	—
S.E.M.	158.8	86.3 ^z	113.0	—

Table 25. 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
Variety - Fung	----- Grain Yield (kg/ha) -----			
MS – untr	3960 cd	5848 de	6845 a	—
MS – flag	3749 d	5907 cde	6853 a	—
MS – head	4235 bcd	5690 e	6846 a	—
MS – dual	3855 cd	6008 cde	6884 a	—
I – untr	5767 a	6330 a-d	7468 a	—
I – flag	5575 a	6470 ab	7336 a	—
I – head	5490 a	6769 a	7647 a	—
I – dual	5780 a	6834 a	7615 a	—
MR – untr	5231 a	6240 bcd	7024 a	—
MR – flag	5362 a	6300 a-d	7242 a	—
MR – head	5035 abc	6463 abc	7290 a	—
MR – dual	5525 a	6377 abc	7477 a	—
S.E.M.	257.5	122.5 ^z	191.9	—

Table 26. 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	—
Synergy (I)	5609 A	3965 A	6917 A	6141 A	—
Connect (MR)	5429 A	3954 A	6751 A	6071 A	—
S.E.M.	123.9	120.6	84.1	55.7	—
Fungicide					
Untreated	5378 A	3635 A	6584 B	5895 A	—
Flag	5444 A	3720 A	6925 A	5867 A	—
Head	5258 A	3735 A	6997 A	5844 A	—
Dual	5286 A	3677 A	7009 A	5919 A	—
S.E.M.	127.7	122.6	92.0	58.2	—

Table 27. 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
Variety - Fung	----- Grain Yield (kg/ha) -----				
MS – untr	4989 bcd	3015 b	6459 c	5454 b	—
MS – flag	5188 a-d	3194 b	6964 abc	5450 b	—
MS – head	4830 d	3251 b	7108 ab	5432 b	—
MS – dual	4938 cd	3165 b	7342 a	5392 b	—
I – untr	5682 a	3984 a	6741 abc	6166 a	—
I – flag	5662 a	3979 a	6936 abc	6132 a	—
I – head	5611 a	4025 a	7036 abc	6049 a	—
I – dual	5481 ab	3871 a	6954 abc	6216 a	—
MR – untr	5464 abc	3906 a	6552 bc	6065 a	—
MR – flag	5483 ab	3987 a	6875 abc	6018 a	—
MR – head	5333 a-d	3930 a	6847 abc	6052 a	—
MR – dual	5439 abc	3994 a	6729 abc	6148 a	—
S.E.M.	154.7	137.2	139.6	75.5	—

Table 28. Variety and fungicide treatment main effect means for barley yield 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)	----- Grain Yield (kg/ha) -----				
Bow (MS)	3394 A	2000 B	4166 A	5292 B	—
Synergy (I)	3691 A	2728 A	4402 A	5669 A	—
Connect (MR)	3630 A	2484 A	4368 A	5518 A	—
S.E.M.	138.0 ^z	226.8 ^z	239.8	123.1	—
<u>Fungicide</u>					
Untreated	3487 A	2553 A	4094 A	5391 A	—
Flag	3691 A	2340 A	4728 A	5511 A	—
Head	3604 A	2382 A	4131 A	5574 A	—
Dual	3505 A	2340 A	4294 A	5496 A	—
S.E.M.	155.0 ^z	239.1 ^z	262.4	127.8	—

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

Table 29. 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	—
MS – flag	3569 a	2112 ab	4241 a	5308 ab	—
MS – head	3438 a	1463 b	4115 a	5502 ab	—
MS – dual	3365 a	2172 ab	4187 a	5133 b	—
I – untr	3772 a	3183 a	4175 a	5694 ab	—
I – flag	3625 a	2484 ab	5399 a	5740 a	—
I – head	3749 a	3123 a	3595 a	5521 ab	—
I – dual	3618 a	2121 ab	4436 a	5722 ab	—
MR – untr	3484 a	2225 ab	3988 a	5253 ab	—
MR – flag	3879 a	2425 ab	4543 a	5486 ab	—
MR – head	3624 a	2559 ab	4682 a	5699 ab	—
MR – dual	3532 a	2727 ab	4260 a	5633 ab	—
S.E.M.	250.4 ^z	320.9 ^z	399.6	160.4	—

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

Table 30. Variety and fungicide treatment main effect means for barley grain yield 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)	----- Grain Yield (kg/ha) -----			
Bow (MS)	2610 B	1948 A	5914 A	2549 A
Synergy (I)	3074 A	1733 AB	6123 A	3215 A
Connect (MR)	2624 B	1207 B	5795 A	2676 A
S.E.M.	124.7	252.3	150.9	445.9
<u>Fungicide</u>				
Untreated	2744 A	1636 A	5772 A	3102 A
Flag	2998 A	1575 A	6004 A	2913 A
Head	2647 A	1741 A	6036 A	2765 A
Dual	2688 A	1564 A	5965 A	2473 A
S.E.M.	140.9	277.1	163.2	459.9

Table 31. 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>	----- Grain Yield (kg/ha) -----			
MS – untr	2800 ab	1763 a	5224 a	3234 a
MS – flag	2692 ab	1668 a	6222 a	2486 a
MS – head	2459 b	2066 a	6128 a	2568 a
MS – dual	2489 b	2294 a	6083 a	1910 a
I – untr	2900 ab	1644 a	5898 a	3009 a
I – flag	3629 a	1987 a	6212 a	3372 a
I – head	2849 ab	1665 a	6111 a	3582 a
I – dual	2920 ab	1635 a	6273 a	2897 a
MR – untr	2533 ab	1501 a	6193 a	3063 a
MR – flag	2674 ab	1070 a	5578 a	2881 a
MR – head	2633 ab	1493 a	5869 a	2147 a
MR – dual	2656 ab	763 a	5540 a	2613 a
S.E.M.	233.2	426.5	240.1	559.9

Table 32. 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	—
Synergy (I)	303.8 A	320.1 A	309.6 B	—
Connect (MR)	302.7 A	315.6 B	308.4 B	—
S.E.M.	1.00	0.84	0.80	—
<u>Fungicide</u>				
Untreated	302.0 A	317.7 A	309.4 A	—
Flag	302.2 A	319.9 A	310.9 A	—
Head	303.7 A	317.5 A	311.1 A	—
Dual	303.3 A	319.6 A	310.0 A	—
S.E.M.	1.16	0.97	0.89	—

Table 33. 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
Variety - Fung	----- Test Weight (g 0.5/l) -----			
MS – untr	301.6 a	319.3 ab	312.9 ab	—
MS – flag	298.9 a	323.1 a	313.7 ab	—
MS – head	304.7 a	318.4 ab	314.3 a	—
MS – dual	303.0 a	320.7 a	311.5 ab	—
I – untr	303.8 a	318.4 ab	308.1 ab	—
I – flag	303.8 a	318.4 ab	310.4 ab	—
I – head	302.9 a	322.8 a	310.1 ab	—
I – dual	304.7 a	320.8 a	309.9 ab	—
MR – untr	300.7 a	315.6 ab	307.3 b	—
MR – flag	304.0 a	318.0 ab	308.6 ab	—
MR – head	303.6 a	311.4 b	309.0 ab	—
MR – dual	302.3 a	317.3 ab	308.7 ab	—
S.E.M.	2.00	1.68	1.44	—

Table 34. 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	—
Synergy (I)	328.5 A	296.6 A	319.9 A	306.4 B	—
Connect (MR)	326.4 A	289.1 B	315.6 B	308.5 A	—
S.E.M.	0.50	0.61	0.93	0.65	—
<u>Fungicide</u>					
Untreated	325.8 A	290.0 B	316.2 B	306.4 A	—
Flag	326.7 A	291.5 AB	316.7 B	305.6 A	—
Head	326.7 A	290.8 B	319.9 A	305.0 A	—
Dual	327.5 A	292.5 A	319.2 A	306.9 A	—
S.E.M.	0.58	0.65	0.97	0.70	—

Table 35. 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
Variety - Fung	----- Test Weight (g 0.5/l) -----				
MS – untr	323.5 b	287.7 c	315.8 bcd	303.7 cde	—
MS – flag	325.7 ab	287.8 c	316.1 bcd	302.6 de	—
MS – head	324.4 b	287.8 c	321.3 a	301.3 e	—
MS – dual	324.9 ab	288.3 c	320.7 ab	304.4 b-e	—
I – untr	328.3 ab	294.4 b	318.7 a-d	307.5 abc	—
I – flag	328.4 ab	297.3 ab	319.3 abc	306.5 a-d	—
I – head	328.1 ab	295.6 ab	321.2 a	304.9 a-e	—
I – dual	329.4 a	299.1 a	320.3 ab	306.7 a-d	—
MR – untr	325.5 ab	287.8 c	314.0 d	308.1 abc	—
MR – flag	326.0 ab	289.6 c	314.7 cd	307.6 abc	—
MR – head	327.8 ab	289.0 c	317.2 a-d	308.7 ab	—
MR – dual	328.1 ab	290.1 c	316.5 a-d	309.5 a	—
S.E.M.	1.01	0.91	1.26	1.05	—

Table 36. 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	—
Synergy (I)	336.2 A	315.7 A	320.0 A	336.4 B	—
Connect (MR)	333.4 B	313.1 AB	318.7 A	339.0 A	—
S.E.M.	0.62 ^z	0.88 ^z	1.06	0.40	—
<u>Fungicide</u>					
Untreated	334.3 A	312.2 A	317.5 A	337.7 A	—
Flag	334.8 A	314.6 A	319.7 A	337.6 A	—
Head	334.7 A	312.4 A	318.1 A	338.0 A	—
Dual	334.6 A	313.5 A	318.4	337.7 A	—
S.E.M.	0.68 ^z	1.01 ^z	1.11	0.46	—

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

Table 37. 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	—
MS – flag	334.6 a	311.7 a	317.4 ab	336.9 a	—
MS – head	334.2 a	310.1 a	316.1 ab	338.2 a	—
MS – dual	333.8 a	310.5 a	317.1 ab	337.8 a	—
I – untr	335.6 a	314.5 a	319.6 ab	336.2 a	—
I – flag	336.7 a	317.7 a	321.7 a	336.5 a	—
I – head	336.4 a	315.6 a	318.5 ab	336.4 a	—
I – dual	336.0 a	315.1 a	320.3 ab	336.6 a	—
MR – untr	333.0 a	311.3 a	317.2 ab	338.8 a	—
MR – flag	333.0 a	314.4 a	320.0 ab	339.3 a	—
MR – head	333.5 a	311.6 a	319.7 ab	339.3 a	—
MR – dual	333.9 a	314.4 a	317.8 ab	338.7 a	—
S.E.M.	1.03 ^z	1.75 ^z	1.47	0.80	—

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

Table 38. 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

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

Table 39. 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
Variety - Fung	----- 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

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

Table 40. 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	—
Synergy (I)	45.6 A	46.6 A	47.6 B	—
Connect (MR)	46.7 A	46.8 A	49.6 A	—
S.E.M.	0.39	0.40	0.48	—
<u>Fungicide</u>				
Untreated	46.3 A	46.1 A	48.1 A	—
Flag	46.3 A	47.6 A	48.7 A	—
Head	46.4 A	46.8 A	49.5 A	—
Dual	46.7 A	46.7 A	49.8 A	—
S.E.M.	0.45	0.46	0.53	—

Table 41. 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
Variety - Fung	----- Seed Weight (g 1000/seeds) -----			
MS – untr	47.0 a	46.8 a	47.9 abc	—
MS – flag	46.0 a	47.7 a	50.4 ab	—
MS – head	47.6 a	46.4 a	51.2 a	—
MS – dual	47.4 a	47.5 a	49.7 bc	—
I – untr	45.6 a	46.0 a	47.1 bc	—
I – flag	45.5 a	47.1 a	46.4 c	—
I – head	44.7 a	47.1 a	47.8 abc	—
I – dual	46.7 a	46.0 a	49.3 abc	—
MR – untr	46.4 a	45.6 a	49.3 abc	—
MR – flag	47.5 a	48.0 a	49.4 abc	—
MR – head	46.8 a	47.0 a	49.7 abc	—
MR – dual	46.1 a	46.6 a	50.3 ab	—
S.E.M.	0.79	0.80	49.28	—

Table 42. 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	—
Synergy (I)	49.1 A	45.0 A	47.3 A	47.7 B	—
Connect (MR)	49.3 A	45.1 A	47.6 A	48.7 A	—
S.E.M.	0.16	0.17	0.25	0.16	—
<u>Fungicide</u>					
Untreated	48.4 A	44.8 A	46.3 B	48.1 A	—
Flag	49.1 A	45.1 A	46.6 B	47.9 A	—
Head	48.7 A	44.9 A	47.6 A	47.9 A	—
Dual	48.8 A	45.4 A	47.0 AB	47.9 A	—
S.E.M.	0.18	0.19	0.27	0.18	—

Table 43. 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
Variety - Fung	----- Seed Weight (g/1000 seeds) -----				
MS – untr	47.3 c	44.8 a	44.8 d	47.4 de	—
MS – flag	48.1 bc	44.9 a	45.2 cd	47.5 de	—
MS – head	48.1 bc	45.1 a	46.6 a-d	47.6 b-e	—
MS – dual	47.9 bc	45.4 a	46.3 bcd	47.3 e	—
I – untr	48.9 ab	44.6 a	46.8 abc	48.1 a-e	—
I – flag	49.7 a	45.0 a	47.3 ab	47.5 cde	—
I – head	48.5 abc	44.7 a	47.8 ab	47.6 b-e	—
I – dual	49.2 ab	45.6 a	47.5 ab	47.7 a-e	—
MR – untr	48.9 ab	44.9 a	47.2 ab	48.8 a	—
MR – flag	49.4 ab	45.4 a	47.4 ab	48.7 ab	—
MR – head	49.6 ab	45.0 a	48.4 a	48.7 abc	—
MR – dual	49.2 ab	45.3 a	47.4 ab	48.6 a-d	—
S.E.M.	0.31	0.33	0.40	0.27	—

Table 44. 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	—
Synergy (I)	46.3 A	45.2 A	47.0 B	48.9 A	—
Connect (MR)	46.1 A	46.2 A	49.3 A	48.9 A	—
S.E.M.	0.41 ^z	0.35 ^z	0.38	0.19	—
<u>Fungicide</u>					
Untreated	45.9 A	45.3 A	47.3 A	48.5 A	—
Flag	45.7 A	45.9 A	48.1 A	48.9 A	—
Head	46.0 A	45.6 A	47.8 A	48.6 A	—
Dual	45.9 A	45.9 A	47.8 A	48.4 A	—
S.E.M.	0.45 ^z	0.40 ^z	0.39	0.22	—

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

Table 45. 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
<u>Variety - Fung</u>	----- Seed Weight (g/1000 seeds) -----				
MS – untr	44.7 a	45.2 a	46.4 c	47.8 a	—
MS – flag	44.5 a	45.0 a	47.1 bc	47.9 a	—
MS – head	44.9 a	45.4 a	47.1 bc	48.3 a	—
MS – dual	45.3 a	46.3 a	47.2 abc	47.8 a	—
I – untr	45.4 a	44.8 a	46.6 c	49.1 a	—
I – flag	46.6 a	45.8 a	47.8 abc	49.3 a	—
I – head	46.6 a	45.3 a	46.4 c	48.6 a	—
I – dual	46.5 a	45.0 a	47.2 abc	48.7 a	—
MR – untr	45.8 a	45.8 a	48.9 abc	48.5 a	—
MR – flag	46.7 a	46.8 a	49.5 ab	49.4 a	—
MR – head	45.7 a	45.7 a	49.8 a	48.8 a	—
MR – dual	46.3 a	46.3 a	49.0 abc	48.9 a	—
S.E.M.	0.66 ^z	0.66 ^z	0.59	0.39	—

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

Table 46. 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 47. 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
Variety - Fung	----- 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 48. 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	—
Synergy (I)	95.1 B	96.5 A	97.0 A	—
Connect (MR)	93.3 C	94.3 B	96.1 B	—
S.E.M.	0.45	0.36	0.18	—
<u>Fungicide</u>				
Untreated	95.2 A	95.1 A	96.7 A	—
Flag	95.5 A	96.0 A	97.2 A	—
Head	94.5 A	95.6 A	96.8 A	—
Dual	95.3 A	95.8 A	96.8 A	—
S.E.M.	0.52	0.40	0.20	—

Table 49. 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
Variety - Fung	----- Plump Kernels (g/100 g) -----			
MS – untr	96.8 ab	95.5 ab	97.3 a-d	—
MS – flag	96.7 ab	96.8 a	98.0 a	—
MS – head	97.4 a	95.3 ab	97.6 ab	—
MS – dual	96.9 ab	96.2 a	97.4 abc	—
I – untr	95.8 ab	96.5 a	96.7 a-d	—
I – flag	95.4 ab	96.5 a	97.2 a-d	—
I – head	93.1 ab	96.7 a	97.0 a-d	—
I – dual	96.1 ab	96.4 a	97.3 a-d	—
MR – untr	92.9 b	93.3 b	96.1 bcd	—
MR – flag	94.4 ab	94.7 ab	96.6 a-d	—
MR – head	93.0 ab	94.7 ab	95.9 cd	—
MR – dual	92.8 b	94.7 ab	95.8 d	—
S.E.M.	0.91	0.60	0.33	—

Table 50. 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	—
Synergy (I)	97.5 A	98.6 A	93.5 B	98.1 A	—
Connect (MR)	96.7 A	98.4 A	92.4 C	97.5 B	—
S.E.M.	0.27	0.14	0.23	0.09	—
<u>Fungicide</u>					
Untreated	96.8 A	98.3 A	92.9 B	98.0 A	—
Flag	97.1 A	98.5 A	93.5 AB	97.9 A	—
Head	97.2 A	98.6 A	94.3 A	98.0 A	—
Dual	97.3 A	98.6 A	94.1 A	97.9 A	—
S.E.M.	0.31	0.15	0.26	0.10	—

Table 51. 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
Variety - Fung	----- Plump Kernels (g/100 g) -----				
MS – untr	96.6 a	98.2 a	90.9 e	98.3 ab	—
MS – flag	96.4 a	98.4 a	91.8 de	98.3 a	—
MS – head	97.0 a	98.7 a	93.6 a-d	98.3 a	—
MS – dual	98.0 a	98.6 a	93.4 abc	98.3 ab	—
I – untr	97.2 a	98.5 a	94.7 abc	98.2 abc	—
I – flag	97.9 a	98.6 a	95.6 a	97.9 a-e	—
I – head	97.8 a	98.6 a	95.4 ab	98.1 a-d	—
I – dual	97.2 a	98.6 a	95.4 cd	98.3 a	—
MR – untr	96.5 a	98.2 a	93.0 cd	97.6 b-e	—
MR – flag	96.9 a	98.5 a	93.2 cd	97.5 de	—
MR – head	96.8 a	98.4 a	94.0 abc	97.6 cde	—
MR – dual	96.8 a	98.5 a	93.7 a-d	97.2 e	—
S.E.M.	0.54	0.20	0.43	0.15	—

Table 52. 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	—
Synergy (I)	97.8 A	98.0 A	96.4 A	98.4 A	—
Connect (MR)	97.9 A	98.0 A	96.2 A	97.6 B	—
S.E.M.	0.30 ^z	0.22 ^z	0.22	0.10	—
<u>Fungicide</u>					
Untreated	97.4 A	98.1 A	95.9 A	98.1 A	—
Flag	98.2 A	98.3 A	96.4 A	98.1 A	—
Head	97.9 A	97.8 A	95.7 A	98.2 A	—
Dual	97.9 A	98.8 A	95.9 A	98.0 A	—
S.E.M.	0.33 ^z	0.24 ^z	0.30	0.11	—

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

Table 53. 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
<u>Variety - Fung</u>	----- Plump Kernels (g/100 g) -----				
MS – untr	97.6 a	98.6 a	95.1 a	98.4 ab	—
MS – flag	98.2 a	98.7 a	95.4 a	98.1 abc	—
MS – head	97.8 a	97.8 a	95.9 a	98.3 ab	—
MS – dual	97.7 a	98.7 a	95.2 a	98.3 ab	—
I – untr	96.9 a	97.9 a	96.7 a	98.6 a	—
I – flag	97.8 a	98.1 a	96.8 a	98.4 ab	—
I – head	98.2 a	97.9 a	95.4 a	98.7 a	—
I – dual	98.2 a	97.9 a	96.8 a	98.1 abc	—
MR – untr	97.6 a	97.9 a	96.0 a	97.3 c	—
MR – flag	98.4 a	98.3 a	97.1 a	97.8 abc	—
MR – head	97.7 a	97.6 a	95.9 a	97.7 bc	—
MR – dual	97.8 a	98.2 a	95.8 a	97.6 bc	—
S.E.M.	0.53 ^z	0.36 ^z	0.47	0.19	—

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

Table 54. 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 55. 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
Variety - Fung	----- 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 56. 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	—
Synergy (I)	0.3 B	0.4 C	0.3 B	—
Connect (MR)	0.5 A	0.8 A	0.5 A	—
S.E.M.	0.04	0.06	0.03	—
<u>Fungicide</u>				
Untreated	0.4 A	0.7 A	0.4 A	—
Flag	0.3 A	0.5 B	0.3 A	—
Head	0.3 A	0.6 AB	0.3 A	—
Dual	0.4 A	0.6 AB	0.3 A	—
S.E.M.	0.05	0.07	0.03	—

Table 57. 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
Variety - Fung	----- Thin Kernels (g/100 g) -----			
MS – untr	0.4 a	0.9 ab	0.4 abc	—
MS – flag	0.3 a	0.4 de	0.3 bc	—
MS – head	0.2 a	0.7 a-e	0.3 abc	—
MS – dual	0.4 a	0.5 b-e	0.2 c	—
I – untr	0.2 a	0.4 de	0.3 abc	—
I – flag	0.3 a	0.5 cde	0.3 bc	—
I – head	0.4 a	0.3 e	0.3 abc	—
I – dual	0.3 a	0.5 b-e	0.3 abc	—
MR – untr	0.6 a	0.8 abc	0.5 ab	—
MR – flag	0.4 a	0.7 a-d	0.5 ab	—
MR – head	0.3 a	0.9 a	0.4 abc	—
MR – dual	0.6 a	0.7 a-d	0.5 a	—
S.E.M.	0.09	0.10	0.05	—

Table 58. 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	—
Synergy (I)	0.2 B	0.1 B	0.4 B	0.2 AB	—
Connect (MR)	0.3 A	0.1 B	0.6 A	0.2 A	—
S.E.M.	0.03	0.01	0.05	0.01	—
<u>Fungicide</u>					
Untreated	0.3 A	0.1 A	0.7 A	0.2 A	—
Flag	0.3 A	0.1 A	0.6 AB	0.2 A	—
Head	0.2 A	0.1 A	0.5 AB	0.2 A	—
Dual	0.3 A	0.1 A	0.5 B	0.2 A	—
S.E.M.	0.030	0.02	0.05	0.01	—

Table 59. 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
Variety - Fung	----- Thin Kernels (g/100 g) -----				
MS – untr	0.3 a	0.1 a	1.0 a	0.1 a	—
MS – flag	0.3 a	0.1 a	0.7 ab	0.1 a	—
MS – head	0.2 a	0.1 a	0.4 b	0.1 a	—
MS – dual	0.2 a	0.1 a	0.5 b	0.2 a	—
I – untr	0.2 a	0.1 a	0.4 b	0.2 a	—
I – flag	0.2 a	0.1 a	0.4 b	0.2 a	—
I – head	0.2 a	0.1 a	0.4 b	0.2 a	—
I – dual	0.2 a	0.1 a	0.4 b	0.1 a	—
MR – untr	0.4 a	0.1 a	0.6 b	0.2 a	—
MR – flag	0.3 a	0.1 a	0.6 b	0.2 a	—
MR – head	0.3 a	0.1 a	0.6 b	0.2 a	—
MR – dual	0.3 a	0.1 a	0.6 b	0.2 a	—
S.E.M.	0.05	0.02	0.08	0.02	—

Table 60. 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	—
Synergy (I)	0.3 A	0.2 A	0.4 A	0.1 A	—
Connect (MR)	0.3 A	0.2 A	0.4 A	0.1 A	—
S.E.M.	0.06 ^z	0.03 ^z	0.04	0.02	—
<u>Fungicide</u>					
Untreated	0.3 A	0.2 A	0.5 A	0.1 A	—
Flag	0.3 A	0.2 A	0.4 A	0.1 A	—
Head	0.3 A	0.2 A	0.4 A	0.1 A	—
Dual	0.3 A	0.1 A	0.4 A	0.1 A	—
S.E.M.	0.07 ^z	0.03 ^z	0.05	0.02	—

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

Table 61. 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	—
MS – flag	0.2 a	0.2 a	0.5 a	0.1 a	—
MS – head	0.3 a	0.3 a	0.4 a	0.2 a	—
MS – dual	0.3 a	0.1 a	0.5 a	0.1 a	—
I – untr	0.5 a	0.2 a	0.3 a	0.1 a	—
I – flag	0.4 a	0.2 a	0.3 a	0.2 a	—
I – head	0.3 a	0.1 a	0.4 a	0.2 a	—
I – dual	0.2 a	0.2 a	0.3 a	0.2 a	—
MR – untr	0.3 a	0.2 a	0.5 a	0.2 a	—
MR – flag	0.2 a	0.1 a	0.3 a	0.1 a	—
MR – head	0.3 a	0.2 a	0.5 a	0.1 a	—
MR – dual	0.3 a	0.2 a	0.4 a	0.1 a	—
S.E.M.	0.09 ^z	0.05 ^z	0.08	0.03	—

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

Table 62. 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 63. 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
Variety - Fung	----- 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 64. 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	—	—
Synergy (I)	Nil	0.41 A	—	—
Connect (MR)	Nil	0.41 A	—	—
S.E.M.	—	0.023	—	—
<u>Fungicide</u>				
Untreated	Nil	0.40 A	—	—
Flag	Nil	0.42 A	—	—
Head	Nil	0.41 A	—	—
Dual	Nil	0.38 A	—	—
S.E.M.	—	0.025	—	—

Table 65. 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
Variety - Fung	----- Deoxynivalenol - DON (ppm) -----			
MS – untr	Nil	0.40 a	—	—
MS – flag	Nil	0.43 a	—	—
MS – head	Nil	0.38 a	—	—
MS – dual	Nil	0.39 a	—	—
I – untr	Nil	0.43 a	—	—
I – flag	Nil	0.39 a	—	—
I – head	Nil	0.43 a	—	—
I – dual	Nil	0.39 a	—	—
MR – untr	Nil	0.39 a	—	—
MR – flag	Nil	0.45 a	—	—
MR – head	Nil	0.44 a	—	—
MR – dual	Nil	0.36	—	—
S.E.M.	—	0.039	—	—

Table 66. 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	—	—
Synergy (I)	0.06 A	Nil	1.42 A	—	—
Connect (MR)	0.03 A	Nil	1.30 A	—	—
S.E.M.	0.026	—	0.113	—	—
<u>Fungicide</u>					
Untreated	0.06 A	Nil	1.64 A	—	—
Flag	0.06 A	Nil	1.62 A	—	—
Head	0.02 A	Nil	1.06 B	—	—
Dual	0.05 A	Nil	1.01 B	—	—
S.E.M.	0.028	—	0.122	—	—

Table 67. 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	—	—
MS – flag	0.04 a	Nil	1.46 ab	—	—
MS – head	0.03 a	Nil	1.03 ab	—	—
MS – dual	0.01 a	Nil	1.03 ab	—	—
I – untr	0.04 a	Nil	1.82 a	—	—
I – flag	0.03 a	Nil	1.64 ab	—	—
I – head	0.03 a	Nil	1.30 ab	—	—
I – dual	0.13 a	Nil	0.93 b	—	—
MR – untr	0.00 a	Nil	1.52 ab	—	—
MR – flag	0.11 a	Nil	1.76 a	—	—
MR – head	0.00 a	Nil	0.84 b	—	—
MR – dual	0.00 a	Nil	1.08 ab	—	—
S.E.M.	0.045	—	0.181	—	—

Table 68. 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	—	—
Synergy (I)	0.10 A	Nil	0.53 AB	—	—
Connect (MR)	0.08 A	Nil	0.48 B	—	—
S.E.M.	0.031	—	0.030	—	—
<u>Fungicide</u>					
Untreated	0.12 A	Nil	0.49 A	—	—
Flag	0.08 A	Nil	0.56 A	—	—
Head	0.13 A	Nil	0.53 A	—	—
Dual	0.05 A	Nil	0.51 A	—	—
S.E.M.	0.035 ^z	—	0.032	—	—

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

Table 69. 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	—	—
MS – flag	0.10 a	Nil	0.54 ab	—	—
MS – head	0.16 a	Nil	0.60 ab	—	—
MS – dual	0.09 a	Nil	0.57 ab	—	—
I – untr	0.18 a	Nil	0.49 ab	—	—
I – flag	0.07 a	Nil	0.69 a	—	—
I – head	0.14 a	Nil	0.46 b	—	—
I – dual	0.01 a	Nil	0.47 b	—	—
MR – untr	0.11 a	Nil	0.47 b	—	—
MR – flag	0.07 a	Nil	0.44 b	—	—
MR – head	0.08 a	Nil	0.53 ab	—	—
MR – dual	0.07 a	Nil	0.49 ab	—	—
S.E.M.	0.061 ^z	—	0.047	—	—

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

Table 70. Variety and fungicide treatment main effect means for barley deoxynivalenol (DON) content at Yorkton, SK (2021-24). 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	—
Synergy (I)	0.00 A	Nil	0.14 A	—
Connect (MR)	0.00 A	Nil	0.08 A	—
S.E.M.	0.004	—	0.037	—
<u>Fungicide</u>				
Untreated	0.01 A	Nil	0.19 A	—
Flag	0.01 A	Nil	0.18 A	—
Head	0.00 A	Nil	0.04 B	—
Dual	0.00 A	Nil	0.07 B	—
S.E.M.	0.005	—	0.040	—

Table 71. Individual variety by fungicide treatment means for barley deoxynivalenol (DON) content at Yorkton, SK (2021-24). 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 - Fung	----- Deoxynivalenol - DON (ppm) -----			
MS – untr	0.03 a	Nil	0.20 a	—
MS – flag	0.00 a	Nil	0.18 a	—
MS – head	0.00 a	Nil	0.07 a	—
MS – dual	0.00 a	Nil	0.10 a	—
I – untr	0.00 a	Nil	0.22 a	—
I – flag	0.00 a	Nil	0.25 a	—
I – head	0.01 a	Nil	0.01 a	—
I – dual	0.01 a	Nil	0.07 a	—
MR – untr	0.00 a	Nil	0.15 a	—
MR – flag	0.02 a	Nil	0.13 a	—
MR – head	0.00 a	Nil	0.03 a	—
MR – dual	0.00 a	Nil	0.03 a	—
S.E.M.	0.008	—	0.059	—