# 2017 Annual Report for the Agriculture Demonstration of Practices and Technologies (ADOPT) Program

**Project Title:** Managing Fusarium Head Blight in CWRS Wheat

**Project Number:** 20160413

**Producer Group Sponsoring the Project:** Western Applied Research Corporation

**Project Location(s):**

- Scott Saskatchewan, R.M. #380 Legal land description: NE 17-39-20 W3

**Project start and end dates (month & year):** April 2017 and completed January 2018

**Project contact person & contact details:**

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## Objectives and Rationale

**Project objectives:**

The objective is to demonstrate the level of fusarium head blight suppression possible through increasing seeding rate, proper varietal selection and proper timing of fungicide. Varieties differ in susceptibility to fusarium head blight and timing of fungicide to suppress FHB can be improved with higher seeding rates.

**Project Rationale:**

The main fungicide product used for the suppression of fusarium head blight (FHB) in Saskatchewan is Prosaro. The optimum timing of this product is at early anthesis and applications past this stage are ineffective. Proper timing to protect all heads is impossible if the timing of head emergence within the crop is highly variable. Increasing seeding rates of wheat is commonly recommended to increase the uniformity of heading and facilitate proper fungicide timing. Increasing seeding rate, improves the uniformity of heading by reducing the number of tillers which produce heads less mature than main stem heads. Varietal selection can also have an impact on fusarium head blight. While no CWRS wheat varieties are truly resistant to FHB there are differences in susceptibility between varieties. The level of susceptibility between varieties is published annually in the Saskatchewan's seed guide. High seeding rates, varietal selection and proper timing of fungicide can reduce the occurrence of fusarium head blight.

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## Methodology and Results

**Methodology:**

The trials were setup as a split-split plot with 4 replications. The first factor compared Prosaro at 50% anthesis vs no fungicide applied. The subplot factor compared the awnless CWRS varieties of CDC Utmost VB and CDC Plentiful. CDC Utmost VB is rated moderately susceptible (MS) to fusarium head blight (FHB) whereas, CDC Plentiful is rated moderately resistant (MR). The sub-subplot factor contrasted seeding rates of 150, 300 and 450 seeds/m$^2$. This produced 12 treatments for this analysis. An additional 2 treatments which are not part of the statistical analysis were added to determine if there is reduced fungicidal efficacy on awned varieties (treatments 7 and 14). Saskatchewan Agriculture has stated "Awns on durum and some hexaploid wheat varieties can further disrupt spray droplets before they reach their destination."

This may result in reduced efficacy of fungicide on bearded varieties. The complete treatment list is in table 1.

Table 1. Treatment list for trials

| # | Fungicide | Variety | Beard type | Fusarium resistance | Seeds/m$^2$ |
|---|---|---|---|---|---|
| 1 | none | CDC Utmost VB | awnless | MS | 150 |
| 2 | none | CDC Utmost VB | awnless | MS | 300 |
| 3 | none | CDC Utmost VB | awnless | MS | 450 |
| 4 | none | CDC Plentiful | awnless | MR | 150 |
| 5 | none | CDC Plentiful | awnless | MR | 300 |
| 6 | none | CDC Plentiful | awnless | MR | 450 |
| 7 | none | AAC Brandon | awned | MR | 300 |
| 8 | Prosaro | CDC Utmost VB | awnless | MS | 150 |
| 9 | Prosaro | CDC Utmost VB | awnless | MS | 300 |
| 10 | Prosaro | CDC Utmost VB | awnless | MS | 450 |
| 11 | Prosaro | CDC Plentiful | awnless | MR | 150 |
| 12 | Prosaro | CDC Plentiful | awnless | MR | 300 |
| 13 | Prosaro | CDC Plentiful | awnless | MR | 450 |
| 14 | Prosaro | AAC Brandon | awned | MR | 300 |

**Data Collection:**

An R-tech seeder on 10-inch row spacing were used to seed the trials. Fertility was applied at recommended rates for wheat at 50 bu/ac. Plant densities were determined by counting numbers of emerged plants on 2 spots x 2 rows x 1m row lengths per plot approximately two weeks after emergence. Disease rating was conducted to determine percent fusarium damaged heads. Lodging rates were done using the Belgian lodging scale (area x intensity x 0.2 - area rated on 1-10 scale, intensity rated on 1-5 scale). DON test was done on one sample per treatment (14 samples) for a fusarium damaged kernel percentage.

Plots were desiccated at the hard dough stage and harvested at 18% moisture. Yields were determined from cleaned harvested grain samples and corrected to 14.6% moisture content. Protein analysis was conducted to determine seed nitrogen. Weather data was recorded from the online database of Environment Canada weather station.

## <u>Growing Conditions:</u>

The 2017 growing season started with great soil moisture in April and May with 30.9 mm and 69 mm of precipitation, respectively. Midseason growing conditions in June and July were very dry with 51% and 68% less precipitation compared to the long-term average. Growing degree days were higher than the long-term average for the months of May and July, and lower for the remaining months (Table 2).

**Table 2.** Mean monthly temperature, precipitation and growing degree day accumulated from April to October in 2016 and 2017 at Scott, SK.

| Year | April | May | June | July | August | Sept. | Oct. | Average /Total |
|---|---|---|---|---|---|---|---|---|
| *Temperature (°C)* | | | | | | | | |
| **2016** | 5.9 | 12.4 | 15.8 | 17.8 | 16.2 | 10.9 | 1.6 | 11.5 |
| **2017** | 3.0 | 11.5 | 15.1 | 18.3 | | | | |
| **Long-term[z]** | 3.8 | 10.8 | 14.8 | 17.3 | 16.3 | 11.2 | 3.4 | 11.1 |
| *Precipitation (mm)* | | | | | | | | |
| **2016** | 1.9 | 64.8 | 20.8 | 88.1 | 98.2 | 22.2 | 33.1 | |
| **2017** | 30.9 | 69.0 | 34.3 | 22.4 | | | | 329.1 |
| **Long-term[z]** | 24.4 | 38.9 | 69.7 | 69.4 | 48.7 | 26.5 | 13 | 290.6 |
| *Growing Degree Days* | | | | | | | | |
| **2016** | 58.9 | 224.9 | 303 | 398.7 | 343.8 | 176.2 | 12.5 | 1518.0 |
| **2017** | 58.9 | 224.9 | 303 | 398.7 | 343.8 | 176.2 | 12.5 | 1518.0 |
| **Long-term[z]** | 44 | 170.6 | 294.5 | 380.7 | 350.3 | 192.3 | 42.5 | 1474.9 |

[z]Long-term average (1985 - 2014)

## <u>Analysis:</u>

The data was statistically analysed using the PROC MIXED in SAS 9.4. The residuals were tested for normality and equal variance to meet the assumptions of ANOVA. The means were separated using a Tukey's Honestly Significant Difference (HSD) test with level of significance at 0.05. Replications were treated as random effect factor whiles treatments were fixed effect factors.

**Results & Discussion:**

As a result of good starter soil conditions emergence did not significantly differ between varieties (Table 3). Seeding rates of 150, 300 and 450 seeds/$m^2$ produced plant populations per $m^2$ of 121, 203 and 282. Unfortunately for this study, infection by fusarium head blight (FHB) was very low as a result of low precipitation. Fusarium damaged kernels (FDK) were usually well below the level of 0.25% which must not be exceeded to maintain a number 1 CWRS grade. As a result, no substantial differences were observed between treatments. Numerically, FDK was a little higher where Prosaro had been applied. However, the FDK data originated from a single replicate and no statistics are supporting this difference. Beres et al. (2011) reported that hard vitreous kernels and FDK decreased as the seeding rate increased. (May, 2014). Levels of FDK were numerically higher for the moderately susceptible variety “CDC Utmost VB” compared to the moderately resistant variety “CDC Plentiful”, but levels for both were still low. No consistent effect of seeding rate on FDK was observed.

Though not statistically significant, yield was consistently higher where Prosaro had been sprayed. On average, there was a 2.3 percent yield increased from spraying fungicide. The yield increase is likely the result of suppressing leaf disease and not FHB. Increasing seeding rate also consistently increased yield with the effect being statistically significant. In turn, increasing seeding rate decreased protein levels due to dilution from increasing yield. The effect was found to be statistically significant. Lodging was not an issue this year due to midseason dryness (data not shown). Treatments 7 and 14 were added to the study for comparison but could not be part of the factorial analysis. They were added to assess whether the awns on an awned variety would interfere with the efficacy of Prosaro. This could not be determined as levels of FDK were very low whether sprayed with fungicide or not.

| Table 3. Main Effects of Emergence, Yield, FDK and Protein of Wheat at Scott[a] | | | | |
|---|---|---|---|---|
| Main Effects | Emergence (plants/m$^2$) | Yield (kg/ha) | FDK (%) | Protein (%) |
| Fungicide (A) | | | | |
| None | 204 a | 5503 a | 0.04 | 11.4 a |
| Prosaro @ 50% anthesis | 201 a | 5631 a | 0.21 | 11.4 a |
| $Lsd_{0.05}$ | NS | NS | NA | NS |
| Variety (B) | | | | |
| CDC Utmost VB (awnless; MS to FHB) | 195 a | 5477 a | 0.21 | 11.7 a |
| CDC Plentiful (awnless MR to FHB) | 209 a | 5658 a | 0.05 | 11.1 a |
| $Lsd_{0.05}$ | NS | NS | NA | NS |
| Seeding rate (C) | | | | |
| 150 seeds/m$^2$ | 121 a | 5320 a | 0.08 | 11.7 a |
| 300 seeds/m$^2$ | 203 b | 5693 b | 0.26 | 11.4 b |
| 450 seeds/m$^2$ | 282 c | 5689 b | 0.05 | 11.1 b |
| $Lsd_{0.05}$ | 14.5 | 283 | NA | 0.31 |
| Significant Interactions between main effects | | | | |
| | NS | NS | NA | NA |
| 7. No fungicide; AC AAC Brandon (awned MR to FHB); 300 seeds/m$^2$ | 196 | 5799 | 0 | 11.1 |
| 14. Prosaro; AC AAC Brandon (awned MR to FHB); 300 seeds/m$^2$ | 180 | 6063 | 0 | 11.8 |
| [a]Means within a main effect followed by the same letter are not significantly different p=0.05 | | | | |

## Conclusion:

Unfortunately for this study, levels of fusarium head blight were quite low. Increasing seeding rate and applying Prosaro did not substantially affect levels of FDK as infection levels in this study were low across treatments. The low levels of infection also made it impossible to determine if awns on a bearded wheat interfered with the efficacy of Prosaro. While yields tended to increase with the application of Prosaro, this was likely the result of suppressing leaf disease and not fusarium head blight. Yield increased and protein decreased with increasing seeding rate but seeding rate did not affect the efficacy of Prosaro due to low levels of infection. Levels of FDK were numerically higher for the moderately susceptible variety "CDC Utmost VB" compared to the moderately resistant variety "CDC Plentiful", but levels for both were still low.

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## Supporting Information

### Acknowledgements

This project was funded through the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward 2 bi-lateral agreement. Adopt signs were posted during the annual tour. We would like to acknowledge Herb Schell and our summer staff for their technical assistance with project development and implementation for the 2017 growing season. This report will be distributed through WARC's website and included in WARC's and Agri-ARM annual reports.

## Appendices

### Appendix A

**Table A1.** Dates of operations in 2017 for Scott, SK

| Operations in 2017 | Scott, Saskatchewan |
|---|---|
| Pre-plant herbicide | May 6 |
| Trial seeded | May 11 |
| Emergence counts | June 7th |
| In-crop Herbicide | June 6th (Axial iPak) |
| In-crop fungicide (Prosaro trt 8-14) | July 18 |
| Lodging | August 18th |
| Preharvest Roundup | September 1 |
| Harvest | September 12 |

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### Abstract

The trial was established at Scott with the objective of demonstrating the level of fusarium head blight suppression possible through increasing seeding rate, proper varietal selection and proper timing of fungicide. Varieties differ in their susceptibility to fusarium head blight and higher seeding rates improve crop staging for fungicide application by reducing the number of immature tillers. Unfortunately, levels of fusarium head blight were extremely low in these studies, making it impossible to demonstrate the principles above. This trial found that fusarium damaged kernels were numerically higher for the moderately susceptible variety “CDC Utmost VB” compared to the moderately resistant variety “CDC Plentiful”, but levels for both were still quite low. While increasing seeding rate and applying Prosaro tended to increase yield it did not affect levels of fusarium damaged kernels.  Prosaro likely increased yield by suppressing leaf disease but not fusarium head blight.

## Extension Activities

As a result of poor FHB presence and a lack of results, this trial will not be presented at the annual Crop Opportunity. However, there will be a fact sheet generated and distributed on the WARC website, as well as all Agri-ARM and WARC events to ensure the information will be transferred to producers.

## References

May, W. E., Fernandez, M. R., Selles, F. and Lafond G. P. 2014. Agronomic practices to reduce leaf spotting and Fusarium kernel infections in durum wheat on the Canadian prairies. Can. J. Plant Sci. 94: 141152.