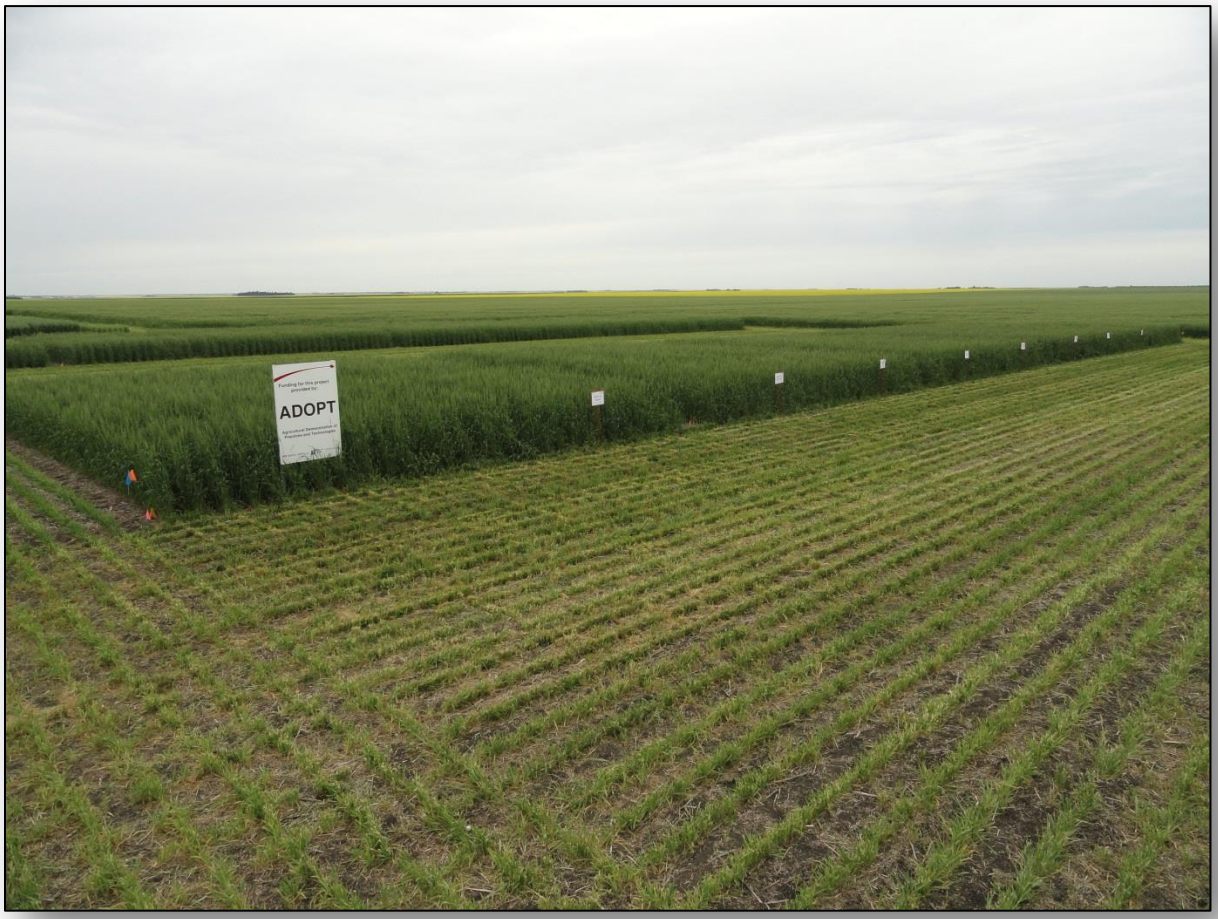
2014 Annual Report

for the

Agricultural Demonstration of Practices and Technologies (ADOPT) Program

Project Title: Fungicide Timing for Controlling Leaf and Head Disease in Spring Wheat

(Project #20130393)



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Project Identification

1. **Project Title:** Fungicide timing for controlling leaf and head disease in spring wheat
2. **Project Number:** 20130393
3. **Producer Group Sponsoring the Project:** Indian Head Agricultural Research Foundation
4. **Project Location(s):** Indian Head, Saskatchewan, R.M. #156
5. **Project start and end dates (month & year):** April 2014 to February 2015
6. **Project contact person & contact details:**

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Objectives and Rationale

7. **Project objectives:**

The objective of this project was to demonstrate the effects of fungicide timing on leaf spot diseases and fusarium head blight on spring wheat. A second objective was to demonstrate the potential benefits of planting cultivars with improved disease resistance.

8. **Project Rationale:**

Due to the wet weather in recent years, the incidence and severity of leaf disease and fusarium head blight (FHB) in spring wheat have risen in many parts of Saskatchewan. Fusarium damaged kernels were a major cause for yield and grade reductions throughout the province in 2012 and again in 2014. While overall disease pressure was somewhat lower in 2013, spring wheat still responded well to foliar fungicide applications in field trials at Indian Head and several other Agri-ARM locations. The increase in cereal diseases combined with frequent grade reductions due to disease has resulted in substantial economic loss and more frequent fungicide use for most growers. The traditionally recommended timing of fungicide application for control of leaf spotting diseases is flag leaf stage, while the optimum timing for suppression of FHB is at early anthesis. Even though the optimum fungicide timing often differs, to reduce costs and labour requirements producers are interested in the effects of a single fungicide application to control both leaf spotting diseases and FHB.

Foliar fungicides are not the only option for managing disease in spring wheat. Varieties differ in their genetic resistance to fungal pathogens and, consequently, the benefits of fungicide application may differ depending on the relative disease resistance of the variety being grown. Research has shown that fungicide application on cultivars with good leaf spot resistance will provide less of a benefit than the same fungicide applied on susceptible cultivars.

Producers will benefit from information on which fungicide application timings provide the greatest benefits and whether or not dual applications (flag-leaf plus anthesis) are viable under heavy disease pressure. The project will demonstrate the effects of fungicide timing on leaf spot disease and FHB on two wheat cultivars that differ in their genetic resistance to fungal pathogens. Unity VB is rated as fair for both FHB and leaf spot disease resistance while Goodeve VB is also rated fair for resistance

to leaf spot disease but very poor for resistance to FHB according to the 2014 Saskatchewan Variety Guide. Both varieties are sold as blends and carry the Sm1 gene for midge tolerance.

Methodology and Results

9. Methodology:

A field trial was established on a heavy clay soil (Indian Head heavy clay) near Indian Head in the thin Black Soil Zone of southeast Saskatchewan (50°32'40" N 103°35'58" W). The varieties Unity VB or Goodeve VB were treated with one of four fungicide treatments where the products and timings of application were varied to target different diseases. The specific timings of application were based on the growth stage of the crop where T1 denotes flag-leaf stage and T2 denotes anthesis stage, or early heading. The specific fungicide rates and products used were 0.5 l Twinline ha^{-1} (64 g pyraclostrobin ha^{-1} and 40 g metconazole ha^{-1}) at the flag leaf stage and 0.8 l Prosaro 250 EC ha^{-1} (100 g prothioconazole ha^{-1}, 100 g tebuconazole ha^{-1}). The plots were arranged in a Randomized Complete Block Design (RCBD) with four replicates and the treatments are provided in Table 1.

Table 1. Fertilizer treatments evaluated in ADOPT Fungicide Timing in Spring Wheat demonstration at Indian Head, Saskatchewan in 2014.

Trt #	Variety	T1 (Flag Leaf)[Z]	T2 (Anthesis)[Y]
1	Unity VB [X]	no	no
2	Unity VB	yes	no
3	Unity VB	no	yes
4	Unity VB	yes	yes
5	Goodeve VB [W]	no	no
6	Goodeve VB	yes	no
7	Goodeve VB	no	yes
8	Goodeve VB	yes	yes

[Z] Zadoks stage 41-47, 0.5 l Twinline ha^{-1}; [Y] Zadoks stage 60-65, 0.8 l Prosaro 250 EC ha^{-1}
[X] Rated F (fair) for both leaf spot and fusarium head blight resistance
[W] Rated F (fair) for leaf spot disease and VP (very poor) for fusarium head blight resistance

The target seeding rate for both varieties was 275 seeds m^{-2} and seeding was completed on May 10, 2014 into canola stubble using a Conserva-Pak plot drill with 14 openers spaced 30 cm apart. Granular urea and monoammonium phosphate were side-banded at seeding to provide 125 kg N ha^{-1} and 30 kg P_2O_5 ha^{-1} as fertilizer. Weeds were controlled with a fall application of PrePass (glyphosate plus florasulam) and in-crop applications of Simplicity (15 g pyroxysulam ha^{-1}) on June 12 followed by Buctril M (280 g MCPA ha^{-1}, 280 bromoxynil ha^{-1}) on June 17, 2014. The foliar fungicide treatments were applied on July 8 (flag-leaf stage) and on July 16 (anthesis). Fungicide treatments were applied in 224 l ha^{-1}

solution using a field sprayer. All plots were driven through at the time of each application to equalize any effects of wheel tracks; however, only the crop rows in between the tracks were utilized for data collection. Pre-harvest glyphosate was applied on August 28, 2014 to assist with crop dry down and the centre five rows of each plot were straight-combined with a Wintersteiger plot combine on September 7.

Various data were collected during the growing season and post-harvest. Initial leaf spot disease ratings were completed prior to the first fungicide applications on July 7 (check plots only) and leaf disease was again rated (on all plots) on August 19, 2012. For both dates, leaf disease was rated for 10 plants per plot according the McFadden Scale (Table 2). Fusarium head blight (FHB) index, incidence and severity were calculated for each plot from ratings completed on 50 heads per plot at the late milk / early dough stage on August 19 (all plots). Fusarium head blight incidence is the proportion of infected heads while severity is the mean proportion of the head area affected amongst infected heads. FHB index is the product of the incidence and severity and is considered to be a good overall indicator of FHB pressure for spring wheat. Seed moisture content and dockage were determined using standard Canadian Grain Commission methods in order to correct seed yields. Yields are expressed in kg ha^{-1} clean seed, corrected to a uniform seed moisture content of 14.5%. Test weights were determined using standard Canadian Grain Commission methods and are expressed as g 0.5 L^{-1} while thousand kernel weights (TKW) were determined by mechanically counting and then weighing approximately 1500 seeds per plot. A 750 g cleaned seed sample from each plot was submitted to Intertek Canada (Winnipeg, MB) for determination of percent protein and fusarium damaged kernels (FDK).

Table 2. McFadden, W. 1991. Etiology and epidemiology of leaf spotting diseases in winter wheat in Saskatchewan. Ph.D. thesis, University of Saskatchewan, Saskatoon, 151 pp.

Leaf Level	0[Z]	1	2	3	4	5	6	7	8	9	10	12
Upper (flag)	0	0	0	0	0	0	0	0-1	2-5	6-10	11-25	26-50
Mid	0	0	0	0	0-1	2-5	6-10	6-10	11-25	26-50	>50	>50
Lower	0	0-1	2-5	6-10	11-25	26-50	>50	>50	>50	>50	>50	>50

[Z] Percentage of leaf area with lesions in the upper, middle and lower leaf canopies

Response data were analyzed with the GLM procedure of SAS 9.3 with the effects of variety, fungicide treatment and their interaction considered fixed. Fisher's protected LSD test was used to separate treatment means for both the main effects and their interactions. All treatment effects and differences between means were considered significant at $P \leq 0.05$.

10. Results:

Mean monthly temperatures and precipitation amounts for the 2014 growing season at Indian Head are presented relative to the long-term averages in Table 3. While it was a late spring with respect to snow melt and field access, May was drier than normal but with slightly below average temperatures. In contrast, June was extremely wet with more than 2.5 times the long-term average precipitation and slightly cooler than average temperatures. Following heavy rains at the start of the month, the weather in July turned dry and hot but August was also very wet with close to normal temperatures. Overall, the spring wheat remained in excellent condition all season long and, despite the extremely wet weather, this site was well-drained overall and standing water did not accumulate for any significant lengths of time. The wet conditions through June and into July were conducive to disease development, particularly fusarium head blight which was wide-spread in the region.

Table 3. Mean monthly temperatures and precipitation amounts along with long-term (1981-2010) averages for the 2013 and 2014 growing seasons at Indian Head, SK.

Year	May	June	July	August	Avg. / Total
	---------- Mean Temperature (°C) ----------				
2014	10.2	14.4	17.3	17.4	14.8
Long-term	10.8	15.8	18.2	17.4	15.6
	---------- Precipitation (mm) ----------				
2014	36.0	199.2	7.8	142.2	385
Long-term	51.8	77.4	63.8	51.2	244

Results from the overall *F*-tests are presented for yield, test weight, TKW, grain protein, FDK, leaf disease and FHB index, incidence and severity are presented in Table 4. Coefficients of variation and correlation coefficients are provided as an overall measure of variability in the data and model fit. The two cultivars differed for all response variables except grain yield ($P = 0.900$) and FHB incidence ($P = 0.856$). Fungicide treatment also affected most variables including grain yield ($P < 0.001$), test weight ($P < 0.001$), protein ($P < 0.001$), leaf disease ($P < 0.001$), FHB index ($P < 0.001$) and FHB incidence ($P < 0.001$). Interactions between variety and fungicide treatment were generally not significant with the exceptions being percent FDK ($P = 0.033$), leaf disease ($P = 0.005$) and FHB index ($P = 0.026$).

Table 4. Tests of fixed effects for variety (V) and fungicide treatment (F) and their interactions on various spring wheat response data at Indian Head (2014). Data were analyzed with the GLM procedure of SAS 9.3 and treatment effects are considered significant at $P \leq 0.05$.

Source	Variety (V)	Fungicide (F)	V × F	Coefficient of Variation	Correlation Coefficient
	---------- Pr > *F* ----------			(%)	(R^2)
Grain Yield	0.900	<0.001	0.869	4.9	0.737
Test Weight	<0.001	<0.001	0.093	0.3	0.927
1000 Kernel Weight	<0.001	0.080	0.561	2.0	0.936
Grain Protein	<0.001	0.026	0.381	1.4	0.861
Fus. Damaged Kernels	0.039	0.484	0.033	21.4	0.518
Leaf Disease	<0.001	<0.001	0.005	3.1	0.903
FHB Index	0.008	<0.001	0.026	24.4	0.748
FHB Incidence	0.856	<0.001	0.135	19.8	0.739
FHB Severity	0.033	0.814	0.339	26.9	0.402

Spring wheat yields were quite high at Indian Head in 2014 and, at 4274-4283 kg ha^{-1} averaged across fungicide treatments, Unity and Goodeve yielded similarly (Table 5). There was a strong overall yield response to fungicide with slightly higher yields with the flag-leaf fungicide application and significant increases with both the anthesis and dual application treatments. While the highest overall mean yield was observed with a dual application, it was not significantly higher than the yield with a single application at anthesis. Spring wheat yields were lowest in the check (4029 kg ha^{-1}), followed by the flag-leaf application (4189 kg ha^{-1}), the anthesis application (4378 kg ha^{-1}) and finally the dual application (4525 kg ha^{-1}) which was 12% higher than the check. Again, the lack of a V × F interaction suggests that the effect of fungicide treatment was consistent across varieties and inspection of the individual treatment means showed similar yields for the two varieties at all individual fungicide treatments (Table 8, Appendices).

The mean test weight for Unity was 394 g 0.5 l^{-1} (64.8 lb A bu^{-1}) while for Goodeve it was significantly lower at 388 g 0.5 l^{-1} (63.8 lb A bu^{-1}). The effect of fungicide treatment on test weight was also significant and followed a similar pattern as grain yield whereby the test weight of the check was lowest (388 g 0.5 l^{-1}), followed by the single application at the flag leaf stage (390 g 0.5 l^{-1}) and then the anthesis and dual applications (392-393 g 0.5 l^{-1}).

Table 5. Least squares means for variety (V) and fungicide treatment (F) effects on spring wheat grain yield and quality at Indian Head (2014). Main effect means followed by the same letter do not significantly differ (Fisher's protected LSD test, $P \leq 0.05$).

Main Effect (Variety/Fungicide)	Grain Yield	Test Weight	1000 Kernel Weight	Grain Protein	FHB Dam. Kernels
	(kg/ha)	(g/0.5 L)	(g/1000 seeds)	(%)	(%)
Unity VB	4283 a	393.6 a	31.4 b	14.0 b	0.62 a
Goodeve VB	4274 a	387.7 b	35.1 a	14.7 a	0.52 b
S.E.M.	52.2	0.30	0.16	0.05	0.03
Untreated	4029 c	388.1 c	32.7 a	14.5 a	0.58 a
Flag Leaf (T1)	4182 bc	389.7 b	33.2 a	14.5 ab	0.57 a
Anthesis (T2)	4378 ab	392.0 a	33.4 a	14.3 b	0.61 a
Dual (T1 + T2)	4525 a	392.7 a	33.6 a	14.3 b	0.52 a
S.E.M.	73.9	0.43	0.23	0.07	0.04

Opposite to test weight, thousand kernel weight (TKW) was lower with Unity than with Goodeve (31.5 versus 35.1 g 1000 $seeds^{-1}$); however, TKW was not significantly affected by fungicide treatment although there was a slight tendency for higher TKW with fungicides (Table 5). While yields were similar for the two varieties, grain protein was significantly higher with Goodeve (14.7%) compared to Unity (14.0%). Fungicide did have a significant effect whereby the treatments that received a fungicide had the highest yield but also had lower protein concentrations relative to

the check (Table 5). While unfortunate, this effect was not necessarily unexpected and is frequently encountered due to N becoming more diluted at higher yields.

While percent fusarium damaged kernels (FDK) were slightly but significantly lower for Goodeve (0.5%) than for Unity (0.6%), fungicide treatment did not significantly affect FDK and there was no trend for lower levels with any fungicide treatments. All of the samples received an grade of #2 CWRS with FDK as the reason for the grade reduction in all cases. The lower FDK of Goodeve and lack of a fungicide effect were unexpected considering the high levels of disease, but it is conceivable that the worst affected kernels were either blown out of the sample during combining and/or cleaned out during dockage determination. Therefore, while yields were affected, the final impact of fungicide applications on grain quality was negligible.

Means for treatment effects on all of the visual disease ratings are presented in Table 6. Initial leaf disease ratings at the flag leaf stage were slightly higher for Goodeve but, from a practical perspective, disease was low for all plots with no disease on the flag-leaf in the vast majority of cases. Overall disease levels were considerably higher towards the end of the season with most flag leaves showing substantial leaf spotting and, again, a small tendency for higher levels in Goodeve. All fungicide applications resulted in a significant reduction in disease, but the greatest reduction was associated with the anthesis application. While the flag-leaf stage is considered the optimal time to control leaf disease, the two applications were only 8 days apart and the fungicide options registered to control FHB are also registered to control leaf spot disease. Furthermore, the weeks leading up to the final ratings were wetter than normal and therefore conducive to disease development late in the season.

Table 6. Least squares means for variety (V) and fungicide (F) effects on spring wheat leaf and head disease at Indian Head (2014). Main effect means followed by the same letter do not significantly differ (Fisher's protected LSD test, $P \leq 0.05$).

Main Effect (Variety/Fungicide)	Leaf Disease T1	Leaf Disease T2	FHB Index	FHB Incidence	FHB Severity
	---------- (1-12) ----------		---------- (%)----------		
Unity VB	5.9 b	10.3 b	6.6 b	19.4 a	34.7 b
Goodeve VB	6.9 a	11.2 a	8.5 a	19.6 a	43.2 a
S.E.M.	0.16	0.08	0.46	0.97	2.62
Untreated	—	11.6 a	9.5 a	25.0 a	38.5 a
Flag Leaf (T1)	—	11.1 b	9.5 a	23.3 a	42.0 a
Anthesis (T2)	—	10.2 c	5.5 b	14.8 b	37.8 a
Dual (T1 + T2)	—	10.1 c	5.5 b	15.0 b	37.4 a
S.E.M.	—	0.12	0.65	1.36	3.7

Visible FHB index and severity ratings both tended to be lower with Unity than for Goodeve; however, the incidence, or percentage of heads showing signs of infection, was similar for the two varieties (Table 6). All the variables calculated from the FHB ratings were affected by fungicide treatment; however, as expected the flag-leaf application did not affect these ratings. Fungicide applied at anthesis did result in lower FHB index, incidence and severity ratings despite there being no measurable impact on FDK. There was a significant V × F interaction for field index whereby the effects of fungicide were significant for Goodeve but not for Unity; however, the overall trends were similar for both varieties (Table 7, Appendices). Again, while the inconsistencies between FDK and the visual FHB ratings was unexpected, it is plausible that many of the worst affected kernels did not make it into the final graded samples due to being cleaned out of the sample during combining and/or dockage determination.

A similar demonstration was conducted at Indian Head in 2013; however different cultivars were used and the fungicide treatments differed slightly and therefore it was not practical to combine the data for analyses. The results from this demonstration in 2013, however, are presented in the Appendices for the sake of interest and discussion (Tables 9-11). While disease pressure was somewhat lower in 2013, overall, the results were consistent for the two years in that the fungicide applied at anthesis (T3 in 2013) provided the greatest overall benefit while the flag leaf application was least beneficial. No fungicide effects on grain quality were detected with the exception of percent blackpoint which was increased slightly when a single fungicide application was applied at the flag-leaf stage. While blackpoint was not specifically measured for each plot in 2014, it was not a grading factor in any cases.

Extension and Acknowledgement

The trial was featured at the 2014 Indian Head Crop Management Field Day on July 22 which was attended by over 200 producers and industry representatives. The discussion at the site revolved around some the opportunities and challenges of managing leaf and head disease in spring wheat. Signs were in place to identify treatments and acknowledge the support of the Agricultural Demonstrations of Technologies and Practices (ADOPT) program. The plots were also shown during multiple smaller tours where producers and agronomists visited the site throughout the season. Results from this project will be made available in the 2014 IHARF Annual Report (available online) and also made available through a variety of other media (i.e. oral presentations, popular agriculture press, fact sheets, etc.).

11. Conclusions and Recommendations

The results of this demonstration were consistent with those of the previous season and are providing insights towards the potential benefits of various foliar fungicide applications on spring wheat in southeast Saskatchewan. Spring wheat yields were above average in both years of the demonstration with moderate to high disease pressure; however, overall disease pressure for both leaf and head disease was higher in 2014. Interactions between variety and fungicide treatment were rare in both years and lead us to conclude that, when disease pressure is moderate to high, similar yield and quality benefits to foliar fungicide applications can be expected regardless of differences in genetic disease resistance. This should not be taken to mean that genetic disease resistance is ineffective or

unimportant; however it does suggest that fungicides are still likely to be beneficial when using a variety with improved resistance when disease pressure is sufficiently high.

Applying fungicide at the flag leaf stage was consistently less beneficial than fungicides applied at anthesis to target fusarium head blight (Figure 1). In 2013 there was no benefit to the flag leaf application while, in 2014, mean yields with a single application at the flag-leaf stage were 4% higher than the check but, when no additional fungicides were applied, this increase was not significant. A single application at anthesis resulted in a 5% yield increase in 2013 and a 9% increase in 2014. A dual fungicide application (flag leaf plus anthesis application) did not result in a statistically significant yield increase over a single application at anthesis in either year; however, yields did tend to be slightly higher with the dual application, particularly in 2014 when disease pressure was higher. A possible explanation for the observed results is that leaf disease always set in relatively late, with relatively little visible symptoms at the flag leaf stage. Because the optimal time to control FHB is typically only 7-10 days past the flag-leaf stage and the registered products for this application also control leaf disease, the later application may provide adequate protection against leaf disease while also suppressing FHB. While there may be temptations to spray at both stages, the probability of a significant and economic benefit to doing so appear to be relatively small under most conditions, unless potentially if disease pressure is high early in the season and symptoms are already appearing on the upper canopy at the time of flag-leaf emergence.

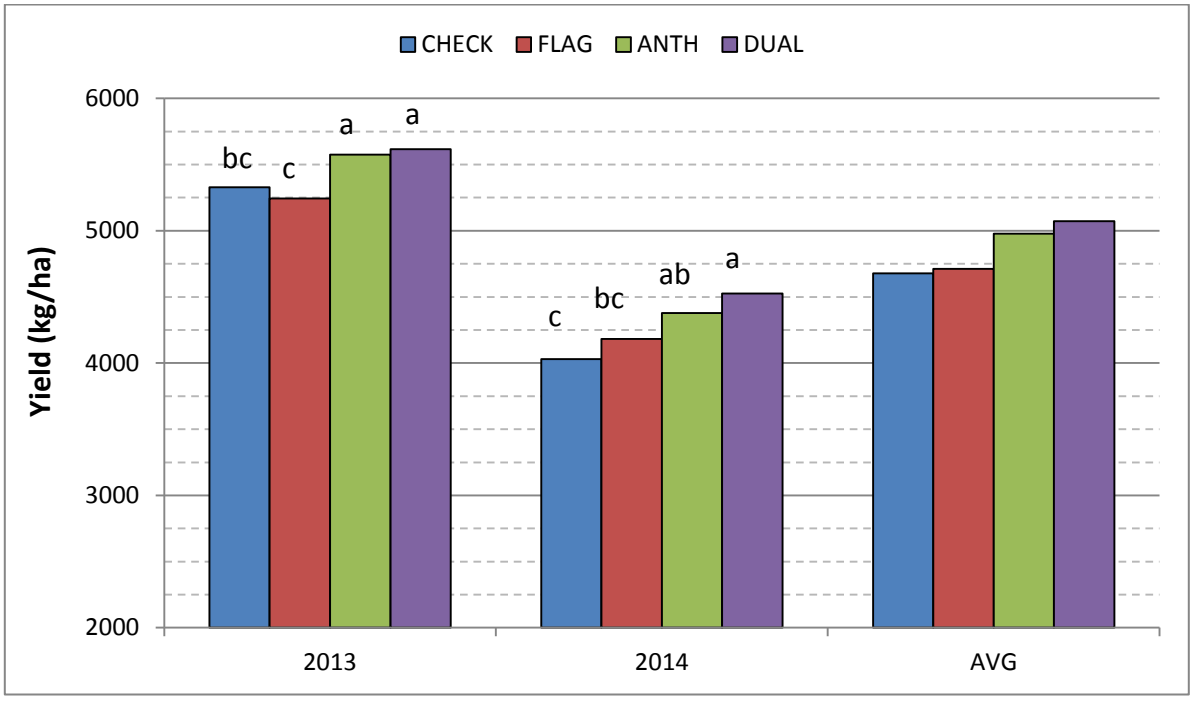

Figure 1. Foliar fungicide effects on spring wheat yield in ADOPT demonstrations at Indian Head in 2013 and 2014.

In conclusion, scouting carefully for disease is still a recommended practice as fungicide applications in general are unlikely to provide economic benefits when disease pressure is low. That said, both leaf spot disease and FHB have resulted in substantial spring wheat yield and quality losses in southeast Saskatchewan over the past few years and the benefits to fungicide application in this

region have been relatively consistent. Under the conditions encountered, a single application at anthesis (early flowering) of a fungicide product registered for both leaf disease and FHB suppression has provided the most consistent yield and quality benefits. That being said, growers are advised to scout carefully as the crop is approaching the flag-leaf stage and, only if disease pressure is particularly high, may wish to consider a dual application.

Supporting Information

12. Acknowledgements:

The project was supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward 2 bi-lateral agreement. Acknowledgement of the Saskatchewan Ministry of Agriculture's support for this demonstration will be included as part of all written reports and oral presentations that arise from this work. Fungicide products were provided in-kind by BASF and Bayer CropScience.

13. Appendices

Table 7. Least squares means for effects of variety (V) by fungicide (F) interactions on spring wheat leaf and head disease at Indian Head (2014). Main effect means followed by the same letter do not significantly differ (Fisher's protected LSD test, $P \leq 0.05$).

Variety - Fungicide	Leaf Disease	FHB Index	FHB Incidence	FHB Severity
	---- (1-12) ----	---------- (%)----------		
Unity - Untreated	11.4 a	7.7 b	22.0	36.3
Unity - Flag Leaf (T1)	10.9 b	7.3 b	23.5	32.6
Unity - Anthesis (T2)	9.5 c	6.0 b	16.0	37.7
Unity - Dual (T1 + T2)	9.4 c	5.3 b	16.0	32.3
Goodeve - Untreated	11.7 a	11.4 a	28.0	40.7
Goodeve - Flag Leaf (T1)	11.4 a	11.6 a	23.0	51.4
Goodeve - Anthesis (T2)	10.8 b	5.1 b	13.5	37.9
Goodeve - Dual (T1 + T2)	10.9 b	5.8 b	14.0	42.6
S.E.M.	0.17	0.91	1.93	5.23

Table 8. Least squares means for effects of variety (V) by fungicide (F) interactions on spring wheat grain yield and quality at Indian Head (2014). Main effect means followed by the same letter do not significantly differ (Fisher's protected LSD test, $P \leq 0.05$).

Variety - Fungicide	Grain Yield	Test Weight	1000 Kernel Weight	Grain Protein	FHB Dam. Kernels
	(kg/ha)	(g/0.5 L)	(g/1000 seeds)	(%)	(%)
Unity - Untreated	4067	390.1	31.1	14.2	0.73
Unity - Flag Leaf (T1)	4166	393.2	31.1	14.1	0.52
Unity - Anthesis (T2)	4410	395.3	31.5	14.0	0.64
Unity - Dual (T1 + T2)	4489	395.8	31.7	13.9	0.58
Goodeve - Untreated	3992	386.2	34.3	14.9	0.44
Goodeve - Flag Leaf (T1)	4199	386.3	35.2	14.9	0.62
Goodeve - Anthesis (T2)	4345	388.8	35.3	14.5	0.58
Goodeve - Dual (T1 + T2)	4560	389.6	35.5	14.6	0.45
S.E.M.	103.5	0.61	0.32	0.10	0.061

Table 9. Tests of fixed effects for variety (V) and fungicide treatment (F) main effects along with their interactions on various response data for spring wheat at Indian Head (2013). Data were analyzed with the GLM procedure of SAS 9.3 and treatment effects are considered significant at $P \leq 0.05$.

Source	Variety (V)	Fungicide (F)	V × F	Coefficient of Variation	Correlation Coefficient
	---------- Pr > *F* ----------			(%)	(R^2)
Grain Yield	<0.001	<0.001	0.081	2.6	0.865
Test Weight	0.081	0.468	0.362	0.4	0.3
1000 Kernel Weight	< 0.001	0.574	0.033	1.8	0.523
Fus. Damaged Kernels	0.926	0.129	0.988	340.2	0.343
Blackpoint	0.003	0.041	0.336	173	0.491

Table 10. Least squares means for effects of variety (V) and fungicide treatment (F) on spring wheat yield and quality at Indian Head (2013). Means within a column followed by the same letter do not significantly differ according to Fisher's protected LSD test.

Main Effect (Variety/Fungicide)	Grain Yield	1000 Seed Weight	Test Weight	Fusarium Damage	Blackpoint Damage
	kg ha^{-1}	*g*	*kg ha^{-1}*	*%*	*%*
Unity	5204 b	34.6 b	82.3 a	0.02 a	0.10 b
Shaw	5705 a	35.2 a	82.2 a	0.02 a	0.79 a
SE	27.4	0.12	0.06	0.17	0.15
Nil	5328 bc	34.9 a	82.2 a	0.09 a	0.71 ab
T1	5243 c	34.7 a	82.2 a	0.03 a	1.28 a
T2	5383 bc	35.0 a	82.3 a	0.00 a	0.30 ab
T3	5576 a	34.7 a	82.3 a	0.00 a	0.10 ab
T1 + T2	5410 b	35.0 a	82.1 a	0.01 a	0.56 ab
T1 + T3	5624 a	35.0 a	82.3 a	0.01 a	0.17 ab
T1 + T2 + T3	5617 a	35.3 a	82.3 a	0.00 a	0.01 b
S.E.M.	51.3	0.23	0.10	0.02	0.28

[Z] T1 – flag-leaf (Zadoks 41-47); T2 – 75% of head emerged (Zadoks 57-59); T3 – anthesis (Zadoks 60-65)

Table 11. Least squares means for effects of variety (V) by fungicide (F) interactions on spring wheat grain yield and quality at Indian Head (2013). Main effect means followed by the same letter do not significantly differ (Fisher's protected LSD test, $P \leq 0.05$).

Source	Grain Yield	1000 Seed Weight	Test Weight	FDK	Blackpoint Damage
Variety × Fungicide	*kg ha^{-1}*	*g*	*kg ha^{-1}*	*%*	*%*
Unity-Nil	5091	34.2 de	82.0	0.11	0.18
Unity-T1	5079	33.8 e	82.2	0.03	0.45
Unity-T2	5132	34.5 cde	82.4	0.00	0.00
Unity-T3	5290	34.8 abcd	82.2	0.00	0.03
Unity-T1+ T2	5203	34.9 abcd	82.1	0.00	0.03
Unity-T1+ T3	5305	35.0 abcd	82.2	0.00	0.10
Unity-T1+T2+T3	5330	35.2 abc	82.2	0.00	0.00
Shaw-Nil	5566	35.5 ab	82.4	0.07	1.24
Shaw-T1	5406	35.6 a	82.2	0.03	2.10
Shaw-T2	5634	35.4 abc	82.2	0.01	0.65
Shaw-T3	5862	34.6 bcde	82.4	0.00	0.18
Shaw-T1+ T2	5618	35.2 abc	82.1	0.01	1.10
Shaw-T1+ T3	5943	35.1 abcd	82.5	0.01	0.24
Shaw-T1+T2+T3	5904	35.3 abc	82.4	0.00	0.03
S.E.M.	72.5	0.32	0.15	0.03	0.40

Abstract

14. Abstract/Summary:

A field trial was established near Indian Head in 2014 to demonstrate the response of two spring wheat varieties with contrasting disease resistance packages to various foliar fungicide applications. A similar demonstration was conducted at this location in 2013. The fungicide treatments evaluated in both years included an unsprayed check, a flag leaf application to target leaf spot disease, an anthesis application to target fusarium head blight (FHB) and a dual application where both fungicides were applied. In 2013, a third timing was included where a fungicide registered for FHB was applied earlier, when approximately 75-85% of the heads had emerged but prior to anthesis. Over the two years, there were very few significant interactions between variety and fungicide treatment for grain yield or quality indicating that similar benefits (or lack thereof) to fungicide applications were observed regardless of varietal disease resistance. The most consistent benefits were achieved with fungicide applied at anthesis to targeting FHB, whereby a single application resulted in a 5-9% yield increase along with higher test weight and/or seed size relative to the unsprayed check. Fungicide applied at the flag leaf stage did not improve yield or quality in 2013 and, even in 2014 with higher disease pressure, the observed yield benefit to the flag-leaf application was not statistically significant and small compared to the anthesis application. In each of the two years, any yield or quality benefits of a dual application over a single application at anthesis were not

significant. As such, the likelihood of dual fungicide applications (flag-leaf and again at heading) being profitable in for spring wheat in southeast Saskatchewan is relatively small, unless perhaps if disease sets in early or is very severe. Despite relatively high FHB pressure and the positive effect on yield, particularly in 2014, fungicides did not significantly reduce percent fusarium damaged kernels or result in a higher grade in either year. This trial was shown as part of the 2014 IHARF Crop Management field days and results will be made available through a variety of media including the 2014 IHARF annual report (available online), fact sheets and oral presentations.