

Last updated on: Dec 2013

## Highlights:

- Results are from only one location and year.
- Study was carried out with artificial inoculation of *Fusarium graminearum* by spreading corn inoculum to promote disease. No artificial inoculation was done for leaf diseases.
- None of the treatments effectively controlled FHB disease incidence and severity.
- Overall Quilt (4 oz/A) and experimental product (4 oz/A) applied at flag leaf timing were effective in controlling leaf diseases.
- None of the treatments resulted in statistically higher or lower yield and test weight compared to untreated.
- Experimental product was more effective when applied at flag leaf stage at the rate of 4 oz/A than other rate and application timing.

## OBJECTIVE

Objective of this study was to evaluate efficacy of experimental foliar fungicides to control tan spot and Fusarium head blight (FHB) in hard red spring wheat.

## METHODS

**Location:** NDSU Langdon Research Extension Center, Langdon, North Dakota.

**Experimental Design:** Randomized complete block with six replications.

**Previous crop:** Hard red spring wheat.

**Cultivars:** FHB susceptible cultivar 'Samson' used.

**Planting:** 1.2 million pure live seed/A was planted on May 24, 2013. A border plot was planted between treated plots to minimize interference from spray drift.

**Plot size:** Seven rows at six inch spacing. 5 x 20 sq. ft., mowed back to 5 x15 sq. ft.

**Inoculation:** Plots were inoculated by spreading corn spawn inoculum (*Fusarium graminearum*) at around boot stage (Feekes 9-10) at the rate of 286 g/plot. No artificial inoculation was carried out for tan spot or other leaf diseases.

**Fungicide treatments:** Fungicide treatments, their chemistry and application rates and time are listed in Table 1. Fungicides were applied, with CO<sub>2</sub>-pressurized backpack sprayer with three nozzle boom (XR8002), at the water volume of 20 GPA. Broadleaf timing fungicide applications (A) were made at Feekes' growth stage 5 on June 18 (wind westerly, speed five MPH, temperature 69 °F at 10:00 AM). Flag leaf timing fungicide application (B) was made at Feekes 9 on July 03 (wind easterly, speed three MPH, 84 °F at 2:30 PM).

**Disease Assessment:** Leaf disease severity was rated on the day of treatment application 14, 21, 28, 35 and 42 days after treatment application (DAT) of broadleaf timing. Leaf disease severity was rated as percent leaf area showing necrosis or chlorosis. Disease ratings were carried out on samples of 10 top three leaves (three of each flag and flag-1 leaves, and four flag-2 leaves) excluding outer rows. Disease incidence was calculated by counting numbers of symptomatic leaves out of 10 leaves that were rated for severity.

**FHB severity (SEV)** was rated 14, 21 and 28 DAT of flag leaf timing on 17, 24 and 31 July, respectively. FHB head severity was rated using 0-100% scale on arbitrary 25 heads, excluding two outer rows. FHB incidence (INC) was calculated by counting numbers of heads showing FHB symptoms out of 25 heads that were rated for severity. FHB index (I) was calculated using formula  $FHBI = (SEV * INC) / 100$ .

**Harvest:** Plots were harvested 04 September (104 days after planting) with a small plot combine and the yield and test weight determined.

**Table 1. Mean comparison of treatments for FHB incidence (%), FHB head severity (%), FHB index assessed 14, 21, and 28 days after treatment (DAT) of flag leaf timing, yield (bu/A), and test weight (lb/bu).**

TRT #	Treatments <sup>t</sup> (app. Timing)	Rate	21 DAT			28 DAT			Yield (bu/A)	Test Weight (lb/bu)
			FHB INC <sup>v</sup> (%)	FHB SEV <sup>w</sup> (%)	FHB I <sup>x</sup>	FHB INC <sup>v</sup> (%)	FHB SEV <sup>w</sup> (%)	FHB I <sup>x</sup>		
1	Untreated		16.00 a	1.31 a	0.28 a	39.33 a	3.71 a	1.64 a	71.93 ab <sup>u</sup>	60.45 a
2	Expt. Product (A)	2 oz/A	15.33 a	1.21 a	0.31 a	34.00 a	3.23 a	1.20 a	75.06 ab	60.41 a
3	Expt. Product (A)	4 oz/A	12.00 a	0.89 a	0.13 a	33.33 a	2.86 a	1.05 a	71.12 b	60.31 a
4	Expt. Product (A)	5 oz/A	12.67 a	0.98 a	0.18 a	30.22 a	2.59 a	0.90 a	73.66 ab	60.14 a
5	Expt. Product (A)	6 oz/A	8.00 a	0.61 a	0.07 a	32.00 a	3.31 a	1.16 a	77.88 a	60.25 a
6	Propiconazole (A)	4 oz/A	15.33 a	1.21 a	0.22 a	34.67 a	3.87 a	1.49 a	78.34 a	60.52 a
7	Expt. Product (B)	4 oz/A	12.00 a	1.03 a	0.18 a	29.33 a	2.38 a	0.76 a	73.43 ab	60.26 a
8	Quilt (B)	10.5 oz/A	13.33 a	1.20 a	0.24 a	29.33 a	2.79 a	0.85 a	78.28 a	60.08 a
% CV			66.07	74.02	119.20	30.80	44.69	70.62 a	7.87	0.65
Mean			13.08	1.06	0.20	32.78	3.09	1.13	74.96	60.30
Max			16.00	1.31	0.31	39.33	3.87	1.64	78.34	60.52
Min			8.00	0.61	0.07	29.33	2.38	0.76	71.12	60.08

<sup>t</sup> A: Broad leaf timing application, B: Flag leaf timing application

<sup>u</sup> Means with same letter within individual variable (within column) are not significantly different at P≤0.05

<sup>v</sup> FHB INC: Fusarium head blight incidence

<sup>w</sup> FHB SEV: Fusarium head blight severity

<sup>x</sup> FHB I: Fusarium head blight index or field severity

## For further information:

Pravin Gautam, PhD  
Plant Pathologist  
North Dakota State University  
Langdon Research Extension Center  
9280 107th Ave NE  
Langdon, ND 58249  
Ph: 701-256-2582

Email: [pravin.gautam@ndsu.edu](mailto:pravin.gautam@ndsu.edu)

**Data Analysis:** To achieve homoscedasticity following variables were squared root transformed; 21 and 28 DAT FHB Severity, 21 DAT Leaf disease incidence, and 14 and 28 DAT Leaf disease severity. Similarly, 21 DAT FHB Incidence, 21 and 28 DAT FHB Index, 14,35, and 42 DAT Leaf disease incidence, and 21 DAT leaf disease severity were log transformed. Other data were analyzed untransformed. Data were analyzed using the general linear model (GLM) in SAS. Fisher's least significant difference (LSD) were used to compare means at  $P \leq 0.05$ . Actual means are presented in table for simplicity of understanding.

## RESULTS

**Table 2. Mean comparison of treatments for Leaf disease incidence (%) and severity (%) rated 14, 21, 28, 35 and 42 days after treatments (DAT) of broadleaf timing.**

TRT #	Treatments <sup>w</sup> (app. Timing)	Rate	14 DAT <sup>v</sup>		21 DAT		28 DAT		35 DAT		42 DAT	
			INC <sup>y</sup> (%)	SEV <sup>z</sup> (%)	INC <sup>y</sup> (%)	SEV <sup>z</sup> (%)	INC <sup>y</sup> (%)	SEV <sup>z</sup> (%)	INC <sup>y</sup> (%)	SEV <sup>z</sup> (%)	INC <sup>y</sup> (%)	SEV <sup>z</sup> (%)
1	Untreated		38.33 ab <sup>x</sup>	0.65 ab <sup>x</sup>	58.33 a <sup>x</sup>	4.38 a <sup>x</sup>	46.67 ab <sup>x</sup>	5.98 a <sup>x</sup>	51.67 ab <sup>x</sup>	8.10 a <sup>x</sup>	70.00 ab <sup>x</sup>	7.20 ab <sup>x</sup>
2	Expt. Product (A)	2 oz/A	11.67 c	0.17 d	50.00 a	2.75 a	38.33 ab	1.20 c	55.00 a	6.32 ab	66.67 ab	9.15 a
3	Expt. Product (A)	4 oz/A	23.33 ab	0.43 bc	56.67 a	4.28 a	60.00 a	3.17 b	55.00 a	4.90 abc	70.00 ab	7.15 ab
4	Expt. Product (A)	5 oz/A	23.33 abc	0.48 bcd	56.67 a	3.78 a	56.67 a	4.37 ab	38.33 bc	5.48 abc	85.00 a	8.05 ab
5	Expt. Product (A)	6 oz/A	16.67 bc	0.18 cd	60.00 a	4.45 a	53.33 a	3.37 b	45.00 abc	7.53 a	66.67 ab	5.47 ab
6	Propiconazole (A)	4 oz/A	26.67 ab	0.48 bc	51.67 a	2.88 a	50.00 ab	3.77 ab	43.33 abc	5.00 abc	76.67 a	9.50 a
7	Expt. Product (B)	4 oz/A	30.00 ab	0.53 ab	56.67 a	3.22 a	28.33 b	0.98 c	33.33 c	2.00 c	50.00 bc	3.28 b
8	Quilt (B)	10.5 oz/A	43.33 a	0.98 a	53.33 a	4.30 a	30.00 b	0.83 c	31.67 c	2.60 bc	41.67 c	3.65 b
% CV			66.24	82.59	22.01	64.23	46.31	86.44	33.63	72.43	30.51	65.64
Mean			26.67	0.49	55.42	3.76	45.42	2.96	33.56	5.24	65.84	6.68
Max			43.33	0.98	60.00	4.45	60.00	5.98	55.00	8.10	85.00	9.50
Min			11.67	0.17	50.00	2.75	28.33	0.83	31.67	2.00	41.67	3.28

<sup>w</sup> No flag leaf treatment was applied until 14 DAT rating. It was applied on 15 DAT of broadleaf timing. Plot had received flag leaf timing treatment in 21, 28, 35 and 42 DAT ratings.  
<sup>x</sup> A: Broad leaf timing application, B: Flag leaf timing application  
<sup>y</sup> Means with same letter within individual variable (within column) are not significantly different at  $P \leq 0.05$   
<sup>z</sup> INC: Leaf disease incidence  
<sup>v</sup> SEV: Leaf disease severity

Results are presented in Table 1 and 2. No FHB disease was observed on 14 DAT.

**Leaf Disease Incidence:** 14 DAT Incidence was significantly lower in broad leaf timing Experimental product at the rate of 2 oz/A than untreated. Severity on flag leaf timing plots, which did not receive any treatment on 14 DAT ratings, had disease severity similar to untreated. On 21 DAT, none of the treatment differed for incidence. On 28 DAT, none of the treatments resulted in significantly lower incidence than in untreated plots. While flag leaf timing Experimental product (4 oz/A) and Quilt resulted in significantly lower 35 DAT disease incidence, only flag leaf timing Quilt significantly reduced incidence on 42 DAT.

**Leaf Disease Severity:** 14 DAT severity was significantly lower in broadleaf timing Experimental product at the rate of 2 and 6 oz/A and than untreated. No statistical difference in leaf disease severity was observed on 21 DAT. Except broadleaf timing Experimental product (5 oz/A) and Propiconazole, all other treatments resulted in lower 28 DAT disease severity than untreated. However on 35 DAT, disease severity was lower only in flag leaf timing Experiment product (4 oz/A) and Quilt compared to untreated. 42 DAT disease severity was significantly lower than untreated only in flag leaf timing quilt.

**FHB Incidence:** None of the treatments resulted into statistically lower FHB Incidence on 21 and 28 DAT than untreated. However, Experimental product at broad leaf timing at the rate of 6 oz/A had numerically lowest 21 DAT FHB Incidence. 28 DAT FHB Incidence was lowest in Quilt and Experimental product (4 oz/A) applied at flag leaf timing.

**FHB Severity:** None of the treatments resulted in significantly lower 21 and 28 DAT FHB severity than untreated. Similar to FHB Incidence, 21 DAT FHB Severity was numerically lowest in Experimental product (6 oz/A) at broadleaf timing, and 28 DAT FHB Incidence was lowest in Experimental product (4 oz/A) applied at flag leaf timing.

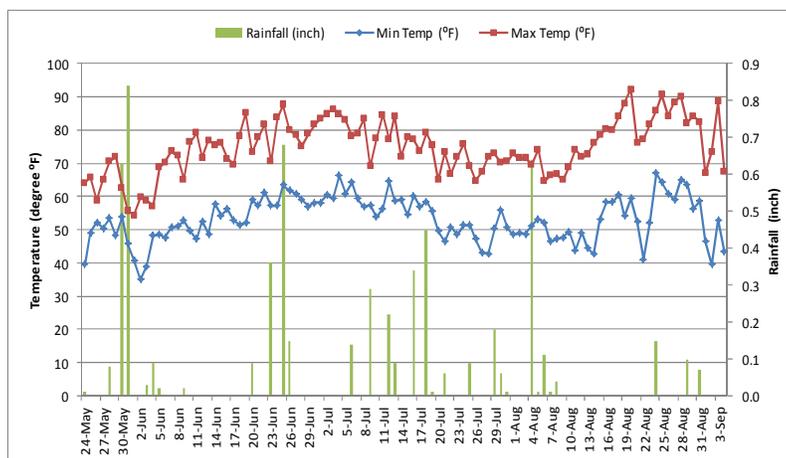
**FHB Index:** Statistically FHB Index in all treatments was similar with untreated on 21 and 28 DAT. Numerically, it was lowest in Experimental product (6 oz/A) applied at broadleaf timing on 21 DAT and 4 oz/A applied at flag leaf timing on 28 DAT.

**Yield:** None of the treatments yield statistically higher or lower yield compared to untreated. However, Experimental product (4 oz/A) at broadleaf timing resulted in significantly lower yield than 6 oz/A at broadleaf timing, Propiconazole and Quilt at flag leaf timing. Except the Experimental product (4 oz/A) at broadleaf timing, all treatments resulted in numerically higher yield by 1.5 - 6.4 bu/A.

**Test Weight:** None of the fungicide resulted in significantly higher or lower test weight than untreated. Numerically, Experimental product (5 oz/A) at broad leaf and Propiconazole at flag leaf timing treatment resulted in the lowest and the highest test weight, respectively.

## ACKNOWLEDGEMENTS

We would like to thank Bryan Hanson, NDSU-LREC for technical assistance and the financial supporter of the study (undisclosed for privacy).



**Daily minimum and maximum temperature, and rainfall recorded in Langdon, ND during planting to harvest of hard red spring wheat in this study.**