EFFECT OF FUNGICIDE AND HOST RESISTANCE ON FUSARIUM HEAD BLIGHT DISEASE DEVELOPMENT AND DON CONTAMINATION IN THREE SOFT RED WINTER WHEAT CULTIVARS IN KENTUCKY, 2009

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As part of the multi-state, National 2009 Uniform Trial for Integrated Control of Fusarium Head Blight (FHB), a test was established to evaluate the benefits of combining host resistance and fungicide treatment for FHB/deoxynivalenol (DON) management. Three soft red winter wheat cultivars ('Coker 9511','Branson' and 'Pioneer 26R15') having partial resistance to FHB were planted no-till following corn harvest on 14 Oct 08 on the Kevil Tract of the University of Kentucky Research and Education Center in Princeton, KY. Wheat strips, consisting of seven, 7-in rows (4.3 ft-wide) were planted at a rate that would achieve a final stand of approximately 36 plants ft^2. Warrior insecticide was applied (3.5 fl oz/A) on 10 Nov 08 and again on 17 Mar 09 (green-up) to reduce the potential for barley yellow dwarf. Liquid nitrogen (28-0-0) was applied in a February/March split application at a rate of approximately 40 and 80 lbs/A on 7 Feb 09 and 23 Mar 09, respectively. Weeds were controlled by applying Harmony Extra herbicide (0.5 fl oz/A) on 17 Mar 09. On 16 Apr 09, strip rows were subdivided into 20-ft plots by application of Round-up herbicide. The experimental design was a split plot randomized complete block with four replications. The main plots were SRWW cultivars and sub-plots were non-treated or application of Prosaro (6.5 fl oz/A + 0.125% Induce v/v) at beginning anthesis (Feeke's stage (F) 10.51). Fungicide treatments were applied with a hand-held CO_2-powered backpack boom sprayer equipped with two Teejet 8002VS nozzles delivering approximately 20 gpa of spray solution at 40 psi. Treatments were applied on 4 May (Coker 9511 and Branson) and 5 May (Pioneer 26R15). Plots were rated for leaf blotch complex (primarily *S. nodorum,* but low levels of speckled leaf blotch [*Septoria tritici*] and tan spot [*Pyrenophora tritici-repentis*] were also present) at late-milk stage (F11.1) on 28 May 09. Foliar ratings were made by visually estimating the percentage of leaf surface area diseased for flag and flag-1 leaves of 10 arbitrarily selected plants per plot. FHB and glume blotch (*S. nodorum)* assessments were made in the laboratory by visually estimating the severity of each disease on 100 heads arbitrarily collected from plots on 27 May 09. Glume blotch severity was determined by visually estimating the percent surface area diseased per spike. FHB severity was estimated by counting the no. of infected spikelets per spike and dividing by the mean number of total spikelets of 10 arbitrarily-selected spikes per given cultivar (i.e. 100% of spike surface area) and multiplying by 100. Entire plots were harvested on 25 Jun 09 using a Wintersteiger small plot combine. Yields

were adjusted to 13.5% moisture and 60 lb/bu. A hand-cleaned, 25-g grain sample from each treatment plot was assessed for Fusarium damaged kernels (FDK) using an air separation technique and submitted to the University of Minnesota, DON Analysis Laboratory, St. Paul, MN for DON analysis. Percentage data were arcsine transformed prior to analysis using ANOVA and Least Significant Difference test ($P \leq 0.05$). Although statistics provided are based on transformed data, arithmetic means are presented in order to provide a better indication of the level of disease control provided by each treatment, as well as the overall disease pressure in the trial.

Wet weather coincided with the onset of anthesis, making conditions highly favorable for FHB and leaf blotch complex; however, glume blotch, FDK and DON levels were lower than anticipated most likely as a result of dry conditions during the later stages of grain fill. Glume blotch and FDK values are not presented due to extremely low levels. Many main effects and interactions were significant ($P \leq 0.05$) (Table 1.) For the three cultivars evaluated, Prosaro-treated plots had significantly less leaf blotch (flag-1 leaf) than the non-treated plots (Table 2). However leaf blotch severity was significantly greater on the flag-1 leaf of Prosaro-treated Coker 9511 than on Prosaro-treated plots of either Pioneer 26R15 or Branson. This is presumably due to greater susceptibility of Coker 9511 to leaf blotch complex. Treatment with Prosaro resulted in significantly lower FHB index for Pioneer 26R15 and Branson, but not for Coker 9511. Prosaro significantly reduced DON levels in each cultivar, but the treatment response was the least for Coker 9511 because of the reduced potential for DON to accumulate in this cultivar (Table 3). Yield and test weight were significantly increased following Prosaro treatment for Pioneer 26R15 and Branson, but not for Coker 9511. Although FHB was significantly reduced when Coker 9511 was treated with Prosaro at F10.51 this treatment did not provide adequate control of leaf blotch complex. Consequently, yields were reduced similarly in both Prosaro-treated and non-treated plots of Coker 9511. Across cultivars, Prosaro significantly reduced the level of leaf blotch (flag leaf) by 14%, and FHB incidence and severity by 13% and 7%, respectively, when compared to the non-treated plots. No phytotoxicity was noted in the test.

Table 1. Significance of *F* value from analysis of variance for leaf blotch, Fusarium head blight (FHB), deoxynivalenol contamination, yield and test weight for three soft red winter wheat cultivars varying in susceptibility to FHB, left untreated or treated with Prosaro (6.5 fl oz/A + 0.125% Induce v/v) at beginning anthesis (Feeke's stage 10.51).

Source of		Leaf blotch[y]		Fusarium head blight			DON[u]	Yield[t]	Test weight
Variation[z]	DF	Flag	F-1	Inc.[x]	Sev.[w]	Index[v]			
Cultivar (cv)	2	0.0439	0.0014	0.0037	0.0282	0.0015	0.0003	0.0614	<.0001
Treatment (t)	1	<.0001	<.0001	<.0001	0.0069	<.0001	<.0001	0.0004	<.0001
CV X T	2	0.7036	0.0244	0.0641	0.5781	0.0422	0.0022	0.0387	0.0004

[z]Rep*cultivar was used as an error term in the *F* Test.
[y]Percent of leaf area affected by leaf blotch, primarily *S. nodorum*, was visually estimated on flag and flag-1 leaves of 20 plants per plot.
[x]Fusarium head blight incidence was based on visual estimation of infected spikelets on 100 heads, rated under laboratory conditions.
[w]Fusarium head blight severity was estimated by counting the no. of infected spikelets per spike and dividing by the mean number of total spikelets of 10 arbitrarily selected spikes per given cultivar (i.e. 100% of spike surface area) and multiplying by 100.
[v]Fusarium head blight index = (% incidence x % severity)/100.
[u]Deoxynivalenol (DON).
[t]Based on 13.5% moisture and 60 lb/bu.

Table 2. Effect of fungicide treatment and cultivar on leaf blotch and Fusarium Head Blight (FHB) index.

	Leaf blotch[z] Flag-1 (%)			Fusarium Head Blight Index[y] (%)		
Cultivar	T[x]	NT[w]	Difference	T	NT	Difference
Coker 9511	77.6a[v]	93.8a	-16.2*[u]	0.4b	1.7b	-1.3NS[t]
Pioneer 26R15	38.3b	81.6b	-43.3*	0.5b	5.0a	-4.5*
Branson	36.2b	84.5ab	-48.3*	2.2a	5.5a	-3.3*

[z]Percentage of leaf blotch, primarily *S. nodorum*, was visually estimated on flag-1 leaves of 10 plants per plot.
[y]Fusarium head blight disease ratings were based on visual estimation of infected spikelets on 100 heads rated under laboratory conditions. Fusarium head blight index = (% incidence x % severity)/100. Fusarium head blight severity was estimated by counting the no. of infected spikelets per spike and dividing by the mean number of total spikelets of 10 arbitrarily selected spikes per given cultivar (i.e. 100% of spike surface area) and multiplying by 100.
[x]Fungicide Treatment, Prosaro 6.5 fl oz + Induce 0.125% at F10.51 on 4 May for Coker 9511 and Branson; 5 May for Pioneer 26R15.
[w]Non-treated control.
[v]All values are averages of four replications. Means in a column followed by the same letter are not significantly different, Least Significant Difference test ($P \leq 0.05$).
[u]*Denotes significance among treatment means within each cultivar, LSD $P \leq 0.05$.
[t]NS = No significant difference ($P \leq 0.05$).

Table 3. Effect of fungicide treatment and cultivar on DON level, yield and test weight.

	DON[z] (ppm)			Yield (bu/A)[y]			Test Weight (lb/bu)		
Cultivar	T[x]	NT[w]	Difference	T	NT	Difference	T	NT	Difference
Coker 9511	0.37b	0.63c[v]	-0.26*[u]	95.6b	92.5a	3.1NS[t]	61.1a	60.1a	1.0NS
Pioneer 26R15	0.76a	1.98a	-1.22*	107.7a	95.8a	11.9*	54.1b	49.2b	4.9*
Branson	0.56ab	1.48b	-0.92*	110.6a	91.5a	19.1*	55.1b	49.4b	5.7*

[z]Deoxynivalenol (DON).
[y]Based on 13.5% moisture and 60 lb/bu.
[x]Fungicide treatment, Prosaro 6.5 fl oz + Induce 0.125% at F10.51 on 4 May for Coker 9511 and Branson; 5 May for Pioneer 26R15.
[w]Non-treated control.
[v]All values are averages of four replications. Means in a column followed by the same letter are not significantly different, Least Significant Difference test ($P \leq 0.05$).
[u]*Denotes significance among the treatment means within each cultivar, LSD $P \leq 0.05$.
[t]NS = No significant difference ($P \leq 0.05$).