EFFECT OF FUNGICIDE AND TIMING OF APPLICATION ON DISEASE DEVELOPMENT, GRAIN YIELD, FUSARIUM DAMAGED KERNELS, DEOXYNIVALENOL CONTAMINATION, AND TEST WEIGHT OF A SOFT RED WINTER WHEAT CULTIVAR IN KENTUCKY, 2009

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The soft red winter wheat cultivar 'Cumberland' was planted with a no-till planter following corn harvest on 22 Oct 08 on the Kevil Tract of the University of Kentucky Research and Education Center in Princeton, KY. Wheat strips were planted at a rate that would achieve a final stand of approximately 36 plants ft^2 and consisted of seven rows on 7-inch spacing. Warrior insecticide was applied at 3.5 fl oz/A on 10 Nov 08 and again at crop green-up on 17 Mar 09 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 0.5 fl oz/A Harmony Extra herbicide on 17 Mar 09. The strip rows were 4.3-ft wide and were subdivided into 25-ft plots which were trimmed to 20-ft by application of Round-up herbicide on 16 Apr 09. The experimental design was a randomized complete block with five replications. Fungicide treatments were applied with a hand-held CO_2-powered backpack sprayer boom equipped with two Teejet 8002VS nozzles delivering approximately 20 gpa of spray solution (40 psi). Treatments were applied on 22 Apr, 1 May, 8 May, and 11 May corresponding to Feeke's (F) growth stage 8, F10.1-3, F10.51 and F10.52, respectively. Macroconidia of multiple isolates of *F. graminearum,* causal agent of Fusarium head blight (FHB), were produced on mung bean agar. Macroconidial inoculum was applied to plots (100,000 spores/ml + 0.33% Tween 20 v/v) at anthesis on 8 May (8 hours after the F10.51 fungicide application) using a hand-held CO_2-powered backpack sprayer boom equipped with four Teejet 8004VS nozzles in two, dual-swivel nozzle bodies, delivering approximately 10 ml/ft^2 of solution (40 psi). Plots were rated for leaf blotch and leaf rust at the late-milk stage (F11.1) on 2 Jun 09. Ratings were made based on a visual estimation of the percent leaf surface area diseased on flag and flag-1 leaves of 10 arbitrarily-selected plants per plot. FHB assessments were made in the laboratory on 50 arbitrarily selected heads per plot which had been hand-harvested from plot centers on 1 Jun 09, bagged and frozen. FHB severity was calculated by counting the no. of infected spikelets/spike and dividing by the mean number of total spikelets of 10 arbitrarily-selected spikes (i.e. 100% of spike surface area) and multiplying by 100. Plots were harvested 25 Jun 09 using a Wintersteiger small plot combine. Yields were adjusted to 13.5% moisture and 60 lb/bu test weight. A 25-g grain sample from each treatment plot was assessed for

Fusarium damaged kernels (FDK) by air separation and submitted the University of Minnesota, St. Paul, MN for deoxynivalenol (DON) analysis. Percentage data were arcsine transformed prior to analysis using ANOVA and Student-Newman-Keuls 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. One purpose for conducting this test was to determine if the strobilurin-based treatments (Headline, Stratego) increase DON compared to a triazole (Prosaro), and if so, at what stage of application this increase occurs.

Conditions in the test were highly favorable for FHB and the leaf blotch development. Inoculating plots with macroconidia at the onset of anthesis more than doubled the amount of FHB and DON compared to the non-inoculated control. Significant differences were observed among treatments for all the variables evaluated, except for FDK. Surprisingly, all fungicides applied at each growth stage, significantly reduced leaf blotch on the f and f-1 leaves compared to the non-treated control. Performance, however, varied according to time of application and fungicide. With one exception (Prosaro applied at F10.52) numerical yield gains associated with treatments were not significantly different from the control unless significant FHB suppression was also achieved. The only treatment that provided significant suppression of FHB in the test was Prosaro applied at F10.51. No treatments significantly lowered DON compared to the control, but Prosaro applied at F10.51 did reduce DON by more than 2 ppm. Similarly, no treatments significantly increased DON compared to the control, but there was a trend towards substantially higher numerical levels associated with application of Headline at F10.1-3 (+4.6 ppm) and 10.5-2 (+3.7 ppm). No phytotoxicity was noted in the test.

	Leaf blotch[x]		Leaf rust[w]	Fusarium head blight			FDK[s]	DON[r]	Yield[q]	Test weight
Treatment, rate/A[z], and growth stage applied[y]	Flag (%)	F-1 (%)	Flag (%)	Inc.[v] (%)	Sev.[u] (%)	Index[t] (%)	(%)	(ppm)	(bu/A)	(lb/bu)
Non-treated, inoculated[p]...	54.0a[o]	100.0a	5.3a	87.2a-c	35.6a-c	31.4a-d	8.9 NS[n]	7.2a-c	70.3c	47.6d
Headline 6 fl oz F8……..	3.3b-d	76.7bc	2.3b	84.4a-c	33.0a-c	28.8a-d	7.9	8.3a-c	72.3bc	49.4cd
Prosaro 6.5 fl oz F8…….	3.7b-d	29.6g	0.7d	94.4a	41.1a	38.8a	11.3	9.2a-c	72.2bc	47.4d
Stratego 10 fl oz F8…….	4.9bc	63.2c-f	1.9bc	84.4a-c	33.8a-c	29.6a-d	10.0	8.4a-c	69.3c	49.2cd
Headline 6 fl oz F10.1-3..	3.7b-d	75.5c	0.0e	91.6a	37.5ab	34.3ab	10.7	11.8a	77.1a-c	47.6d
Prosaro 6.5 fl oz F10.1-3..	0.9de	50.1ef	0.0e	91.0ab	34.7a-c	31.7a-d	5.6	8.2a-c	78.0a-c	49.0cd
Stratego 10 fl oz F10.1-3..	2.4b-e	79.7bc	1.0d	85.5a-c	34.0a-c	29.6a-d	8.7	8.0a-c	75.7bc	48.4cd
Headline 6 fl oz F10.51…	3.2b-e	74.8c	0.0e	83.5a-c	30.1b-d	25.8b-d	12.5	10.9ab	78.4a-c	49.4cd
Prosaro 6.5 fl oz F10.51...	1.5c-e	67.6c-e	0.0e	60.0d	21.5d	12.8e	5.1	5.1c	86.2a	53.6a
Stratego 10 fl oz F10.51...	7.5b	88.2b	1.3cd	90.8ab	36.3a-c	33.1a-c	7.7	9.0a-c	70.1c	47.8d
Headline 6 fl oz F10.52…	2.7b-e	71.0cd	0.0e	78.0c	27.7cd	21.7de	9.3	8.3a-c	78.4a-c	50.9a-c
Prosaro 6.5 fl oz F10.52...	0.3e	53.3d-f	0.0e	77.5c	28.8b-d	22.6cd	6.2	6.8bc	81.1ab	52.8ab
Stratego 10 fl oz F10.52...	0.9de	45.0fg	0.2e	80.0bc	28.4b-d	22.8cd	9.1	8.7a-c	76.9a-c	50.7bc
Non-treated, non-inoculated[m]……	61.3	100.0	5.9	49.6	26.4	13.9	6.2	3.4	77.3	51.2
P-value for F statistic	<.0001	<.0001	<.0001	0.0007	0.0247	0.0026	0.7099	0.4353	0.0499	0.0005
CV (%)	40.40	15.15	41.12	10.53	12.57	16.45	30.52	40.78	10.03	4.23

[z]Induce was added to all fungicide treatments at 0.125% v/v.

[y]Feeke's growth stage (F); Fungicide applications were made 22 Apr, 1 May, 8 May, and 11 May corresponding to F8, F10.1-3, F10.51 and F10.52, respectively.

[x]Percentage of leaf blotch, primarily *S. nodorum*, was visually estimated on flag and flag-1 leaves of 10 plants per plot.

[w]Leaf rust, *P. triticina* was visually estimated on flag leaves of 10 plants per plot.

[v]Fusarium head blight incidence was based on visual estimation of infected spikelets on 50 heads rated under laboratory conditions.

[u]Fusarium head blight severity was calculated by counting the no. of infected spikelets/spike and dividing by the mean number of total spikelets of 10 arbitrarily-selected spikes (i.e. 100% of spike surface area) and multiplying by 100.

[t]Fusarium head blight index = (% incidence x % severity)/100.

[s]Fusarium damaged kernels were assessed by air separation.

[r]Deoxynivalenol (DON).

[q]Based on 13.5% moisture and 60 lbs/bu.

[p]*F. graminearum* macroconidia (100,000 sp/ml + 0.33% Tween 20 v/v) were applied, 10 ml/ft^2 to all plots unless noted otherwise on 8 May (8 hours post fungicide treatment).

[o]Column numbers followed by the same letter are not significantly different, Student-Newman-Keuls test ($P \leq 0.05$).

[n]NS = no significant differences with the column of data.

[m]Indicates natural level of disease pressure. Data from this treatment were not included in statistical analysis.