EVALUATION OF BM 608 ON FUSARIUM HEAD BLIGHT AND FOLIAR LEAF DISEASES OF WINTER WHEAT IN KENTUCKY, 2010.

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The soft red winter wheat cultivar 'Cumberland' was planted with a no-till planter following corn harvest on 19 Oct 09 on the Kevil Tract of the University of Kentucky Research and Education Center in Princeton, KY. Wheat strips (4.3 ft-wide) were planted at a rate that would achieve a final stand of approximately 36 plants ft^2 and consisted of seven rows on 7-in. spacing. Warrior insecticide was applied (3.5 fl oz/A) on 21 Nov 09 and again on 23 Mar 10 at crop green-up to reduce the potential for barley yellow dwarf. Liquid nitrogen (28-0-0) was applied in a February/April split application at a rate of approximately 40 and 80 lbs/A on 20 Feb 10 and 1 Apr 10, respectively. Weeds were controlled by applying Harmony Extra herbicide (0.5 fl oz/A) on 23 Mar 10. On 2 Apr 10, wheat passes were subdivided into 20-ft plots by application of Round-up herbicide. Two separate experiments were established: 1) non-inoculated test, which evaluated the effects of the different treatments under natural disease pressure and 2) test spray-inoculated with macroconida of *Fusarium graminearum* (Fg) at early anthesis (Feeke's (F) growth stage 10.51). The experimental design for each test was a randomized complete block with five and six replications for the non-inoculated and Fg-inoculated tests, respectively. Fungicide treatments were applied to both tests on 3 May at beginning anthesis with a hand-held CO_2-powered backpack boom sprayer equipped with two Teejet 8002VS nozzles and delivering approximately 20 gpa of spray solution at 40 psi. Macroconidia of multiple *F. graminearum* isolates were produced on mung bean agar and sprayed on plots in the inoculated test (100,000 spores/ml + 0.33% Tween 20 v/v) at F10.51 (3 May) approximately 8 hrs after the 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 spore suspension (40 psi). Plots were rated for Stagonospora blotch and leaf rust at the at late-milk/early dough stage (F11.1-2) on 27 and 28 May. Foliar ratings were made by visually estimating the percentage leaf surface area diseased for flag and flag-1 leaves of 10 arbitrarily-selected plants/plot. FHB incidence was based on visual estimation of infected spikelets on a total of 50 spikes/plot at late-milk (F11.1) on 24 to 25 May. In the non-inoculated test, FHB severity was visually estimated at late-milk (F11.1) as a percentage of surface area affected on five arbitrarily-selected spikes/plot on 25 May. In the Fg-inoculated test, FHB severity was determined by counting the number of infected spikelets/spike and dividing by the mean number of total spikelets of 25 arbitrarity-selected spikes (i.e. 100% of spike surface area) and multiplying by 100 at late-milk (F11.1) on 24 May. Plots were harvested on 15 Jun 10 using a Wintersteiger small-plot combine. Yields were adjusted to 13.5% moisture and based on 60 lb/bu. A hand-cleaned, 25-g grain sample from each plot was assessed for kernel health by counting the number of shriveled kernels per 100 kernel sample and submitted to the University of Minnesota, DON Analysis Laboratory, 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.

Natural FHB pressure was low to moderate in the non-inoculated test with mean FHB incidence reaching 16%. FHB incidence was significantly less for plots treated with the BM 608+Prosaro mixture when compared to the non-treated control and solo treatments of BM 608 at either concentration. Prosaro applied alone did not provide significant control of FHB compared to the control. Treatment with the BM 608+Prosaro mixture resulted in the lowest FHB index, but was not significantly less than the non-treated control. No significant differences were observed for any of the treatments for FHB severity, shriveled kernels, or DON. In the Fg-inoculated test, a wet period immediately following inoculation with Fg macroconidia favored infection and resulted in a four-fold increase in FHB incidence compared to non-inoculated plots. FHB levels in the inoculated test (incidence, severity, and index) were reduced significantly for treatments involving Prosaro when compared to the non-treated control, and solo treatments of BM 608 at either concentration. The Prosaro treatments had significantly lower DON and fewer shriveled kernels than the other treatments, although levels were not significantly different from the non-treated control. In both tests, conditions were favorable for development of foliar diseases throughout the month of May (i.e., grain fill period). In both tests, treatments involving Prosaro significantly reduced Stagonospora blotch (flag and flag-1 leaves) and leaf rust (flag leaf) levels when compared to the solo BM 608 treatments and the non-treated controls. BM 608 did not provide control of FHB or DON when applied alone, at either concentration, in either test. Similarly the material did not substantially enhance control of FHB, DON, or foliar diseases when applied as a mixture with Prosaro. However, a slight reduction of Stagonospora leaf blotch was associated with the low rate of BM 608 in the non-inoculated test. In the Fg-inoculated test, the high rate of BM 608 provided slight control of Stagonospora leaf blotch and leaf rust. Overall, application of Prosaro, with or without BM 608, resulted in the greatest FHB/DON suppression and foliar disease control, and higher yields and test weights compared to the non-treated control. No phytotoxicity was noted in either test.

Treatment, rate/A[z], and growth stage applied[y]	Stagonospora blotch[x] Flag (%)	Stagonospora blotch[x] F-1 (%)	Leaf rust[w] Flag (%)	Fusarium head blight (FHB) Inc.[v] (%)	Fusarium head blight (FHB) Sev.[u] (%)	Fusarium head blight (FHB) Index[t] (%)	SK[s] (%)	DON[r] (ppm)	Yield[q] (bu/A)	Test weight (lb/bu)
Non-Inoculated Test[p]										
Non-treated control…..	16.6a[o]	92.1a	11.9a	14.4a	24.2 NS[n]	3.4ab	10.5 NS	0.7 NS	106.3b	59.5b
BM 608 0.5% (v/v)…...	7.7a	67.8b	6.5a	16.4a	28.4	4.9ab	9.3	0.4	95.2c	59.6b
BM 608 1 % (v/v)…….	7.7a	75.8ab	7.9a	16.4a	35.2	5.4a	11.8	0.5	104.8b	60.7ab
BM 608 0.5% (v/v) + Prosaro 6.5 fl oz……...	0.3b	4.5c	0.0b	6.8b	18.7	1.3b	6.5	0.2	112.6ab	61.2a
Prosaro 6.5 fl oz……...	0.6b	2.8c	0.0b	10.4ab	18.9	2.0ab	6.5	0.3	117.1a	60.5ab
P-value for F statistic	< .0001	< .0001	< .0001	0.0066	0.2535	0.0246	0.1783	0.1311	0.0026	0.0282
CV (%)	45.5	25.8	42.4	18.1	27.8	33.5	21.4	70.0	4.9	1.2
F.graminearum-Inoculated Test[m]										
Non-treated, inoculated control[l].........................	11.5a	79.8a	11.8a	99.3a	48.7a	48.4a	36.5ab	6.9ab	84.4b	56.0NS
BM 608 0.5% (v/v)…...	6.5ab	59.8a	9.2ab	100.0a	54.2a	54.2a	40.0a	7.8a	85.0b	55.9
BM 608 1 % (v/v)…….	2.9b	54.4a	5.9b	100.0a	57.4a	57.4a	45.7a	9.0a	83.7b	53.9
BM 608 0.5% (v/v) + Prosaro 6.5 fl oz……...	0.1c	0.6b	0.0c	59.3b	14.0b	10.0b	26.8b	2.8b	106.5a	57.5
Prosaro 6.5 fl oz……...	0.0c	1.8b	0.0c	60.7b	11.7b	8.9b	26.2b	3.5b	101.7ab	58.4
Non-treated, non-inoculated[k]……………				25.3	5.6	1.5				
P-value for F statistic	< .0001	< .0001	< .0001	< .0001	< .0001	< .0001	0.0008	0.0046	0.0028	0.1325
CV (%)	57.3	36.5	37.4	16.1	19.8	23.6	13.1	48.9	11.6	5.3

[z]Induce was added to all treatments at 0.125% v/v.
[y]Feeke's growth stage (F); Applications were made at F10.51 on 3 May.
[x]Percentage of Stagonospora blotch, primarily *S. nodorum*, was visually estimated on flag and flag-1 leaves of 10 plants per plot at late-milk-early dough stage (F11.1-2) on 27 May and 28 May.
[w]Leaf rust, *P. triticina* was visually estimated on flag leaves of 10 plants per plot at late-milk-early dough stage (F11.1-2) on 27 May and 28 May.
[v]Fusarium head blight incidence was based on visual estimation of infected spikelets on a total of 50 spikes per plot in the non-inoculated test and 25 spikes per plot in the FHB-inoculated test; ratings were made at late-milk (F11.1) on 24 May and 25 May.
[u]Fusarium head blight severity for the non-inoculated test was visually estimated as a percentage of surface area affected on 5 total spikes per plot at late milk (F11.1) on 25 May. FHB severity for the FHB-inoculated test was calculated by counting the no. of infected spikelets/spike and dividing by the mean number of total spikelets (i.e. 100% of spike surface area) and multiplying by 100. Twenty-five spikes per plot were evaluated at late milk (F11.1) on 24 May.
[t]Fusarium head blight index = (% incidence x % severity)/100.
[s]Percentage of shrievled kernels in a 100 kernel grain sample.
[r]Deoxynivalenol (DON).
[q]Based on 13.5% moisture and 60 lbs/bu.
[p]Planted no-till following corn harvest on 19 Oct 09. Disease data are the mean of 5 replications; SK, DON, Yield and Test weight are the mean of 4 replications.
[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]Planted no-till following corn harvest on 19 Oct 09. Data are the means of 6 replications.
[l]*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 3 May (8 hours post fungicide treatment).
[k]Included to indicate natural level of disease pressure. Data from this treatment were not included in statistical analysis.