MANAGEMENT OF FUSARIUM HEAD BLIGHT IN WHEAT USING SELECTED BIOLOGICAL CONTROL AGENTS AND FOLIAR FUNGICIDES, 2001

D.E. Hershman[1], P.R. Bachi[1], D.M. TeKrony[2] and D.A. VanSanford[2]
Department of Plant Pathology[1], University of Kentucky, Princeton, KY 42445 and
Dept. of Agronomy[2], University of Kentucky, Lexington, KY 40546

OBJECTIVES:

To evaluate selected foliar fungicides and biological control agents for potential use in soft red winter wheat Fusarium head blight management programs in Kentucky. Also, to generate data as a cooperator in the 2001National Fusarium head blight Uniform Fungicide and Biocontrol Test.

INTRODUCTION:

Fusarium head blight (FHB) of wheat and barley is a significant disease concern in all wheat and barley producing regions of the United States. Statewide, epidemics in Kentucky are rare, but each year some fields are severely damaged by FHB. Currently, the only options available for the management of FHB are the use of cultural practices that encourage escape from disease. These include the use of multiple planting dates and varieties representing different flowering dates and periods. Moderate resistance is also available in several different wheat varieties, but severe FBH will occur under conditions that favor FHB. Preliminary studies conducted in various states indicate that foliar fungicides (Milus and McMullen, 2000) and biological control agents (BCA's) (Schisler et al, 2000) may be capable of providing safe, effective and economical management of FHB. Nonetheless, specific and consistent data are lacking in regards to which products and rates are most suitable for use in FHB management programs. The National FHB Uniform Fungicide and Biocontrol Test program was established as a means of addressing this deficiency in data. This test involves cooperators at various test locations across the county, the use of a standard set of promising treatments, and a reasonably standardized testing protocol. Each state, including the one in Kentucky during 2001, also evaluate unique treatments of interest locally.

MATERIALS AND METHODS:

The test site was established at the University of Kentucky Research and Education Center in Princeton, KY. The core set of treatments evaluated was determined by collective agreement of the scientists involved in the National FHB Uniform Fungicide and Biocontrol Test. Specific local treatments were also evaluated. Treatments included a variety of foliar fungicides and two BCA's. The test site was planted in a conventionally-tilled seed bed on October 18, 2000 and maintained according to standard crop husbandry

practices for soft red winter wheat production in west Kentucky (Bitzer and Herbek, 1997). The wheat variety planted was 'Clark'; maize was the previous crop grown in the test site.

Plots were inoculated on April 1, 2001 with sterilized, cracked corn infested with a mixture of several highly pathogenic isolates of *Fusarium graminearum*, the primary causal agent of FHB. Test plots were mist-irrigated according to a strict regime in order to encourage the causal fungus to produce infectious spores and infect the test plots. Between inoculation and the onset of flowering, plots were mist-irrigated for two hours daily, between 7pm and 9 pm. Following the onset of flowering, plots were mist-irrigated twice daily from 5-7am and 7-9pm. Fungicides were applied to plots on May 7, 2001 when the crop was in the early flowering. Treatments were applied using a CO^2-propelled plot sprayer delivering at 40 PSI in 18-20 GPA. The spray boom was equipped with twinjet XR8001 nozzles oriented at a 60 degree angle forward and backward. FHB incidence, severity, and field severity data were obtained by collecting and visually rating 100 heads from each test plot. Plots were harvested with a small plot combine and grain yield and test weight where calculated. Deoxynivalenol (DON) levels were determined at the Michigan State University Don Testing Laboratory. Tests for standard germination, percent dead seed, and percent seed infected by Fusaria were conducted at Dr. TeKrony's seed technology laboratory in Lexington, KY. Percent visually scabby kernels (VSK) was determined by segregating healthy from scabby kernels for two sets of 100-seed samples for each treatment replication.

RESULTS AND DISCUSSION:

Overall conditions of the test favored moderate crop yield and significant, but not excessive, FHB pressure. At the first rating date (late milk wheat stage), all treatments except Folicur alone had significantly lower disease incidence than the non-treated check (Table 1). Disease severity and field severity, however, were similar among treatments. By the soft dough stage eight days later, the following treatments had significantly lower disease incidence ratings compared to check plots: Folicur 4.0 fl oz/A, AMS 12619 5.7 fl oz/A, BAS 505 0.2 lb a.i./A, and Tilt 4 fl oz/A plus Quadris 4.11 fl oz/A. Of these treatments, none had significantly lower severity ratings and only the treatments involving AMS 12619 and BAS 505 alone had significantly lower field severity ratings. The only significant yield difference was with the AMS 12619 treatment. In contrast, test weight values were significantly higher than the check for treatments involving Folicur alone, AMS 12619, BAS (0.1 lb. a.i.) + Folicur (2 fl oz) and BAS 500 alone. None of the treatments resulted in significantly reduced percent Fusaria as determined by culturing fungi from surface-sterilized seed (Table 2); lack of significance appeared to be the result of significant variability between treatment replications

treatments. Regarding percent VSK, only AMS 12619 and BAS 505 alone resulted in values significantly below the check. AMS 12619, BAS 505 + Folicur, BAS 505 alone, and the Cornell BCA (TrigoCor 1448) each significantly reduced ppm of DON compared to the check. Standard germination of harvested seed was significantly greater than the check for treatments involving AMS 12619 and BAS 505 alone. Number of dead seed was statistically similar between all treatments.

No fungicide or BCA reduced FHB severity at either rating date. This is consistent with previous studies (McMullin et al, 1999). In our study, AMS 12619 (5.7 fl. oz) + induce (0.125% v/v) was the only treatment that resulted in a significant yield advantage when compared with the check. Foliar and other head diseases were not a factor in this test, so this yield result was apparently directly related to partial control of FBH. Several foliar fungicide treatments, including AMS 12619, suppressed FHB to a moderate extent, reduced DON levels in grain and minimized test weight losses when compared with the check. No treatment provided excellent control of FHB. Seed quality, as indicated by standard germination and percent VSK, was maintained at higher levels in treatments involving AMS 12619 and BAS 500 alone. Other treatments, including both BCA's, had no positive effect on any of the seed quality parameters measured. Overall, the treatment involving AMS 12619 was the most consistent and effective performer across all parameters measured. In contrast, Folicur performed very poorly in this study. Specifically, there was only a slight reduction in FHB incidence (at the early but not late rating date, Table 1) and a higher test weight when compared with the check; other measurements were statistically similar to the check. This is an interesting finding considering that Folicur is usually among the most efficacious fungicides for managing FHB (E. Milus, *personal communication*; McMullin et al, 1999). The two BCA's studied where ineffective across all data sets. The one exception was a significant reduction in DON for the Cornell University BCA, TrigoCor 1448. Similarly, three treatments involving Tilt performed very poorly in the test, with the exception of a significant reduction in FHB incidence when Tilt (4.0 fl oz/A) was mixed with Quadris (4.11 fl oz/A).

Table 1. Effect of various fungicides and BCA's on FHB, yield and test weight.

	Disease Ratings*							
	May 22			May 30				Tst
Treatment and rate/A	**Inc**	**Sev**	**Fld Sev**	**Inc**	**Sev**	**Fld Sev**	**Bu/A****	**Wt**
Non-treated	19.2	12.9	2.4	43.3	43.4	19.0	61.3	55.6
Folicur: 4.0 fl oz + Induce 0.125% v/v	14.3	10.4	1.5	37.1	45.6	16.9	61.6	56.4
AMS 12619 5.7 fl oz + Induce 0.125% v/v	7.3	9.3	0.7	30.3	41.3	12.4	67.7	57.2
BAS 505: 0.1 lb a.i.+ Folicur: 2.0 fl oz + Induce 0.125% v/v	7.5	15.3	0.8	37.4	52.5	19.6	63.7	56.6
BAS 505 0.2 lb a.i. + Induce 0.125% v/v	6.1	24.4	1.3	24.8	48.5	10.8	66.1	57.2
Cornell BCA (TrigoCor 1448)	8.8	13.9	1.1	38.8	52.1	20.1	60.4	55.9
USDA BCA (OH 182.9)	11.9	14.3	1.7	39.5	55.5	22.0	63.2	55.7
Tilt 4 fl oz + Induce 0.125% v/v	9.1	11.3	1.1	42.4	57.8	24.4	60.9	55.5
Tilt 4 fl oz + Quadris 3.42 fl oz + Induce 0.125% v/v	12.8	9.7	1.3	43.6	61.5	26.2	60.4	55.7
Tilt 4 fl oz + Quadris 4.11 fl oz + Induce 0.125% v/v	8.5	18.1	1.5	31.6	59.9	16.8	65.1	56.2
LSD P=0.05	**6.1**	**NS**	**NS**	**5.9**	**6.5**	**5.3**	**6.1**	**0.7**

*Inc = Incidence; Sev = Severity; Fld. Sev = Field Severity. All ratings are based on 100 heads collected and rated at late milk (May 22) and soft dough (May 30) stages. ****** Based on 13% moisture and 60lb/bu test weight.

Table 2. Effect of various fungicides and BCA's on FHB on various seed quality parameters.

Treatment and rate/A	% Fusaria	VSK*	DON (ppm)	Std** Germ	No. Dead Seed
Non-treated	38.0	25.8	5.7	75.2	18.0
Folicur: 4.0 fl oz + Induce 0.125% v/v	39.5	23.8	4.6	76.4	17.3
AMS 12619 5.7 fl oz + Induce 0.125% v/v	24.8	14.8	1.7	84.1	10.4
BAS 505: 0.1 lb a.i.+ Folicur: 2.0 fl oz + Induce 0.125% v/v	33.2	20.0	3.8	77.0	15.6
BAS 505 0.2 lb a.i. + Induce 0.125% v/v	26.4	14.4	3.4	82.5	12.7
Cornell BCA	42.0	24.8	3.5	80.3	14.8
USDA BCA	34.4	23.6	4.7	76.1	16.4
Tilt 4 fl oz Induce 0.125% v/v	33.2	26.8	5.7	77.0	16.3
Tilt 4 fl oz + Quadris 3.42 fl oz + Induce 0.125% v/v	41.2	27.2	6.1	73.5	18.9
Tilt 4 fl oz + Quadris 4.11 fl oz + Induce 0.125% v/v	28.8	21.0	5.5	74.4	18.7
LSD P=0.05	**NS**	**7.9**	**1.8**	**6.2**	**NS**

***** Visually Scabby Kernels: 100 seed per plot were examined twice for scabby kernels and the average was used. ******Percent of seed germinated.

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