Variety and Fungicide Applications on Fusarium Head Blight and Deoxynivalenol in Delaware: A Collaborative Outreach Study

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Introduction:

Soft red winter wheat (SRWW) is an important agricultural crop in the mid-Atlantic region. Results of a recent survey indicate that over 2/3 of growers in Delaware (**Figure 1**) and Maryland have been negatively impacted by Fusarium head blight (FHB) and associated deoxynivalenol (DON) contamination since 2011. Discussions with producers and agricultural industry in the region indicated a need to increase grower awareness and implementation of FHB management practices after a severe outbreak in 2013. Concerns and criticisms of published FHB management research included the use of small, uniform plots and ambiguity in the definition of anthesis, or FGS 10.5.1. An on field FHB study was conducted in 2016 to help address these concerns, as well as provide producers with field level information pertaining to the effectiveness of FHB management practices on yield, FHB, and DON.

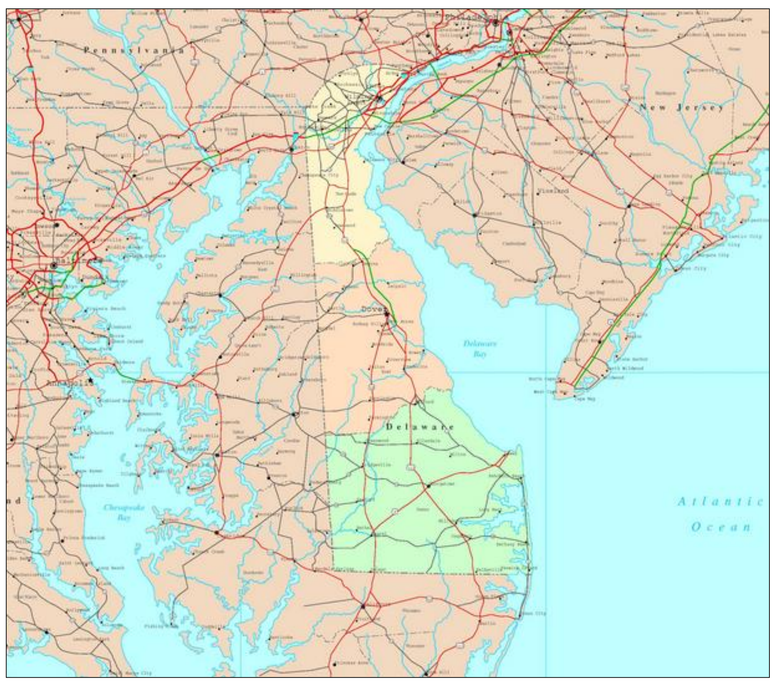

Figure 1. Soft red winter wheat is an important agricultural crop in Delaware, where approximately 60% of available land is used for agricultural production. Production of small grains is difficult in this region due to persistent high humidity resulting from the location of the state between the Chesapeake Bay and Atlantic Ocean, widespread use of no-till agriculture, and extensive corn production. Image from www.yellowmaps.com.

Materials & Methods:

A total of 21 fields located throughout Delaware were included in the 2016 on farm survey/study. At planting, growers indicated the variety planted. Information from the Virginia Tech FHB misted nursery, SCABSMART, and other sources were used to characterize the variety as S, MS, MS/MR, or MR to FHB/DON. Information on preceding crop and maturity were also recorded. Growers applying a fungicide were instructed to do so within the 6 day period from the start of anthesis (FGS 10.5.1), which was defined as the point when 50% heads on main tillers were actively flowering. In some cases, sections of fields were left untreated for direct comparison. These were treated as independent observations for simplicity, resulting in 34 "fields". Approximately 18-20 days after flowering each field was assessed to FHB severity, index, and incidence. To do this, 200 heads were haphazardly collected throughout each field, and rated for visual symptoms of bleaching following standard protocols provided at the USWBSI website. Immediately prior to harvest, 200 heads were haphazardly harvested, threshed, and samples sent for DON analysis at the University of Minnesota. Data were analyzed using ANOVA to analyze the main effects of resistance, fungicide, and preceding crop on measured variables. Incidence, index, and DON were LN transformed prior to analysis. Back transformed data are shown. Results were shared with producers and a 6 question survey was administered to determine the impact and value of the project to producers.

Table 1. Main effects of wheat resistance level to FHB on FHB severity, incidence, index, and DON in 34 SRWW fields in Delaware, 2016. 200 wheat heads were evaluated per field. Different letters within the same variable indicate significant differences using LSD (α=0.05). S = susceptible, MS = moderately susceptible, MS/MR = marginal MR, and MR = moderately resistant

Resistance	Severity (%)	Incidence (%)	Index	DON (ppm)
S	20.4 a	12.1 a	6.1 a	1.75
MS	12.2 b	5.3 ab	4.3 ab	0.66
MS/MR	12.5 b	1.1 b	1.4 b	0.42
MR	5.7 b	3.5 b	0.5 b	0.34
P(F)	<0.0001	<0.05	<0.05	0.17

Table 2. Main effects of fungicide application (Caramba® or Prosaro®) on FHB severity, incidence, index and DON in 34 SRWW fields in Delaware, 2016. Fungicides were applied within 6 days from the start of FGS 10.5.1. Ground rig and aerial application was used. 200 wheat heads were evaluated per field. Different letters within the same variable indicate significant differences using LSD (α=0.05).

Fungicide	Severity (%)	Incidence (%)	Index	DON (ppm)
Yes	9.6 a	0.01 a	1.8 a	0.42 a
No	15.8 b	10.9 b	8.6 b	2.43 b
P(F)	<0.05	<0.0001	<0.0001	<0.001

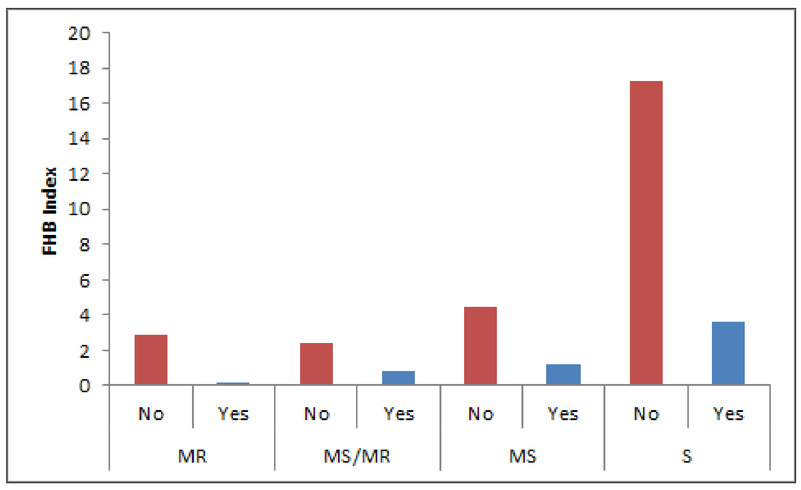

Figure 2. Impacts of variety resistance and fungicide application on FHB index of 34 fields located in Delaware in 2016. Means presented without statistical analysis.

Table 3. Main effects of preceding crop on FHB severity, incidence, and DON in 34 SRWW fields in Delaware, 2016. Fungicides were applied within 6 days from the start of FGS 10.5.1. Ground rig and aerial application was used. 200 wheat heads were evaluated per field. Different letters within the same variable indicate significant differences using LSD (α=0.05).

Preceeding Crop	Severity (%)	Incidence (%)	Index	DON (ppm)
Vegetable	10.4 a	1.0 a	0.05 b	0.14
Soy	9.4 a	1.4 a	0.05 b	0.13
Corn	20.4 b	12 b	4.8 a	1.24
P(F)	<0.01	<0.0001	<0.01	0.23

Results & Discussion

Conditions were favorable for FHB in 2016, with several rain events occurring during the flowering period for most varieties. However, severe FHB was not widespread, even in fields where untreated, FHB susceptible varieties were planted. This may have been a result cool temperatures which persisted through FGS 11.1 or some other factor.

Data were variable, and ranged from 0-59.3% (severity), 0-41.4% (incidence), 0-34.4 (index), and 0-8.8 ppm (DON). Variety resistance to FHB significantly impacted severity, incidence, and index, but not DON (**Table 1**). In all cases, these measured indicators of FHB were significantly lower in moderately resistant (MR) varieties when compared to susceptible (S) varieties. For example, MR varieties reduced FHB index by over 91% compared to susceptible varieties (**Table1**).

Fungicide applications significantly reduced all measured indicators of FHB and DON in this study (**Table 2**). Fungicides reduced index by nearly 80% and DON by 83%. DON levels of untreated fields were slightly over the 2.0 ppm dockage threshold set in the region at 2.43 ppm.

The crop preceding SRWW

Acknowledgements: This work was funded by The United States Wheat and Barley Scab Initiative.