REDUCING FUSARIUM HEAD BLIGHT VOMITOXIN LEVELS THROUGH AGRONOMIC PRACTICES

[1]Katherine Rod, [1*]Carrie Knott, [2]Carl Bradley, and [3]Jordan Shockley
[1]Department of Plant and Soil Sciences, University of Kentucky, Princeton, KY 42445
[2]Department of Plant Pathology, University of Kentucky, Princeton, KY 42445
[3]Department of Ag Economics, University of Kentucky, Lexington, KY 40546
*Corresponding author, PH: (859) 562-1320; Email carrie.knott@uky.edu

Grain quality is a critically important component of profitable wheat production. In general, one of the major quality concerns for soft red winter wheat producers and millers is deoxynivalenol (DON). Deoxynivalenol is a vomitoxin that is produced by *Fusarium graminearum.* In Kentucky, the threat of *F. graminearum* infection is an annual concern.

Current agronomic recommendations to reduce DON contamination in wheat grain include planting a cultivar that is moderately resistant to Fusarium head blight (FHB) along with a fungicide application at beginning flowering (Feekes 10.5.1). The goal of this project is to examine whether additional agronomic practices can reduce DON contamination in harvested grain. These practices include harvesting at an elevated grain moisture (20 to 22% grain moisture), in-furrow phosphorus application at planting (42 lbs P_2O_5 acre^{-1}), and two seeding rates (35 seed ft^{-2} or 56 seeds ft^{-2}).

The objectives of this study are to determine the effect of:

1. Harvesting wheat at different grain moisture contents (20 to 22% versus 13 to 15% grain moisture) on DON contamination, *F. graminearum* infection of healthy wheat kernels, and grain yield;
2. In-furrow phosphorus application at planting (0 lb P_2O_5 acre^{-1} versus 42 lbs P_2O_5 acre^{-1}) on the uniformity of wheat heading (Feekes 10.5) and flowering (Feekes 10.5.1 and 10.5.3), DON contamination, *F. graminearum* infection of healthy wheat kernels, and grain yield
3. Seeding rate (35 pure live seed ft^{-2} versus 56 pure live seed ft^{-2}) on the uniformity of heading and flowering, DON contamination, *F. graminearum* infection of healthy wheat kernels, and grain yield
4. The profitability of these management practices

Fingernail polished used to track heading and flowering growth stages throughout the 2019 growing season.
Photo credit: Carrie Knott

Experimental fields were established in the fall of 2016, 2017, and 2018 at the University of Kentucky's Research and Education Center in Princeton, KY. There were two fields of ambient infection of *F. graminearum* and one field that was inoculated with *F. graminearum*-infested corn kernels. A mist irrigation system was used in the inoculated field to promote Fusarium head blight development. All fields were planted as no-till wheat into corn stubble. In each field, there were two harvest timings, an early (20 to 22% grain moisture) and a normal (13 to 15% grain moisture). Within each harvest timing there were two planting timings, an October and a November. Within the planting and harvest timing combinations there were eight treatments that were replicated five times. Treatments included two cultivars (one with moderate resistance to FHB [Pembroke 2016] and one moderately susceptible to FHB [Pioneer 26R53]), in-furrow phosphorus application (0 lb P_2O_5 acre^{-1} or 42 lbs P_2O_5 acre^{-1}), and two seeding rates (35 pure live seed ft^{-2} or 56 pure live seed ft^{-2}). Wheat harvested at 20 to 22% grain moisture was dried to 12.5% grain moisture with a laboratory-scale thin layer drying system (UKY's Department of Biosystems and Agricultural Engineering).

Fusarium Head Blight Nursery used to promote disease development. Photo Credit: Katherine Rod

A complementary laboratory study was included to determine if harvest timing, in-furrow phosphorus, or seeding rate had an effect on the percentage of healthy looking seeds infected with *F. graminearum*. Twenty seeds from each plot were surface sterilized prior to being plated onto PCNB agar that was used as a selective media for *F. graminearum.* This was replicated six times for every plot. Seeds were surface sterilized before plating. Five days after plating, seed germination and percentage of *F. graminearum* infected seeds were measured. If the seeds were infected with *F. graminearum,* the fungal growth of the mycelia would turn pink on the agar. This experiment will be continued this winter to complete the 2019 harvest data.

Preliminary analyses from the ambient *F. graminearum* fields in 2017 and 2018 found that grain yield was similar when wheat was harvested at 20 to 22% grain moisture (89 bu/A) and at 13 to 15% grain moisture (90 bu/A) when it was planted in October. However, when wheat was planted in November grain harvested at 20 to 22% grain moisture had significantly lower yields (72 bu/A) compared to the 13 to 15% grain moisture harvest timing (82 bu/A). Harvest timing also influenced the percentage of Fusarium damaged kernels (FDK). The early harvest timing (20 to 22% grain moisture) had less FDK (2.8%) than the traditional (13 to 15% grain moisture) harvest timing (4.8%). The early harvest timing also had a lower percentage of healthy-looking kernels infected with *F. graminearum* for both planting dates. In contrast, DON contamination was greater for wheat that was harvested early (20 to 22% grain moisture) than for the traditional harvest (13 to 15% grain moisture) for both the October and November planting dates. The in-furrow phosphorus treatment had no effect on grain yield, test weight, FDK, DON contamination, nor the percentage healthy-looking kernels infected with *F. graminearum*. The inoculated environment showed the same trends at the ambient environment at a higher magnitude. The 2019 data is still being measured and analyzed. Once all data are collected and analyzed the profitability of the additional management practices will be evaluated.

Healthy looking wheat kernels germinating in a petri dish containing selective growth media for *Fusarium graminearum*. The kernels with pink mycelia, fungal growth, are infected with *F. graminearum*. Photo credit: Curtis Bradley