Influence of Fusarium Head Blight Management Practices on Mycotoxins in Wheat Straw

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INTRODUCTION

The effect of foliar fungicides and resistant cultivars have been evaluated for their effects on mycotoxins in grain associated with Fusarium head blight (FHB); however, little is known about how these FHB management practices affect mycotoxins in wheat straw. High mycotoxin levels in wheat straw could be a serious problem for livestock producers who use wheat straw for bedding in their livestock facilities. This could be most detrimental to non-ruminant animals such as swine sows, which can eat 2 to 4 kg of wheat straw bedding per day. The objectives of this research study were to:

1. Evaluate the effect of foliar fungicides on mycotoxin levels in wheat straw.
2. Evaluate the effect of FHB-resistant cultivars on mycotoxin levels in wheat straw.
3. Evaluate the integrated management effects of moderately-resistant cultivar and foliar fungicide on mycotoxin levels in wheat straw.

MATERIALS AND METHODS

Fungicide trials. Fungicide trials were conducted at 4 locations in Illinois (Brownstown, Dixon Springs, Monmouth, and Urbana). The fungicides evaluated were Headline at 0.4 L/ha (pyraclostrobin), Caramba at 1 L/ha (metconazole), Folicur at 0.3 L/ha (tebuconazole), and Prosaro at 0.5 L/ha (tebuconazole + prothioconazole). Headline was applied at Feekes growth stage (FGS) 10.5, and all other fungicides were applied at FGS 10.5.1. The cultivar at each site was Pioneer 25R47, which was planted into corn stubble and mist-irrigated.

Cultivar trial. Twenty cultivars were evaluated in a mist-irrigated FHB nursery in Urbana. These cultivars represent a range of reactions to FHB, from susceptible to moderately-resistant.

Fungicide x cultivar trials. Trials were conducted to evaluate the integrative effects of cultivar x foliar fungicide. A mist-irrigated trial was conducted at Urbana, and trials that relied on natural rainfall were conducted at Dixon Springs, Monmouth, and Urbana. The cultivars Pioneer 25R47 (susceptible) and BW5228 (mod. resistant) were either left non-treated or treated with Prosaro fungicide at FGS 10.5.1.

Wheat straw collection and mycotoxin testing. Immediately after plots from each trial were harvested, standing wheat stems were cut just above the soil surface and trimmed to a length of approximately 25 cm. The stem samples were dried with forced air (32°C) and ground with a mill. Ground stem samples were shipped to the University of Minnesota Mycotoxin Testing Lab (St. Paul, MN), where they were assayed for deoxynivalenol (DON), 3-acetyl-DON (3-ADON), 15-ADON, nivalenol (NIV), and zearalenone (ZEA) levels.

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Fig. 1. Effect of foliar fungicides on DON levels found in wheat straw.

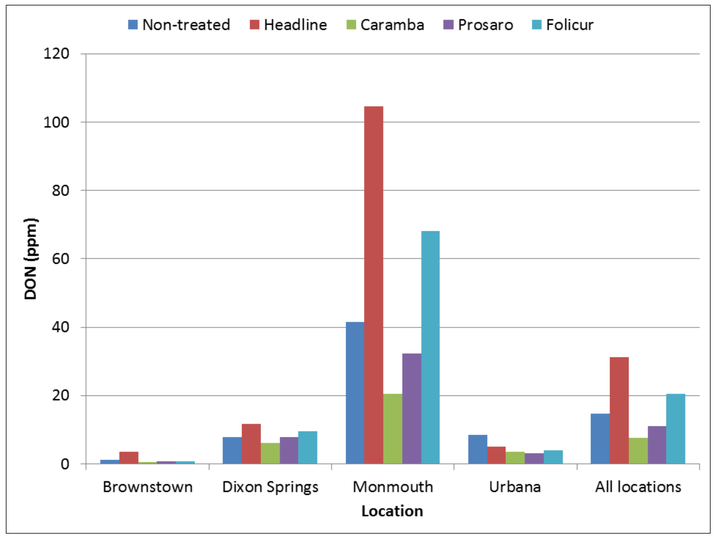


Fig. 2. Effect of wheat cultivar on levels of DON found in straw and grain.

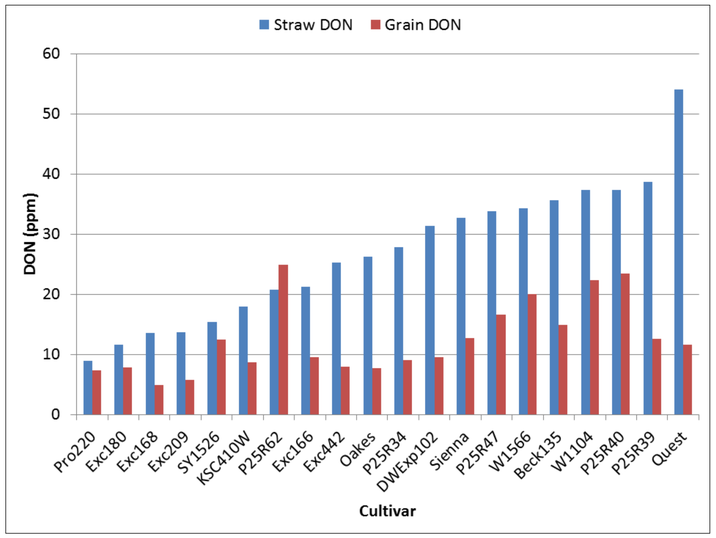


Table 1. Ranges of mycotoxins found in wheat straw in Illinois field research studies.

Mycotoxin	DON	3-ADON	15-ADON	NIV	ZEA
Range (ppm)	0.1 – 104.6	0 – 5.7	0 – 17.8	0 – 1.6	0 – 1.5

RESULTS

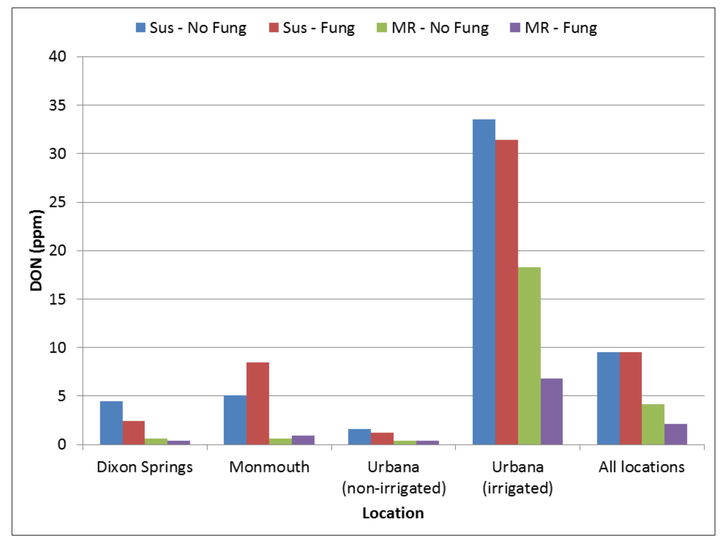
Mycotoxin levels. All five mycotoxins in which straw samples were assayed were found in measurable levels in at least one of the trials. The ranges of their concentrations are shown in Table 1.

Fungicide trials. In general, Headline fungicide increased the level of DON in straw compared to the non-treated control (Fig. 1). Other fungicides had inconsistent effects on DON in straw.

Cultivar trial. Cultivars varied widely in their level of DON in straw (Fig. 2). Cultivar resistance to DON accumulation in grain did not necessarily relate to their level of resistance to DON accumulation in straw, although there was a significant (P = 0.0001) Spearman correlation between grain and straw DON levels (R = 0.50).

Fungicide x cultivar trials. The moderately-resistant cultivar generally had less DON in the straw compared to the susceptible cultivar (Fig. 3). The effect of fungicide on DON in straw was inconsistent.

Fig. 3. Effect of wheat cultivar (susceptible to FHB and moderately resistant to FHB) and foliar fungicide (Prosaro or non-treated) on the level of DON in straw.



CONCLUSIONS:

1. In some cases, mycotoxins were detected at very high levels in wheat straw. This could pose a threat to the livestock industry, and warrants further investigation.
2. Headline fungicide tended to increase DON levels in straw compared to the non-treated control, while other fungicides were inconsistent in their effect on DON levels in straw.
3. Cultivar appeared to have the largest effect in decreasing DON levels in straw, but resistance to DON accumulation in grain did not always relate to resistance to DON accumulation in straw.