Fusarium Head Blight Management Coordinated Project: Uniform Fungicide Trials 2018-2019

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Introduction: Miravis Ace, a new Succinate Dehydrogenase Inhibitor (SDHI; Adepidyn/Pydiflumetofen) + Demethylation Inhibitor (DMI; Propiconazole) premix fungicide, was recently labeled for management of diseases of wheat, barley, and other small grain crops. Preliminary results from a limited number of trials showed that when applied at early anthesis (Feekes 10.5.1) or within the first 6 days after anthesis, Miravis Ace was just as effective as Prosaro and Caramba (2,3,4). However, one of the primary questions being asked about Miravis Ace is whether it is just as effective when applied at Feekes 10.3 (early heading). If it is, this will extend the application window to as many as 10 days, allowing greater flexibility in terms of application timing. In addition, having a new, effective fungicide, particularly one of a different chemistry, and a wider application window creates opportunities for evaluating two-treatment fungicide programs for FHB and DON management. **The objective of this study was to compare the efficacy of Miravis Ace when applied at, before, or after anthesis, or sequentially with a DMI fungicide to that of a standard anthesis-only application of Prosaro or Caramba**.

Materials and Methods: To accomplish the aforementioned objective, field experiments were conducted in 10 US wheat-growing states in 2018 and 2019. The standard protocol consisted of the application of fungicide treatments (**Table 1**) to plots of a susceptible cultivar. The experimental design was a randomized complete block, with at least 4 replicate blocks. In all experiments, plots were artificially inoculated with either *F. graminearum*-colonized grain spawn (5) or a spore suspension of the fungus applied approximately 24-36 h after anthesis. Plots were mist-irrigated during and shortly after anthesis in some experiments to enhance inoculum production and infection. FHB index (IND) was rated or calculated as previously described (1,6) on 60-100 spikes per plot at approximately Feekes growth stage 11.2. Grain was harvested and samples were sent to a USWBSI-supported laboratory for mycotoxin analysis. Linear mixed models (multi-location) were fitted to the pooled arcsine square root-transformed IND and log-transformed DON data to evaluate treatment effects. Overall percent IND and DON control/reduction relative to the check was also estimated as a measure of efficacy.

Table 1. The following treatments were randomly assigned to experimental units. All fungicide treatments were applied along with a nonionic surfactant

Treatment - product, rate and timing	
Core	
1	Untreated check
2	Prosaro at 6.5 fl oz/A at anthesis
3	Caramba at 13.5 fl oz/A at anthesis
4	Miravis Ace at 13.7 fl oz/A at Feekes 10.3
5	Miravis Ace 13.7 fl oz/A at Anthesis
6	Miravis Ace at 13.7 fl. oz. at anthesis followed by Prosaro at 6.5 fl. oz. at 4-6 days after
7	Miravis Ace at 13.7 fl. oz. at anthesis followed by Caramba at 13.5 fl. oz. at 4-6 days after
Optional	
8	Miravis Ace at 13.7 fl. oz. at anthesis followed by tebuconazole at 4 fl. oz. 4-6 days after
9	Miravis Ace at 13.7 fl. oz. at 4-6 days after anthesis
10	Prosaro at 6.5 fl oz at 4-6 days after anthesis

Results and Discussion: Mean Fusarium head blight index (IND) and deoxynivalenol (DON) contamination data from 26 environments (trial x state x year combinations), representing different wheat market classes, are summarized for different fungicide treatments in Figure 1 and 2. Plot-level mean index ranged from 0 to 68% and DON from 0.16 to 39 ppm. For both responses, the nontreated check has the highest over means, whereas treatments that consisted of an early anthesis (Feekes 10.5.1) application of Miravis Ace followed by an application of Prosaro, Caramba, or tebuconazole 4-6 days later had the lowest means (**Fig. 1** and **2**).

FHB index: All treatments resulted in significantly lower mean FHB IND (on the arcsine square root-transformed scale) than the nontreated check. Treatments applied at anthesis reduced mean IND by 51 (Caramba) to 66% (Miravis Ace) relative to the check, whereas those consisting of sequential applications of Miravis Ace and a DMI reduced the mean by 73 (Miravis Ace followed by Prosaro) to 88% (Miravis Ace followed by tebuconazole). Differences between pairs of anthesis-applied (Feekes 10.5.1) treatments were not statistically significant. Similarly, differences between treatments applied at

Feekes 10.5.1 and Miravis Ace applied at early heading were not statistically significant. On the other hand, treatments with sequential applications (Miravis Ace followed by a DMI) resulted in significantly lower mean IND than treatments with a single application.

Deoxynivalenol: All treatments resulted in significantly lower mean DON contamination of grain (on the transformed scale) than the nontreated check. All treatments that included an application at or within the first 6 days after early anthesis resulted in significantly lower mean DON than the early application of Miravis Ace. Among the treatments applied at early anthesis alone, Miravis Ace resulted in the lowest mean DON; differences between pairs of log-transferred means were statistically significant for Miravis Ace vs Prosaro and Miravis Ace vs Caramba. As was the case with IND, treatments with sequential applications (Miravis Ace followed by a DMI) resulted in significantly lower mean DON than treatments with a single application. Anthesis-only treatments reduced DON by 31 to 44% and sequentially applied treatments reduced the toxin by 56%, compared to only 9% with the Feekes 10.3-5 Miravis Ace treatment.

As additional data become available, a more complete set of analyses will be performed. However, the results summarized herein suggest that while a Feekes 10.3-5 application of Miravis Ace may suppress FHB IND to levels comparable to, or even better than, those achieved with an anthesis application, such an early application is considerably less effective than a single anthesis application in terms of DON suppression.

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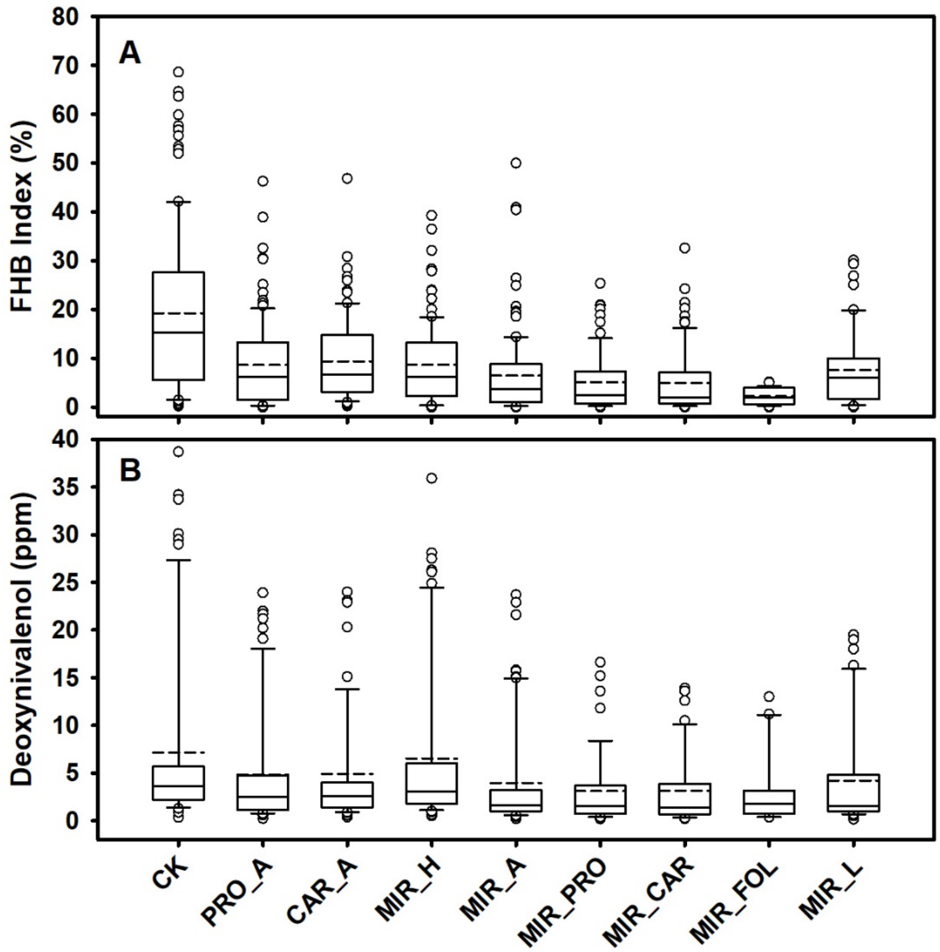

Fig. 1. Boxplots showing the distribution of **A**, mean Fusarium head blight index and **B**, deoxynivalenol grain contamination for different fungicide treatments. **PRO_A** = Prosaro at 6.5 fl. oz applied at anthesis, **CAR_A** = Caramba at 13.5 fl. oz applied at anthesis, **MIR_H** = Miravis Ace at 13.7 fl. oz applied at Feekes 10.3-5, **MIR_A** = Miravis Ace at 13.7 fl. oz applied at anthesis, **MIR_PRO** = Miravis Ace at anthesis followed by Prosaro 4-6 days later, **MIR_CAR** = Miravis Ace at anthesis followed by Caramba 4-6 days later, **MIR_FOL** = Miravis Ace at anthesis followed by Tebuconazole (4 fl. oz) 4-6 days later, and **MIR_L** = Miravis Ace applied at 4-6 days after anthesis.

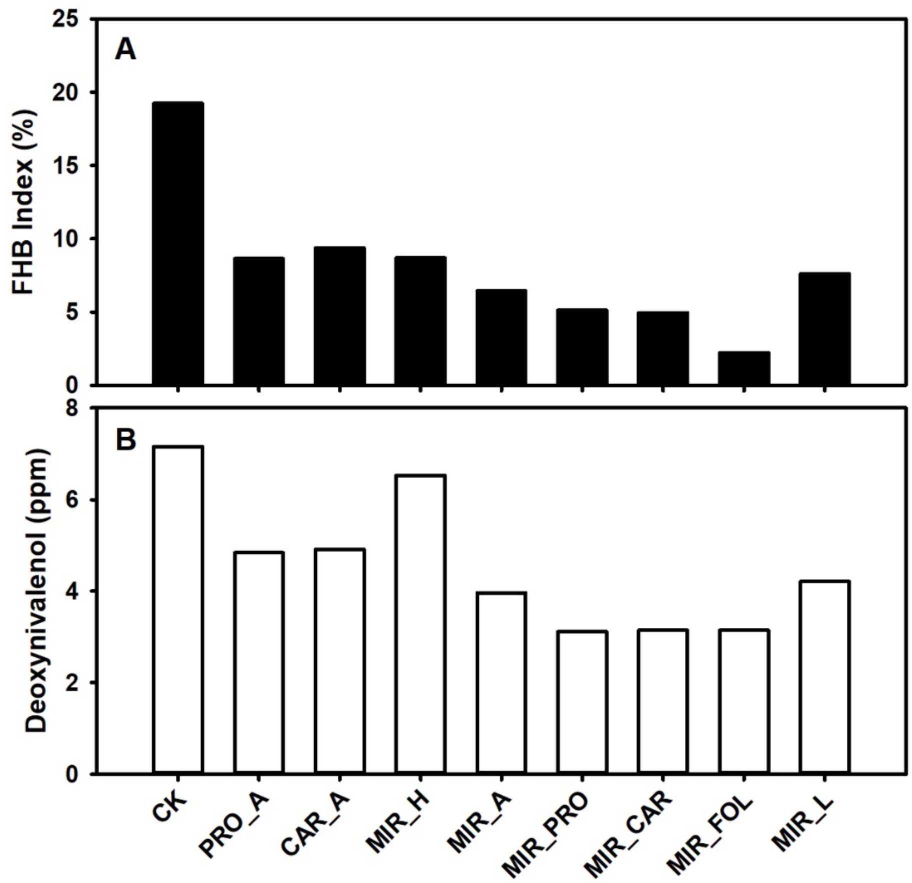

Fig 2. Mean **A**, Fusarium head blight index and **B**, deoxynivalenol grain contamination for different fungicide treatments. **PRO_A** = Prosaro at 6.5 fl. oz applied at anthesis, **CAR_A** = Caramba at 13.5 fl. oz applied at anthesis, **MIR_H** = Miravis Ace at 13.7 fl. oz applied at Feekes 10.3-5, **MIR_A** = Miravis Ace at 13.7 fl. oz applied at anthesis, **MIR_PRO** = Miravis Ace at anthesis followed by Prosaro 4-6 days later, **MIR_CAR** = Miravis Ace at anthesis followed by Caramba 4-6 days later, **MIR_FOL** = Miravis Ace at anthesis followed by Tebuconazole (4 fl. oz) 4-6 days later, and **MIR_L** = Miravis Ace applied at 4-6 days after anthesis.