The Efficacy of Spraying Fungicides to Control Fusarium Head Blight Infection in Spring Malting Barley

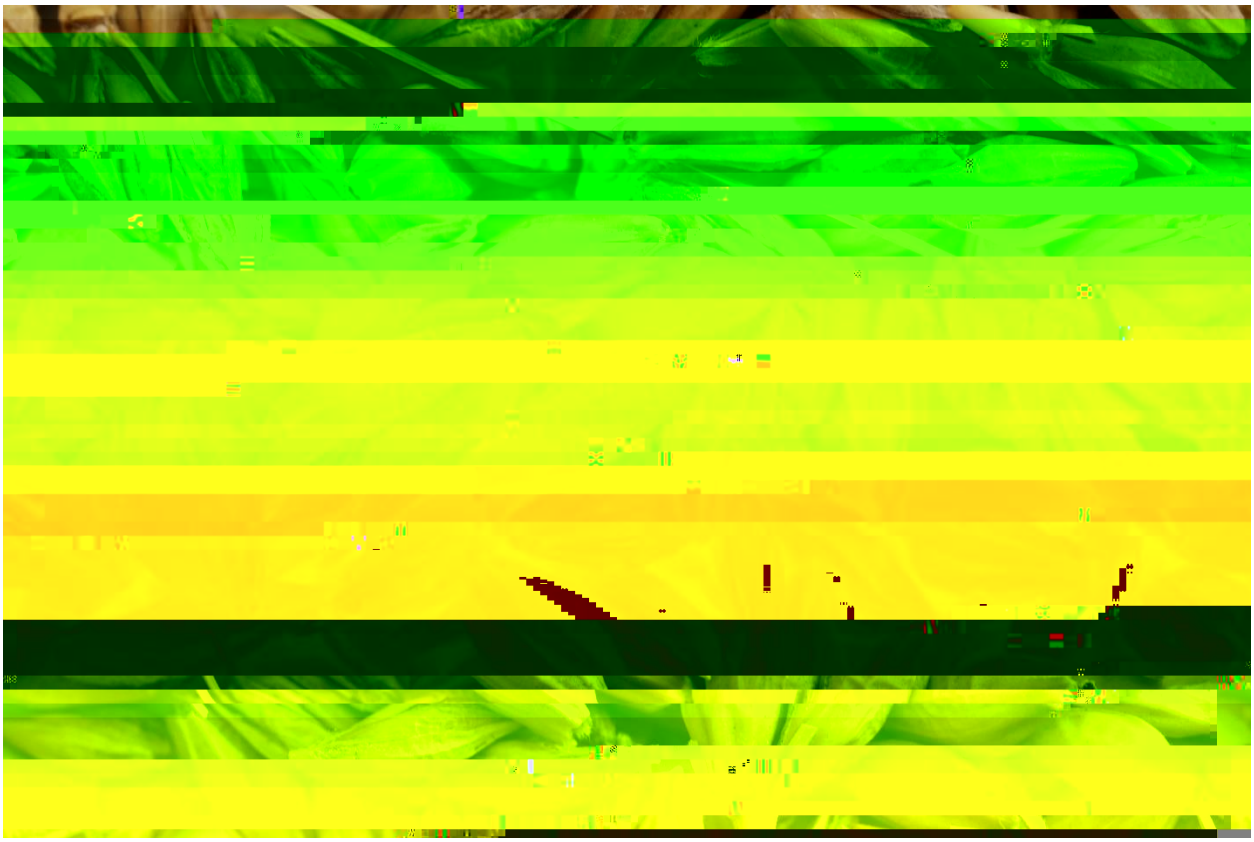

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Table 1. General plot management of the trial, 2019.

Fungicides trialed in the 2019 spring barley fungicide trial included Miravis Ace, Prosaro, Caramba, and ChampION (Tables 2 and 3). Miravis Ace was applied at Feekes stage 10.3 (when the grain head is half-emerged from the sheath), at heading, and at five days past heading. Prosaro was applied at heading. Caramba was applied at heading and at five days post-heading. ChampION was applied at heading, at five days post-heading, and one plot per replicate was treated both at heading and at five days post-heading. Cold and erratic weather in the early growing season resulted in marked differences in maturity between varieties. Each variety was treated as it reached the appropriate state of maturity (Table 2).

Heading date applications were applied when the barley reached 50% spike emergence (Table 2). The adjuvant 'Induce' was added to the Miravis Ace and Caramba applications at a rate of 0.125%. All but one plot (control) in each replicate was inoculated on the same day that the heading treatment was applied, with a spore suspension (40,000 spores/ml) consisting of a mixture of isolates of *Fusarium graminearum* endemic to the area. The control plots were sprayed with water with no *Fusarium* spores. One plot per replicate was inoculated with *Fusarium* but was not treated with a fungicide (*Fusarium* only). Five days after the heading application, plots not previously treated with a fungicide were sprayed with the fungicides treatments except for the control and *Fusarium* only plots (Table 2). The applications were made using a Bellspray Inc. Model T4 backpack sprayer. This model had a carbon dioxide pressurized tank and a four-nozzle boom attachment. It sprayed at a rate of 10 gallons per acre.

Table 2. Treatment Application Dates.

Variety and Treatment	Application Date
Conlon 10.3 Feekes Miravis Ace	22-Jun
Conlon Inoculated with *Fusarium*	24-Jun
Conlon Heading Applications	24-Jun

On 10-Jul, when the barley reached the soft dough growth stage, FHB intensity was assessed by randomly clipping 60-100 heads from each plot, counting spikes, and visually assessing each head for FHB infection. The infection rate was assessed by using the North Dakota State University Extension Service's "A Visual Scale to Estimate Severity of *Fusarium* Head Blight in Wheat" online publication.

Grain plots were harvested with an Almaco SPC50 plot combine on 29-Jul. The harvest area was 5' x 20'. Grain moisture, test weight, and yield were measured at harvest. Harvest moisture and test weight were determined for each plot using a DICKEY-john Mini GAC moisture and test weight meter. Higher test weight in barley is associated with better malting quality. The acceptable test weight for barley is 48 lbs bu^{-1}.

Following harvest, barley was cleaned with a small Clipper cleaner (A.T. Ferrell, Bluffton, IN). A one-pound subsample was collected to determine quality. Approximately 300 g of each sample was ground into flour using the Perten LM3100 Laboratory Mill. Deoxynivalenol (DON) concentrations were analyzed using Veratox DON 2/3 Quantitative test from the NEOGEN Corp. This test has a detection range of 0.5 to 5 ppm. Samples with DON values greater than 1 ppm are considered unsuitable for human consumption by the FDA.

Following is a list of the fungicides and application rates evaluated in this trial (Table 3). Descriptions have been provided from manufacturer information.

Prosaro® (EPA# 264-

Barley Variety x Fungicide+Timing Interactions:

There were no significant interactions between treatment and variety.

Impact of Fungicide and Timing

There were significant differences between treatments for harvest moisture, yield, DON concentrations, FHB severity, and incidence of infected heads (Tables 5 and 6, Figure 1). The *Fusarium* only treatments had the lowest average harvest moisture at 16.8% moisture content. All barley harvested required drying down for storage.

Yields in the spring barley variety trial were all over 3600 lbs ac^{-1}, with an average yield of just over two tons ac^{-1} for the trial. The highest yield by treatment was the Miravis Ace applied five days after heading, at 4460 lbs ac^{-1}

ChampION Post-heading	17.5[abcd]	46.6	3747[c]
Miravis Ace Feekes 10.3	17.2[ab]	47	4415[ab]
Miravis Ace Heading	18.4[cd]	46.8	

trials, including the fungicide trials. The weather remained mild through the rest of growing season and produced high yields of barley at harvest.

All fungicide applications reduced DON concentrations significantly