Field, Cereal, and Forage Crops

Assessment of Fungicides for Control of Barley Head Diseases in Georgetown, DE, 2022

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Fusarium head blight, caused by *Fusarium graminearum*, is a devastating disease of barley in most production regions worldwide. The disease results in yield losses, low seed germination, and contamination of grain by mycotoxins. This report evaluates the efficacy of fungicides for the control of Fusarium head blight in malting barley ‘Violetta’ in Georgetown, Delaware, in 2022. Disease incidence and severity, yield, and deoxynivalenol (DON) levels were evaluated for all treatments. Results from these trials will help advise U.S. barley growers in developing management programs for this disease and should lead to a reduction of yield losses and mycotoxin levels in malting barley.

Keywords: Caramba, Deoxynivalenol, *Fusarium*-damaged kernels, Miravis Ace, Prosaro, Prosaro Pro, Sphaerex, tebuconazole

Malting barley ‘Violetta’ was grown at the University of Delaware Carvel Research and Education Center in Georgetown, Delaware to evaluate the effectiveness of various fungicides for disease control and impact on yield. Barley was planted on 20 October 2021 into corn residue in Rosedale loamy sand. The experimental design was a randomized complete block with five replicates. Trial plots were 22 feet long and 10 feet wide with alleys five feet wide. Production practices outlined by the University of Delaware Cooperative Extension Service were followed.

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Treatments included a non-treated control, five treatments of Prosaro, Caramba, Miravis Ace, Prosaro Pro, and Sphaerex applied at anthesis and three treatments of Miravis Ace applied at anthesis followed by Prosaro Pro, Sphearex, and Tebuconazole applied five days after anthesis. Fungicide treatments were applied at anthesis (Feekes 10.5/Zadoks 59) on 25 April and five days after anthesis (DAA) on 29 April. Applications were made using a CO_2 backpack sprayer equipped with Turbo TwinJet 11002 nozzles calibrated to deliver 20 GPA at 30 psi. In addition to natural inoculum, infested corn spawn was applied to treatment plots at a rate of 1.7 lb/plot on 13 April. Frost damage was evaluated on 19 May by visually rating damage incidence (% damaged heads) and severity (% damaged glumes per head) of 10 randomly selected barley heads. Fusarium head blight (FHB) was evaluated on 19 May by visually rating disease incidence (% heads with symptoms) and severity (% of symptomatic glumes per head) of 20 randomly selected barley heads. Plots were harvested on 21 June and yields were adjusted to 13.5% moisture. Subsamples of grain from each plot were collected for assessment of *Fusarium*-damaged kernels (FDK) and for submission for deoxynivalenol (DON) levels. Disease and yield data were analyzed using ANOVA and means were separated using Fisher's least significant difference ($\alpha = 0.05$).

Environmental conditions were conducive to FHB disease development. A late frost during early heading occurred causing 46-70 percent frost incidence with no difference in incidence or severity across treatments. FHB incidence and severity did not vary significantly among treatments, but there were differences in FDK and DON. Reduced FDK was observed with Miravis Ace applied at anthesis or in combination with any of the 5 DAA applications, Prosaro Pro at anthesis, and Sphaerex at anthesis. All treatments except for Prosaro at anthesis had lower DON than the control. The lowest DON was observed in Miravis Ace at anthesis followed by

Prosaro Pro. Miravis Ace applied at anthesis and Miravis Ace followed by Tebuconazole 5 DAA had significantly increased yields compared to the control. Phytotoxicity was not observed in any treatment (Supplementary Table S1).

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Evaluation of Fungicide Standards for Cotton Disease Control in Central Alabama, 2022

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Areolate mildew, caused by *Ramularia gossypii*, and target spot, caused by *Corynespora cassiicola*, are increasingly causing substantial losses of cotton throughout the southeastern United States. The diseases often occur simultaneously as similar environmental conditions favor their development. This report evaluates the efficacy of 10 conventional fungicide programs for the management of areolate mildew and target spot on cotton (*Gossypium hirsutum* 'Deltapine 1646 B2XF'). The trial was conducted in 2022 at a research field with a cotton-soybean rotation in Shorter, Alabama. Defoliation caused by areolate mildew and target spot, boll counts, and yield were determined for each treatment. Results from this study will help inform cotton producers in developing fungicide programs for these two devastating diseases.

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Keywords: Miravis Top, Priaxor, Revytek

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One fungicide trial consisting of ten different fungicide spray programs using 'Deltapine 1646 B2XF' was planted on 20 May at the E.V. Smith Research Center- Field Crops Unit in

Shorter, AL in a field with a cotton-soybean rotation at a rate of approximately 2 seed/row ft. Recommendations of the Alabama Cooperative Extension System for tillage, fertility, weed, and nematode control were followed. The experimental design was a randomized complete block with four replications. Individual plots consisted of four 30 ft rows spaced 3 ft apart. Fungicide programs were broadcast with a high clearance sprayer on 20 July (1st week of bloom), 3 August (3rd week of bloom), and 16 August (5th week of bloom) with AITTJ60-11002VP nozzles on 18 in. centers using 15 gal/A of spray volume at 40 psi. Areolate mildew and target spot severity were assessed on 17 September using a 1 to 10 leaf spot scoring system where 1 = no disease, 2 = very few lesions in canopy, 3 = few lesions noticed in lower and upper canopy, 4 = some lesions seen and < 10% defoliation, 5 = lesions noticeable and < 25% defoliation, 6 = lesions numerous and < 50% defoliation, 7 = lesions very numerous and < 75% defoliation, 8 = numerous lesions on few remaining leaves and <90% defoliation, 9 = very few remaining leaves covered with lesions and < 95% defoliation, and 10 = plants defoliated. Defoliation values for areolate mildew and target spot were calculated separately using the formula [% Defoliation = 100/(1 + e(-(disease score - 6.0672)/0.7975)]. Cotton growth was managed with a 10 August application of 1 pt/A Potenza. Cotton was prepared for harvest with a 19 September application of Ginstar EC at 1 pt/A + 8 oz/A Boll'd fl oz/A and 3 October application of DFT 6 EC at 2 pt/A + Aim EC at 1.5 oz/A. Cotton was mechanically harvested on 24 October. Significance of interactions was assessed using the PROC GLIMMIX procedure in SAS [SAS Institute, Cary, NC]. Statistical analyses were calculated on rank transformation for non-normal data for areolate mildew and target spot defoliation (%), boll counts, and yield. Non-transformed data are reported. Means were separated using Fisher's protected least significant difference (LSD) test ($P < 0.05$).

During the 2022 production season, temperatures were near yearly norms during June, July, August, September, and October while monthly rainfall totals were at or above yearly norms during June, July, August, September, and October. Overall, both areolate mildew and target spot pressure were moderate in this trial as demonstrated by the nontreated controls (Supplementary Table S1). All fungicide spray programs, except for Miravis Top at 13.6 fl oz applied at the 5th week of bloom, significantly reduced areolate mildew severity when compared to the nontreated control; however, no significant differences were observed in target spot severity, boll counts, or cotton yield.

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Tree Fruits, Small Fruits, and Nuts

Evaluation of Bactericide Programs for the Management of Fire Blight on 'Empire' Apples in New York, 2020

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Fire blight, caused by the bacterial pathogen *Erwinia amylovora*, is a threat to pome fruit production worldwide. *E. amylovora* can infect blossoms, vegetative shoots, woody tissues, and rootstock crowns. The blossom blight stage of the disease can lead to current season yield losses, whereas systemic infection may ultimately result in tree death. This report evaluates conventional antibiotics, biopesticides, and SAR inducers for the management of blossom blight and shoot blight. The trial was conducted in 2020 on 22-year-old *Malus domestica* 'Empire' trees on M.9/M.111 interstem rootstocks. Results from these trials should advise organic and conventional U.S. apple producers in developing blossom blight and shoot blight management programs.

Keywords: Actigard, Alum, Apogee, Blossom Protect, Buffer Protect, Cinnerate, Cueva, Double Nickel, LifeGard, FireLine, FireWall, Kasumin, Prophyt, Regulaid, Serenade Optimum, Vacciplant

A trial was conducted at Cornell AgriTech in Geneva, NY to evaluate the effectiveness of bactericide programs for the management of blossom blight and shoot blight on apple (Ayer et al. 2019, 2020). The orchard site is a planting of 22-yr-old 'Empire' trees on M.9/M.111 interstem rootstocks. Treatments were applied using a gas-powered backpack sprayer calibrated to deliver

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References are not recommended but can be included to cite a method.

100 gal/A (0.5 gal/tree) at the following timings: “tight cluster” (29 April), “full pink” (7 May), 40% bloom (16 May), 80% bloom (20 May), full bloom/petal fall (22 May), petal fall/early terminal shoot growth (29 May), active terminal shoot growth (5 June). Applications of systemic acquired resistance inducers (SAR) were made both prior to and during terminal elongation to manage shoot blight. Bloom began on 8 May and trees progressed from 40% bloom (16 May) to full bloom/petal fall (22 May) with daily temperature highs ranging from 45°F to 85°F. Trees were inoculated at 80 to 90% bloom (21 May) with *Erwinia amylovora* strain Ea 273 at 1×10^6 CFU ml^{-1} using a hand-pumped Solo backpack sprayer. Blossom blight and shoot blight symptoms were assessed on blossom clusters and terminal shoots on 7 June and 19 June, respectively. The incidence of blossom blight was expressed as the number of blighted blossom clusters out of five clusters with 20 cluster assessments for four replicate trees per treatment. Shoot blight was assessed as the percentage of terminal shoots with discoloration or ooze out of the total number of shoots for four replicate trees. The incidence of chemical injury in the form of russeting on fruit was calculated from the number of fruit with russeting out of five randomly collected fruit. Ten fruit collections were evaluated for each of four treatment replications. Disease incidence and chemical injury data were subjected to analysis of variance (ANOVA) for a randomized block design using accepted statistical procedures and software (i.e. Generalized Linear Mixed Models (GLIMMIX)) procedure of SAS (version 9.4; SAS Institute Inc., Cary, NC). All percentage data were subjected to arcsine square root transformation prior to analysis.

The incidence of blighted blossom clusters ranged from 2 to 88%, and the incidence of blighted shoots ranged from 1 to 54.7% in all treatments. While fire blight pressure was higher in 2020 than 2019 and 2018 due to warmer bloom time temperatures, most treatment programs still resulted in less than 30% incidence of blossom blight. All programs provided still more than 70% control of blossom blight. The programs focusing on excluding the pathogen or impeding invasion of tissues (e.g. Blossom Protect and Apogee) provided the highest levels of control. Similar trends were observed for the incidence of shoot blight, which developed from blossom blight infections. None of the fire blight management programs resulted in any fruit finish damage in the form of russeting (Supplementary Table S1).

References

Ayer, K. M., Choi, M.-W, and Cox, K. D. 2020. Evaluation of bactericide programs for the management of fire blight on 'Gala' apples in NY, 2019. Plant Dis. Manag. Rep. 14:PF020.

Ayer, K. M., Cox, K. D., and Choi, M.-W. 2019. Evaluation of bactericide programs for the management of fire blight on 'Gala' apples in NY, 2018. Plant Dis. Manag. Rep. 13:PF002.

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