Ohio State University Extension

CORN HYBRID RESISTANCE SCREENING FOR DEOXYNIVALENOL IN SILAGE AND GRAIN

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Objective

- Evaluate if hybrid resistance could affect the concentration of Deoxynivalenol in corn silage.
- Evaluate the difference between corn hybrids in Deoxynivalenol, mycotoxin contamination.

Materials and methods

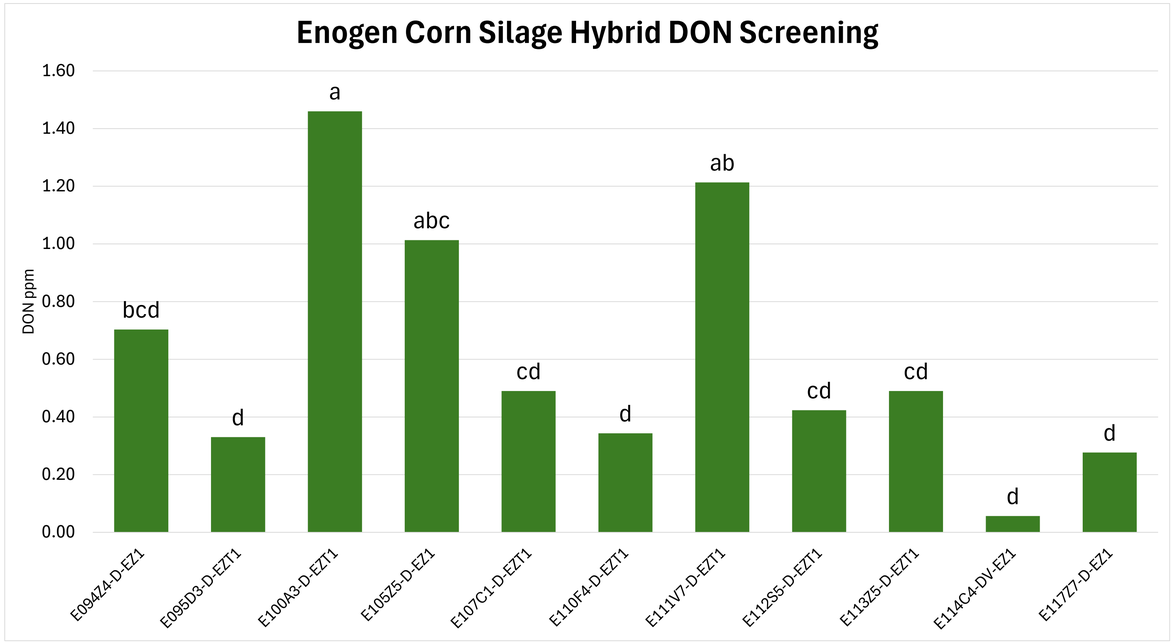
General overview of hybrid recruitment and submission: To evaluate a diverse group of hybrids, a call for hybrid entries was sent to all company field representatives who work with the Ohio State University Corn Performance Trial or have conducted research with the Ohio State University. The funding for this trial came from the Ohio Corn Board and the Ohio Dairy Research Fund, with the stipulation that all entered hybrids' Deoxynivalenol, DON, results be published, and that all hybrids had to currently be marked in Ohio. The funders of this project wanted farmers to be able to apply the results from this trial to hybrid selection the following year, thereby reducing DON risk on their farms. Corn grain entries were limited to 5 hybrids per company or 100 entries at no charge. Silage hybrids were limited to 25 entries at no charge. Companies could and did submit more hybrids for the cost of DON testing.

Corn silage hybrid management: The silage trial was conducted at The Ohio State University Northwest Research Station in Custar, Ohio, in 2024. A randomized complete block split block design with three replications was used, with the block split by hybrid maturity to better facilitate disease inoculation and harvest. Plots were four rows, 3.05 meters wide by 10 meters long. Plots were managed for high yield with a planting population of 89,000 plants per hectare and 224 Kg/ha of nitrogen applied. The center two rows were inoculated using a backpack sprayer with Fusarium Graminearum spore solution during the R1 growth stage for each hybrid. The center two rows of each plots were harvested at the three-quarter milk line using a Kemper silage harvester and plot weigh system. Corn silage samples were collected and fermented for one month before being analyzed by Gas chromatography-mass spectrometry for DON levels.

Corn grain hybrid management: The grain trial was conducted in three locations in conjunction with the Ohio Corn Performance Trial. This trial was at The Ohio State University Western research station near South Charleston, the Wooster research station near Apple Creek, and on a production farm near Bucyrus, Ohio in 2023 and 2024. At each location, a randomized complete block split-block design was used with the block split by maturity range to facilitate inoculation and harvest. Plots were two rows wide and 30.05 meters long and were replicated twice at each location. With a total of 4 replications per hybrid per location. Plots were managed for high yield, planted at 84,000 seeds/ha, and 224 kg/ha of nitrogen applied.

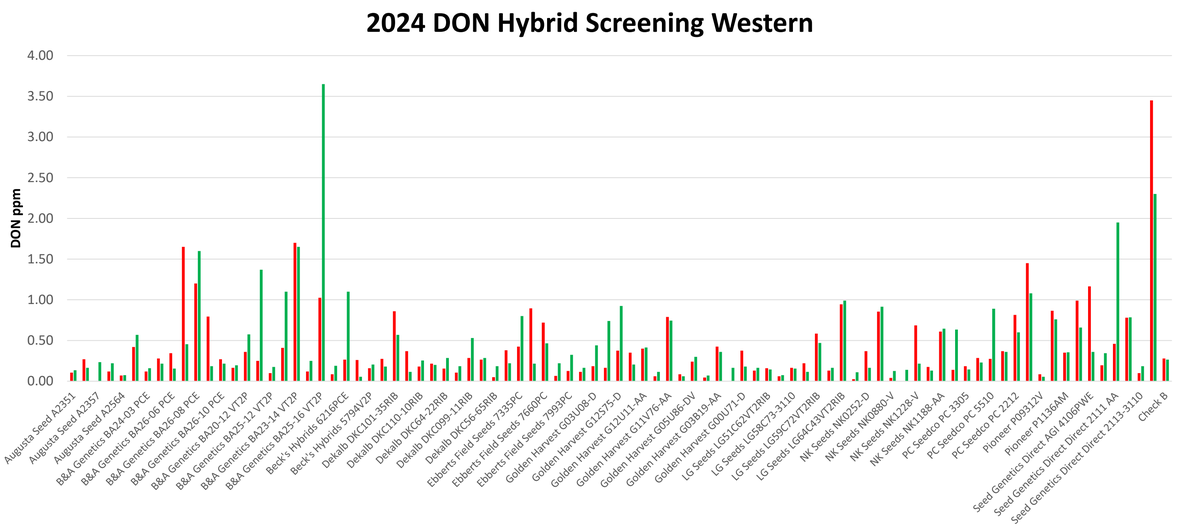
At tassel, one row of the two-row trial was inoculated with Fusarium Graminearum spores using a backpack sprayer. The inoculated row of the 2-row plot was paired with the plot beside it of the next plot so that overspray would fall on another inoculated row. Plots were harvested as single-row plots with an Almaco R1 combine equipped with a cyclone grain sampler. The design was a 2-replication randomized complete block split-plot design. This allowed for an analysis of both natural infection and inoculated plots as separate single-row plots. 1.5 Kg grain samples were collected and dried to 15 percent moisture in a low-heat air drier. The entire sample was ground, mixed, and then sub-sampled for DON analysis by gas chromatography-mass spectrometry. Results were then analyzed using SAS to compare hybrid, location, and inoculation method.

Results Corn silage hybrid evaluation

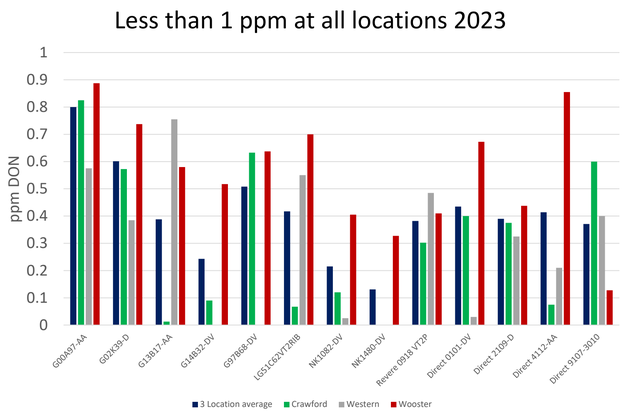


While 23 hybrids were submitted in 2024, only eleven were harvested due to early-season flooding that damaged the non-identity-preserved section of plots. All of the identity-preserved plots were Enogen brand hybrids. Between these hybrids, a significant difference in DON levels was observed, $P < .01$. Hybrids with different letters above them indicate significantly different DON levels. While overall DON levels were low in 2024 due to unfavorable DON development conditions after silking, these hybrid differences could play a significant role in ration DON levels.

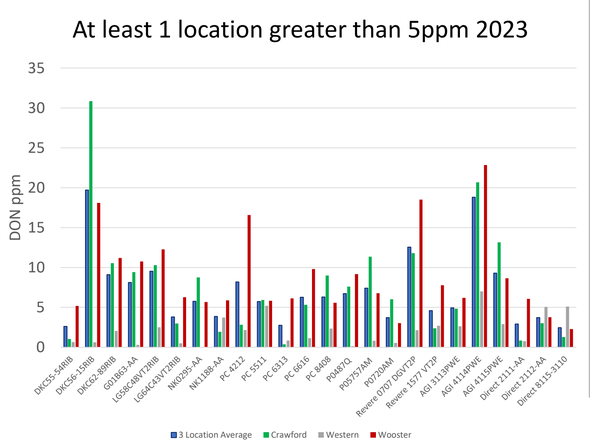
Results Corn grain hybrid evaluation



Above: Results of the 2024 hybrid screen at the Western research station location. Weather conditions after silking were unfavorable for disease development. For each hybrid, the green bars represent the inoculated treatment, while the red bars represent the natural infection treatment. In 2024, location and inoculation were significant; any hybrid green bar over 0.6 ppm had higher DON levels than the lowest hybrid, while the hybrids with red bars greater than 0.8 ppm had higher DON levels than the lowest hybrid under natural infection. Both the inoculated and natural infections trended similarly for higher and lower DON hybrids but varied in magnitude.



Left: Results from all locations of the hybrids that had DON levels of less than 1 ppm. Inoculation was not significant in 2023 under favorable conditions for disease development. For both Dairy and Swine rations, DON levels of less than 1 ppm are desired. Out of 80 hybrids, 13 met this requirement across all 3 locations.

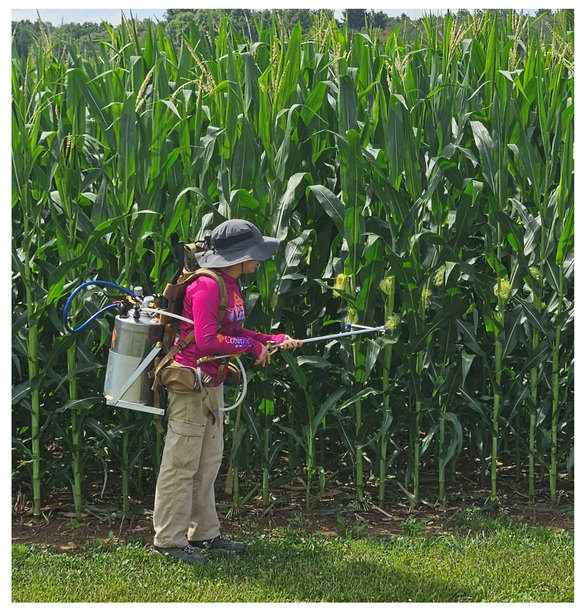


Right: Results from all locations of the hybrids that had DON levels of greater than 5 ppm in at least one location. Inoculation was not significant in 2023 under favorable conditions for disease development. 5 ppm was identified as a high DON cut-off due to restrictions in livestock rations and the challenges of high DON levels in DDGS after ethanol production. Out of 80 hybrids, 24 hybrids crossed this threshold for disease susceptibility.

Corn ear during the silking growth stage to be inoculated with Fusarium Graminearum to cause Gibberella ear rot and DON mycotoxin production.

Discussion

Hybrid screening allows growers to select for hybrids with partial resistance to Gibberella Ear Rot and the production of the DON mycotoxin. This is one tool for reducing the challenges that producers face from this mycotoxin. Plant breeders have also indicated to us that they can use the information provided by this screening project to identify hybrid parents that may possess genetic resistance, thereby improving the resistance in future hybrids they produce. Even under unfavorable growing conditions for DON production, a hybrid screen trial can identify hybrids that are more susceptible than others. By understanding the susceptibility of the hybrid that the producer is planting, they are better equipped to make informed management decisions to reduce the levels of DON in their harvested crop, such as applying fungicides or harvesting early. For future work, our team is developing a disease risk prediction weather model and investigating fungicide application methods for DON control.



Backpack sprayer inoculation of corn ears with Fusarium Graminearum spores to infect the ear with Gibberella ear rot.

ACKNOWLEDGEMENTS

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