Project Abstract

Project Title:	Early Detection of Fusarium Damaged Kernels Resilient to Barley and Wheat Malting	
USWBSI Project ID:	FY24-FR-002	
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Project Summary

The overall **goal** of this project is to identify Fusarium damaged kernels (FDKs) resilient during the malting process of barley and wheat by rapidly quantifying mycotoxin production in single kernels. Practical experience has shown that Fusarium head blight (FHB) infected barley with low deoxynivalenol (DON) levels (e. g. <0.50 mg/kg) can be used in malting as DON declines during steeping and remains lower on malt. However, a dilemma arises when the germination of low DON grains sometimes results in malt with higher DON contents. Our previous research discovered that the aggravation of FDKs, with asymptomatic kernels included, during malting played a significant role in the increase of mycotoxin contents within bulk malt.

Objectives and expected outcomes:
(1) Developing a hyperspectral imaging method for rapidly and nondestructively quantifying FDKs of barley, wheat and their malt;
-The expected outcome is to find hyperspectral imaging/wavelengths highly correlated to toxigenic *fusarium* biomass and/or mycotoxin contents of FDKs.
(2) Monitoring the growth of *fusarium* and mycotoxin production in FDKs during malting;
-It's expected to profile the progression of FDKs under favorable conditions during the grain germination.
(3) Predicting *fusarium* and mycotoxin presence in bulk malt by identifying FDKs in grains for five manor varieties used for brewing;
-It's anticipated to precisely assess mycotoxin contents in bulk malt by detecting the presence of *fusarium* and mycotoxins in single kernels, as well as determining the percentage of FDKs in unmalted barley and wheat.

Approaches are planned for this study in the following steps: First, to develop a training set, approximately three hundred kernels of each sample will be nondestructively scanned by hyperspectral imaging and then measured by wet chemistry to quantify mycotoxins and verify fusarium toxigenic gene. Wavelengths that are highly correlated to mycotoxin contents will be selected for the rapid detection of FDKs. Second, the rapid detection is used to assess the presence of fusarium and deoxynivalenol in single kernels and the percentage of FDKs surviving or emerging in the malting of major varieties. Third, machine learning is employed to predict the generation of FDKs from grains to malt.

The endeavor should be of **mutual interest** to malting grain breeders, elevators, maltsters and brewers, given their shared responsibility to provide consistently low DON malt for brewing industries. This study serves as a crucial step toward establishing the groundwork for precisely evaluating the threshold of FHB infection for malting suitability and sorting FDKs.