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PROJECT 1 ABSTRACT
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Boosting Wheat and Barley Type I Resistance to FHB

The proposed research addresses FY20-21 GDER priority 1: Identify native and induced wheat and barley gene variants that improve FHB resistance and/or reduce DON accumulation; and FY20-21 PBG research priority 2: Gain new understanding of initial fungal infection that may be utilized to boost FHB resistance.

The goal of this project is to improve FHB resistance to initial *F. graminearum* infection and to reduce mycotoxin contamination, by boosting plant immunity. Chitin and chitosan induce a series of plant defense responses including reactive oxygen species (ROS) production, lignin synthesis, and pathogen related genes. The application of chitosan reduces *Fusarium* seedling and head blight on wheat. We demonstrated that several *F. graminearum* effectors can suppress ROS production, suggesting that ROS signaling plays a critical role during FHB pathogenesis. Interestingly, our preliminary studies found that no ROS burst was induced by chitin in Type II resistant or susceptible wheat varieties. In contrast, ROS burst was observed in barley varieties. To determine the role of ROS during FHB and mycotoxin production, we will investigate the expression of fungal effector genes and plant ROS signaling during infection and the efficacy of chitosan treatment for reducing FHB and mycotoxin content in wheat and barley with different baseline ROS burst activity.

Objective 1: Determine the expression of selected effector genes, FHB incidence and mycotoxin content in wheat and barley with different ROS induction ability.

Objective 2: Determine the effect of chitosan treatment on FHB and mycotoxin production.

Objective 3: Determine the differences in the underlying mechanisms of chitin-mediated defense signaling between wheat and barley and identify targets for enhancement of wheat and barley FHB resistance.

The major outputs from the proposed research: evaluation of FHB and mycotoxin susceptibility in relation to ROS response in wheat and barley; determination of the effectiveness of chitosan treatment; and identification of genes associated with chitin-induced defense signaling. These findings will assist breeders in screening germplasm to identify wheat and barley lines that respond to chitosan treatment and identify potential gene targets for USWBSI-funded scientists and others to develop transgenic plants that can boost wheat and barley resistance and reduce mycotoxin contamination of grain.