Project FY22-GD-002: Characterization and Expression of Plant Transporters to Reduce FHB and Mycotoxins

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1. What are the major goals and objectives of the research project?

The goal of this project is to identify plant transporters and utilize it to reduce FHB and mycotoxin contamination.

The objectives of this proposal are:

- Identification of transporters responsible for 3-ADON excretion using transgenic Arabidopsis expressing FgTri101.
- Generation of transgenic wheat expressing FgTri101 and determine if transgenic wheat expressing FgTri101 can excrete 3-ADON.
- Stacking FgTri101 and the Arabidopsis transporter in transgenic wheat and evaluate transgenic lines for DON detoxification and resistance to FHB.

2. What was accomplished under these goals or objectives? *(For each major goal/objective, address these three items below.)*

What were the major activities?

Objective 1:

- This objective has been achieved, and a manuscript has been published in Frontiers in Plant Science.

Objective 2:

- We showed that transgenic wheat expressing FgTRI101 increase FHB resistance and reduced DON contamination. We prepared a manuscript, submitted and accepted by Frontiers in Plant Science.

Objective 3:

- Based on the promising FgTRI101 transgenic wheat data, we optimized FgTri101 using wheat codon (MTRI101) and generate a new construct for wheat transformation.
- My collaborator, Dr. Harold Trick, introduced the new construct MTRI101 to several wheat varieties, including Bobwhite, Fielder and Forefront, to enhance their resistance to FHB and mycotoxin contamination.
- Obtained transgenic wheat expressing MTRI101.
- Tested transgenic wheat expressing MTRI101, confirmed gene integration by PCR and gene expression by RT-PCR.

What were the significant results?

- We characterized an Arabidopsis DTX1 is involved in 3-ADON efflux.
- We showed that transgenic wheat expressing FgTRI101 increased FHB resistance and reduced DON contamination. The promising data led us to optimize FgTri101 coding sequence and introduced it to the moderately resistant wheat varieties to enhance its effectiveness on FHB and mycotoxin control.

List key outcomes or other achievements.

First, we identified an Arabidopsis transporter involved in 3-ADON efflux. Second, we increased wheat FHB resistance and reduced DON contamination by expressing FgTri101 in wheat. Two manuscripts have been published for these results.

3. What opportunities for training and professional development has the project provided?

One ORISE fellow (Nick Rhodes) has been trained in molecular biology including DNA isolation, RCR and RT-PCR, screening transgenic plants, inoculation and scoring of FHB assays.

4. How have the results been disseminated to communities of interest?

Poster presentation at the 2024 National Fusarium Head Blight Forum, Dec. 7-11, 2024. Austin, TX

A paper has been published in the current funding cycle.
Hao, G., Edwards, J., Rhoades, N. A., McCormick. S. P. **2025.** Arabidopsis thaliana detoxification gene AtDTX1 is involved in trichothecene 3-acetyl-deoxynivalenol efflux. Front. Plant Sci. 16:1574367. doi: 10.3389/fpls.2025.1574367

5. What do you plan to do during the next reporting period to accomplish the goals and objectives?

- Propagate transgenic wheat expressing optimized FgTRI101.
- Perform toxin conversion assays
- Obtain T2 seeds for FHB virulence and toxin content assays.
- Analyze data and prepare a manuscript for publication.