Project FY22-FR-003: Natural Photosensitizer for Decontamination of Mycotoxin in Sprouted Cereal Grains

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

Goal one: Screening natural photosensitizers (PS), designing and characterizing the natural PS loaded delivery system

Major goal and objective one: Screening natural photosensitizers (PS), designing and characterizing the natural PS loaded delivery system;
Major goal and objective two: Antifungal and mycotoxin inhibitory activity of PS loaded delivery system in vitro;
Major goal and objective three: Antifungal and mycotoxin inhibitory efficacy of PS in cereal grains and sprouted cereal grains.

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

Major activities in goal three:

- The antifungal activity of Menadione sodium bisulfite (MSB), coumarin and curcumin in fusarium contaminated wheat grains have been tested in the field. In general, the susceptible wheaton cultivars were planted in 20 rows following a randomized complete block design (RCBD) with five blocks. During the flowering stage, the wheaton cultivars were point inoculated with a mixture of Fusarium spp. and the application of photosensitizers (curcumin, MSB, and coumarin) was applied at two different timings of a day after one day of point inoculation. The FHB scoring data was recorded after 17 days and 21 days of infection.
  - The FHB scoring have shown the promising results by applying curcumin and MSB. In addition, FHB scoring data was correlated with the mycotoxin data. For example, DON has shown significant lower level at $p<0.05$ for curcumin treated seeds as compared to control. In addition, spraying time also plays an important role on mycotoxin production. NIV demonstrated significant differences at $p<0.05$ for three different PSs compared to control samples in morning-sprayed samples, as opposed to those in the evening.

- The antifungal and mycotoxin inhibitory activities of curcumin and MSB was evaluated in FHB infected wheat seeds.
  - Initially, the chemical composition of FHB infected wheat seeds including protein content, moisture content was measured. The fungal infection rate and fungal types were identified. The results showed that, FHB infected seeds also contaminated with *Pencillium*, *Alternaria*, *Cladosporium* as well.
  - To evaluate the decontamination process of FHB-infected seeds, 3 mM curcumin, 4 mM MSB, and 4 mM coumarin were used. The surviving fungal populations were measured by counting mold colonies growing on the media and expressed as $\log_{10}$ CFU/g. Overall, all treatments significantly reduced the number of fungal colonies, with 4 mM coumarin combined with light treatment demonstrating the most effective performance.

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

This project has provided an opportunity for one Ph.D. student to improve their fundamental knowledge of cereal, food, physicochemical and statistics sciences.

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

The result has been submitted in peer review journal and some of results has been presented in national conference (International association for food protection 2024 annual meeting) and 2024 FHB annual meeting

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

- The impact of MSB, curcumin and coumarin on the quality and mycotoxin level of sprouted fusarium infected wheat will be tested.
- The Fungicidal Property of MSB, curcumin and coumarin against fusarium infected wheat in a field will be tested in 2025