USDA-ARS | U.S. Wheat and Barley Scab Initiative

FY22 Performance Progress Report

Due date: July 26, 2023

Cover Page

USDA-ARS Agreement ID:	59-0206-2-131
USDA-ARS Agreement Title:	Fusarium Mycotoxins Management in Sprouted Cereal Grains
Principle Investigator (PI):	Jiajia Rao
Institution:	North Dakota State University
Institution UEI:	EZ4WPGRE1RD5
Fiscal Year:	2022
FY22 USDA-ARS Award Amount:	$42,933
PI Mailing Address:	North Dakota State University, Department of Plant Sciences NDSU Depart. #7670, PO Box 6050 Fargo, ND 58108
PI E-mail:	Jiajia.Rao@ndsu.edu
PI Phone:	701-231-8474
Period of Performance:	May 1, 2022 – April 30, 2026
Reporting Period End Date:	April 30, 2023

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
FST-R	Natural Photosensitizer for Decontamination of Mycotoxin in Sprouted Cereal Grains	$42,933
	FY22 Total ARS Award Amount	$42,933

I am submitting this report as an: ☒ Annual Report

I certify to the best of my knowledge and belief that this report is correct and complete for performance of activities for the purposes set forth in the award documents.

Jiajia Rao _____ 05/23/2023 _____

Principal Investigator Signature Date Report Submitted

‡ BAR-CP – Barley Coordinated Project
DUR-CP – Durum Coordinated Project
EC-HQ – Executive Committee-Headquarters
FST-R – Food Safety & Toxicology (Research)
FST-S – Food Safety & Toxicology (Service)
GDER – Gene Discovery & Engineering Resistance
HWW-CP – Hard Winter Wheat Coordinated Project
MGMT – FHB Management
MGMT-IM – FHB Management – Integrated Management Coordinated Project
PBG – Pathogen Biology & Genetics
TSCI – Transformational Science
VDHR – Variety Development & Uniform Nurseries
NWW –Northern Soft Winter Wheat Region
SPR – Spring Wheat Region
SWW – Southern Soft Red Winter Wheat Region

Project 1: 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.
   Goal two: Antifungal and mycotoxin inhibitory activity of PS loaded delivery system *in vitro*
   Goal 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.)*

   a) **What were the major activities?**
   Majority activities in goal one:
   - Physically stabled curcumin nanoemulsions have been formed using different type of solvent combination.
   - The physiochemical proprieties of curcumin nanoemulsions have been characterized including particle size, curcumin encapsulation yield, turbidity of nanoemulsion.
   - The long term physical stability of curcumin nanoemulsions have been identified
   - The long term chemical stability of curcumin in nanoemulsion delivery systems have been measured.

   Majority activities in goal two:
   - The antifungal activity of curcumin nanoemulsions have been evaluated in terms of inhibition of mycelial growth and spore germination.
   - The morphological change of spores upon curcumin nanoemulsion treatment has been evaluated by using scanning electron microscope.
   - The mycotoxin inhibitory activity of curcumin nanoemulsions have been evaluated in rice culture and TBI medium.

   b) **What were the significant results?**
   - Very Interesting finding is the turbidity of curcumin nanoemulsion greatly impact on their antifungal activity. The more turbid curcumin nanoemulsion had lower antifungal activity as compared to the clear curcumin nanoemulsion.
   - The physically stabled 11 wt%, 10 wt% Tween 80 and 79 wt% (water-propylene glycerol mixture) of curcumin nanoemulsion could be fabricated using ultrasonic method.
   - The optimum condition
   - The antifungal activities of curcumin nanoemulsions against two Fusarium graminearum isolates were strongly dependent on the curcumin concentrations. By applying 2 mM of curcumin nanoemulsion, it could inhibit over 95% of spore germination.
   - The antifungal activity of curcumin nanoemulsions has been elucidated including decreasing the total lipid content in outer cell membrane, and damaging the cytoplasmic membrane as evidenced by scanning electron microscope (SEM).

c) List key outcomes or other achievements.

- N/A

ci) What opportunities for training and professional development has the project provided?

- One PhD student (Anil Kunapareddy) have been trained by this project.

cii) How have the results been disseminated to communities of interest?

- Results will be presented in upcoming USWBSI National Fusarium Head Blight Forum (2023).

Publications, Conference Papers, and Presentations

Please include a listing of all your publications/presentations about your FHB work that were a result of funding from your FY22 grant award. Only citations for publications published (submitted or accepted) or presentations presented during the **award period** should be included.

Did you publish/submit or present anything during this award period May 1, 2022 – April 30, 2023?

☐ Yes, I've included the citation reference in listing(s) below.
☒ No, I have nothing to report.

Journal publications as a result of FY22 award

List peer-reviewed articles or papers appearing in scientific, technical, or professional journals. Include any peer-reviewed publication in the periodically published proceedings of a scientific society, a conference, or the like.

Identify for each publication: Author(s); title; journal; volume: year; page numbers; status of publication (published [include DOI#]; accepted, awaiting publication; submitted, under review; other); acknowledgement of federal support (yes/no).

N/A

Books or other non-periodical, one-time publications as a result of FY22 award

Report any book, monograph, dissertation, abstract, or the like published as or in a separate publication, rather than a periodical or series. Include any significant publication in the proceedings of a one-time conference or in the report of a one-time study, commission, or the like.

Identify for each one-time publication: Author(s); title; editor; title of collection, if applicable; bibliographic information; year; type of publication (book, thesis, or dissertation, other); status of publication (published; accepted, awaiting publication; submitted, under review; other); acknowledgement of federal support (yes/no).

N/A

Other publications, conference papers and presentations as a result of FY22 award

Identify any other publications, conference papers and/or presentations not reported above. Specify the status of the publication.

N/A