

**USDA-ARS**  
**U.S. Wheat and Barley Scab Initiative**  
**FY19 Performance Report**  
**Due date: July 24, 2020**

**Cover Page**

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<b>Fiscal Year:</b>	2019
<b>USDA-ARS Agreement ID:</b>	59-0206-8-212
<b>USDA-ARS Agreement Title:</b>	Using Chitosan Nanoparticles Targeting Fusarium and Mycotoxins during Malting
<b>FY19 USDA-ARS Award Amount:</b>	\$ 29,097
<b>Recipient Organization:</b>	North Dakota State University Office of Grant & Contract Accounting NDSU Dept 3130, PO Box 6050 Fargo, ND 58108-0650
<b>DUNS Number:</b>	80-388-2299
<b>EIN:</b>	45-6002439
<b>Recipient Identifying Number or Account Number:</b>	FAR0030321
<b>Project/Grant Reporting Period:</b>	7/1/19 - 6/30/20
<b>Reporting Period End Date:</b>	6/30/2020

**USWBSI Individual Project(s)**

<b>USWBSI Research Category*</b>	<b>Project Title</b>	<b>ARS Award Amount</b>
FST-R	Using Chitosan Nanoparticles Targeting Fusarium and Mycotoxins during Malting	\$ 29,097
<b>FY19 Total ARS Award Amount</b>		<b>\$ 29,097</b>

*Jiajia Rao*

07/01/2020

Principal Investigator

Date

\* MGMT – FHB Management  
FST – Food Safety & Toxicology  
GDER – Gene Discovery & Engineering Resistance  
PBG – Pathogen Biology & Genetics  
EC-HQ – Executive Committee-Headquarters  
BAR-CP – Barley Coordinated Project  
DUR-CP – Durum Coordinated Project  
HWW-CP – Hard Winter Wheat Coordinated Project  
VDHR – Variety Development & Uniform Nurseries – Sub categories are below:  
SPR – Spring Wheat Region  
NWW – Northern Soft Winter Wheat Region  
SWW – Southern Soft Red Winter Wheat Region

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**Project 1: Using Chitosan Nanoparticles Targeting Fusarium and Mycotoxins during Malting**

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

This project is designed to using chitosan as cationic emulsifier coating on lipid Nano-droplets to improve their solubility at neutral pH, while maintaining its desirable attribute (antifungal and antimycotoxigenic efficacy) and test the feasibility during micro-malting process.

**Objectives:**

Objective 2: Optimization of Antifungal and Antimycotoxigenic Efficacy in Vitro System

Objective 3: Application of Chitosan Nanoparticles for Reducing Fusarium Infection and DON production during Micro Malting processing

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

a) What were the major activities?

- The physically stable chitosan stabilized cinnamon oil-in-water nanoemulsions were formed.
- The antifungal and mycotoxin inhibitory activity chitosan stabilized cinnamon-oil-in-water nanoemulsions were evaluated and compared with chitosan solution *in vitro*

b) What were the significant results?

- Physical stability of cinnamon oil-in-water emulsion was improved considerably by electrostatically depositing 0.10 wt% chitosan on diluted emulsion droplets at pH 5.
- Significant antifungal activities of cinnamon oil-in-water emulsion were observed on the basis of mycelial growth, spore germination and mycotoxin production rather than chitosan.

c) List key outcomes or other achievements.

- The antifungal activity of chitosan itself against *Fusarium graminearum* growth and mycotoxin production were very weak.
- Essential oil has stronger antifungal and antimycotoxigenic effect than that of chitosan solutions
- There is no synergetic effect between cinnamon oil and chitosan.

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**3. Was this research impacted by the COVID-19 pandemic (i.e. university shutdowns, reduced or lack of support personnel, etc.)? If yes, please explain how this research was impacted or is continuing to be impacted.**

- Because of COVID-19, university only allows the essential work to come to the lab, therefore there is lack of support personnel.
- In general, the graduate student will run the experiments in three labs because this project is collaborated with three PIs. However, the university recommended the “one lab has one person” rule, therefore it is hard to conduct experiment smoothly in different PI’s lab.
- There is no lab training section will be provided to the new graduate student and visiting scientist due to the social distancing.

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

One Ph.D. student and one visiting scientist were involved in the activities supported by the project.

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

Publish two research articles in high impact journals to inform international risk assessors

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## **Training of Next Generation Scientists**

**Instructions:** Please answer the following questions as it pertains to the FY19 award period (7/1/19 - 6/30/20). The term “support” below includes any level of benefit to the student, ranging from full stipend plus tuition to the situation where the student’s stipend was paid from other funds, but who learned how to rate scab in a misted nursery paid for by the USWBSI, and anything in between.

- 1. Did any graduate students in your research program supported by funding from your USWBSI grant earn their MS degree during the FY19 award period?**

**If yes, how many?** Nothing to report

- 2. Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY19 award period?**

**If yes, how many?** Nothing to report

- 3. Have any post docs who worked for you during the FY19 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?**

**If yes, how many?** Nothing to report

- 4. Have any post docs who worked for you during the FY19 award period and were supported by funding from your USWBSI grant gone on to take positions with private ag-related companies or federal agencies?**

**If yes, how many?** Nothing to report

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### Release of Germplasm/Cultivars

**Instructions:** In the table below, list all germplasm and/or cultivars released with full or partial support through the USWBSI during the FY19 award period. All columns must be completed for each listed germplasm/cultivar. Use the key below the table for Grain Class abbreviations.

*NOTE: Leave blank if you have nothing to report or if your grant did NOT include any VDHR-related projects.*

Name of Germplasm/Cultivar	Grain Class	FHB Resistance (S, MS, MR, R, where R represents your most resistant check)	FHB Rating (0-9)	Year Released

Add rows if needed.

**NOTE:** List the associated release notice or publication under the appropriate sub-section in the ‘Publications’ section of the FPR.

**Abbreviations for Grain Classes**

- Barley - BAR
- Durum - DUR
- Hard Red Winter - HRW
- Hard White Winter - HWW
- Hard Red Spring - HRS
- Soft Red Winter - SRW
- Soft White Winter - SWW

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## **Publications, Conference Papers, and Presentations**

**Instructions:** Refer to the FY19-FPR\_Instructions for detailed more instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY19 grant award. Only citations for publications published (submitted or accepted) or presentations presented during the **award period (7/1/19 - 6/30/20)** should be included. If you did not publish/submit or present anything, state ‘Nothing to Report’ directly above the Journal publications section.

**NOTE:** Directly below each citation, you **must** indicate the Status (i.e. published, submitted, etc.) and whether acknowledgement of Federal support was indicated in the publication/presentation. See example below for a poster presentation with an abstract:

De Wolf, E., D. Shah, P. Paul, L. Madden, S. Crawford, D. Hane, S. Canty, R. Dill-Macky, D. Van Sanford, K. Imhoff and D. Miller. 2019. “Impact of Prediction Tools for Fusarium Head Blight in the US, 2009-2019.” In: S. Canty, A. Hoffstetter, H. Campbell and R. Dill-Macky (Eds.), *Proceedings of the 2019 National Fusarium Head Blight Forum*, Milwaukee, WI; December 8-10. University of Kentucky, Lexington, KY. p. 12.  
Status: Abstract Published and Poster Presented  
Acknowledgement of Federal Support: YES (Abstract and Poster)

### **Journal publications.**

Dianhui Wu, Jian Lu, Shaobin Zhong, Paul Schwarz, Bingcan Chen, Jiajia Rao\*. Influence of nonionic and ionic surfactants on the antifungal and mycotoxin inhibitory efficacy of cinnamon oil nanoemulsions. *Food & Function*, 2019, 10, 2817-2828.

Status: Journal Published

Acknowledgement of Federal Support: YES

Dianhui Wu, Jian Lu, Shaobin Zhong, Paul Schwarz, Bingcan Chen, Jiajia Rao\*. Physical stability, antifungal and mycotoxin inhibitory activities of lecithin stabilized cinnamon oil emulsions in the presence of chitosan. *LWT*, 2019, 106: 98-104.

Status: Journal Published

Acknowledgement of Federal Support: YES

### **Books or other non-periodical, one-time publications.**

Nothing to report

### **Other publications, conference papers and presentations.**

Nothing to report