

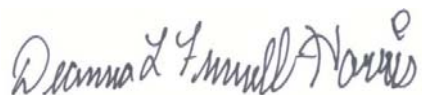
**USDA-ARS/  
U.S. Wheat and Barley Scab Initiative  
FY17 Final Performance Report  
Due date: July 31, 2018**

**Cover Page**

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<b>Fiscal Year:</b>	2017
<b>USDA-ARS Agreement ID:</b>	N/A
<b>USDA-ARS Agreement Title:</b>	Response of Transgenic Wheat Altered in Defense Metabolites to Head Scab.
<b>FY17 USDA-ARS Award Amount:</b>	\$ 32,950

**USWBSI Individual Project(s)**

<b>USWBSI Research Category*</b>	<b>Project Title</b>	<b>ARS Award Amount</b>
GDER	Response of Transgenic Wheat Altered in Defense Metabolites to Head Scab.	\$ 32,950
	<b>FY17 Total ARS Award Amount</b>	<b>\$ 32,950</b>



Principal Investigator

7-24-2018

Date

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\* 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

**Project 1:** *Response of Transgenic Wheat Altered in Defense Metabolites to Head Scab.*

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

The goal of this proposed research is to identify Fusarium head blight (FHB) resistance in transgenic wheat lines overexpressing genes involved in the monolignol biosynthetic pathway. Four genes, one a MYB transcription factor (SbMyb60) that acts as a positive regulator, and three for genes encoding enzymes in the pathway, caffeoyl CoA 3-O-methyltransferase (SbCCoAOMT), 4-coumarate-coenzyme A ligase, (Sb4CL), and p-coumarate 3-hydroxylase (SbC3H) were cloned into overexpression constructs and individually transformed into wheat using *Agrobacterium tumefaciens*-mediated transformation. The objectives of this proposal are to:

- 1) screen transgenic wheat overexpressing genes from the lignin biosynthesis pathway for Type I (to initial infection) and Type II (to spread after infection) resistance and reduced mycotoxin (deoxynivalenol or DON) production following infection with the FHB pathogen, *Fusarium graminearum*.
- 2) conduct metabolic profiling to identify changes in levels of metabolites that could contribute to disease resistance in transgenic wheat.

The hypotheses to be tested are:

Obj. 1: Transgenic wheat lines will be resistant to FHB or have reduced DON production by the pathogen.

Obj. 2: At least one metabolite contributes to increased resistance to FHB or reduced DON production by the pathogen.

**2. What was accomplished under these goals?** *Address items 1-4) below for each goal or objective.*

Objective 1: screen transgenic wheat overexpressing genes from the lignin biosynthesis pathway for Type I (to initial infection) and Type II (to spread after infection) resistance and reduced mycotoxin (deoxynivalenol or DON) production following infection with the FHB pathogen, *Fusarium graminearum*.

- 1) major activities: Three repetitions of the assay have been completed, including analysis of disease severity; analysis of FDK for two repetitions is complete. Mycotoxin analyses has been sent to ND for all three repetitions. The first field repetition of all transgenic lines plus control and checks are currently in the field.
- 2) specific objectives: To identify sorghum lignin biosynthesis gene expressed in wheat that results in increased resistance to infection by *F. graminearum*.
- 3) significant results: Wheat transgenic events expressing *SbC3H* and *SbCCoAOMT* exhibit increased resistance to *F. graminearum*.
- 4) key outcomes or other achievements: The enzymes C3H and CCoAOMT are central to the formation of both S- and G-monolignols. Increases in these phenolic compounds have been associated with resistance against pathogen infection in other systems.

Objective 2: conduct metabolic profiling to identify changes in levels of metabolites that could contribute to disease resistance in transgenic wheat.

- 1) Major activities: We have collected biomass from the four sets of transgenic lines, the parental recipient line and control susceptible and resistant checks, from inoculated and control treatment plants. The biomass is being prepared for analysis of phenolic compounds using GC-MS.
- 2) Specific objectives: To identify compounds or pathways associated with increased resistance.
- 3) Significant results: Because there were three reliable repetitions of the greenhouse assay, there will be strong indications of compounds that could contribute to resistance observed in SbC3H and SbCCoAOMT expression lines.
- 4) Key outcomes or other achievements: Analyses of biomass from lines exhibiting resistance and those exhibiting increased susceptibility will indicate which compounds in the phenylpropanoid accumulate to higher levels in these transgenic lines and which ones are specifically associated with increased resistance.

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

-We have trained three undergraduate students in basic microbiology, agronomy and plant pathology skills. These include wheat harvesting and threshing techniques, procedures for grinding biomass samples, and scoring wheat seed for Fusarium Head Blight. One student has also been trained in inoculum preparation while another has been trained in wheat emasculations.

-We invited our biological science technologist to give an oral presentation on the head scab project to the research unit.

-We also have trained a second biological science technologist in all steps of wheat culturing, and FHB inoculations, disease scoring and preparation of materials for further analyses.

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

Poster presentation at 2017 National Fusarium Head Forum, Milwaukee, WI, Dec. 3 – 5, 2017:

Funnell-Harris, D.L, Z. Duray, R.A. Graybosch, Sattler, S.E., S.N. Wegulo and T.E. Clemente 2017. “Response of Wheat Constitutively Expressing Monolignol Biosynthesis Genes to Fusarium Head Blight” In: S. Canty, B. Wiermer and D. Van Sanford (Eds.), *Proceedings of the 2017 National Fusarium Head Blight Forum* (p. 45). East Lansing, MI/Lexington, KY: U. S. Wheat & Barley Scab Initiative.

## **Training of Next Generation Scientists**

**Instructions:** Please answer the following questions as it pertains to the FY17 award period. 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 FY17 award period? No**

**If yes, how many?**

- 2. Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY17 award period? No**

**If yes, how many?**

- 3. Have any post docs who worked for you during the FY17 award period and were supported by funding from your USWBSI grant taken faculty positions with universities? No**

**If yes, how many?**

- 4. Have any post docs who worked for you during the FY17 award period and were supported by funding from your USWBSI grant gone on to take positions with private ag-related companies or federal agencies? No**

**If yes, how many?**

### 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 FY17 award period. All columns must be completed for each listed germplasm/cultivar. Use the key below the table for Grain Class abbreviations. *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

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

**Instructions:** Refer to the FY17-FPR\_Instructions for detailed instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY17 grant. Only include citations for publications submitted or presentations given during your award period. If you did not have any publications or presentations, state ‘Nothing to Report’ directly above the Journal publications section.

**NOTE:** Directly below each reference/citation, you must indicate the Status (i.e. published, submitted, etc.) and whether acknowledgement of Federal support was indicated in publication/presentation.

### **Journal publications.**

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

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

Funnell-Harris, D.L, Z. Duray, R.A. Graybosch, S.E. Sattler, S.N. Wegulo and T.E. Clemente 2017. “Response of Wheat Constitutively Expressing Monolignol Biosynthesis Genes to Fusarium Head Blight” In: S. Canty, B. Wiermer and D. Van Sanford (Eds.), *Proceedings of the 2017 National Fusarium Head Blight Forum* (p. 45). East Lansing, MI/Lexington, KY: U. S. Wheat & Barley Scab Initiative.

Status: Abstract Published and Poster Presented

Acknowledgement of Federal Support: YES (poster), YES (abstract)