

PI: Nidhi Rawat

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Project ID: FY20-BA-036

ARS Agreement #: 59-0206-0-179

Research Category: BAR-CP

Duration of Award: 1 Year

Project Title: Analyzing Commercial Barley Cultivars for FHB Reaction in MD/DE

PROJECT 1 ABSTRACT

(1 Page Limit)

- **Project Goals:**

Evaluation of Fusarium head blight (FHB) reaction in popular local varieties of barley is critical for management of scab by growers. The aim of this project is to conduct misted nursery to assess variety response to FHB in Maryland (MD) and Delaware (DE) cultivars. In field, the most significant losses due to FHB occur when flowering heads get exposed to spores of the FHB pathogen, resulting in yield loss and elevation in DON levels. In natural conditions, flowering times of cultivars vary due to differences in their genetic background. Therefore, varieties may not be at a highly susceptible stage in development when environmental conditions favoring FHB infections occur in natural conditions. In addition, weather conditions for FHB may not be favorable in all the years, resulting in little FHB and DON. The misted nursery will help to avoid these issues by prolonging the conditions that may be favorable for FHB infection, reducing the chance that varieties will escape infection due to sub-optimal environmental conditions for disease development. In addition, for commercial varieties, the seed companies provide their ratings based only on their own standards, the misted nursery allows for head to head comparison of FHB responses across variable seed sources.

- **Project Objectives and Expected Outcomes:**

1. Conduct misted nursery for local barley varieties from Maryland and Delaware.
2. Make the results available to the growers in a timely manner so that they can use them in making planting decisions in the growing season.
3. Organize field day to make growers aware of the importance of planting resistant varieties in management of FHB.

The misted nursery data made available here will help guide growers in Maryland and Delaware in selecting high-yielding barley varieties with moderate resistance to FHB and DON. Field visits/ field days will be organized to make growers aware of the importance of selecting resistant varieties to manage FHB.

- **Plans to accomplish project goal(s) within proposed period:**

In order to analyze the level of resistance in commercial varieties of barley in MD/ DE, the protocols and methodology of nursery will be as have been established in prior years.

- **Statement of Mutual Interest:**

Growers and stakeholders will be provided the data on varietal resistance against FHB. Efforts will also be made towards increasing awareness about the support of USWBSI to the scab research by organizing field days.

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Project ID: *FY20-SW-036*

ARS Agreement #: *59-0206-0-179*

Research Category: VDHR-SWW

Duration of Award: 1 Year

Project Title: *Analyzing Commercial Soft Winter Wheat Cultivars for FHB Reaction in MD/DE*

PROJECT 2 ABSTRACT

(1 Page Limit)

- **Project Goals:** Evaluation of Fusarium head blight (FHB) reaction in popular local varieties of soft red winter wheat is critical for management of scab by growers. The aim of this project is to conduct misted nursery to assess variety response to FHB in Maryland (MD) and Delaware (DE) cultivars. In field, the most significant losses due to FHB occur when flowering heads get exposed to spores of the FHB pathogen, resulting in yield loss and elevation in DON levels. In natural conditions, flowering times of cultivars vary due to differences in their genetic background. Therefore, varieties may not be at a highly susceptible stage in development when environmental conditions favoring FHB infections occur in natural conditions. In addition, weather conditions for FHB may not be favorable in all the years, resulting in little FHB and DON. The misted nursery will help to avoid these issues by prolonging the conditions that may be favorable for FHB infection, reducing the chance that varieties will escape infection due to sub-optimal environmental conditions for disease development. In addition, for commercial varieties, the seed companies provide their ratings based only on their own standards, the misted nursery allows for head to head comparison of FHB responses across variable seed sources.
- **Project Objectives and Expected Outcomes:**
 1. Conduct misted nursery for local wheat varieties from Maryland and Delaware.
 2. Make the results available to the growers in a timely manner so that they can use them in making planting decisions in the growing season.
 3. Organize field day to make growers aware of the importance of planting resistant varieties in management of FHB.

The misted nursery data made available here will help guide growers in Maryland and Delaware in selecting high-yielding wheat varieties with moderate resistance to FHB and DON. Field visits/ field days will be organized to make growers aware of the importance of selecting resistant varieties to manage FHB.
- **Plans to accomplish project goal(s) within proposed period:**

In order to analyze the level of resistance in commercial varieties of wheat and barley in MD/ DE, the protocols and methodology of nursery will be as have been established in prior years.
- **Statement of Mutual Interest:**

Growers and stakeholders will be provided the data on varietal resistance against FHB. Efforts will also be made towards increasing awareness about the support of USWBSI to the scab research by organizing field days.

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Project ID: FY20-IM-018

ARS Agreement #: 59-0206-0-179

Research Category: MGMT

Duration of Award: 1 Year

Project Title: Evaluation of Fungicide Performance for FHB Management on SRW Wheat and Barley Varieties

PROJECT 3 ABSTRACT

(1 Page Limit)

- **Overall project goal(s)**

FHB has been a major challenge to small grain farmers in the state of Maryland due to several compounding factors. Maryland has wet spring seasons, which is the time of highest susceptibility to *Fusarium graminearum* infections. Farmers practice No-Tillage agriculture, and often follow corn: wheat or corn: barley rotations. Miravis-Ace is a new product and farmers still do not know: If it can be applied early to their crop and hope it works equally well as a regular application; What is the need of planting a resistant variety if Miravis-Ace is really as good as the company claims. Also, they are interested in knowing how this fungicide will work on barley. The overall project goal is to provide research-based recommendations to wheat and barley farmers for managing FHB.

- **Project Objectives and Expected Outcomes:**

1. Evaluate the combined effect of fungicide treatment and genetic resistance on FHB and DON in SRW wheat varieties and barley, with emphasis on Miravis Ace:
2. Compare the efficacy of Miravis Ace when applied at heading or at anthesis to that of standard anthesis application of Prosaro or Caramba.

- **Expected Outcomes:**

Robust evaluation of fungicide performance of Miravis-Ace with and without genetic resistance. Efficacy of timing of fungicide application to manage FHB.

- **Plans to accomplish project goal(s) within period of proposed work:**

PI and CoPI conduct misted nursery at Beltsville research farm of the University of Maryland to provide evaluation of genetic resistance of popular varieties in the state, and so pipeline for planting, inoculating and disease evaluation is already in place. The experiments proposed in this project will be conducted at two locations: Beltsville and at Wye. The planting and fungicide application plans will be finalized by the team in August 2020, and 2021 for planting of the respective seasons.

- **Statement of Mutual Interest**

Because of the humid and warm climate, Maryland small grain farmers are especially distraught by FHB. The results generated in this project will directly benefit small grain farmers and stakeholders in the Mid-Atlantic region. Due to the high disease pressure of FHB in the region, farmers are desperately looking for solutions to manage FHB and minimize crop loss and quality depletion.

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Project ID: FY20-SH-005

ARS Agreement #: 59-0206-0-179

Research Category: GDER

Duration of Award: 1 Year

Project Title: Wheat Variants Deficient in a FHB Susceptibility Factor

PROJECT 4 ABSTRACT

(1 Page Limit)

- **Project Goals:** The goal of this project is to identify native wheat gene variants that improve FHB resistance and reduce DON accumulation. Wheat genes that contribute to susceptibility by facilitating fungal growth, development and virulence provide excellent targets for controlling disease. With previous support from the USWBSI, the PI's lab identified wheat 9-lipoxygenases (9-LOXs) as susceptibility factors, which when knocked-down by RNA-interference (RNAi) in the cv Bobwhite, limit spread of *Fusarium graminearum* infection and limit DON accumulation. The goals of the proposed work are to establish whether (i) the FHB resistance promoting effect of Lpx3 knockdown is also effective in wheat backgrounds other than Bobwhite, (ii) one or more Lpx3 homeolog(s) in wheat contribute towards susceptibility to *Fusarium graminearum*, and (iii) nonsense and/or missense Lpx3 variants can provide a non-GMO strategy that in the future can be utilized by breeding programs to enhance FHB resistance in wheat. As a first step in this direction, several TILLING mutants that cover all three Lpx3 homeologs on chromosomes 4A, 4B and 4D have been identified in the hexaploid and tetraploid wheat varieties Cadenza and Kronos, respectively. Mutations in these TILLING lines are predicted to yield prematurely truncated Lpx3 protein, or strong missense alleles.
- **The specific objectives of this project are to:**

 1. Characterize the response to *F. graminearum* in backcrossed progeny of Lpx3 variants.
 2. Develop wheat lines containing mutant combinations at more than one Lpx3 homeologous loci and characterize their response to *F. graminearum*.
- **Expected Outcome:** The proposed work addresses GDER's priority to 'Identify native and induced wheat and barley gene variants that improve FHB resistance and/or reduce DON accumulation'. The completion of this work will identify hexaploid and tetraploid wheat lines with variations at the Lpx3 loci that confer enhanced resistance to FHB. Our approach, and the wheat gene targeted in this study, complement the activity of other USWBSI sponsored projects.
- **Plan to Accomplish Project Goals Within Period of Proposed Work:** PCR-based co-dominant markers that distinguish wild-type from mutant alleles will facilitate this work. The distribution of work with hexaploid and tetraploid wheat between University of North Texas and the University of Maryland, respectively, will expedite identification of both, hexaploid and tetraploid wheat Lpx3 variants with enhanced FHB resistance.
- **Statement of Mutual Interest:** The non-GMO FHB resistant wheat variants developed as a result of this work will provide novel genetic material that can be integrated into wheat breeding programs.