Progress Report

Project #: 3682

Progress Report Year: 2 of 3

Title: Control of Strawbreaker Foot Rot (Eyespot) and Cephalosporium Stripe in Winter Wheat

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Executive summary: Variety trials for eyespot and Cephalosporium stripe were not conducted in 2016-17. However, the trial was planted in 2017 for evaluation in 2018, and data from previous plots was used to update variety disease ratings in the Washington State Crop Improvement Association Seed Buyers Guide. A seed treatment trial conducted in 2016-17; this is the second year with no yield or disease control benefit, so this work will not be continued. A study was begun to map disease resistance genes to both of the eyespot fungi in Madsen. Although Madsen is one of the first eyespot resistant varieties in WA, its resistance to both eyespot pathogens has never been mapped to determine whether the same genes control resistance to both pathogens. In collaboration with colleagues, we are also mapping resistance to cereal cyst nematode (CCN). Spore-trapping for the eyespot fungi was conducted again at the Palouse Conservation Field Station and Spillman Farm to understand the seasonal dynamics of ascospore release, which may contribute to pathogen genetic variation; data are still being collected and analyzed. Field studies to determine the effect of variety mixtures on eyespot and Cephalosporium stripe were continued. Disease data were collected from both experiments, but the eyespot nursery was flooded by spring rains and yield was not determined.

Impact: Although variety trials for Cephalosporium stripe and eyespot were not conducted this year, data from previous years was used to provide ratings for some newly released varieties and to update others already listed in the WSCIA seed buyer's guide and the WSU Small Grains variety selection tool for use by growers in making variety selection decisions. Currently, the gene present in Madsen is the primary source of resistance in all other PNW eyespot-resistant varieties and understanding its genetic control will insure it remains effective. New genes are needed for eyespot resistance to improve effectiveness, further reduce losses to this disease and broaden the genetic base of resistance. Developing a better understanding of genetic variation in the eyespot and Cephalosporium stripe pathogens will help insure resistance genes remain stable and effective.

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WGC project title: Control of Eyespot and Cephalosporium Stripe in Winter Wheat
Project PI(s): T. Murray, A. Carter, K. Garland-Campbell
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Project year (X of 3-yr cycle): 2 of 3

Objective	Deliverable	Progress	Timeline	Communication
1. Evaluate mixtures of resistant/tolerant and susceptible varieties in field plots for their impact on eyespot and Cephalosporium stripe.	The potential effectiveness of variety mixtures in controlling eyespot and Cephalosporium stripe will be determined. This is particularly important for Cephalosporium stripe where varieties with highly effective resistance are not available.	**2016:** Field plots were established in Fall 2015 on the Plant Pathology Farm (eyespot) and Palouse Conservation Field Station (Cephalosporium stripe) to determine the effect of mixtures on each disease. Each plot contains two reistant/tolerant and two susceptible varieties planted separately and in all possible combinations. Plots were inoculated in November and disease severity and yield determined in summer 2016. Unfortunately, yield data were not obtained from the eyespot plot due to spring flooding. Data are being analyzed now. **2017:** Data was collected from field plots planted in 2016 and is being analyzed. Field plots were planted again in fall 2017 for data collection in 2018.	Multiple years of data are needed to reach conclusions, so this work continue each year of the project.	Results from these plots will be presented at field days, variety plot tours and other talks to grower and industry groups, and availble online at the Extension Small Grains Team website.
2. Screen wild wheat relatives for potential new sources of resistance genes	Identify potential new eyespot resistance genes for use by breeders to improve effectiveness of resistant varieties.	**2016:** No activity in 2016. Inoculum is being produced now to screen a Madsen population being mapped for cereal cyst nematode resistance to determine the relationship between these genes. Repeat tests of some wild species is anticipated during 2017 to confirm previous results and identify potential donors for genetic studies. **2017:** A Madsen population was screened for resistance to one of the two eyespot pathogens to determine whether the same genes are involved in resistance to both pathogens. This population is also being screened for cereal cyst nematode resistance.	**2016:** This work will begin in fall 2016 or spring 2017, but not completed until the end of the project. **2017:** Screening of the Madsen population will continue during the first half of 2018, afterwhich we plan to compelte screening some wheat relatives through 2018 into 2019.	Results of this research will be shared with breeders, presented at field days, variety plot tours and other talks to grower and industry groups. Results also will be published in appropriate scientific journals.
3. Evaluate eyespot pathogen populations for resistance to new fungicide active ingredients.	Provide data that will help growers and field consultants make decisions about whether and which fungicide to use in controlling eyespot by testing fungicides registered for eyespot control in multiple locations in eastern WA.	**2016:** A field plot was established near Ritzville, WA in spring 2016, but later abandoned due to inadequate eyespot disease and too much dryland foot rot to provide meaningful results. A seed treatment trial was planted in fall 2015, disease evaluated and yield determined in summer 2016. **2017:** No activity on this objective during 2017.	**2016:** This is the last year of fungicide testing in this funding cycle unless the agchem industry provides support.	Results from these plots will be presented at field days, variety plot tours and other talks to grower and industry groups, and availble online at the Extension Small Grains Team website.

4. Determine impact of pathogen genetic variation on disease epidemiology, especially the eyespot pathogens, to insure resistance genes remain effective	Develop molecular and microbiological data describing genetic variation in the eyespot and Cephalosporium stripe pathogens and its potential effect on disease control using resistant varieties .	**2016:** Molecular markers were developed for one of the eyespot fungi during 2015. Marker development for the other eyespot fungus and *Cephalosporium gramineum* are in progress, but limited progress was made in the second half of 2016 due to personnel turnover. Spore-traps were established at the Palouse Conservation Field Station and Spillman Farm to understand the seasonal dynamics of ascospore release, which may contribute to pathogen genetic variation. Traps are sampled weekly and evaluated using microscopy and real-time PCR to determine when and relatively how many spores were released. **2017:** Aerial spore-traps were again deployed from September through May, with samples collected weekly. Samples from spring have been analyzed; data from fall collections are still being collected and summarized to determine when ascospores of the eyespot fungi are present. No progress was made on development of molecular markers for the eyespot fungi.	This is a long-term objective and work will be completed each year of the project.	Results of this research will be shared with breeders, presented at field days, variety plot tours and other talks to grower and industry groups. Results also will be published in appropriate scientific journals.
	Prepare an article for Wheat Life during the three-year project summarizing results.	**2016:** No progress. **2017:** An article on eyespot and Cephalosporium stripe will be submitted in April 2018.	Submit an article in spring 2018.	
5. Evaluate advanced breeding lines and new varieties for resistance to eyespot and Cephalosporium in field plots	Provide unbiased data on the resistance reactions of advanced selections and new varieties to eyespot and Cephalosporium stripe.	**2016:** Forty-four breeding lines and advanced selections were established in field plots and inoculated in fall 2015. Disease evaluation was conducted on both plots in June 2016. Yield data were not taken due to extensive lodging in both plots that was not related to disease resistance and would have led to misleading results. **2017:** Variety screening was not conducted in 2017, but field plots were planted and inoculated for both eyespot and Cephalosporium stripe rating in 2018. Data from previous trials was used to provide and update ratings for the WSCIA Seed Buyer's Guide and WSU Small Grains variety selection tool.	**2016:** Testing did not occur due to staff and funding limitations. **2017:** Disease testing plots for new varieties were planted in collaboration with the WSU Variety Testing progam in fall 2017 for rating in 2018.	Results from these plots will be presented at field days, variety plot tours and other talks to grower and industry groups, and availble online at the Extension Small Grains Team website.