

Project #:

Progress Report Year: 1 of 1 (maximum of 3 year funding cycle)

Title: Imaging and Rhizosphere Microbial Analysis of Wheat Seedlings Experiencing Root Rot Caused by *Rhizoctonia solani* AG8

PI: Isaac Madsen

Cooperators: Rick Lewis, Tarah Sullivan, Christine Jade Ermita

Executive summary:

Root rot is a yield reducing fungal disease in the inland Pacific Northwest. *Rhizoctonia solani* AG8 is a fungal pathogen responsible root rot and bare patch in wheat. The present methods for assessing disease severity are subjective and/or expensive disease analysis. This project set out to initiate the development of objective and inexpensive methods for assessing disease severity. The method proposed in this project is an innovative imaging method which uses a scanner based rhizobox and allows for non-destructive observations of disease progression. Four successful experimental runs have been conducted and the project is currently in the analysis phase. The initial experiments demonstrated the ability of the rhizobox methods to detect disease symptoms on infected roots, but has not successfully led to the differentiation between tolerant and susceptible wheat genotypes. The current difficulties in detecting varietal differences are likely due to a lack of variation in tolerance between the wheat varieties used in the study. In a corresponding screening experiments utilizing the conventional screening methods, no differences were found between the varieties used in the trial of the rhizobox method. However, as we are endeavoring to find a more sensitive technique than the conventional technique we intend to continue using image processing and analysis to attempt to delineate between the genotypes. Additionally, we intend to use different wheat genotypes in at least two more experimental runs with the rhizoboxes. These additional runs will focus on using what are known to be highly susceptible varieties of wheat in order to maximize the variation. In addition to the development of the imaging methods described above the soil microbiome of the rhizosphere (soil near the root) and the bulk soil are being analyzed. To date the rhizosphere and bulk soil have been sampled and the DNA has been successfully extracted from the soil. DNA sequencing will be completed by the spring of 2020 and analysis will follow shortly after.

Impact:

The primary immediate impact of the project is the demonstration of rhizoboxes as an effective means of differentiating between diseased and non-diseased wheat plants. These results have been presented at two international meetings. In the short-term we plan to demonstrate the effectiveness of this technique in differentiating between susceptible and tolerant wheat lines. The successful differentiation between wheat lines will lead to accelerated wheat breeding. In the long-term we hope the microbial analysis conducted in this study may help develop biocontrol agents for root pathogens.

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Project PI(s): Isaac Madsen, Ph.D., Rick Lewis, Ph.D., Tarah Sullivan Ph.D., Scot H. Hulbert, Ph.D. and Christine Jade

Project initiation date: July 1, 2019

Project year (1 of 3-yr cycle):

Objective	Deliverable	Progress	Timeline	Communication
Develop method of assessing root - pathogen interactions using a flatbed scanner mounted rhizobox.	A method to assess root-pathogen interactions through time that will result in more objective assessment of root injury and/or pathogen tolerance	Preliminary results suggest lesions and spear tips induced by <i>R. solani</i> can be observed and enumerated over time by examining scans of rhizoboxes. Videos demonstrating root responses to the fungal pathogen have already been generated. Results suggest some differences among wheat genotypes in terms of lesion formation. Root growth rate data strongly indicates the effectiveness of the proposed methods for detecting lesions. A wheat beat podcast is scheduled for 2020 and we expect to submit a manuscript shortly.	November, 2019	Wheat Beat Podcast (incomplete), Peer Reviewed Journal Article (incomplete), results presented at Agronomy Society of America and Rhizosphere 5 (international conference)
Improve techniques for assessing pathogen tolerance.	Identification/validation of wheat genotypes resistant to <i>R. solani</i> .	We have not successfully been able to detect tolerance in wheat varieties. However, this may be due an actual lack of variation in the wheat genotypes.	November, 2019	Wheat Beat Podcast (incomplete), Peer Reviewed Journal Article (incomplete), results presented at Agronomy Society of America and Rhizosphere 5 (international conference)
Assessment of microbiome associated with infection in wheat varieties and lines having various degrees of tolerance/susceptibility to <i>R. solani</i> AG8	Tangible information regarding the effect of microbiome on disease.	Rhizosphere soil samples have been sampled and sent off for sequencing microbial sequencing should be completed within the next month.	June, 2020	Wheat Beat Podcast, Wheat Life Article
Examine alterations in predicted bacterial community function associate with tolerance/susceptibility	Data which supports the development of potential biocontrols.	Not yet initiated	June, 2020	Wheat Beat Podcast, Wheat Life Article
Examine the role of plant genotype on rhizosphere recruitment of bacteria.	Tangible information regarding the potential for developing biocontrol in conjunction with resistant varieties	Not yet initiated	June, 2020	Wheat Beat Podcast, Wheat Life Article

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