

Washington Grain Commission
Wheat and Barley Research Annual Progress Reports and Final Reports
Format

Project # 3019-3685

Progress Report Year: 2 of 3 (maximum of 3 year funding cycle)

Title: **Fusarium Crown Rot on Wheat: Prebreeding and Development of Tools for Genetic Disease Management**

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Cooperators: Yvonne Thompson, WSU, Nuan Wen, WSU, Arron Carter, WSU; Chris Mundt and Christina Hagerty, OSU

Executive summary:

- In 2019, 197 lines from a cross of Louise and a resistant Iranian land race (IWA8608077), further backcrossed to Louise, were tested in the field and greenhouse assays. The field test was at Lind, planted into land previously cropped with durum, highly susceptible to Fusarium. We had very high disease pressure in the field nursery. In the greenhouse, higher disease was seen in the adult plant assay than the seedling assay. The population was genotyped with GMS markers in the Western Small Grains Genotyping lab and 245 markers were selected to look for QTLs. The population has also been genotyped with GBS markers which are still being analyzed. Several of the lines had yields similar to Louise, indicating that this population may be useful for introgression.
- Twenty-one additional land Iranian land races were evaluated in the greenhouse, and six showed consistent tolerance in seedling assays (AUS28329, AUS28452, AUS28459, AUS28706, AUS28714 and AUS28723). AUS28452 also showed good adult plant resistance in the greenhouse. These lines are being increased for further evaluation.
- A doubled haploid population from Cara/Xerpha was evaluated in the greenhouse. Fifteen lines showed lower disease ratings than Xerpha and Madsen.
- To reduce variability in the greenhouse test, we experimented with grinding the millet inoculum and quantifying it with dilution planting. The previous method relies on whole millet seed. Future work will examine different inoculum amounts, covering the inoculum with soil, the effects of humidity, different methods to standardize the rating system itself, and the number of plants that have to be rated to achieve a consistent result.

Impact: The economic impact of this disease continues to be large and affects all growing areas of Washington including both high and low precipitation zones

What measureable impact(s) has your project had in the most recent funding cycle?

- A list of the most susceptible and resistant varieties
- Better methods for greenhouse screening
- The first QTLs for resistance to *F. culmorum* have been identified.

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WGC project title: Fusarium Crown Rot on Wheat: Prebreeding and Development of Tools for Genetic Disease Management
Project PI(s): M. Pumphrey, K. Garland-Campbell, and T. Paulitz
Project initiation date: 7/1/2018
Project year: Year 2 2019-2020

Objective	Deliverable	Progress	Timeline	Communication
Objective 1. Screen spring and winter variety trials and breeding lines for resistance in the greenhouse.	Ratings of varieties for <i>Fusarium</i> tolerance in the the WSCIA seed buyers guide and other publications.	We continue to screen varieties in the greenhouse, and are still trying to optimize the methods to reduce variability. We experimented with grinding the millet inoculum and quantifying it with dilution planting. The previous method relies on whole millet seed. Future work will examine different inoculum amounts, covering the inoculum with soil, the effects of humidity, different methods to standardize the rating system itself, and the number of plants that have to be rated to achieve a consistent result.	Greenhouse screening will continue with optimized methods in 2020-2021	Paulitz, T. C. and Campbell, K.G. 2019. Fusarium crown rot: Disease is prevalent, persistent, pernicious. Wheat Life, June 2019
Objective 2. Select for QTLs associated with resistance in segregating populations	Resistant sources that can be used for variety development.	A doubled haploid population from Cara/Xerpha was evaluated in the greenhouse. Fifteen lines showed lower disease ratings than Xerpha and Madsen. These lines can be introgressed directly.	Because this population is already PNW adapted soft white wheat, the lines with better resistance will be crossed to some of our better <i>Fusarium</i> resistance sources in 2020.	Yvonne, M., Paulitz, T. C. and Campbell, K. G. 2019. Genome-wide association study for Fusarium crown rot in a diverse wheat germplasm. Manuscript in Preparation. Paulitz, T. C. and Campbell, K.G. 2019. Fusarium crown rot: Disease is prevalent, persistent, pernicious. Wheat Life, June 2019
Objective 3. Look for new sources of resistance in a new set of synthetic wheat that was developed by CIMMYT in Turkey.	Resistant sources that can be used for variety development.	We are developing populations between the synthetics and Chet, Ryan, DH11SRW070-14, Selbu, WA8252, Sequoia, and Cara. We chose good breeding lines from each market class. These are currently at the BC1F2 stage and we'll begin screening them this year for various traits.	Greenhouse screening of backcrosses will begin in 2020 2021.	
Objective 4. Screen the population of AUS28451 X Louise in the greenhouse for tolerance to <i>Fusarium</i> , to identify new possible sources of resistance.	Resistant sources that can be used for variety development.	In 2019, 197 lines from a cross of Louise and a resistant Iranian land race (IWA8608077), further backcrossed to Louise, were tested in the field and greenhouse assays. The field test was at Lind, planted into land previously cropped with durum, highly susceptible to <i>Fusarium</i> . We had very high disease pressure in the field nursery. In the greenhouse, higher disease was seen in the adult plant assay than the seedling assay. The population was genotyped and 245 markers were selected to look for QTLs (still being analyzed). Several of the lines had yields similar to Louise, indicating that this population may be useful for introgression. Twenty-one additional land Iranian land races were evaluated in the greenhouse, and two showed consistent tolerance in seedling assays (AUS28329 and AUS28714).	QTL analysis will be conducted in 2020, since both genotyping and phenotyping have been completed.	Paulitz, T. C. and Campbell, K.G. 2019. Fusarium crown rot: Disease is prevalent, persistent, pernicious. Wheat Life, June 2019