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

Project #

Progress Report Year: *__1__ of _3___ (maximum of 3 year funding cycle)*

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

K. Garland-Campbell, T. Paulitz and R. Koenig.

Cooperators: Emily Klarquist, WSU; Nikayla Strauss, WSU; Nuan Wen, WSU**;** Patricia Demacon, WSU; Arron Carter, WSU; Michael Pumphrey, WSU; and Christina Hagerty, OSU

Executive summary:

- As part of the PhD work of Nikayla Strauss, greenhouse methods were further modified and optimized for winter wheat, building on the work of Yvonne Thompson with spring wheat. This included inoculation at the start of vernalization and increasing temperature and water stress at the end of the experiment.
- A new method of assessing Fusarium crown rot was tested. Instead of a 1-9 rating, the number of discolored internodes was counted. The results were highly correlated with the more time-consuming 1-9 rating. A power analysis was conducted on the data and showed that fewer replicates are required with the node rating system, and that a minimum of 8 replicates are needed. The method separated the resistant check (2-49) from the susceptible check (Soft Svevo). This method should be more reproducible and enable quicker screening of material.
- A panel of winter wheat lines were assessed with the above method and identified Norwest Tandem with a high degree of resistance or tolerance.
- The Western Regional Winter Wheat Nursery was screened, and identified WA 8315, WA8321 and WA 8330 with a higher level of tolerance.
- Another panel of spring wheat lines was tested in the greenhouse, but the level of disease was not high enough for reliable ratings.

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

WGC project number:
WGC project title: **Fusarium Crown Rot on Wheat: Prebreeding and Development of Tools for Genetic Disease Management**
Project PI(s): **K. Garland-Campbell, T. Paulitz and R. Koenig**
Project initiation date: **7/1/2021**
Project year: **Year 1 2021-2022**

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 *Fusarium* tolerance in the the WSCIA seed buyers guide and other publications.	Most of our efforts in 2021 were aimed at improved our greenhouse screening method. This included inoculation at the start of vernalization and increasing temperature and water stress at the end of the experiment. A new method of assessing Fusarium crown rot was tested. Instead of a 1-9 rating, the number of discolored internodes was counted. The results were highly correlated with the more time-consuming 1-9 rating. A power analysis was conducted on the data and showed that fewer replicates are required with the node rating system, and that a minimum of 8 replicates are needed. The method separated the resistant check (2-49) from the susceptible check (Soft Svevo). This method should be more reproducible and enable quicker screening of material. In 2021, we screened 234 lines (winter wheat, spring wheat and Winter Wheat Regional Nursery). A high level of tolerance/resistance was identified in Norwest Tandem, identified WA 8315, WA8321 and WA 8330.	Greenhouse screening will continue with optimized methods in 2022-2023	Strauss, N. M., Klarquist, E. F., Kaya, J., Thompson, Y. M., Paulitz, T. C. and Garland-Campbell, K. 2021. Screening of Winter Wheat for Fusarium Crown Rot in a Controlled Environment. Frontiers in Plant Science: submitted Strauss, N. M. 2021. Identifying novel disease resistance and drought tolerance genes in a synthetic DNAM population. PhD Thesis, Washington State University.
Objective 2. Look for new sources of resistance in a new set of synthetic wheat that was developed by CIMMYT in Turkey and in other collections	Resistant sources that can be used for variety development.	Crosses have been made with soft white winter wheat lines such as NW Tandem, that are exhibiting more resistance to FCR. We will select progeny during early generation increase using our improved screening system, followed by marker assisted selection for resistance to other soil borne diseases such as strawbreaker foot rot.	Crosses will be evaluated, advanced, and intercrossed in 2022 and 2023.	Strauss, N. M., Klarquist, E. F., Kaya, J., Thompson, Y. M., Paulitz, T. C. and Garland-Campbell, K. 2021. Screening of Winter Wheat for Fusarium Crown Rot in a Controlled Environment. Frontiers in Plant Science: submitted. Strauss, N. M. 2021. Identifying novel disease resistance and drought tolerance genes in a synthetic DNAM population. PhD Thesis, Washington State University.
Objective 3. Breed for Fusarium crown rot resistance using our greenhouse and field screening systems and marker assisted selection for other important traits for wheat in the Pacific Northwest, (for example: eyespot and stripe rust resistance; grain quality, reduced height, and cold tolerance)	Resistant sources that can be used for variety development.	This work has been on hold because of lower staffing during the pandemic. The resistant lines will be crossed to new soft winter wheat populations in 2022.	Greenhouse screening of backcrosses will continue in 2022-2023.	