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

PROJECT #: 30109-6600

Progress report year: 1 of 3

Title: Evaluation And Selection For Cold Tolerance In Wheat


Executive summary:
We used the artificial screening system in the greenhouse to evaluate:
Winter wheat breeding lines from the WSU and ARS breeding programs.
The Western Regional Winter wheat hard and soft nurseries
The Northern and Southern Regional Performance Nurseries
The Association Mapping Training Panel representing the WSU and ARS breeding programs
The WSU Spring Variety Trials
The WSU Winter Wheat Variety Trials are currently being evaluated.
The Winter Wheat Core Nursery

We now have a dataset of survival scores from 3135 winter wheat breeding lines, cultivars and
germplasm.
We evaluated the large association mapping panels and regional nurseries for allelic and copy
number variation at genes that are known to be associated with cold tolerance in wheat. Many of
these alleles are segregating in our populations.
We conducted an association mapping project for cold tolerance using data available in our
breeding programs. In addition to the known loci, we discovered new loci on the group 1 and
group 6 chromosomes.

Impact
• The data from these cold tolerance trials can be used by growers to select winter wheat that is
  less sensitive to winter kill (data available on smallgrain.org)
• Our results from screening the regional nurseries, and screening breeding lines has been used
  by winter wheat breeders to select for resistance to winter injury.
• Varieties released from the WSU winter wheat breeding program have consistently excellent
cold tolerance and this tolerance has been maintained because of testing using the procedures
developed by this project.
• Because of the high correlation between our artificial screening trial and winter survival in
  the field, we are able to incorporate better cold tolerance into our early generation breeding
  lines.
• Most breeding programs have both winter tolerant and less tolerant breeding lines. The
  identification of molecular markers associated with freezing tolerance complements our
  screening system and increases our current screening capacity from about 1000 varieties and
  breeding lines to several thousand progeny from segregating populations per year.
### Objective Deliverable Progress Timeline Communication

1. **Evaluate Washington winter wheat variety trials.**
   - Survival data for all lines in winter wheat variety trials.
   - In 2016 survival data was collected for the soft and hard winter wheat variety trials.
   - Data available by Feb. of the year following the field trials, Feb. 2017-2019
   - [http://smallgrains.wsu.edu/](http://smallgrains.wsu.edu/)

2. **Evaluate cold tolerance of new breeding lines in US regional nurseries in order to identify germplasm to use in crossing for better winter survival.**
   - Survival data for lines in US regional nurseries
   - The Western Regional soft and hard winter wheat trials and the Northern and Southern Performance trials were evaluated.
   - Data available by April of the year following the field trials, April 2017-2019
   - Presentation at grower meetings, Wheat commission meetings, field days, plot tours, Wheat Life and Research Review. Refereed publications.

3. **Evaluate cold tolerance of spring wheat variety trials.**
   - Survival data for lines in spring wheat variety trials
   - Hard Spring Variety Trials evaluated.
   - Data available by Feb. of the year following the field trials, Feb. 2017-2019
   - [http://smallgrains.wsu.edu/](http://smallgrains.wsu.edu/)

4. **Evaluate cold tolerance of advanced breeding lines contributed by A. Carter, K. Gill, M. Pumphrey, R. Zemetra and others in the PNW as well as those in the ARS breeding program.**
   - Survival data for advanced breeding lines submitted by regional breeders
   - Survival data was evaluated for the WSU Winter Wheat and the USDA Winter Wheat breeding programs.
   - Data available by June of the year that entries are submitted, June 2017-2019
   - Presentation at grower meetings, Wheat commission meetings, field days, plot tours, Wheat Life and Research Review.

5. **Evaluate cold tolerance of F3-F5 (early generation) wheat populations that are segregating for cold tolerance and select resistant progeny.**
   - Populations that have been selected for tolerance to deep freezing.
   - Lack of freezer space delayed progress. New freezers are being installed.
   - Populations selected each year, 2016-2019
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