

Spring Wheat Breeding

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Reporting period: July 1, 2014 – June 30, 2015

Total project period: (Continuous)

Report type: Annual progress report

Research Summary:

The general objective of this research program is to release new and improved hard red spring wheat cultivars to regional producers in SD, MN, and ND. This objective has been successfully accomplished through the release of five cultivars since 2010 (i.e., 'Select', 'Advance', 'Forefront', 'Prevail', and 'Focus'). Each cultivar possesses unique agronomic, disease resistance, and end-use quality characteristics, but are all known for their high levels of grain production.

Introduction:

Specific objectives of this program are to 1). continuously create and evaluate hard red spring wheat germplasm populations for eventual derivation of experimental breeding lines, 2). further evaluate experimental breeding lines for agronomic performance potential, resistance/tolerance to biotic and abiotic stresses, and end-use quality characters through conducting replicated performance trials, and 3). ultimately release a new cultivar at a rough frequency of one every other year.

Description of Accomplishments:

During this reporting period, 278 unique wheat hybridizations were created. These are known as F_1 populations and should result in the same number of segregating F_2 populations next year. Operations within the program are cyclical and continuous, so that a subset of materials from within selected first year segregating populations (i.e., F_2 's) in 'year x' become F_3 materials which are evaluated in 'year x+1'. Likewise, lines from within selected F_3 's, evaluated in 'year x+1', are evaluated as F_4 's in 'year x+2'. During the 2015 growing season, field trial plots of about 430 F_2 , 700 F_3 , and 680 F_4 populations were grown at two locations and tested for grain yield potential, volume weight, protein content, Fusarium head blight resistance, and some end-use quality characteristics. At the end of 'year x+2', focus then shifts from within segregating populations to individual experimental breeding lines by harvesting grain from 72 F_4 plots for continued evaluation as Preliminary Yield Trial (PYT) entries. Lines are tested as PYT entries, grown at seven locations throughout the SD spring wheat production region, for a single year. During the 2015 growing season, 72 entries were evaluated. Upon PYT examination each year, several lines are chosen for perpetuation as Advanced Yield Trial entries. Typically, AYT entries are examined for three or four years prior to release as a cultivar. During each year, poorly performing AYT entries are removed from consideration. This allows for new entries to be admitted each year. In 2015, 36 lines were tested along with 12 check cultivars. Trials were grown in nine SD locations, two in ND, and as part of a collaborative research agreement with a European seed company, one location in England. Lines in the AYT are tested for grain yield potential, volume weight, protein content, Fusarium head blight and other

disease resistance, and many end-use quality characteristics. Comparisons over years and locations are made with respect to the check cultivars. When line performance over two or three years suggests there is potential for consideration as a cultivar release, steps are initiated for more wide-spread agronomic testing, usually via SDSU Crop Performance Testing, and seed increase which takes place in conjunction with SD Foundation Seed Stocks Division. As of fall 2015, two experimental breeding lines are in various stages of seed increase.

Projections:

During fall 2015 the advanced experimental breeding lines SD4299 and SD4383 will be proposed for release as a new cultivars to Certified seed growers for the 2016 growing season. Official release through the SD Agricultural Experiment Station is anticipated. Other advanced experimental breeding lines, such as SD4465 and SD4579, will begin being increased in California during winter 2015-2016 with the hopes that one will be proposed for release as a new cultivar in fall 2018 or 2017.

Publications:

Kandel, Yuba R., Karl D. Glover, Lawrence E. Osborne, and Jose L. Gonzalez-Hernandez. 2015. Mapping quantitative resistance loci for bacterial leaf streak disease in hard red spring wheat using an identity by descent mapping approach. *Euphytica*. 201: 53-65.

Kindelspire, Julie, Karl D Glover, Melanie Caffé-Treml, and Padmanaban Krishnan. 2015. Dough strain hardening properties as indicators of baking performance. *Cereal Chemistry*. 92:293-301.

Szczepaniec, Adrianna, Karl D. Glover, and William Berzonsky. 2015. Impact of Solid and Hollow Varieties of Winter and Spring Wheat on Severity of Wheat Stem Sawfly (Hymenoptera: Cephidae) Infestations and Yield and Quality of Grain. *Journal of Economic Entomology*. DOI: <http://dx.doi.org/10.1093/jee/tov207>

Rasul, Golam, Karl D. Glover, Padmanaban G. Krishnan, Jixiang Wu, William A. Berzonsky, Amir M. H. Ibrahim. 2015. Additive-dominance genetic model analyses for late-maturity alpha-amylase activity in a bread wheat factorial crossing population. *Genetica*. 143:671-680.