

Spring Wheat Breeding

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Reporting period: July 1, 2016 – June 30, 2017

Total project period: (Continuous)

Report type: Annual progress report

Research Summary:

The objective of this research program is to develop and 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 six cultivars since 2011 (i.e., 'Advance', 'Forefront', 'Prevail', 'Focus', 'Boost', and 'Surpass'). Each cultivar possesses unique agronomic, disease resistance, and end-use quality characteristics, but are all known for their regionally competitive 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 new cultivar release at a rough frequency of one every other year.

Description of Accomplishments:

During this reporting period, 360 unique hybridizations were created. These are known as F₁ populations and should result in the same number of segregating F₂ 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., F₂'s) in 'year x' become F₃ materials which are evaluated in 'year x+1'. Likewise, lines from within selected F₃'s, evaluated in 'year x+1', are evaluated as F₄'s in 'year x+2'. During the 2017 growing season, field trial plots of about 300 F₂, 600 F₃, and 500 F₄ 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 selecting the best 72 F₄ entries for continued evaluation as Preliminary Yield Trial (PYT) entries for a single year. Lines tested as PYT entries in 2017 were grown at seven locations throughout the SD spring wheat production region. Upon completion of PYT examination each year, several lines are then 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 which allows for new entries to be admitted each year. In 2017, 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, and one location in England with another European seed company. 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 2017, two experimental breeding lines were in various stages of seed increase for potential release as early as fall 2018.

Projections:

During fall 2017 no advanced experimental breeding lines were proposed for release. As many as three additional experimental breeding lines will be sown in California as first year seed increases for potential release in fall 2019.

Publications:

Rasul, Golam, Karl D. Glover, Padmanaban G. Krishnan, Jixiang Wu, William A. Berzonsky, and Bourlaye Fofana. 2017. Genetic analyses using GGE model and a mixed linear model approach, and stability analyses using AMMI bi-plot for late- maturity alpha-amylase activity in bread wheat genotypes. *Genetica*. 145:259–268.

Abdullah, Sidrat, Sunish K. Sehgal, Karl D. Glover, and Shaukat Ali. 2017. Reaction of Global Collection of Rye (*Secale cereale* L.) to Tan Spot and *Pyrenophora tritici-repentis* Races in South Dakota. *The Plant Pathology Journal*. 33:229-237.

Kandel, D. R., K. D. Glover, W. A. Berzonsky, J. L. Gonzalez-Hernandez, S. Ali, S. Chao, and S. J. Bhusal. 2017. Flanking SSR markers for alleles involved in the necrosis of hybrids between hexaploid bread wheat and synthetic hexaploid wheat. *J. Crop Improvement*. 31:879-892.

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