Spring Wheat Breeding

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Reporting period: July 1, 2013 – August 29, 2014
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 2008 (i.e., 'Brick', 'Select', 'Advance', 'Forefront', and 'Prevail'). Brick is most well-known for its high level of resistance to Fusarium head blight. The remaining four cultivars each possess unique agronomic 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 an approximate frequency of one every other year.

Description of Accomplishments:
During this reporting period, 385 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 2014 growing season, field trial plots of 284 F_2, 584 F_3, and 542 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 2014 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 2014, 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 2014, six experimental breeding lines are in various stages of seed increase.

Projections:
During fall 2014 the advanced experimental breeding line SD4362 will be proposed for release as a new cultivar to Certified seed growers for the 2015 growing season. Official release through the SD Agricultural Experiment Station is anticipated. Another advanced experimental breeding line, SD4299, will undergo a large-scale increase in California with the hopes that it will be proposed for release as a new cultivar in fall 2015.

Publications:
Kandel, Yuba R., Karl D. Glover, Lawrence E. Osborne, and Jose L. Gonzalez-Hernandez. 2014. Mapping quantitative resistance loci for bacterial leaf streak disease in hard red spring wheat using an identity by descent mapping approach. Euphytica. DOI 10.1007/s10681-014-1174-5.

Bondalapati, Krishna D., Jixiang Wu, and Karl D. Glover. 2014. An augmented additive-dominance (AD) model for analysis of multi-parental spring wheat F_2 hybrids. Australian Journal of Crop Science. (Accepted).

Glover K. D., J. C. Rudd, R. N. Devkota, R. G. Hall, Y. Jin, L. E. Osborne, E. B. Turnipseed, J. A. Ingemansen, J. R. Rickertsen, and G. A. Hareland. 2014. Registration of Advance Wheat. Journal of Plant Registrations. (accepted).