Hard Spring and Durum Wheat Quality Laboratory, Fargo, North Dakota

MISSION

The mission of the Hard Red Spring and Durum Wheat Quality Laboratory (WQL) is to enhance the quality of U.S. wheat for domestic and overseas markets, develop new and improved objective tests for measuring wheat and flour quality, and gain a better understanding of the physical and biochemical constituents of wheat that impact end use quality.

The WQL collaborates with Federal, State, and private wheat breeders to test early generation and advanced lines of spring and durum wheat that are being considered for future commercial release. Current objectives are to identify milling, baking, and pasta processing traits of experimental and advanced lines of hard spring and durum wheat that impact end-use quality and the overall development and release of new commercial cultivars of wheat, and to identify specific biochemical components in wheat that are associated with end-use baking quality traits.

CURRENT OBJECTIVES

- Identify milling, baking, and pasta processing traits of experimental and advanced lines of hard spring and durum wheat that impact end-use quality and the overall development and release of new commercial cultivars of wheat.

- Identify specific biochemical components in wheat that are associated with end-use baking quality traits.

BACKGROUND

In the U.S., over 2 billion bushels of wheat are produced annually on ca. 50 million acres. Wheat is comprised of six different classes that are grown according to region. Hard spring wheat is unique because it is used throughout the world as blending wheat to increase the value and end-use of wheat of other classes. Hard spring wheat protein content averages 13 percent to 16 percent, which results in strong gluten strength characteristics that are required for production of specialty baked products. Durum wheat

is used primarily for pasta products because of its strong gluten characteristics and aesthetic yellow endosperm color.

Average annual hard spring and durum wheat production over the past 5 years (2007-2011) was over 620 million bushels (over 536 million bushels for hard spring wheat and over 84 million bushels for durum wheat), which is over 28 percent of total annual wheat production in the U.S. The average value of hard spring and durum wheat production was approximately $4.3 billion. The hard spring and durum wheat classes are typically grown in the Upper Great Plains, primarily North Dakota, Minnesota, Montana, and South Dakota. North Dakota ranked first among wheat producing states in spring and durum wheat production with 45 percent and 55 percent, respectively, of the nation's total production. In an average crop year in North Dakota alone, the wheat crop has an estimated value of $2 billion. Of the total hard spring and durum wheat produced in the U.S., over 50 percent of hard spring wheat and 40 percent of durum wheat is exported to other countries.

The Hard Spring and Durum Wheat Quality Laboratory in Fargo, North Dakota, has been in operation for over 40 years, and is the only ARS laboratory to investigate quality traits of the hard spring and durum wheat classes. Measureable end-use quality traits include test weight, size, seed weight, sprout damage, physical evidence of disease, and protein and ash content; milling performance as a function of flour and semolina yield; flour and semolina color, protein, and ash content; dough strength properties; bread baking quality; and pasta processing quality. Research is currently being conducted on the rapid characterization of protein for gluten strength evaluation, variation in free asparagine content in wheat lines, and identification of quantitative trait loci associated with end-use quality.

CURRENT STAFF AND RESOURCES

This research project supports quality evaluation and research activities of two scientists, three full time Physical Science Technicians, and one Biological Science Technician.

The WQL is located in Harris Hall on the campus of North Dakota State University in Fargo, North Dakota. Laboratory space is allocated as follows: 1200 sq ft bake lab; 1500 sq. ft. mill room that is shared with the Department of Cereal and Food Sciences; 900 sq. ft. wheat preparation lab; 400 sq. ft. dough rheology lab; 200 sq. ft. freeze dry lab; 1200 sq. ft. chemistry and instrumentation lab; three offices; and shared access to two walk-in cold rooms and a storage garage. Equipment includes: Miag mill, Buhler spring wheat mill and Buhler durum mill, Brabender spring and durum wheat experimental mills, laboratory grinders, seed cleaning facilities,

NIR and combustion apparatus for protein and sulfur determinations, mixograph, farinograph, alveograph, TA.XT Texture Analyzer, C-Cell Image Analyzer, experimental bread baking equipment, GC/MS, HPLC, UV/Vis spectrophotometer, DSC, electrophoresis equipment, FT-IR spectrophotometer, and freeze dryers. We are currently renovating the small pilot scale flour milling facility (Miag Mill).

LABORATORY IMPACT

The Hard Spring and Durum Wheat Quality Laboratory at Fargo evaluates over 4000 samples of hard spring and durum wheat annually and reports are provided to wheat breeders and other Federal, State, and private organizations with an interest in wheat end-use quality. Almost all new commercial cultivars are evaluated in this lab prior to release. In fact, these cooperative efforts have resulted in the release of over 40 new commercial cultivars of spring wheat and over 10 cultivars of durum over the past 10 years. The released cultivars show relatively stable quality traits over many growing environments, which relates to wheat and flour consistency that is demanded by customers and consumers of baked products. In addition to evaluating end-use quality traits of wheat, research performed in this laboratory has provided knowledge that has impacted global marketing of U.S. wheat.

Customers/collaborators include public and private wheat breeders. Advanced wheat lines considered for commercial release are submitted to the Hard Spring and Durum Wheat Quality Laboratory through the Wheat Quality Council, whose mission is to advocate the development of new wheat cultivars that improve the value of all wheat classes to all parties in the U.S. supply chain, including producers, millers, and processors.

CONTACT

Dr. Linda Dykes (701-239-1412; linda.dykes@ars.usda.gov)

Click here to go to the webpage for the project associated with this laboratory.