HWWQL Bulletin

"Improving Wheat Quality Through Testing, Innovation, & Technology"

July | Hard Winter Wheat Quality Laboratory | 2006

http://hwwql.gmprc.ksu.edu

Greetings from the Hard Winter Wheat Quality Lab

Our First Bulletin

Brad Seabourn
Director

"Great. One more thing to read that looks good but doesn't offer much?" I truly hope not. As wheat research scientists, or as producers and growers in the 'Wheat Belt', we often spend as much time and effort telling others what we do and why, as we spend *doing* what we do. However, the great Nobel Laureate, George Bernard Shaw, said "The greatest problem in communication is the illusion that it has been accomplished." Thus, the primary reason for this bulletin.

In the 69 years since the HWWQL was first established

continued on page 2

*This issue of **HWWQL Newsletter** is available online at: http://gqsru.gmprc.ksu.edu/hwwql/hwwqlhome.htm.*

Inside This Issue

Improving Bread with Biotechnology

HWWQL Collaborates With USDA Researcher in Albany, CA

A recent article by Bill Tomson in the Dow Jones Newswire (June 29, 2006) featured collaborative work between the HWWQL and Dr. Ann Blechl, USDA-ARS, Western Regional Research Center, Albany, CA. The following article has been reprinted with permission from Dow Jones.

© 2006 The Associated Press. WASHINGTON. U.S. government scientists are trying to bake a better bread - one that will provide the kind of reliable, consistent quality that commercial bakers yearn for - and they are using biotechnology to do it.

For two years researchers planted and harvested genetically modified wheat on small plots in Idaho and California and now, for the second time, scientists at a U.S. Department of Agriculture facility in Manhattan, Kan., are baking it into loaves they hope will provide a model for the future.

The first harvest of glutenin-enriched wheat yielded mixed results when it was baked in USDA's Kansas facility, scientists said, but stressed that was to be expected in any experiment. Glutenin is a protein essential for keeping dough firm while it is baking.

Bradford Seabourn, a USDA chemist in Kansas who oversaw the milling, baking and data collection, said: "The great majority of what geneticists work with are not going to hit the mark ... You're tossing a lot of stuff out there with the hope that one or two combinations prove successful."

Bottom line, though, USDA scientist Ann Blechl said she succeeded in creating a wheat breed that will give

continued on page 7

continued from page 1

in 1937 to "*evaluate the most favorable new wheat varieties for their environmental adaptability, and milling and bread-making properties*," significant improvements have been made to wheat quality in terms of both genetics and agronomics. Our 'definition' of quality has evolved as well. Where yield and test weight were once considered to encompass the bulk of hard winter wheat 'quality' for, primarily, bread, we now consider such things as the ratio of high and low molecular weight glutenin subunits or polyphenol oxidase levels in the quality equation, and for many products other than bread.

"Guidance and direction in quantifying hard winter wheat quality, however one chooses to define it, should emanate from the HWWQL."

The fundamental goal of the HWWQL then, with this, and future bulletins (as well as our research), is to go beyond our mandate to "*evaluate the most favorable new wheat varieties* …" We intend to take a more proactive approach in assisting breeders and producers with wheat quality issues. In other words, we shouldn't be asking breeders (for example) "What do you want to measure?" or "Which quality factors do you believe are most useful or important?" We should be informing the breeder --- "This is what we think you need to measure" --- and then provide the tools to measure it. Guidance and direction in quantifying hard winter wheat quality, however one chooses to define it, should emanate from the HWWQL.

Therefore, future bulletins will reflect current and planned research here at the HWWQL, as well as new and interesting developments in grain science and cereal chemistry research around the world. We will attempt to keep you informed of 'the state of the art' with regard to wheat quality. Occasionally we will highlight the results of a specific manuscript, or review a traditional quality test to help you better understand and perform the test in your own quality lab. At its worst, the bulletin will be useful information; at its best, it will be insightful.

Mark Twain said "The difference between the right word and almost the right word is the difference between lightning and a lightning bug." I hope, with this introductory bulletin, that we have found 'the right word.' ■ - *Brad*

HRW Wheat Quality Targets

HWWQL Assumes Leadership Role

The HWWQL and the USDA-Agricultural Research Service (ARS) have historically played a pivotal role in the improvement of U.S. wheat quality, as well as the development of analytical tools for quality assessment. More than 95% of the new wheat varieties that are released in the U.S. by private, state, and federal breeding programs are currently evaluated by the HWWQL and the other ARS wheat quality laboratories. Given this significant role in U.S. wheat improvement, the HWWQL is in a unique position to provide the leadership and resources necessary to develop numerical quality values to be used as breeding and production targets for HRW wheat.

While roughly half of the U.S. wheat crop is currently exported, the U.S. share of world wheat exports has decreased dramatically over the last twenty years. Since 1990, U.S. world market share has varied between 25 – 30%. In addition, since 1981, the number of wheat acres harvested has decreased by ~27 million. One reason for this decline in acreage is the fact that competition in the world wheat market has caused wheat returns to decrease relative to other crops that U.S. farmers could produce.

"Quality is a major factor determining U.S. export market share, with consistent end-use quality being the major concern … "

However, it is critically important to note that international trading partners of the U.S. wheat industry are also becoming more sophisticated about the role of wheat quality in relation to end-use functionality. *Quality* is a major factor determining U.S. export market share, with consistent end-use quality being the major concern of international purchasers of wheat.

In response, members of the Hard Winter Wheat Quality Council (WQC), following their annual meeting in 2004, formed The Hard Winter Wheat Quality Targets Committee (HWWQTC). Members of this committee are volunteers from a broad and diverse cross-section of the wheat industry, with the HWWQL Director as Chair. *Recommended Target Values for Hard Red Winter Wheat* for the production of pan

continued on page 7

Personnel Changes

Familiar Faces Wearing 'New Hats'

With the retirement in Sept. 2005 of Dr. Okky Chung as Research Leader (RL) of the Grain Quality & Structure Research Unit (GQSRU) and Director of the HWWQL, our Center Director, Dr. Don Koeltzow, began the difficult task of searching for her replacement. As a result, we have interviewed several candidates for the position, but the search for the best candidate continues. The position will be advertised nation-wide again, beginning this month. If you have a potential candidate in mind, please do not hesitate to contact GMPRC Center Director, Dr. Don Koeltzow (donald.koeltzow@gmprc.ksu.edu).

New HWWQL Director Named

Dr. Brad Seabourn has been named the new Director of the HWWQL to replace Dr. Okky Chung. Dr. Seabourn is a research chemist with the USDA-ARS Grain Marketing and Production Research Center (GMPRC) in Manhattan, KS. He has been the Acting Director for the HWWQL since Dr. Chung's retirement, and was the HWWQL Coordinator from 1992-2006. He previously supervised personnel in the near-infrared analysis lab and the milling lab, as well as conducted research in the field of mid-infrared spectroscopy on various molecular and biochemical aspects of flour quality and dough rheology. Dr. Seabourn has worked full-time at the GMPRC since 1982, primarily in the areas of wheat quality, protein chemistry, and infrared spectroscopy, and will continue his research in these important areas in addition to his duties as Director. Dr. Seabourn holds a Bachelor of Science degree in Animal Science, a Bachelor of Science degree in Chemistry, a Master's degree in Grain Science, and a Ph.D. in Cereal Chemistry, all from Kansas State University.

Contact: bradford.seabourn@gmprc.ksu.edu.

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New HWWQL Coordinator Hired

Dr. Richard Chen has been hired as the new Coordinator for the HWWQL. His duties will be to manage the routine daily activities of the HWWQL, as well as develop new and/or improved tests for the rapid prediction of end-use quality in wheat.

Dr. Chen began work at the HWWQL in June 2006, and comes to us from the Wheat Quality Lab at the Dept. of Grain Science, Kansas State University (KSU), where he was Senior Scientist and Lab Manager. He was responsible for conducting quality tests on experimental wheat lines for the wheat breeding program at KSU. His hands-on experience and bench-top skills in milling and baking, food technology and cereal chemistry, as well as his unique background in products such as biscuits, pancakes, gravy mixes, batters and breading, and oriental noodle testing, will add a new and exciting dimension to the quality determinations made by the HWWQL, particularly with regard to non-traditional products such as tortillas and Asian noodle products.

Dr. Chen previously held positions at Griffith Laboratories, Chicago, IL and the American Institute of Baking, Manhattan, KS as a research scientist and cereal chemist, respectively. Dr. Chen holds a Bachelor of Science degree in Agronomy, Shanghai Agriculture College, Shanghai, China, a Master's degree in Grain Science and a Ph.D. in Cereal Chemistry, from Kansas State University. *Contact: richard.chen@gmprc.ksu.edu.*

Support Staff You Should (Need to!) Know

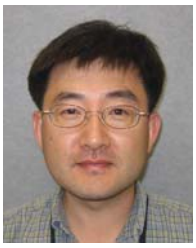
The HWWQL has a very knowledgeable and highly skilled group of technicians and support scientists who 'get the work done'. Approximately forty quality parameters for roughly 3000 experimental wheat lines

continued on page 4

continued from page 3

are evaluated each year by the HWWQL for pan bread end-use functionality. In addition, specific tests for suitability to products such as tortillas and Asian noodles are also performed. If at any time you need expert advice on a specific wheat quality test, please do not hesitate to contact any one of these superb support staff members.

Dr. Seok-Ho Park



Dr. Park has been with the HWWQL since 2002, after completing both an M.S. (1996) and Ph.D. (2001) in Grain Science from Kansas State University. His expertise is in wheat end-use quality as it specifically pertains to the relationship of starch properties to bread making quality and crumb grain. His work on Asian noodle color, PPO measurement, and rapid cereal starch isolation methods have been invaluable to the lab. *Contact: seokho.park@gmprc.kdu.edu*.

Dr. Feng Xie

Dr. Xie received her M.S. degree from the Food Engineering Department at Henan University of Technology, P.R. China, in 1998, and her Ph.D. in Grain Science from Kansas State University in 2002. She came to the GMPRC as a graduate research assistant in 1998 and then became a research associate at KSU in 2003, working collaboratively with the HWWQL. Dr. Xie's research is focused on spectroscopic determination of dough rheology *Contact: feng.xie@gmprc.ksu.edu*.

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Margo Caley

The HWWQL bake lab is expertly managed by Ms. Margo Caley, who has been performing experimental test baking in the HWWQL since 1975. She received her B.S. degree in Early Childhood Education from KSU (1975), and her initial training on the mixograph and the pup-loaf straight dough baking procedure from well-known cereal chemists, such as, Karl Finney, Merle Shogren, Robert Bequette, and Dr. Bernie Bruinsma. Ms. Caley is also a graduate of eight short courses from the American Institute of Baking, and three semesters of baking science courses from KSU. *Contact: margo.caley@gmprc.ksu.edu*.

Kevin Fay

All of the routine Single Kernel Characterization System (SKCS) and near-infrared (NIR) analyses in the HWWQL are performed by Mr. Fay. He first came to the GMPRC in 1983 as a technician under Dr. Dave Sauer. In 1991, he was transferred to the HWWQL to perform quality tests using these rapid techniques, and to specifically build a diverse infrared spectral database on thousands of experimental wheat lines. Mr. Fay graduated from KSU in 1975 with a degree in physical science. *Contact: kevin.fay@gmprc.ksu.edu*.

continued on page 5

continued from page 4

Zina Haden

Ms. Haden is a 1988 graduate of Kansas Wesleyan University, Salina, KS with a B.A. in Education. She is a technician in the HWWQL bake lab, and supports all of the experimental baking procedures. In addition, Ms. Haden performs the Glutomatic Gluten Index test when requested. She has been employed at GMPRC since 1995, and has over 10 years of experimental baking experience.

Contact:zina.haden@gmprc.ksu.edu.

Lucy Lu

Ms. Lu received her medical degree in 1984 from Shanghai Univ. of Traditional Chinese Medicine, Shanghai, China, and was a physician at Shanghai Minghang Central Hospital from 1984-1991. Since arriving in the U.S., she worked as a research assistant in the Wheat Quality Lab at KSU from 1994-2002. In 2002, she became a full-time technician in the HWWQL responsible for determining physical dough characteristics using the farinograph, mixograph, alveograph, and extensigraph.

She also determines noodle color and stability, cooked noodle texture, starch pasting/viscosity, bread imaging, and PPO analysis. *Contact: guixang.lu@gmprc.ksu.edu.*

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Rhonda Lyne

Protein, moisture, and ash contents are determined in the proximate analysis lab, which is managed by Ms. Rhonda Lyne. In addition, she performs the SDS sedimentation test when requested. Ms. Lyne also contributes to our work in assessing tortilla quality, and has helped to establish standard tests and measures for screening flour for this popular product.

Ms. Lyne has a B.S. in Biology (1994), and a M.S. in Grain Science (2006), both from KSU. She has been with the HWWQL since 1995. *Contact: rhonda.lyne@gmprc.ksu.edu.*

Laura McLaughlin

Ms. McLaughlin is the HWWQL milling technician, and is responsible for sample cataloging and inventory, as well as all of the physical tests and milling evaluations made by the lab. She graduated from Kansas State University with a B.S. in Milling Science in 1993. After several positions in the milling, baking, and extrusion industries, she began her current position in the HWWQL in 1997. *Contact: milling@gmprc.ksu.edu.*

continued on page 6

continued from page 5

Jeff Milligan

Mr. Jeff Milligan received his B.S. degree in chemistry at Iowa State University in 1999. After working at Iowa State University and Oklahoma State University, he joined the staff of the HWWQL as a technician in December 2004. His primary focus is on NIR calibration and the spectral evaluation of dough rheology using mid-IR spectroscopy. *Contact: jeff.milligan@gmprc.ksu.edu.*

Susan Xiao

Ms. Xiao attended Jiangxi Medical College and obtained her B.S. degree in medicine in 1986. From 1986 to 1989, she worked as a pediatrician at Pingxiang Women and Children's Hospital. Then she taught at Pingxiang Nursing School from 1990 to 1991. Ms. Xiao began work as a full-time technician at GMPRC in 1996. She does all of the mixograph and RVA analyses performed by the lab. In 2003, she received her M.S. degree in Grain Science from Kansas State University. *Contact:* susan.xiao@gmprc.ksu.edu.

Merle Shogren

Mr. Shogren is our 'guide' and 'knowledge base'. He has been with the HWWQL since 1954, first under Mr. Karl

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Finney, and then Dr. O.K. Chung, who were previous Directors of the HWWQL. Mr. Shogren received his B.S. degree (1951) in chemistry from Bethany College, Lindsborg, KS and his M.S. degree in grain science (1954) from KSU. As part of his MS degree, he developed a micro bread-making system designed to use 8 g of flour --- a prelude to development of the 10-g mixograph and bake test. He has spent many years evaluating flour components responsible for baking quality, applying the fractionation and reconstitution techniques previously introduced by Mr. Finney. He 'officially' retired from federal service in 1989, but has continued work on a part-time basis as both an honored mentor and collaborator. *Contact: merle.shrogren@gmprc.ksu.edu.* ❖

A Commitment to Excellence

You hear it all the time, but rarely do you hear anyone say what it means.

So, what is *excellence*?

Excellence simply means that you make the decision to be the best YOU can possibly be. Excellence also means continually striving to become better than you used to be.

How does an individual or organization achieve excellence? At a minimum, excellence requires these qualities:

1. High standards – *aim* to be excellent
2. Burning desire – *want* to be excellent
3. Hard work – *prepare* to be excellent
4. Courage – *pursue* excellence no matter the cost
5. Strength – *persist* in excellence when others do not

We must choose to be excellent --- excellence does not choose us. The Greek philosopher Epictetus said "We are what we repeatedly do." Excellence is not an ACT … it is a HABIT.

The Hard Winter Wheat Quality Laboratory is committed to EXCELLENCE in everything that we do. If it is worth doing, then we believe it is worth doing well. Our commitment to excellence is our commitment to the U.S. taxpayer and the individual collaborators, customers, and stakeholders that we work with and serve.

It is our commitment to YOU. ❖

continued from page 2

bread were submitted to, and endorsed by, the WQC general membership at the 2006 annual meeting.

Critical to the acceptance of the recommended target values was the ***Statement of Purpose***, which reads as follows:

"The purpose of Recommended Quality Targets (RQT) for Hard Red Winter Wheat (HRW) is to provide specific quality 'goals' for the breeding community, wheat producers, and marketing programs in order to assist and guide the decisions needed to maintain the consistency and end-use quality of the U.S. HRW market class. The RQT will be dynamic over time in direct response to the primary needs of the marketplace (domestic and foreign), and the needs of the U.S. industry to breed, produce and market wheats to meet market needs. The RQT should NOT be used as essential criteria for variety release decisions in breeding programs, or as marketing/grading standards for private companies or federal/state agencies. This Statement of Purpose must accompany all published forms of the RQT."

If you would like to receive a copy of the Recommended Quality Targets, have suggestions for the Committee, or would like to be a member of the Committee, please contact Dr. Brad Seabourn (ph: 785-776-2751, email: bradford.seabourn@gmprc.ksu.edu). ❖

Late-Maturity α-Amylase

Apparent Sprout Damage without Sprouting

In the latest issue of Cereal Foods World (May-June 2006, 51(3):124-125), Dr. Colin Wrigley, Wheat CRC and Food Science, Sydney, Australia, reviews the late-maturity α-amylase (LMA) defect in wheat. Sometimes referred to as 'pre-maturity α-amylase,' this genetic defect has appeared in many recent crosses, and its prevalence in breeding programs has been estimated to be as high as 20 percent. It is difficult to detect because the expression of elevated α-amylase is only triggered under certain growing conditions: specifically low temperatures during the second half of the grain-filling period. Conventional sprout damage, on the other hand, is triggered by moisture falling on ripe grain. Unlike sprout damage, distribution of α-amylase in LMA wheat is uniform throughout the kernel.

For further information or how to obtain a copy of the CFW article, please contact the HWWQL. ❖

continued from page 1

bakers an edge in the kitchen.

Commercial bakers, who depend on flour from a mix of wheat varieties, can easily over-mix their dough, Blechl said, and that can create expensive losses in an industry with small profit margins.

Over-mixing, she said, breaks down the glutenin in dough "and it won't trap the gas bubbles as efficiently and you'll get a flat loaf."

Blechl believes her wheat, modified to include much more of the naturally occurring glutenin, can prevent that from happening.

"By increasing the levels of these native proteins, we've been able to increase what's called a tolerance to mixing," Blechl said. That would increase the window in which bakers have to create an optimal dough for the shape of bread they're after.

That window can be very small with traditional flour from traditional wheat, and if bakers "accidentally overshoot it, they have to throw a ton of dough away," she said.

A large bakery may use as much as 300,000 pounds of flour per day, according to the North American Millers Association.

Jim Bair, a NAMA vice president, said bakers' demands on millers can be hard to meet, often sending flour makers scrambling to get just the right mix of wheat, even if it means importing from Canada.

"You're taking a biological product and then putting it into a highly automated industrial system," Bair said, and often Mother Nature is not agreeable.

That is especially true, USDA's Seabourn said, in years like this one when wheat crops are stressed by drought. "This is extremely important work, I think, because we're going to deal with these kinds of stresses in the future," Seabourn said. "To be able to manipulate the genetics of the plant in a predictable way is very, very important."

A genetically modified wheat plant that takes risk out of milling, Bair said, would be very welcome.

"This is a low- or no-margin business so it's all about driving cost out of the business," Bair said.

continued on page 8

continued from page 7

It was USDA's Blechl, working out of Albany, Calif., who began the work years ago to improve the flour bakers need make the bread loaves and buns Americans eat, but her work may be just the tip of a transgenic iceberg that opens the door for a revolution in baking.

USDA's Seabourn, at one of the government four wheat laboratories, said Blechl's work may just be the beginning.

Hard winter wheat is a variety of wheat used in bread-making.

The American Bakers Association represents 85 percent of wholesale bakeries. Adding vitamins, reducing calories and eliminating allergens are all traits the group said it would like to see come out of genetic engineering. The improvement of flour and dough consistency is also extremely important to bakers, though, spokeswoman Lee Sanders said.

"Probably the average consumer wouldn't think about water absorption levels or the mixability or the protein level, but all those things determine how the bread bakes up and how it comes out ... and how it looks," Sanders said. "All those things are important and (they are) based on the wheat."

Genetically modified wheat will have to be welcomed on to the U.S. market for consumers to gain any benefit, though, and that has not happened yet. Biotechnology has revolutionized soybean, corn and cotton farming in the United States. More than half of all the corn and 87 percent of the soybeans planted in the United States last year were genetically modified, according to USDA data. For cotton, it was 79 percent.

Most of those commodities are now planted with seeds genetically modified to help protect the crops from insects or weeds, and NAMA's Bair said that has helped yields for those plants, while wheat has lagged behind.

For more information, contact Dr. Ann Blechl, (510-559-5716, ablechl@pw.usda.gov). ❖

2005 Regional Performance Nursery (RPN) Data

Data for the 2005 crop RPN is available online at the Hard Winter Wheat Quality Laboratory webpage: http://gqsru.gmprc.ksu.edu/hwwql/crop%20reports.html. Data may be viewed directly online, by downloading a PDF file, or in raw form (Excel). The RPN Relational Database, containing quality data for the crop years 1996-2005, is also available. You may receive a copy of the database by contacting Dr. Brad Seabourn, HWWQL, 1515 College Ave., Manhattan, KS 66502. ❖

Calendar of Events

Special Event

Kansas Wheat Conference
Place: Wichita, KS
Date: July 26-27, 2006
www.kswheat.com

Special Event

Wheat Quality Council Annual Meeting
Place: Kansas City, MO
Date: Feb. 20-22, 2007
www.wheatqualitycouncil.org

Special Event

North American Wheat Workers Workshop
Place: Saskatoon, Saskatchewan, Canada
Date: March 12-14, 2007
www.wheatworkers.ca

Special Event

SWQL Research Review
Place: Wooster, OH
Date: March 28, 2007
www.ars.usda.gov/News/News.htm?modecode=36-07-05-00

Special Event

HWW Breeders Field Day
Place: Ft. Collins, CO
Date: June 2007 (tentative)
rag@unlserve.unl.edu

*The GMPRC July 2006 issue of **Research Kernels** is now available at our website: http://www.ars.usda.gov/npa/gmprc.*

HARD WINTER WHEAT QUALITY LABORATORY

*The Hard Winter Wheat Quality Laboratory is committed to **EXCELLENCE** in everything that we do. If it is worth doing, then we believe it is worth doing well. Our commitment to excellence is our commitment to the U.S. taxpayer and the individual collaborators, customers, and stakeholders that we work with and serve.*

It is our commitment to YOU!

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