PROJECT NO: BJKV33

TITLE: Assurance and Improvement of the Milling, Baking, and End-Use Quality of Idaho Wheat

PERSONNEL: Katherine O'Brien, Manager, U of I Wheat Quality Lab, Aberdeen
Lyona Anderson, Lab Technician
Ericka Ziebarth, Lab Technician
Mary Corbridge, part time

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JUSTIFICATION: Characterization of end-use quality traits of varieties and advanced breeding lines is valuable to wheat breeding programs, researchers evaluating environmental effects and production practices on wheat, wheat growers and end-use industries. The mission of the University of Idaho wheat quality lab is to provide end-use quality information for wheat developed in the University breeding programs to ensure there are satisfactory characteristics for both producers and end-users. High flour yield, favorable protein content, protein quality, and flour functionality as well as good bakery performance are attributes of wheat cultivars with favorable end-use quality. Screening experimental lines for various quality traits gives breeders the information needed to select wheat that has value for both growers and end-users. Early screening allows wheat breeders to cull out lines that have marginal use for end-users. Resources are not wasted advancing poor quality lines, and the lines retained have a higher potential for release. End-use quality of wheat may be affected by both production practices and environmental factors. Wheat researchers in both University breeding and extension programs benefit from receiving end-use quality data obtained from multiple locations for evaluating environmental affects and diverse production practices on both released varieties and experimental lines.

The quality lab compiles data on samples submitted and provides it to interested parties, including University and other wheat researchers, industry personnel, and growers. This data may be used to select those varieties that provide the best yield and end-use quality for particular growing environments. Acceptable or high end-use quality wheat may give Idaho producers market advantages that may improve the profitability of their operations.

OBJECTIVES: Genetics, environmental conditions, and management practices all influence the end-use functionality of wheat. With this in mind, the mission of the University of Idaho wheat quality lab is to pursue the following objectives.

1. Support the U of I wheat breeding programs by providing accurate quality analyses of potential, new, and established varieties in a timely manner.
2. Support U of I extension personnel by evaluating the quality of advanced lines and established varieties grown in diverse environments and with variable management

inputs. Provide quality analyses for other wheat researchers to help ensure that all wheats available to Idaho growers are of marketable quality.

3. Evaluate, develop, and implement new procedures for measuring wheat quality.
4. Promote the importance of high and specific quality characteristics desired by the flour industry to increase the market share and volume of Idaho wheats.

PROCEDURES: University of Idaho wheat breeders and cereal extension agronomists submit wheat samples grown in multiple locations across the grain producing areas throughout Idaho. Private wheat breeding companies also submit samples for analysis as time and resources allow. Lab services are offered to private breeding programs and special projects on a fee basis.

Protocols used are American Association of Cereal Chemists International approved methods or modifications of those methods. Flour yield is an important component of wheat quality, higher yields increase profit margins of millers and higher break flour yields usually indicate higher quality flour. Grain hardness and size may also be evaluated using the single kernel characterization hardness tester. Whole grain protein may be determined on some samples with the Perten 9100 whole grain analyzer. A minimum of 180 grams is needed for this test. Meal is prepared on a UDY hammermill. Flour is obtained by milling on either the Brabender Quadromat Senior or Jr. mill. Flour is sifted using Great Western Sieve Shakers. Flour protein, moisture, hardness, and ash values are obtained using a Perten 8611 NIR analyzer. 10% of samples are verified with bench top methods for protein, moisture and ash. Confirmation of protein values is obtained using an N-Cube combustion nitrogen analyzer. NIR moisture and flour ash are confirmed with moisture and ash oven methods. National Mfg. computerized mixographs are used for obtaining rheological data and dough absorption.

Generation	End-use quality test	Amount of seed needed
F_4	Whole meal protein, hardness, SDS Sedimentaion	>40 grams
F_5	Whole meal protein, hardness, SDS Sedimentation, Jr. mill or Sr. Mill(bake test-cookies for soft wheats, bread for hard wheats)	>40 grams for ground meal testing >80 grams for Jr. Milling 450 grams for Sr. Milling
F_6	Hardness, Sr. Mill for flour yield, noodle color, sugar snap cookie or white pan bread analysis, Solvent Retention Capacity test (SRC)	450 grams
F_7 and up	Hardness, Sr. Mill for flour yield, noodle color, sugar snap cookie or white pan bread analysis, SRC	450 grams
F_{11} and up	Hardness, Sr. Mill for flour yield, noodle color, sugar snap cookie or white pan bread analysis, SRC. May be submitted to PNWWQC	450 grams PNW wheat quality council samples are milled on USDA Miag mill in Pullman and distributed to collaborators

To accomplish goal three to evaluate, develop, and implement new procedures for measuring wheat quality, the quality lab participates in regional methods collaboratives, AACCI methods collaboratives and the PNW wheat quality council (PNWWQC).

Goal four is accomplished by providing information on end-use quality to researchers for inclusion in presentations, publications and popular press articles. Presentations on wheat quality may be given as well as hosting interested parties in the lab. Participation in the PNW wheat quality council and regional collaborative projects also helps promote development and release of high end use quality cultivars.

The FY2019 budget proposal includes salaries for two full-time classified employees and one part-time irregular help employee. It will be necessary to process our samples in the August 1 through May 31 window to keep funding reasonable. This is a normal time frame as we eventually run out of samples to process around or before June 1 and new crop generally arrives the end of July or the first part of August.
The budget also includes funds for travel and operating expenses.

DURATION: One year of a continuing project.

COOPERATION:

Jianli Chen, U of I Wheat Breeder, Aberdeen
Juliet Marshall, U of I Extension Crop Management Specialist, Aberdeen
Arash Rashed, U of I Entomologist, Aberdeen
Kurtis Schroeder, U of I Extension Crop Management Specialist, Aberdeen
Yueguang Wang, U of I Assistant Wheat Breeder, Moscow
Doug Finkelnburg, U of I Extension Educator, Nez Perce County
Jay Kalous, Wheat Breeder-Limagrain Cereal Seeds LLC, Waitsburg, WA

ANTICIPATED BENEFITS/EXPECTED OUTCOMES/INFORMATION TRANSFER:
With end-use functionality information, University of Idaho wheat research programs are better able to select improved quality cultivars, identify optimal production practices, and determine how environmental conditions may affect a cultivar's acceptability to end-users. Idaho wheat producers may use this information to select those wheat varieties that have the best agronomic characteristics for their growing environment and provide a quality product to meet the needs of our diverse wheat grain and flour consumers.

Wheat end-use quality information will be communicated via journal articles, UI publications, presentations, and cereal schools.

LITERATURE REVIEW: Wheat is a complex biochemical entity that varies in composition and properties from year to year, location to location and from one cultivar to another (Hoseney 1994). "Good quality wheat" depends on the desired end-use. Hard wheat products such as bread require higher protein and water absorption levels than soft wheat typically used for pastry products. Wheat cultivars have been developed for Idaho with diverse end-use properties for

distinct markets (Souza et al., 2004). End-use quality can be determined through milling and baking tests as well as more definitive tests such as the solvent retention capacity test (Guttieri et al., 2001). End-use quality testing of wheat cultivars enables growers in Idaho to choose wheat cultivars suitable for their environment that are marketable for end-users in the flour industry.

Literature Cited:

Guttieri, M.J., D. Bowen, D. Gannon, K. O'Brien, and E. Souza. 2001. Solvent retention capacities of irrigated soft white spring wheat flours. Crop Sci. 41:1054–1061.

Hoseney, C.R. 1994. Cereal Science and Technology. 2nd. Ed. American Association of Cereal Chemists, Inc: St. Paul, Minnesota.

Souza, E.J., Martin, J.M., Guttieri, M.J., O'Brien, K.M., Habernicht, D.K., Lanning, S.P., McLean, R., Carlson, G.R., & Talbert, L.E. 2004. Influence of genotype, environment, and nitrogen management on spring wheat quality. Crop Sci. 44:425-43

IDAHO WHEAT COMMISSION - BUDGET FORM

Principal Investigator: Katherine O'Brien

Allocated by	**Idaho Wheat Commission**	**during FY 2017**	**$ 122,629**
Allocated by	**Idaho Wheat Commission**	**during FY 2018**	**$ 122,704**

REQUESTED FY2019 SUPPORT:

	Salary (*staff, post-docs, etc.*)	Temporary Help	Fringe	Travel	OE	Graduate Tuition/Fees	TOTALS
Idaho Wheat Commission	$ 64,588	$ 15,962	$ 26,420	$ 3,800	$ 10,500	$ -	$ 121,270

TOTAL BUDGET REQUEST FOR FY 2019: $ 121,270

BREAKDOWN FOR MULTIPLE SUB-BUDGETS:

	(Insert PI Name)	*(Insert CO-PI Name)*	*(Insert CO-PI Name)*	*(Insert CO-PI Name)*
Salary	$ -	$ -	$ -	$ -
Temporary Help	$ -	$ -	$ -	$ -
Fringe Benefits	$ -	$ -	$ -	$ -
Travel	$ -	$ -	$ -	$ -
Operating Expenses	$ -	$ -	$ -	$ -
Graduate Student Tuition/Fees	$ -	$ -	$ -	$ -
TOTALS	$ -	$ -	$ -	$ -

Total Sub-budgets $ -

Explanatory Comments: (see FY2019 RFP for definition)

Fall 2017 Version

ANNUAL REPORT

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Staff:
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Mary Corbridge

Cooperators:

Dr. Jianli Chen, U of I Wheat Breeder, Aberdeen
Dr. Jay Kalous, Wheat Breeder, Limagrain Cereal Seeds
Dr. Juliet Marshall, U of I Extension Crop Management Specialist, Aberdeen
Dr. Arash Rashed, U of I Entomologist, Aberdeen
Dr. Kurtis Schroeder, U of I Extension Crop Management Specialist, Aberdeen
Dr. Yueguang Wang, Assistant Breeder, U of I, Moscow
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ADDRESS:

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ACCOMPLISHMENTS: Using American Association of Cereal Chemistry International (AACCI) methods and accepted modified methods, the University of Idaho wheat quality lab provides wheat end-use quality evaluations to wheat researchers and other wheat industry entities. This information assists wheat breeders in making decisions regarding the end-use acceptability of their experimental lines and released varieties. University extension personnel use end-use quality data to identify best management practices. The goal is to enhance and preserve the end-use functionality of wheats developed and produced in Idaho and the PNW.

Objectives:

1. **Support the University of Idaho wheat breeding programs by providing accurate quality analyses of potential, new, and established varieties in a timely manner. And:**

2. **Support extension personnel by evaluating the quality of advanced lines and established varieties grown in diverse environments and with variable management inputs.**

In the last fiscal year, we have continued to support the U of I wheat breeding program in Aberdeen as well as the North Idaho/Limagrain partnership program. U of I extension programs remain an additional priority for our efforts.

New crop samples from the 2017 harvest began arriving in early August and we have entered approximately 5000 experimental lines since that time. This was a good harvest year and anticipate most samples this year to be sound for quality.

Researcher	No. of samples analyzed to date
Jianli Chen	1883
North Idaho/Limagrain	1033
U of I Extension/others	2045

We have completed much of the material sent from the Limagrain/U of I partnership, protein analysis of Kurt Schroeder's extension winter wheat variety trials and management trials, and selected winter wheat trials from the Aberdeen wheat breeding program. We continue working on the North Idaho Extension spring wheat variety trials. We have begun grinding and analyzing spring wheat headrows from Aberdeen and some spring wheat milling and baking entries from Aberdeen. We have milled the wheat samples in Amber Moore's manure study and have them in the processing queue. The lab is also cooperating with Xi Liang by milling and baking wheat samples from one of her experiments. Routine maintenance has kept equipment operating well again this year.

3. **Evaluate and develop new procedures for measuring wheat quality.**
Collaboration on new and revised AACCI methods improves efficiencies and assures that methods used are relevant, accurate, and efficient. Through continued collaboration with other quality labs, the U of I lab refines techniques to improve productivity and repeatability of protocols. Annual participation in the PNW Wheat Quality Council, where we listen to experts in the field of wheat quality, frequent communication with Oregon State University (Dr. Andrew Ross) and the USDA-ARS Wheat Quality Lab (Doug Engle), and collaborative opportunities with Limagrain, Nabisco and Syngenta end use quality personnel have all resulted in expanding professional collaborations and extending the reputation of UI in cereal chemistry.

4. **Promote the importance of high and specific wheat end-use quality characteristics desired by the flour industry to increase the market share and volume of Idaho wheats.**
The lab participates in the PNW wheat quality council as a collaborator. The council is made up of PNW wheat researchers, millers, bakers, and other stakeholders in the PNW wheat industry. Advanced experimental lines nearing release are submitted by regional wheat breeders. These lines are milled at the USDA wheat quality lab in Pullman and

distributed to participating wheat quality labs, millers, and bakers. Samples are then evaluated by those parties for standard end-use quality parameters, and usefulness in their specific applications. Samples have been given to collaborators as "blind" entries again this year to reduce potential biases. The council meets annually in January with a roundtable discussion of their results.

The lab had a display at the Aberdeen U of I Twilight Tour in July, where we were able to discuss specific uses for various market classes of wheat with members of the general public. We were also available to discuss and promote critical, sound evaluations of current market propaganda.

PROJECTIONS: The University of Idaho wheat quality lab will continue to support wheat breeding and extension programs by providing accurate and timely end-use quality analyses. Wheat end-use quality data will be communicated at cereal schools, field days, and cereal quality forums, as well as University publications, Idaho Grain Producers Magazine, and the popular press.

PUBLICATIONS:

Juliet Marshall, Chad Jackson, Tod Shelman, Linda Jones, Suzette Arcibal, and Katherine O'Brien. 2017. South Central and Southeast Idaho Cereals Research & Extension Program, 2017 Small Grains Report. University of Idaho College of Agricultural and Life Sciences. Research Bulletin 191.