**Grant Code:** AP3637

**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, Irregular help lab technician

**ADDRESS:** Katherine O'Brien, Aberdeen R&E Center, University of Idaho, 1693 S 2700 W, Aberdeen, Phone: 208-397-4181, E-mail: katho@uidaho.edu

**JUSTIFICATION/RATIONALE:** 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 determine market suitability of new releases. Characterization of end-use quality traits of varieties and advanced lines is valuable to wheat programs, researchers evaluating environmental effects and production practices on quality, growers and end-use industries. 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 end use desirability. This increases efficiency of utilizing resources by not wasting efforts advancing poor quality lines. End-use quality may be affected by both production practices and environmental factors. Wheat researchers in both breeding and extension 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 gives Idaho producers market advantages that may improve the profitability of their operations.

**HYPOTHESIS & OBJECTIVES:** Genetics, environmental conditions, and management practices all influence the end-use functionality of wheat. Considering this, 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/PLAN OF WORK:** To accomplish goals one and two, University of Idaho wheat breeders and cereal extension agronomists submit wheat samples grown in multiple locations across the grain producing areas throughout Idaho. The U of I lab also processes samples submitted from the Limagrain/U of I wheat breeding partnership. Private wheat breeding companies may 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 accepted modifications of those methods. Whole grain meal prepared on a UDY hammermill is analyzed for protein content and grain hardness and may be used to estimate gluten quality using the SDS sedimentation test. Flour is obtained by milling on either the Brabender Quadromat Senior or Jr. mill. Flour is sifted using Great Western Sieve Shakers. Whole grain meal protein, flour protein, moisture, hardness, and ash values are obtained using a Perten 8611 NIR analyzer. Results from 10% of the samples are verified with bench top methods for protein, moisture and ash content. Confirmation of protein values is obtained using an Elementar 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 Sedimentation | >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<br>>80 grams for Jr. Milling<br>450 grams for Sr. Milling |
| $F_6$ | Hardness, Sr. Mill 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<br>PNW WQC samples are milled on USDA Miag mill in Pullman and distributed to collaborators |

To accomplish objective three, the quality lab participates in regional methods collaboratives, AACCI methods collaboratives and the PNW Wheat Quality Council (PNWWQC).

Objective four is accomplished by providing information on end-use quality to researchers for inclusion in presentations, publications and popular press articles. Participation in the PNW

Wheat Quality Council and regional collaborative projects also helps promote development and release of quality cultivars for our producer's markets.

The FY2021 budget proposal includes salaries for two full-time classified employees and one part-time employee, as well as 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
Kurtis Schroeder, U of I Extension Crop Management Specialist, Moscow
Yueguang Wang, U of I Assistant Wheat Breeder, Moscow
Jay Kalous, Wheat Breeder-Limagrain Cereal Seeds LLC, Waitsburg, WA

**ANTICIPATED BENEFITS/EXPECTED OUTCOMES/INFORMATION TRANSFER:**
We provide essential end-use quality information to our partners in variety development and management. Wheat varieties for growers need to have excellent agronomic characteristics for the economic benefit of the grower, good milling characteristics of value to the millers and desirable end-use properties that are preferred by the baking industry and others using wheat flour products. Data for varieties both in selection of what to plant and management practices of those varieties are helpful to growers to maximize their knowledge and ability to grow a healthy and marketable wheat crop. The cost benefit to growers is identifying lines that are desirable for end-users subsequently improving marketability of varieties.

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. AACCI, Inc: St. Paul, MN.

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: (insert name)

| | | | | |
|---|---|---|---|---|
| If applicable, | Allocated by | Idaho Wheat Commission | during FY 2019 | $ 121,270 |
| If applicable, | Allocated by | Idaho Wheat Commission | during FY 2020 | $ 124,150 |

**REQUESTED FY2021 SUPPORT:**

| Budget Categories | (10) Salaries (*staff, post-docs, etc.*) | (12) Temp Help | (11) Fringe | (20) Travel | (30) OE | (70) Graduate Tuition/ Fees | TOTALS |
|---|---|---|---|---|---|---|---|
| Idaho Wheat Commission | $ 56,094 | $ 19,600 | $ 38,756 | $ 4,000 | $ 10,800 | $ - | $ 129,250 |

**TOTAL BUDGET REQUEST FOR FY 2021:** $ 129,250

**BREAKDOWN FOR MULTIPLE SUB-BUDGETS:**

| Budget Categories | *(Insert PI Name)* | *(Insert CO-PI Name)* | *(Insert CO-PI Name)* | *(Insert CO-PI Name)* |
|---|---|---|---|---|
| (10) Salaries | $ - | $ - | $ - | $ - |
| (12) Temp Help | $ - | $ - | $ - | $ - |
| (11) Fringe Benefits | $ - | $ - | $ - | $ - |
| (20) Travel | $ - | $ - | $ - | $ - |
| (30) Other Expenses | $ - | $ - | $ - | $ - |
| (70) Graduate Student Tuition/Fees | $ - | $ - | $ - | $ - |
| TOTALS | $ - | $ - | $ - | $ - |

Total Sub-budgets $ -

Brief Explanatory Comments: (see FY2021 RFP for guidance)
Fringe benefits rates were 33.9% in FY20 and rose to 40.5% in FY21
Salaries and IH temp pay were calculated using a "possible" estimated 2% salary increase(unlikely to have increases)
If no salary increase, salaries need will be $54,573
Requested FY2021 support would then be $127,729

*Fall 2019 Version*

## ANNUAL REPORT

**GRANT CODE:** AP3637

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

**PERSONNEL:**


Project Leader:
Katherine O'Brien, Manager, Idaho Wheat Quality Lab

Staff:
Lyona Anderson, Lab Technician
Ericka Ziebarth, Lab Technician
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. Kurtis Schroeder, U of I Extension Crop Management Specialist, Aberdeen
Dr. Yueguang Wang, Assistant Breeder, U of I, Moscow


**ADDRESS:**


Katherine O'Brien, Manager, Idaho Wheat Quality Lab, Aberdeen R & E Center, 1693 S 2700 W, Aberdeen, Idaho 83210. 208-397-4181 katho@uidaho.edu


**ACCOMPLISHMENTS:** Using American Association of Cereal Chemistry International (AACCI) methods and accepted modified methods, the University of Idaho wheat quality lab provided wheat end-use quality evaluations to wheat researchers and other wheat industry entities. This information assisted wheat breeders in making decisions regarding the end-use acceptability of their experimental lines and released cultivars. University extension personnel used end-use quality data to identify best management practices and best environments suited for released cultivars.

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 breeding program. U of I cereal extension variety and management trials were another priority for our efforts. The lab also provided wheat end-use quality data for graduate student research projects.

New crop samples from the 2019 harvest began arriving in late July and we have evaluated over 300 experimental lines since that time.

| Researcher | No. of samples analyzed to date |
|---|---|
| Jianli Chen | 2319 |

| | |
|---|---|
| North Idaho/Limagrain | 575 |
| U of I Extension/others | 2383 |

We have completed end-use evaluation of samples sent from the Limagrain/U of I partnership, protein analysis of Dr. Kurt Schroeder's extension variety and management trials, and selected winter wheat trials from the Aberdeen wheat breeding program. We have begun grinding and analyzing spring wheat headrows and breeder rows from Aberdeen. The lab collaborated with Dr. Xi Liang by milling and baking wheat samples from one of her experiments. We have completed milling and baking wheat entries in the long-term manure trial provided by April Leytem. We are currently working on spring wheat trials from the Aberdeen program.

In June, we set up the new Quad Senior mill, with assistance of the Brabender technician. We made modifications to use our Great Western sieving system rather than the plansifter system that is provided with the mill. Flour yields are much higher and in line with yields obtained in the USDA wheat quality lab in Pullman. Mill rolls on the old mill were replaced often without much difference in milling yields. The new mill is performing very well.
With funds from the IWC and some from the U of I experiment station director, we have repaired our Elementar nitrogen analyzer in order to ensure the accuracy of protein analyses of grain and flour.

**PROJECTIONS:** The goal is to enhance and preserve the end-use functionality of wheats developed and produced in Idaho and the PNW. This will be achieved through the following 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.**

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

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. Frequent communication with Oregon State University (Dr. Andrew Ross) and the USDA-ARS Wheat Quality Lab (Dr. Craig Morris, Doug Engle), and opportunities with Limagrain, Syngenta, and other industry end use quality personnel have all resulted in expanding professional collaborations and extending the reputation of UI in wheat quality.

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 to reduce potential biases. The council meets annually in January with a roundtable discussion of results.

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. 2019. Southcentral and Southeast Idaho Cereals Research & Extension Program, 2019 Small Grains Report. University of Idaho College of Agricultural and Life Sciences. Research Bulletin 196.