

Barley Coordinated Agricultural Project Work Plan for Year 4 (4/1/2009-3/30-2010)
Paul Schwarz, North Dakota State University

1) Describe the research, education, and outreach activities you are planning for Year 4 (4/1/2009-3/30-2010)

Malt Quality Assays

Research: We will analyze ~500 additional CAP breeding lines (2008 crop) for beta-glucanase. Malt samples will be provided by Dr Mark Schmitt at the USDA Cereal Crops Research Unit (Madison, WI). The assay method will be based on absorbance change with azurine cross-linked barley beta-glucan. Each sample will be assayed a single time at room temperature and a single time after incubation for 10 min at 50°C. The difference in activity will be used as a measure of beta-glucanase thermal stability.

Based on our new lipoxygenase assay method, we are going to analyze 200-300 CAP breeding lines for lipoxygenase. We will work with Kevin Smith to determine most appropriate materials (populations) for lipoxygenase analysis.

Education: A post-doctoral research scientist (Dr Yin Li) will conduct the analyses.

Outreach: Final results will be published in a peer reviewed journal

2) List specific outcomes and deliverables that will be accomplished in the first 6 months (4/1-9/30). These will be used as benchmarks for your bi-annual progress report.

Barley Information Specialist

- Several *Barley Production for Management and Profit* workshops for producers will be held in ND, ID and MT with CAP updates and distribution of outreach materials
- Statistical Experimental Design Short Course will be offered in 2009
- Publish quarterly IBMS Newsletter that will include updates of barley CAP activities

Malt Quality Assays

- I The data of beta-glucanase and their thermal stability in malt samples for all the measured 2007 lines will be provided to Kevin Smith; University of Minnesota.
- I The data of lipoxygenase activity in barley samples for all the measured 2007 lines will be provided to Kevin Smith; University of Minnesota.

3) List specific outcomes and deliverables will be accomplished in the second 6 months (10/1-3/30). These will be used as benchmarks for the bi-annual progress report.

Barley Information Specialist

- BIS will assist with production of new Fact Sheets
- Outreach materials will be evaluated at producer workshops and educational meetings
- CAP presentations at producer workshops and educational meeting will be evaluated
- IBMS Newsletters will include updates of barely CAP activities.

- Presentation of IBMS/CAP outreach activities at January 2009 and 2010 barley CAP meetings
- Publish IBMS Newsletter that will include updates of barley CAP activities

Malt Quality Assays

- | Begin beta-glucanase and their thermal stability assay of 2008 crop samples.
- | Begin lipoxygenase assay of 2008 crop samples.
- | Prepare publication of results on thermal stability of barley beta-glucanase
- | Prepare publication of results on lipoxygenase activity of barley lines

**Barley Coordinated Agricultural Project Six-Month Progress Report
(4/1/08 – 9/30/08)**

Paul B. Schwarz, North Dakota State University

1) Describe the research, education, and outreach activities you completed (4/1/08 to 9/30/08)

Research Our objective is to screen germplasm for lipoxygenase and β -glucanase activity. Dr Yin Li has been conducting this research since May 2005.

Beta-glucanase degrades cell wall β -glucans during germination. Beta-glucanase is quite heat labile, and less than 10% of the activity developed during seed germination is thought to remain in the kilned malt. The enzyme is readily inactivated in mashing, and thus heat stable beta-glucanase is of interest to brewers, as it can help avoid lautering and filtration problems associated with beta-glucans. We will screen beta-glucanase on kilned malts provided by the USDA-ARS CCRU in Madison, WI. These will be assayed at both 25 and 50 °C to provide an indication of thermal stability. We just received all malt samples from Madison lab and are working with Kevin Smith to decide samples for beta-glucanase and their thermal stability assay.

Existing lipoxygenase (LOX) assays are very difficult to adapt to high throughput screening, as the substrate (linoleic acid) is very easy to be oxidized and the reaction products (fatty acid hydroperoxides) are extremely unstable. The methods were amenable to testing <10 samples/day. During the past six months, we have worked on the development of a method for measuring LOX that was more suitable for screening large sample numbers. This method is based on the determination of lipid hydroperoxides by ferrous oxidation-xylenol orange (FOX) assay. With the new method, we are able to perform >100 lipoxygenase assays per day. This method makes it possible for cereal breeders to achieve high throughput screening of low- or null- lipoxygenase lines.

Education

- *Barley Malt Quality Education Course* held in cooperation with Northern Crops Institute and ASBC – 10 scientists attended. CAP research was explained during the course.
- Barley CAP research and objectives were presented to regional IBMS Extension Team Leaders during meetings in June.
- MBAA TQ article *Survey of Barley Producers in Idaho, Montana and North Dakota* published in June.

Outreach

- CAP Outreach materials (Fact Sheets, Brochure, Plant Breeding Display and Podcast) were presented to regional IBMS Extension Team Leaders for evaluation of effectiveness of materials and need for any new materials.
- IBMS Website including CAP recognition and links updated.
- Sixty copies of current Fact Sheets distributed to North Dakota Barley Council County Representatives in June.

- Barley CAP articles were included in four IBMS Newsletters which are each distributed to more than 300 stakeholders and published on the IBMS website.
- Articles prepared for four CAP Update Newsletters.

2) List specific outcomes and deliverables accomplished (4/1/08 to 9/30/08)

Barley Information Specialist

- CAP Fact Sheets, Brochure and MBAA TQ article *Survey of Barley Producers in Idaho, Montana and North Dakota* distributed to 10 *Barley Malt Quality Education Course* attendees
- Evaluations of CAP Outreach materials from regional IBMS Extension Team Leaders were analyzed and new Fact Sheets are planned as a result.

Malt Quality Assays

- I Collected 2007 crop malt samples for beta-glucanase and their thermal stability assay
- I Developed a new high-throughput screening method for measuring lipoxygenase in barley
- I The new high-throughput screening method for measuring barley lipoxygenase will be presented at 19th North American Barley Researchers Workshop, Madison, WI, Oct 26-29, 2008.