

**Barley Coordinated Agricultural Project Work Plan for Year 4 (4/1/09 – 3/30/10)**  
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**1. Describe the research, education, and outreach activities you are planning for Year 4 (4/1/09 – 3/30/10)**

*Mapping:*

- a. Continue map coordinating/ liaison role with the CAP groups at Iowa State and UCR-Riverside and international cooperators at IPK, SCRI, and U. of Haifa.
- b. Ensure map data are properly integrated with other efforts – e.g. QTL Miner and QTL Workbook.
- c. Complete the second round of CAP mapping-related publications.

*Diversity and association mapping:*

- Continue CAP core germplasm coordinating/ liaison role with the CAP groups at Iowa State and UCR-Riverside and international cooperators at IPK, SCRI, and U. of Haifa.
- Complete the second round of publications on comparative genetic diversity, as revealed by CAP SNPs in multiple germplasm arrays.
- Complete the second round of publications on the applications of association mapping to the development of winter malting and food barley.

*Winter hardiness traits as a model for LD mapping:*

- Complete in-depth studies on LD in novel winter hardiness-related genes revealed by expression analysis of Vrn isogenic lines haplotyped with Barley CAP OPAs.
- Prepare the fourth year of germplasm for assessment of hardiness phenotypes.

*Malting barley as a model for MAS:*

- Using QTL Miner, integrated with candidate gene and QTL mapping, promulgate and validate the “six-row malting quality” and “winter hardiness” genotype footprints.
- Demonstrate the application of these integrated footprints for cross design and accumulation of all possible favorable alleles for composite phenotypes.
- Contribute to the global view of allelic diversity for agronomic traits in North American barley germplasm via the coordinated activities of the CAP.

*MAS:*

- Initiate novel MAS projects to add value to winter habit germplasm.
- Conduct validation studies and publish results of the stripe rust quantitative resistance projects.
- Provide re-educational opportunities for recalcitrant adopters of MAS.

**Education**

- Continue graduate student training involving MAS for quality, resistance, and productivity traits.
- Continue with the undergraduate thesis projects involving characterization of genetic diversity using molecular markers and exploiting this variation using MAS.

**Outreach**

- Continue with presentations of Barley CAP goals, accomplishments, and plans.
- Domestic activities will include presentations at field days, grower meetings and special CAP-supported events. International presentations will be made as appropriate: one is scheduled for Spain (5/09).

**List specific outcomes and deliverables that will be accomplished in the first 6 months. These will be used as benchmarks for your bi-annual progress report.**

- OWB SNP map resources expanded and made available through multiple venues.

- Publication of papers on SNP diversity and LD.
- Publication of quantitative resistance MAS projects.
- Publication of association analyses of agronomic and quality traits.
- Additional genotyping and targeted sequencing of winter hardiness-related genes.
- Conduct all field trials as scheduled for breeding lines in the Barley CAP.
- Prepare and submit DNA of all breeding lines as scheduled for the Barley CAP.
- Record all phenotypes as stipulated in Barley CAP and submit data to data coordinator.
- Organize the fourth round of collaborative winter hardiness testing.
- Based on integration of phenotype and genotype, make new crosses to continue accumulation of all favorable alleles.

#### **Education**

- Recruit new graduate and undergraduate thesis students for MAS projects.
- Promote MAS with missionary zeal.
- Make significant contribution to MAS workshop.

#### **Outreach**

- Present CAP project at field days and international venues

## **2. List specific outcomes and deliverables that will be accomplished in the second 6 months These will be used as benchmarks for the bi-annual progress report.**

- “Rosetta stone” barley maps available through multiple venues.
- Record all phenotypes as stipulated in Barley CAP and submit data to data coordinator.

#### **Education**

- Recruit new graduate students to work with CAP-related data.
- Develop and implement new undergraduate thesis research projects.

#### **Outreach**

- Present CAP project at grower meetings, annual CAP meeting, and other venues as these present themselves.

**Barley Coordinated Agricultural Project Biannual Progress Report**  
**(4/1/08 – 9/30/08)**  
**Patrick Hayes**  
**Oregon State University**

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

The activities described below are expanded versions of what was outlined in the work plan submitted with the initial proposal.

**Research:**

*Mapping:*

- d. We continued our map coordinating/ liaison role with the CAP groups at Iowa State and UCR-Riverside and international cooperators at IPK, SCRI, and U. of Haifa.
- e. We have completed integration of Pilot OPA 1, 2, and 3 data with prior data (2383 loci) on the OWB population. The results are posted at the Research Progress link of the CAP website and all files made available to THT.
- f. A publication (target journal Molecular Breeding) on the OWB integrated map is in the final stages of preparation.
- g. We provided SNP information on 62 genes for POPA 3; 49 are represented and are useful reference points for known function genes important for flowering time, winter hardiness, and malting quality.

*Diversity:*

- We continued our CAP core germplasm coordinating/ liaison role with the CAP groups at Iowa State and UCR-Riverside and international cooperators at IPK, SCRI, and U. of Haifa.
- We completed diversity analysis of the CAP CORE with Pilot OPA 1, 2, and 3 data. The results are posted at the Research Progress link of the CAP website and all files made available to THT.
- We await the SCRI to take the next steps on a manuscript describing integration of North American and European germplasm genotypes with Pilot OPA 1, 2, and 3 SNPs.

*Winter hardiness traits as a model for LD mapping:*

- We are using QTL Miner and TASSEL to perform association analyses for winter hardiness traits based on B-OPA1 and phenotype data from multiple field sites in North America and controlled freeze test data from the Martonvasar, Hungary phytotron.
- We are in the final stages of preparing a manuscript on the extent of genomic vs. intragenic LD in winterhardiness-related adaptive gene clusters via analysis of B-OPA 1 SNPs in target genes and targeted sequencing of functional domains in the same genes.

*Winter malting barley as a model for MAS*

- Using B-OPA 1 data, integrated with candidate gene and QTL mapping, we have defined “six-row malting quality” and “winter hardiness” genotype footprints and applied these to Oregon lines in the AMBA Pilot screening program.
- We will advance to field tests germplasm derived from crosses between Oregon and Nebraska accessions that will allow us to use the CAP genotyping platform to accumulate all favorable alleles for both composite phenotypes.
- We contribute to the global perspectives on high throughput with specific reference to North American barley epigenetic vs. epistatic regulation via diverse coordinated activities.

**Education**

- Completed the MAS M.S. thesis project for simultaneous improvement of winter hardiness and grain beta glucan. MAS lines were harvested and selections made for field validation experiments. A new M.S. thesis will use these data to advance germplasm.

- Completed a MAS experiment for transferring three QTL alleles conferring resistance to barley stripe rust to a susceptible background.
- A new student is pursuing MAS and SNP genotyping projects.

### **Outreach**

- Continued with presentations of Barley CAP goals, accomplishments, and plans.
- Participated in a join wheat/barley CAP outreach program – June 29, 2008.
- Domestic activities included presentation of the barley CAP in classroom and production settings. An international presentation with specific reference to the CAP was made in the context of an invited Gaterslabian Lecture at the IPK, Germany (June).

## **2. List specific outcomes and deliverables that were accomplished (4/1/08 to 9/30/08).**

### **Research:**

- Maps completed and made available.
- Genetic diversity analyses on CAP core germplasm completed and made available.
- Analyses of OSU germplasm winter hardiness phenotypes and B-OPA1 genotypes used for selection decisions in 2008 harvest.
- Harvested winter barley field trials of CAP lines.
- Prepared and submitted seed of all breeding lines as scheduled for Barley CAP III genotyping.

### **Education**

- Completed M.S. thesis project on food barley MAS and harvested selected lines in summer, 2008.
- Completed a MAS project for quantitative resistance to barley stripe rust.
- Recruited new undergraduate and graduate students.

### **Outreach**

- Participated in a join wheat/barley CAP outreach program – June 29, 2008.
- Presented CAP project at the IPK, Germany.
- Submitted abstracts for presentations at PAG '09.