

**Project Title:** Doubled haploids and foundational winter hardy germplasm: a resource for U.S. breeders of facultative/winter 2-row malting barley

**Researchers:** Dr. Patrick M. Hayes, Ms. Tanya Filichkin, Mr. Scott Fisk, Ms. Laura Helgerson

**Department:** Crop and Soil Science

**Institution:** Oregon State University, Corvallis, OR 97331

### **Executive Summary**

This project helped meet AMBA's mission and objectives by using anther culture to produce barley doubled haploids, an efficient technology to accelerate variety development. This project is focused on developing winter/facultative 2-row malting barley germplasm with superior winter hardiness. The project framework is collaborative in nature: crosses were solicited from all AMBA-funded researchers working on facultative/winter barley. The concept was that one parent would represent an elite winter/facultative malting variety/selection and the other parent would be a superior source of low temperature tolerance, ideally one of the most low temperature tolerant accessions identified in the TCAP LTT trial. A criterion was that at least one parent had to be 2-row. Ideally, at least one parent would be facultative. Thirty three crosses were nominated. However, in view of available resources and after implementing the aforesaid criterion and ensuring that sufficient F1 seed was available, nine crosses were selected. Doubled haploid production is in progress.

#### *One-year objectives and outputs:*

- Development of ~ 540 2-row malting barley doubled haploids with superior winter hardiness (one-year). Doubled haploid production is in progress. Achieving the goal is anticipated.
- Establishing the foundation for national collaboration in the development of facultative/winter barley (one-year and long-term). The framework for a national collaborative effort at developing facultative/winter malting barley varieties with superior low temperature tolerance is in place. A second cycle was requested for 2016.
- Maximizing the efficiency and cost-effectiveness of doubled haploid production through economies of scale (one-year and long-term). This research helps to provide the grant resources necessary for maintain the doubled haploid lab at Oregon State University. Long-term, it is anticipated that the Small Grains Genomics Initiative will provide a sustainable funding platform and allow for expanded collaboration.

#### *Most significant accomplishments:*

A national collaborative effort was initiated and executed. Doubled haploid production is underway.

### **Detailed Report on Objectives, Methodology and Results – AMBA Funded Project**

#### ***Objectives and Expected Benefits:***

Our objective is to develop and implement a national collaboration for developing facultative/winter doubled haploid 2-row malting varieties with superior low temperature tolerance. The benefit to AMBA will be an expanded pool of competitive malting barley

varieties and the benefit to the plant breeding community will be the synergy that accrues from collaboration.

### **Methodology**

We are using the anther culture technique implemented in the lab over four years ago and that we have been constantly improving.

The doubled haploids currently in production will be grown in the greenhouse this summer and in field plots fall, 2016 for seed increase and preliminary assessment. Seed will be distributed to cooperators in fall 2017.

### **Results:**

Doubled haploids are being produced from the crosses listed in Table 1.

Table 1. Crosses from which doubled haploids are being produced for collaborative development of facultative/winter 2-row malting barley

<b>DH #</b>	<b>Female</b>	<b>Rationale</b>	<b>Row type and growth habit</b>	<b>Male</b>	<b>Rationale</b>	<b>Row type and growth habit</b>
1500	Admire-1	TCAP LTT survivor	6 winter	DH130004	Oregon malt	2 facultative
1502	Antelope	TCAP LTT survivor	2 winter	DH130004	Oregon malt	2 facultative
1504	MOB475	TCAP LTT survivor	2 winter	DH10.1044	Oregon malt	2 facultative
1506	NB10440	TCAP LTT survivor (Nebraska)	6 winter	DH120293	Oregon malt	2 facultative
1508	MOB2566	TCAP LTT survivor	2 winter	SC85942	European malt	2 winter
1510	NB10425	TCAP LTT survivor (Nebraska)	2 winter	KWS Scala	European malt	2 winter
1512	KWS Scala	European 2-row malt	6 winter	VA11B-143	Virginia malt	6 winter
1515	Violetta	European malt	2 winter	VA11B-141	Virginia malt	6 winter
1518	MOB2301	TCAP LTT survivor	2 winter	DH10.1044	Oregon malt	2 facultative

### **Other Barley Research and Future Direction of Program**

The other research activities of the OSU Barley Project are detailed in the AMBA Breeding Program Progress Report.

Beginning in fall 2016, the doubled haploid laboratory will focus exclusively on grant-funded research and breeding projects – either our own or collaborative endeavors. Contract doubled haploid production was fiscally and logistically complicated and it did not meet our land Grant missions of contributing to the fundamental body of knowledge and stimulating economic activity through germplasm/variety development.

### **Project Personnel involved in the doubled haploid lab**

- Patrick Hayes, Professor
- Tanya Filichkin, Senior Research Assistant
- Scott Fisk, Research Assistant
- Laura Helgerson, Research Assistant
- Josh Daker, Student worker

### **Recent Publications (2016-2016)**

Publications are detailed in the AMBA Breeding Program Progress Report.