

**Barley Coordinated Agricultural Project Work Plan FY07 (4/1/09 – 3/30/10)**  
**Blake Cooper, Busch Agricultural Resources Inc.**

**1) Describe the research, education, and outreach activities you are planning for the next year (4/1/09 – 3/30/10)**

Research By March 1, 2009 we will identify 96 breeding lines for 2009 Barley CAP set per the requirements outlined in the Barley CAP Participants Guide. For 2009, these lines will come mostly from our domestic two row, and domestic six row breeding programs, at the Y3 stages; with a few coming from the remaining active lines in our International two row breeding program, which is scaling back. We are planning on planting the domestic lines at the following locations as part of our elite variety trials which are typically 3 replicated plots of ~1.5 m x ~5 m in size, laid out in a randomized complete block design that is optimized for nearest neighbor analysis as listed in table 1 below, it is expected that the International lines will be grown at the same locations as the two row lines in the table below.

Trial Name	Mid Western Locations					
	Sidney, MT	Fairview, MT	Cartwright ND	Casselton, ND	Bottineau, ND	Carpio, ND
Water type	Irrigated	Dry land	Irrigated	Irrigated	Rain fed	Rain fed
Two row		X				
Six row	X	X	X	X	X	X

Trial Name	Intermountain West Locations					
	Twin Falls, ID	Idaho Falls, ID	Rexburg, ID	Brady, MT	Fairfield, MT	Conrad, MT
Water type	Irrigated	Irrigated	Irrigated	Dry land	Irrigated	Dry land
International two row		X			X	
Two row	X	X	X	X	X	X
Six row		X		X	X	

Some of these same lines may be included in paid testing at sites in the provinces of Alberta, Saskatchewan, and Manitoba, Canada. The international two row lines may also be tested at several sites in Europe, the Peoples Republic of China and Argentina.

The respective two-row trials will have Harrington as one of the check varieties. Robust will be one of the check varieties in the six row trials. We will accommodate as many of the other approved checks as we can, either in the Y3 trials directly or in adjacent trials at the same location as the Y3 trials, however, we reserve the right to grow only as many check varieties as we can logistically accommodate.

We typically collect data on grain yield, plump grain % (assortment), and grain protein concentration from all sites that are taken to harvest. In addition; we will collect data such as plant height, stem length, heading date, lodging, various disease reactions, etc. at all locations where such notes are justified. We normally do not collect data on test weight, but are prepared to record this observation on all locations that are taken to harvest. Additionally; we commit to micro-malting several of these locations in our own malt quality laboratory in Ft. Collins managed by Dr. Jolanta Menert. We reserve the right to abandon any of these locations for yield harvest, and / or malting quality evaluations at our sole discretion, if we feel that the data would be compromised due to adverse weather conditions (hail storms, other Acts of God and Nature, etc.) or limitations on our laboratory or research resources.

We will also participate in a collaborative FHB trial with the four Midwest breeding programs. Prior to April 1, 2009, we will send seed from our 96 entries to North Dakota (Richard Horsley and Stephen Neate) and Minnesota (Kevin Smith) and we may assist in the collection of data at these sites if time and personnel availability permits. We will send breeders source seed of our 96 CAP lines seed to Brian Steffenson (5 g), and Tom Blake (10 g) for evaluation of spot blotch and backup Breeders Source seed increases respectively.

In 2009, we will continue to offer planting (~10 g) of the Breeders Seed Source of each of the 96 breeding lines from each of the 8 participating spring barley programs (anticipated 768 lines total) in the 2008 barley CAP project at Ft. Collins in a single replicate mini-plots (6 rows by ~1.5 m<sup>2</sup> in length). These plots will represent a back up source on the primary breeders seed increase at St Paul, MN. We will not plant the winter barleys at Ft. Collins in 2008. Although it is worth noting that we have fall planted a large number of winter barleys at both Ft Collins, CO and Conrad, MT for several of the respective winter barley breeding programs and it is likely that some of these lines would overlap parts of the respective winter CAP lines (i.e. even though we will not be growing the pure seed back up source for the winter types we do in fact have many of them seeded at Ft. Collins and in Fairfield, MT in a winter barley survival nursery. Data will be made available to the “owners” of this germplasm and they can decide if it is worth including in the Barley CAP data set. The spring lines will be planted as soon as practicable after April 1, 2009 at Ft. Collins, CO. We plan to record observations such as plant height, heading date, and other botanical traits as deemed appropriate on these plots and to harvest each of the 768 plots either 1.) As “combine pure seed” which will subsequently be de-awned, cleaned and ~ 600 grams distributed to other participants as listed in the Barley CAP Participant Guide for testing of the Breeders Seed Source, only if the primary source in St. Paul fails; or 2.) As hand-sickled heads from individual plots, if the primary source in St. Paul is successfully harvested. (*In 2006, we combine harvested, in 2007 and 2008 we only hand harvested heads as the primary source was harvested in St Paul, MN.*)

Education We plan to continue to ‘educate’ some of our corporate upper management on the general goals and purposes of the Barley CAP program. This may occur at various field day locations and as we make presentations to management at scheduled company meetings.

Outreach We typically give tours every year to several school groups from high schools and colleges; trade or association groups (teachers, Master Brewer’s of America, Agronomy Clubs, etc.). We will attempt to include what we are doing and share any Barley CAP publications, promotional materials, etc. as appropriate with each of these groups.

**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.**

- Send seed of our 96 lines for 2008 to (Smith, Steffenson, Horsley, Neate and Blake) by April 1.
- Plant out ~1.5 m<sup>2</sup> Breeders Seed Source at Ft. Collins, CO of all 768 spring CAP lines for 2008.
- Plant replicated yield trials of our own 96 lines as listed in table 1.
- Collect botanical observations such as plant height, heading date etc. as appropriate on the 768 spring CAP lines and make the plots available to other participants for any other botanical observations or notes they may wish to make at Ft. Collins, CO.
- Make available any desired prior data, including malting quality data on our own 96 lines to the data base coordinator Dr. Jennifer Kling, OSU. Most of these 96 lines will have had 3-4 years of prior data collected from multiple locations and growing conditions. The prior data set will have Merit, Harrington and B1202 checks for two row trials and Morex, Robust and Legacy for six row trials. Because these checks are all included in the planned OPA 2 standard set and are also included in the Y4 and Y3 stage trials there should be enough common check overlap to make this very extensive prior phenotypic data set highly useable for association mapping of our 96 barley CAP lines.

**3) List specific outcomes and deliverables that will be accomplished in the second 6 months (10/1 – 3/31). These will be used as benchmarks for the bi-annual progress report.**

- Record observations for grain yield, plant height, heading date, etc. according to the Barley CAP Participants Guide as we deem appropriate in our own elite trials from the locations listed in table 1.
- Micro-malt and evaluate malting quality traits from our own elite trials from selected locations among those available in table 1. as we deem appropriate. Final malting data may only be available after 02/28/08.
- Harvest the back-up breeders pure seed source of all 768 lines either as combine pure seed only if the primary source in St Paul fails or as hand-sickled heads for a backup source should the St .Paul source be successfully harvested.

## Barley Coordinated Agricultural Project Six-Month Progress Report

(4/1/08 – 9/30/08)

Blake Cooper, Busch Agricultural LLC.

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

Research - We identified 96 lines from our breeding program to include in the 2008 CAP genotype set. These include 34 six-row Y3 (*third year of replicated testing*) from our Midwest breeding program; 32 two-row Y3 lines from our Intermountain breeding program and 30 two-rowed Y4 lines from our International breeding program, along with appropriate check cultivars either as a direct entries in the respective trials or as a single replicate plot of equal side in an adjacent border row for alternate checks such as Baronesse. These were evaluated in regional performance trials with plots of ~1.5 m x ~5 m size in a randomized complete block design with 3 replicates and optimized for nearest neighbor analysis at the following locations.

Trial Name	Mid Western Locations					
	Sidney, MT	Fairview, MT	Cartwright ND	Casselton, ND	Bottineau, ND	Carpio, ND
Water type	Irrigated	Dry land	Irrigated	Irrigated	Rain fed	Rain fed
Two row		X				
Six row	X	X	X	X	X	X

Trial Name	Intermountain West Locations					
	Twin Falls, ID	Idaho Falls, ID	Rexburg, ID	Brady, MT	Fairfield, MT	Conrad, MT
Water type	Irrigated	Irrigated	Irrigated	Dry land	Irrigated	Dry land
International two row		X			X	
Two row	X	X	X	X	X	X
Six row		X		X	X	

The site at Fairview, MT was abandoned due to severe and prevailing drought. All other locations were taken to harvest. Notes were recorded in season at the various sites to include traits like Julian Heading date, Plant Height (cm), Lodging, and assorted disease observations on an as available basis. In addition to the trials listed above in the US some of these lines were also tested in Canada and in other countries such as Argentina.

Once the agronomic and pathology data is completely summarized we will supply it in its entirety to the data coordinator. Selected locations will also be mico-malted in our facility in Ft. Collins and when completed that data also will be supplied to the data coordinator.

Seed from our 96 entries were also supplied to cooperators for Uniform FHB nurseries in North Dakota (Rich Horsley and Stephen Neate) and Minnesota (Kevin Smith). Seeds were also sent to Brian Steffenson and Tom Blake for evaluation of spot blotch and back up Breeders' Source seed increases respectively.

Additionally; we conducted a small pure seed plot grow-out (~1.5 m in length) on a total of 768 lines from the eight spring programs including our own at our facility here in Ft Collins. Notes were recorded for Julian Heading date and Plant Height (cm) on each entry. A handful of heads were harvested by hand and retained in labeled bags. These heads (*and the heads from 2007 and pure seed from 2006*) will be retained here for at least the next five years for use by any in the CAP project. Literally 1 day after the heads were harvested this field experienced a severe hail storm which caused considerable amount of remaining grain to shatter out and subsequently germinate under natural field conditions. There was a marked difference in the speed and extent to which this shattered seed germinated... we recorded a note (1-5 scale) on the amount of germination about five days after the

storm and we believe this may have a close relationship with dormancy / pre-harvest sprouting. Since we don't really have a designated data field for this type of field germination in our data base we have stored it in a comments field. This information may be useful to those looking at Dormancy – PHS, including Rich Horsley at NDSU and will be made available to the data coordinator or individuals on request.

Education - We generally have limited opportunities to do education in the private sector. During this period we did have several senior corporate executives visit our site in late June. The fields were too wet to visit, but we did drive them directly beside the Barley CAP plots (768 pure seed plots) and attempted to 'educate' them about how we are the only private breeding program that is participating in this important endeavor and helping to conserve the germplasm resource for the entire group. Blake Cooper and Joe Glaser attended the Barley CAP Workshop in St Paul, MN on June 16-18. We also paid for Dr Ann Hess who is acting as a consultant for us to attend this important training session.

Outreach - Again, we generally have limited opportunities for outreach in the private sector. However, we did more this year than normal. In April 2008 we provided a tour of our facility to 15 Canadian Farmer Producers – Certified Seedsmen affiliated with Syngenta Seeds. On June 3<sup>rd</sup> we did a similar tour and brewery tour for about 30 members of the Barley Coordinated Project of the USW&BSI. On June 19<sup>th</sup> we did a tour for about 20 undergraduate students from around the U.S. who were attending a Wheat CAP workshop held at Colorado State University. During the course of the season we also entertained the CSU Agronomy Club. At each of these events we mentioned the Barley CAP program and offered Barley CAP brochures and "business cards" to the attendees. On July 23-24 Blake Cooper presented at the annual farmer field days in Fairfield and Conrad, MT. These field days were attended by approximately 100 farmer growers and members of their immediate families. The Busch- Ag LLC connection to the Barley CAP was noted at each field day and Barley CAP tri-fold brochures were made available. I estimate that all together we distributed about 3 dozen brochures and about two dozen Barley CAP business cards during the year.

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

- Sent seed of our 96 lines for 2008 to (Smith, Horsley, Neate and Blake).
- Planted out 1.5 m<sup>2</sup> mini pure seed plots for 768 spring lines at Ft. Collins recorded notes and hand harvested heads from each for long term storage.
- Evaluated our own lines in regional trials as listed in the table above. Archived the data from these trials in our internal database where they can be supplied to the data Coordinator on request. Lab samples have been submitted and that data will be added when completed. (~Feb 2009). It should be noted that our internal (BARMS) database also has extensive historical data on our 96 lines from prior years of testing, and limited unbalanced observations on some of the other participants advanced lines. This extensive data set can be made available to the data coordinator or individuals upon request.
- Blake Cooper, Joe Glaser and Dr Ann Hess were trained at the Barley CAP workshop on the use of various data analysis programs and strategies. We expect that this training will be useful as we begin to explore the genotype data that is rapidly coming on line. We are gradually preparing our breeding program to begin MAS selection on a few key traits. The development of "Breeder-Friendly" markers and marker systems will be of prime importance as we attempt to utilize the wealth of information that will be generated from the Barley CAP.