What is Wheat Cap?

Coordinated Agricultural Project for Wheat is a multi-state, multi-institution project, funded by USDA/CSREES National Research Initiative, dedicated to the genetic improvement of US wheat through research, education, and extension.

Combine to Kitchen

Two Combine to Kitchen Trips were conducted in the summer of 07 hosted by the Wheat CAP. The trips were meant to raise student awareness about all the necessary steps in food production as well as increasing student appreciation for grower’s and end-user’s perspective.

Georgia:

Jerry Johnson, Lilian Miranda, and Zhenbang Chen organized a Combine to Kitchen trip for Georgia this summer. The 17 participants included undergraduate and graduate students as well as faculty and extension. A local farmer hosted the group at his 1400 acre wheat operation. He discussed different tillage and planting regimes as well as necessary equipment. The group also toured a flour mill and discussed soft wheat flour usage and bakery requirements. Presentations also included a Marker Assisted Selection demonstration with wheat DNA isolation, PCR and gel electrophoresis.

“As a graduate student in plant breeding, the Combine to Kitchen was a great learning experience. I enjoyed observing the farmer’s field and the massive John Deere combine that had a 30 foot header. Milner’s Mill was very enlightening; we were able to see all the steps involved in cleaning and processing of wheat grain to produce flour.,” Kathryn Harman

North Dakota:

By Emma Gamotin

Bill Berzonsky organized the Combine to Kitchen Trip in North Dakota collaborating with the Barley CAPS. A group of 10 students participated in a Combine to Kitchen Tour July 11, 2007. The first stop was the Northern Crops Institute (NCI) based on the campus of NDSU in Fargo, ND. NCI markets crops grown in the Northern Plains area of the US, specifically North Dakota, South Dakota, Minnesota, and Montana by helping wheat end-users understand product development, training trade teams in the area of wheat quality, and coordinating meetings where wheat breeders, farmers, grain traders, and food processors interact to discuss wheat quality. Brian Sorensen, Technical Director of NCI, also gave us a tour of the facilities at the NCI. Our group was shown many different milling and production processes involved in making pasta and bread.

After touring the NCI, we proceeded to Roman Meal Milling in Fargo where we were hosted by Lora Stone (Quality Control/Microbiologist). This private milling company supplies large-scale, custom-mill flours and flour blends to customers and bakers across North America. They buy raw materials which are carefully inspected to ensure that good quality products meet customer specifications.

The last place we toured was the North Dakota State Mill based in Grand Forks, ND, where we were hosted by Travis Devlin (Miller). The North Dakota Mill is the only state-owned mill and the largest flour mill in the US. We toured the mill areas involved in milling and packaging final products. The mill also processes organic wheat products.

For more information visit http://maswheat.ucdavis.edu
Combine to Kitchen (con)

North Dakota:

On July 18, 2007 the Barley focused trip occurred. The group visited NDSU Malt Quality Lab. Our host Paul Schwarz discussed tests to determine malting quality. Next the Cargill Malt Facility was visited and we were hosted by Ray Albrecht (Grain Procurement). Finally, we visited a Barley/Wheat Producer, Jim Slag, with his wife, and daughter in Wimbledon, ND. They kindly showed us their operation and provided us with great discussion and refreshments.

As a plant science student, this tour was a great learning experience for me. It showed the marketing aspects of these grains after harvest, grain/flour processing on a large-scale basis, and how important it is to develop spring wheat varieties with good quality characteristics.

Purdue:

Herb Ohm organized a mini trip this year for his and Steve Scofield’s students. On March 12 and 13 five graduate students from Purdue University visited the Mennel Milling Co, Fostoria, OH. Jan Levenhagen and others at Mennel Milling discussed wheat milling and baking qualities that are important for various pastry and bread making purposes, and the various laboratory and baking tests that are used to evaluate wheat lines and cultivars for various quality attributes. They also discussed the milling process as they toured Mennel’s two mills at Fostoria and Bucyrus, OH.
Wheat CAP Learns QTL Mapping in Seattle
By Nicholas Crowley

In June, members from universities participating in wheat CAP, attended the 12th Annual Summer Institute in Statistical Genetics (SISG), at the University of Washington in Seattle. The main module attended, was QTL Mapping. A few of our group also attended the Advanced QTL Mapping module. Each module consisted of three days of in class and computer lab instruction. Instructors for the QTL Mapping session were R. Doerge from Purdue University and Z. Zeng from North Carolina State University. Advanced QTL Mapping instructors were B. Yandell from the University of Wisconsin and Z. Zeng from North Carolina State University.

Topics of interest focused on experimental design, linkage analysis, phenotyping, permutations, single marker analysis, interval mapping, composite interval mapping, multiple interval mapping, and QTL Cartographer software. Emphasis was also placed on segregation distortion of populations, error checking, threshold significance, QTL effect, model selection, and the underlying statistical concepts.

During the lunch and evening hours, CAP members gathered for enjoyable social events and fellowship. Information and ideas learned at the SISG were beneficial to all participating members and will help in current mapping projects.
UC Davis Hosts Bakers-
A group of over 20 California bakers recently visited UC Davis to learn how plant breeding impacts them. The bakers were hosted by Jorge Dubcovsky’s lab. General plant breeding was discussed as well as marker assisted selection (MAS). The lab provided a MAS demonstration. Most of the attendees found the presentation informative as is reflected by the following comments:

“It definitely adds value what you are doing there and will benefit everyone, the growers, the millers, the bakers and the consumers.”

“I really thought that the seminar was phenomenal. I went into the seminar with no knowledge of what goes into keeping our nation in wheat products, and came out realizing that there is a whole science that goes into it. AND that without the researchers, farmers and commission working together to come up with resistant varieties, there could be a serious wheat shortage. I knew nothing about this industry before I went to the seminar, and although I learned a lot about Wheat and the testing that is done – I realize there is a lot more to know.”

“Thank you for your time and your preparedness. Your team made the research fun and interesting, and spoke in a language that even those who knew the least about it could understand.”

“Thanks again to you and your staff for spending so much time and energy with us on Tuesday! Since getting back, I have been prattling endlessly about the fascinating (and important!) work you are doing. Our visit to your lab was a real treat.”

“The presentation was incredibly helpful to understand the process of selecting and breeding new wheat varieties using biotechnology. It gave me a great appreciation of the amount of dedicated work and patience that goes into developing a new variety of wheat and the obstacles that are presented with the constantly changing strains of disease. The presentation also helped to clarify that biotechnology is being used to speed up traditional forms of wheat breeding, rather than to genetically modify plant strains in the lab. I still feel that biotechnology has some risks with the temptation to unnaturally alter genetic material, but I now have a better understanding than when used correctly, it can be a useful tool for the agricultural industry.”

Educational Exchange-
Drs Jeff Bennetzen and Katrien Devos, and several graduate and undergraduate students from the University of Georgia visited Purdue University on June 11 and 12 for an educational exchange with students and faculty in research areas relating to plant genetics/genomics and crop improvement, organized by Herb Ohm. On June 11 we had a mini symposium during which there were research presentations/discussions led by four Purdue faculty (Drs. Christie Williams, Joseph Anderson and Steve Scofield and Cliff Weil) and there were two discussions led by Katrien Devos and Jamie Estill from the U. of GA. The group toured various facilities including the Purdue Genomics Center led by Dr. Phillip San Miguel. Students and faculty were invited to the home of Dr. Jianxin Ma in the evening for a relaxed time of discussions. On June 12 in the afternoon the visitors participated in the Purdue Wheat Field Day, which included posters and discussions on various genetics research on important traits in wheat, and plot tours.
Western Wheat Workers at WSU by Kim Kidwell

During the annual Western Wheat Workers meeting held at Washington State University in Pullman, WA, wheat researchers and extension personnel gathered to discuss problems facing the wheat industry in the western region of the U.S. Possible solutions to these problems were discussed as well. Wheat researchers and extension specialists were brought together to bridge the gap between the people who execute the research and those who disseminate results of this research to the community. As part of this meeting, a special workshop entitled “From Problem to Solution: Breeding Stripe Rust Resistant Wheat”, was presented by Arron Carter, a CAPs supported PhD student, and Dr. Dipak Santra, a post-doc with WSU’s Spring Wheat Breeding and Genetics Program. The objective of the workshop was to introduce extension specialists to biotechnology techniques used to solve wheat production problems. A total of 35 participants attended representing six western states, including plant pathologists, virologists, extension specialist, public and private plant breeders, and research support scientists.

Participants cross-hybridized wheat plants and performed or witnessed various laboratory techniques used to incorporate novel stripe rust resistance genes into wheat varieties including DNA extraction, PCR, gel analysis, and gel imagery. Participants learned how associations between molecular markers and traits of interest are identified, and how marker-assisted selection (MAS) is used to introgress target traits into wheat plants. Participants were given the opportunity to select plants with the target trait based on DNA profiles. The efficiency of this approach was contrasted with traditional screening procedures to demonstrate the impact of MAS on the efficacy of variety development efforts.

Following the hands-on workshop, Dr. Deven See discussed MAS efforts in the Pullman-based USDA-ARS Genotyping Laboratory. Different types of markers systems and equipment used for MAS were discussed. The high-throughput nature of the laboratory was emphasized, and relevant ongoing research designed to compliment the service component, including marker development and optimization, were presented. Participants interacted with each other, as well as the presenters, during both workshops, which enriched discussion. Participants left the workshops empowered with the knowledge of how MAS is used to enhance variety development. Plant breeders that rely on traditional selection methods expressed interest in incorporating MAS into their programs, and collaborative relationships among researchers and extension experts to educate the public on the importance of biotechnology for solving wheat production problems were established.
MAS Demonstrations at Field Days
WSU

The Department of Crop and Soil Sciences at Washington State University hosted a field day entitled “Novel Solutions to Traditional Problems” at Spillman Agronomy Farm on July 12, 2007. Experimental breeding lines and variety release candidates developed through marker-assisted selection (MAS) were featured on the tour. MAS-derived germplasm carrying novel all-stage resistance genes for stripe rust, the early senescence gene Gpc-B1, novel Hessian fly resistance genes, and Foot rot resistance where highlighted in advanced field breeding trials. WSU’s first DNA marker-based MAS-derived variety, WA7975, a hard red winter wheat carrying Gpc-B1, is expected to be approved for variety release in February 2008.

Many wheat producers have heard about MAS, yet they do not fully understand how this breeding strategy works. As an outreach activity, we held a two-hour MAS workshop during the afternoon of the field day to expose growers and industry representatives to the application of DNA marker technology to wheat improvement. Arron Carter, a CAPs supported PhD student from WSU, created the workshop entitled “CSI Plant Style: From the Laboratory to the Wheat Field”. A total of 18 participants attended the workshop, including farmers, seed dealers, crop consultants and association executives. The objective was to demonstrate the process of integrating DNA technologies into wheat variety improvement efforts through hands-on learning. Participants identified current wheat production problems, and then were taken through a scenario involving the development of stripe rust resistance varieties through MAS as an example of how biotechnology can be used to solve production problems. Explanations of genes, molecular markers, linkage and MAS were provided. Participants cross-hybridized susceptible and resistant plants, and learned how to use molecular markers to identify progeny carrying the target resistance gene. Participants extracted DNA from wheat tissue, learned the concept behind PCR, and were given the opportunity to select plants with the target trait based on DNA profiles. The efficiency of this approach was contrasted with traditional screening procedures to demonstrate the impact of MAS on the efficacy of variety development. Participants enjoyed the opportunity to interact, learn and explore with researchers in a non-intimidating setting where they were encouraged to ask questions. Many participants asked if we would create similar workshop opportunities for other personnel from their respective organizations in the future. Participants were empowered with the knowledge and understanding of how plant breeders develop new varieties for commercial production using MAS. Please contact Arron Carter (ahcarter@wsu.edu) for additional information concerning workshop content and delivery style.

Colorado: In conjunction with the Hard Winter Wheat Breeder’s Field Day, there was a genotyping lab liaison meeting in Fort Collins on June 19.

Purdue: The Purdue Wheat Improvement Program held two Wheat Field Days, one at Evansville, IN on May 22, with 35 seed producers and others attending; and a second Field Day at West Lafayette, with 50 participants.

University of Idaho: Jianli Chen, a research scientist in wheat breeding and genetics at Virginia Tech, has joined the faculty of the University of Idaho College of Agricultural and Life Sciences as its wheat breeder in Aberdeen.

Chen having earned her Ph.D. in 2005 in plant genetics and breeding at Virginia Tech will be the newest Wheat CAP member. She is pictured at right participating in a field days this summer in Idaho.
**FFA Workshop at WSU**

by Arron Carter

Every year during the second week of May, the state FFA convention is held at Washington State University. Over 2,000 FFA students from around the state gather in Pullman, WA to participate in various competitions and career development events. In order to expose these students to cutting edge technologies used in wheat improvement, Arron Carter, a CAPs supported PhD student from WSU, created a workshop for visiting FFA students entitled “CSI Plant Style: From the Laboratory to your Lunch Tray.”

Also, helping with the presentation was Dr. Dipak Santra, a post-doc with WSU’s Spring Wheat Breeding and Genetics Program. The first objective of the workshop was to demonstrate the process of integrating DNA technologies into wheat variety improvement efforts through hands-on learning. Participants cross-hybridized wheat plants, and learned how to identify superior traits through traditional breeding and marker-assisted selection. They extracted DNA from wheat plants, and were given the opportunity to identify plants carrying specific traits based on DNA profiles. The processes through which improved varieties are released to farmers for production, and how flour from resulting grain is made into consumable products that end up on their lunch trays was explained. The second objective was to introduce interested high school students to potential career opportunities in agriculture involving field, greenhouse and/or laboratory research. Announcements for the workshop were distributed through the state FFA coordinator to all FFA advisors, and within 20 minutes of sending the e-mail, 40 participants had signed up for the event. In the end nearly 60 participants, including FFA students and advisors, attended one of three workshops with 20 participants each, presented throughout the day. By integrating the use of Power point slides to provide general details and definitions followed by hands-on activities, participants were empowered to experience the difference they can make in agriculture today. Please contact Arron Carter (ahcarter@wsu.edu) for additional information concerning workshop content and delivery style.

**Virginia Polytech Institute Planning DNA Lab for Extension**

By Marla Dale Hall

This December Virginia Cooperative Extension personnel will be invited to participate in a hands-on lab experience focusing on wheat molecular genetics. Participants will spend the afternoon in the lab learning about molecular genetic techniques such as DNA extraction, polymerase chain reaction, and fragment analysis. The process of using marker assisted selection in a breeding program will be demonstrated; showcasing its advantages for both the breeder and ultimately the agricultural producer. Research being completed at Virginia Tech as part of the national Wheat CAP will also be highlighted and discussed. Virginia Tech Extension Grain Specialist, Wade Thomason, Small Grains Breeder, Carl Griffey, and Postdoctoral Research Associate, Marla Hall will all assist with the program.