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.

Marker Assisted Selection

A primary goal of the Wheat CAP is to establish marker-assisted selection (MAS) in public wheat breeding programs across the U.S. Traits important to growers and end-users are controlled by the genetic makeup of each wheat cultivar. Scientists work to identify genes controlling agronomic, disease resistance and quality traits. Historically, a laborious selection process has been necessary to breed for these traits. Now, selection can be made more efficient with MAS, where molecular markers close to the genes of interest are used to assist breeders in selecting the best gene combinations. Wheat CAP members are using MAS to select for a variety of traits that will improve wheat yield, disease resistance and end-use quality.

What is:

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
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<tbody>
<tr>
<td>DNA</td>
<td>The genetic code that controls the structure and function of all organisms.</td>
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<td>Gene</td>
<td>A specific segment of DNA that codes for a certain trait.</td>
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<td>Marker</td>
<td>A specific DNA segment that is close to a gene and can be used to track the gene during MAS</td>
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<td>MAS</td>
<td>A selection technique that uses DNA markers to select beneficial individuals.</td>
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Genotyping Labs

There are four USDA-ARS Regional Small Grains Genotyping Laboratories (RSGGL) located at Manhattan, KS; Raleigh, NC; Fargo, ND; and Pullman, WA. Current lab coordinators include G. Bai, G. Brown-Guedira, S. Chao and D. See, respectively. Using modern high-throughput laboratory equipment, the genotyping laboratories have the capability of processing a large number of plant samples and rapidly generating molecular marker data, making MAS even more efficient. In the first year, the genotyping labs have provided Wheat CAP breeders with approximately 87,600 MAS datapoints. This interaction between molecular geneticists and breeders will help speed the breeding process.

Outreach

Education and outreach are important components of the Wheat CAP. The genotyping labs participate by providing workshops on high throughput MAS. Dr. D. See of RSGGL in Pullman, WA in collaboration with Kim Kidwell of WSU will help provide a MAS workshop at the Western Wheat Workers meeting in June. Through this workshop, we hope to enlist the help of Ag Educators and Extension Agents in garnering continued public support for MAS and the Wheat CAP.

For more information visit http://maswheat.ucdavis.edu
Association of agronomic traits with markers
The genotyping labs, also, are involved in identifying new markers for agronomically important traits. Dr. G. Bai, director of Central Genotyping Lab in Manhattan, KS, and his associates identified new molecular markers for wheat resistance to Fusarium head blight, aluminum toxicity, leaf rust resistance and pre-harvest sprouting. Dr. S. Chao, director of the RSGGL in Fargo, ND, screened the parents of the Wheat CAP mapping populations for marker differences. These marker differences are being related to important agronomic traits, providing new markers to be used in MAS breeding.

Forward Breeding
Another important function of the genotyping labs is to help breeders prepare for potential problems. For example, a new stem rust identified in Africa has overcome the most commonly used resistance genes, and poses a potential threat in the US. G. Brown-Guedira of RSGGL in Raleigh, NC used markers to determine the resistance genes currently present in US varieties. This provides important information that allows breeders to target the appropriate genes with MAS to improve the level of resistance in their breeding programs.

What is the Wheat CAP Doing?
The Wheat CAP has established marker-assisted selection in 25 public wheat breeding programs. We will continue to use MAS to improve wheat disease resistance, yield and quality.