

WHEAT CAP

Carl Griffey, Marla Hall and Jamie Sherman, May 2007

FACTS: Powdery Mildew

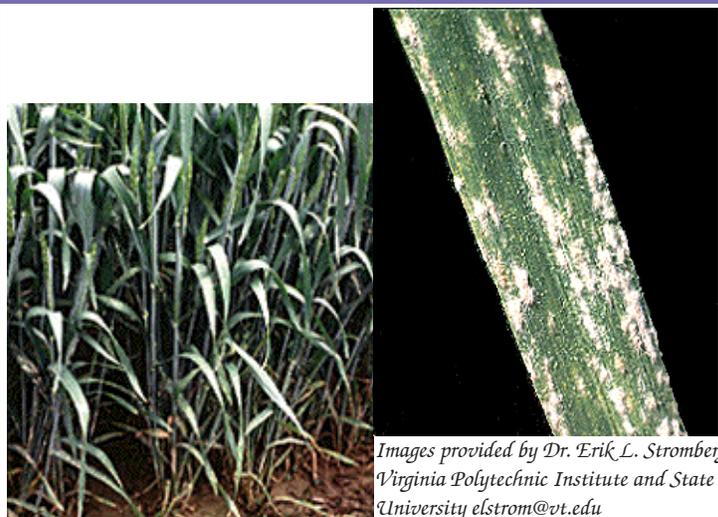
What is Wheat Cap?



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.

The Problem - Powdery mildew, a wheat fungal disease caused by *Blumeria graminis*, is an important foliar disease worldwide. It is a particular problem where climate is relatively cool and moist. Optimum development of powdery mildew occurs at temperatures between 59° and 71° F, so it is usually the first leaf disease of the season. High nitrogen application and high stand density can also favor the disease. Powdery mildew is easy to recognize as the body of the fungus is visible as white cottony patches on the leaves. Wind- or rain-borne spores spread the disease and new spores can be produced every 7 to 10 days. The fungus causes damage by increasing the number of non-productive tillers, reducing yield even at low levels of infection. Yield is reduced both due to reduced seed size and reduced number of seeds per unit area. Yield reduction may be as high as 40 percent. Growing mildew resistant varieties is the most economical way to control powdery mildew.

Breeding -Over 30 genes have been identified that provide some level of resistance. Most of these genes are race specific. In most cases, the effectiveness of race-specific genes is temporal, generally less than 5 years, in commercial cultivars. The presence of a race specific gene selects for races that are not effected by that gene. A more permanent resistance can be provided with adult-plant resistance because it is non-race specific and has remained effective in cultivars for more than 25 years. However, this type of resistance is controlled by several genes each having additive effects. With multiple genes involved it is difficult to assess and incorporate into new cultivars using traditional breeding and selection techniques. Therefore, a main research objective is to identify DNA markers that are adjacent to resistance genes and to use these markers to select elite wheat lines and cultivars possessing multiple genes conferring durable resistance to powdery mildew.



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Powdery mildew infected wheat

Marker Assisted Selection -The molecular technique that uses markers to track genes is called marker assisted selection (MAS). In MAS, markers are used as flags to help breeders select the best gene combinations. Wheat CAP members Carl Griffey and Marla Hall are working to identify markers for adult-plant resistance to powdery mildew. Markers allow breeders to choose the best resistance gene combinations that will provide stable resistance against powdery mildew.

Mapping - To identify markers associated with powdery mildew resistance Carl Griffey's group is building a genetic map. To make the map they first had to create a large population by crossing a parent susceptible for the disease with a parent resistant to the disease. The individuals in the population are scored for disease resistance as well as a number of molecular markers. Markers that are found to be inherited with the resistance can then be used to breed for resistance in other populations. The Wheat CAP group is creating 18 mapping populations to associate important traits with markers to facilitate breeding.

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.