UA Division Of Agriculture Developing Aflatoxin Resistant Corn

FAYETTEVILLE, ARK.

University of Arkansas Division of Agriculture plant pathologists are developing transgenic corn lines that could help level the field for corn producers in the South compared to those in the Midwest where a cooler climate eliminates the risk of a major fungal disease that plagues Southern growers.

A major issue for corn in the South is infection by a fungus that produces aflatoxin in the grain, which makes it unmarketable. The fungus, Aspergillus flavus, thrives in corn plants that are stressed by hot, dry weather, says Research Assistant Professor Ron Sayler. Aflatoxin is rarely a concern for corn producers in the Midwest because of the cooler climate there.

In Arkansas, irrigation is highly recommended for corn to reduce the risk of aflatoxin contamination, however, it frequently occurs even in irrigated fields, particularly in a very hot, dry summer such as occurred in 2010, Sayler said. In many third world countries where grain marketing is unregulated, people and farm animals often die from aflatoxin poisoning.

Sayler and Assistant Professor Burt Bluhm are working to develop transgenic corn lines in which the growth of the A. flavus fungus that produces aflatoxin would be inhibited. The project is funded in part by the Arkansas Corn and Sorghum Promotion Board.

A gene in hyacinth bean has been proven to inhibit the alpha amylase enzyme activity of A. flavus necessary for both fungal growth and the subsequent accumulation of aflatoxins, Sayler said. Plant pathologist Charles Woloshuk isolated the gene about 10 years ago at Purdue University, where Bluhm was a member of the research team before coming to Arkansas. Insertion of the gene into corn was not being pursued, so Bluhm and Sayler picked up the project in Arkansas.

Sayler developed a DNA segment containing the gene and introduced the transgene into corn line Hi II.

Sayler reported that, "the amylase inhibitor gene family member B01 has been cloned into the plant transformation vector 1300S, which is designed to express B01 in all tissues (of the corn plant). Twenty-one lines with the B01 amylase inhibitor transgene have been regenerated and are being grown to maturity in the greenhouse. Seed from each of these lines will be tested for their ability to inhibit Aspergillus flavus infection and aflatoxin accumulation."

Plant Pathologist Ron Sayler shows transgenic corn plants grown from clones (inset) of plants regenerating from tissue cultures after insertion of a gene for resistance to the fungus that produces aflatoxin.

"When you introduce a gene into corn, it goes to different parts of the corn chromosome. Where the gene is located affects the expression of the desired genetic trait," Sayler said. Tests of seed from each transgenic line will determine which line will significantly inhibit growth of the fungus and production of aflatoxin. Results should be known by this summer, he said.

"I am optimistic that one of the lines will express (amylose inhibitor) levels high enough to inhibit growth of the fungus," Sayler said. He is also pursuing a different method of expressing the gene in corn to optimize the effectiveness of this technology.

When a transgenic line is identified that significantly inhibits A. flavus growth and aflatoxin development, it will be made available to plant breeders for use in developing improved corn varieties with a combination of traits best suited for Arkansas and other Southern states, Sayler said. Δ