A greener way to raise cotton and combat nematodes

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A juvenile root-knot nematode, Meloidogyne incognita, penetrates a tomato root. Once inside, the juvenile, which also attacks cotton roots, causes a gall to form and robs the plant of nutrients. Credit: William Wergin and Richard Sayre. Colorized by Stephen Ausmus.

(Phys.org) -- U.S. Department of Agriculture (USDA) scientists are using molecular tools to help cotton growers cut back on their use of pesticides in controlling one of their worst adversaries: the root-knot nematode (Meloidogyne incognita). Worldwide, the soil pest costs growers up to 10 percent of their crop, and it's a constant threat in the

Southeastern United States, where it thrives in the sandy soils.

Richard Davis, a plant pathologist with the Agricultural Research Service (ARS) in Tifton, Ga., and his colleagues are hunting for genetic markers that will lead to development of commercial varieties of cotton better equipped to resist root-knot nematodes. They also have released a new line that gives cotton breeders a boost in their efforts to develop resistant lines.

ARS is USDA's principal intramural scientific research agency, and this project supports USDA's priority of promoting agricultural sustainability.

Much of Davis' research is being funded by the cotton growers who want to replace their chemical treatments with environmentally friendly ways to control nematodes. The work has taken on a sense of urgency because a pesticide called Temik, used to control nematodes in cotton fields, is in short supply and is scheduled to be discontinued because of health and environmental concerns.

Davis and Peng Chee, his University of Georgia partner, published a paper in 2006 that identified areas of the cotton genome where root-knot resistance genes are likely to reside. They have since refined the search by mapping portions of the chromosome where the resistance genes are located, and identifying "flanking markers" that lie on either side of the genes themselves. These results, published in Theoretical and Applied Genetics, will be critical in the search for the specific genes that confer resistance.

Developing cotton lines that resist the root-knot nematode is time-consuming and extremely expensive, in part because resistance is a multi-gene trait. Cotton also has a diverse genome—some plants have two sets of chromosomes, while others have four—making it difficult to cross

"wild" resistant germplasm with commercial cultivars and come up with a hybrid that will produce seed.

But the line developed by Davis and Chee will be an excellent tool for breeders because it can grow throughout the Southeast and produces higher yields and a higher fiber quality than the line now used in many field trials. The new line is the result of several years of trials where researchers evaluated crosses among cotton plants, some raised in fields inoculated with the nematode and others raised in fields free of it. The researchers recently released it in the Journal of Plant Registrations.

More information: Read more about this research in the July 2012 issue of Agricultural Research magazine.

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