ECOLOGY

New Corn Plant Draws Fire From GM Food Opponents

Improved methods for controlling corn rootworms could help the farmer, but a novel corn strain genetically modified to do just that is raising safety concerns

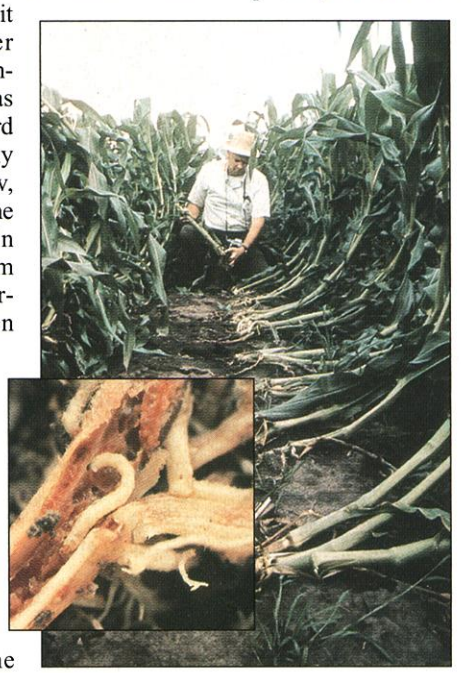
The next battle in the war over genetically modified (GM) foods may be shaping up in Washington, D.C. In December, Monsanto Corp. applied to the U.S. Environmental Protection Agency (EPA) for approval to field-test and sell a new line of modified corn. The plant carries a bacterial gene that produces a toxin that kills one of the toughest insect pests of corn, the so-called corn rootworm complex, actually the larvae of three related beetle species. A go-ahead for field tests could come as early as next month, and Monsanto says it hopes to be able to sell seeds to farmers in time for planting next year. But biotech watchdogs are urging EPA to reject Monsanto's applications unless a host of safety questions are answered.

Currently, corn rootworms, which infest virtually all of the 30 million hectares of corn planted annually in the United States, are controlled either by rotating corn with another crop, such as soybeans, whose roots are not palatable to the pests, or with chemical insecticides. For the most part, the insecticides are applied to the 5.7 million hectares where crop rotation isn't practiced. Even so, they cost farmers about $200 million each year—about one-fifth of the total spent on insecticides for all crops in the United States.

The new GM corn could dramatically reduce this pesticide use, at least for a few years, experts say. "Farmers have been waiting for something like this for a long time," says Fred Yoder, a spokesperson for the National Corn Growers Association who farms about 400 hectares of corn, soybeans, and alfalfa near Plain City, Ohio. Indeed, finding a new rootworm control strategy is becoming increasingly important as rootworms are becoming resistant, not just to chemical pesticides but to the crop rotation strategy as well. In the past few years, some beetles have adapted to lay eggs in soybean fields that hatch to attack the next year's corn crop.

But despite the potential benefits of a rootworm-resistant corn plant, the new strain is raising concerns among environmental and consumer groups. Monsanto scientists created the modified corn by putting in the gene encoding one of the Bt toxins, so called because they come from the soil bacterium *Bacillus thuringiensis*. But this toxin, from *B. thuringiensis tenebrionis*, is different from the ones previously used to produce corn resistant to the European corn borer, which don't deter rootworms. And because no transgenic crop expressing this toxin has ever been planted commercially, all sorts of safety questions should be addressed anew, says Charles Benbrook, an agricultural consultant in Sand Point, Idaho, who works with consumer and environmental groups.

He and representatives of three public-interest groups, including Consumers Union, the publisher of *Consumer Reports*, urged the EPA in written comments to reject the application to field-test the corn unless Monsanto proves that it is not toxic to other species, including beneficial beetles such as the pest-eating ladybird beetle. The company also needs to show, Benbrook says, that the toxin breaks down in soil and doesn't harm soil organisms, a particular concern given recent work showing that the roots of other Bt corn plants secrete their toxins into the soil (*Nature*, 2 December 1999, p. 480), where they can bind to soil particles and remain active for months. Finally, the groups opposing the new corn strain worry that it could lead to the development and spread of Bt-resistant corn rootworms, which could ultimately make the technology useless.



Voracious eaters. Corn rootworms, such as the one shown in the inset, can weaken roots to the point where the plants fall over.

Entomologist Michael Gray of the University of Illinois, Urbana-Champaign, considers such resistance inevitable. He points out that the worms eat little else except corn roots, which means they can't escape to so-called refuges that are free of the toxin as European corn borers can, and that they've already demonstrated their adaptability by becoming resistant to chemical pesticides. "Any notion that they will not develop resistance to transgenic [corn] is foolhardy," Gray says.

But Randy Krotz, director of business and industry affairs for Monsanto, says that the company has been working for more than 2 years with corn-rootworm experts from midwestern universities to devise a plan to contain resistance to the Bt toxin should it develop. He also says that Monsanto has already conducted its own studies, some of which were submitted with the applications, showing that the corn does not secrete the Bt toxin into the soil. Even if it did, he adds, toxicity studies show that the new corn line does not harm nontarget organisms such as earthworms, ladybird beetles, lacewings, and more than nine other species. "The environmental profile is great," Krotz says.

Buoyed by these results, Monsanto is pushing the technology as fast as it can. The company applied in mid-December to conduct large-scale field tests, and they applied less than 2 weeks later for full commercialization, even though the field tests, if approved, would not be completed until late next summer. Other biotech companies say they are not far behind. Novartis Biotechnology is developing its own transgenic corn for corn rootworm control, and a joint effort by Dow Agrosciences and Pioneer Hi-Bred International has already yielded rootworm-resistant Bt corn lines.

EPA will take a hard look at the new technology before deciding whether to approve it, says Steve Johnson, associate deputy assistant administrator for the EPA's Office of Prevention, Pesticides, and Toxic Substances. "If we feel that there is additional research needed, we'll not grant the EUP [Experimental Use Permit for field trials] or the full license," he says. But under the most favorable scenario for Monsanto, the EUP could be granted as early as March, although the agency won't decide whether to let Monsanto commercialize the corn until after data are in from the field tests. Meanwhile, biotech watchdogs are getting ready to bark if EPA approves the crops quickly. "There will be a global reaction," Benbrook says.

–DAN FERBER

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