# Plastic Mulch

## Harmful or Helpful?

Many gardeners and homeowners use wood chips, paper, or other shredded materials as mulch around their plants to reduce weed growth and enhance storage of soil moisture. Though fields of large-scale commercial produce farms look very different from the typical backyard veggie garden, they too use mulch. But tomato producers, for instance, use plastic sheeting instead of wood chips as mulch on large parts of their fields to prevent the same kinds of problems.

Both the pro and the backyard gardener often have something else in common: They use pesticides to combat weeds and insect pests. But when used in combination with pesticides, the plastic mulch favored by many commercial growers can have unintended effects. Unfortunately, plastic mulch, which can cover between 50 percent and 70 percent of a field, increases surface water runoff from both rainfall and irrigation. That means more of the pesticides applied on plastic-mulched fields makes it into runoff leaving the field.

Cathleen Hapeman of the Environmental Quality Laboratory in Beltsville, Maryland; Pamela Rice of the Soil and Water Management Research Unit in St. Paul, Minnesota; and Don Wauchope of the Southeast Watershed Research Laboratory in Tifton, Georgia, are collaborating in comparing various management practices to find ways to reduce or possibly eliminate pollution from agricultural practices. To get a handle on the solution, the scientists have to first find out what happens to the pesticides applied to the fields. Specifically, they want to determine the environmental fate of the pesticides. To do this, they use computer simulation models to predict pesticide movement and then identify management practices to reduce that movement.

Model predictions of the effects of agricultural practices on water quality are being compared with experimental measurements at ARS locations nationwide and in other countries, as well.

Hapeman and Rice are exploring a computer model's application to the fate and transport of pesticides. Rice, formerly of the Environmental Quality Laboratory, and now with the Soil and Water Management Laboratory in Minnesota, is using a model in conjunction with her research on the effect of agricultural management practices on pesticide movement—specifically copper—with water.

Copper, applied as copper hydroxide, is the most widely used fungicide-bactericide for control of tomato diseases. Copper from this pesticide formulation has been found in runoff from fields that have plastic mulch. Unfortunately, elevated levels of copper can harm shellfish, finfish, and other aquatic organisms. More than 80 percent of the copper measured in runoff was attached to soil particles in the runoff. Rice is inputting all variables from the

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**Using plastic mulch without vegetative strips between the plant beds increases soil erosion.**

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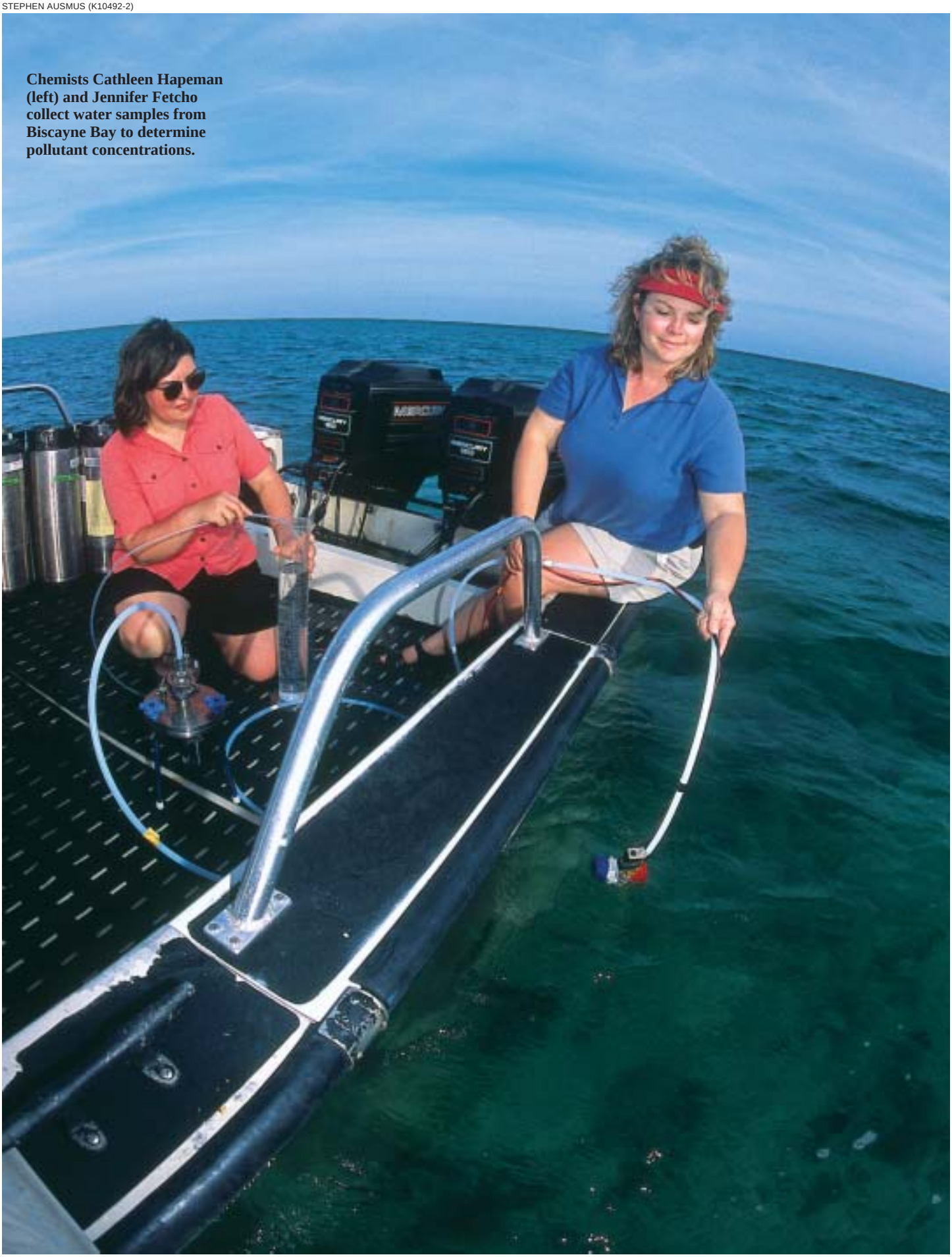

**Chemists Cathleen Hapeman (left) and Jennifer Fetcho collect water samples from Biscayne Bay to determine pollutant concentrations.**

field—such as acreage, crop type, and pesticides applied—into the computer model to determine whether it will predict the same type of runoff seen in her data. Her research will be used to develop management practices to reduce the movement of soil particles in runoff.

More than 12 years ago, ARS plant physiologists Aref Abdul-Baki and John R. Teasdale, of the Sustainable Agricultural Systems Laboratory in Beltsville, developed hairy vetch as an alternative to plastic mulch in tomato plots in the Northeast. More recently, these scientists have conducted cooperative research with the University of Florida in Homestead. Tomato plants in the hairy vetch system were vigorous and had a 25-percent increase in yield. Hairy vetch can be used as a sustainable management practice, unlike plastic mulch, which contributes to soil loss, increased runoff volume, and off-site pesticide loading. Hairy vetch helps soil retain moisture, prevents destructive insects from taking hold in the soil, and allows less fertilizer use.

Researchers found that vegetative mulches like hairy vetch reduced the amount of dissolved pesticides in runoff. Another method to slow pesticide movement from the field is to plant a different type of vegetation, like cereal rye, between the rows of plastic mulch. Several management systems were investigated for their environmental impact: plastic mulch only; plastic mulch with rye grown between rows; or hairy vetch.

"There's a lot of pesticide use in Florida by both commercial growers and private citizens. We wanted to provide a new way to reduce that use," says Hapeman.

In a 2-year study, Rice and Hapeman found that there was less runoff volume, less sediment in the runoff, less soil erosion, and less pesticide in runoff when cereal rye was used along with plastic mulch. This mechanism can reduce runoff concentrations and still allow use of plastic mulch. In another study, there was 30 percent less soil loss and 10 times less water runoff with hairy vetch mulch than with plastic mulch.

The ongoing struggle is to prevent harm from pesticides by providing information about their environmental fate and giving growers alternatives to plastic mulch.

"We need a baseline level to find out the impact of the pesticides," says Hapeman. "Only with a full understanding of the proportion of pesticides that are present in runoff can effective alternatives to plastic mulch be completely investigated and used."

The research group will continue to study vegetative mulches to assist commercial farmers. "The goal is to provide an environmentally friendly management practice that has minimal impact on production," says Hapeman.—By **Sharon Durham,** ARS.

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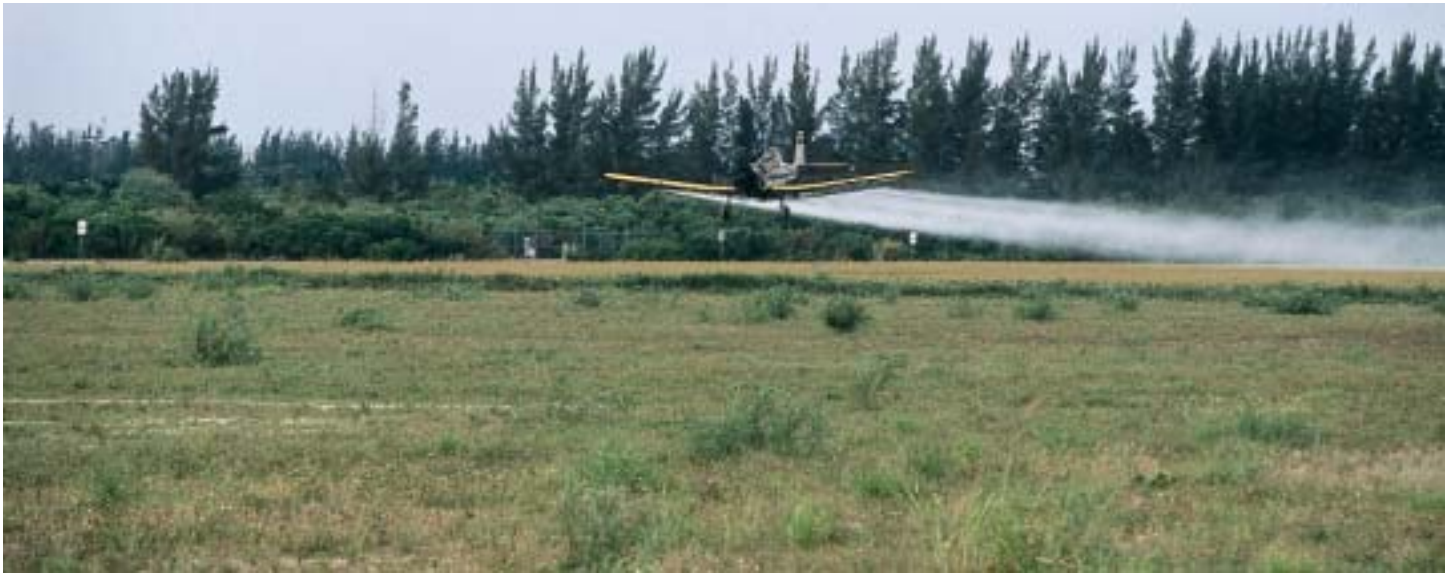

**Pesticides applied to crops may inadvertently end up in groundwater. Results from Cathleen Hapeman's work will be used to develop management practices to better protect sensitive ecosystems.**