Computer Tool Provides New Methods Of Plant Disease Control

WOOSTER, Ohio — A computer model linking simulation techniques with a geographic information system (GIS) is providing vegetable farmers with new strategies for controlling a serious plant disease carried by insects.

The epidemiological model, developed by Ohio State University researchers, combines GIS technology with a mathematical representation of insect and plant populations, to map out the movements of aster leafhoppers among lettuce fields. Such a tool enables the researchers to track the spread of aster yellows, a disease carried by the aster leafhopper, that can cause severe economic losses to such crops as lettuce, carrots, and celery.

Casey Hoy, an Ohio Agricultural Research and Development Center entomologist and the project leader, said that since the aster leafhopper is responsible for spreading aster yellows from plant to plant, it's important to understand the movement of the insect as a means for controlling the spread of the disease.

"With the model, we can predict where the leafhoppers will go, how many wind up in each field, and whether they are healthy or infected with the disease. Such information allows us to recommend to farmers better timing on when to spray their fields," said Hoy, adding that farmers will frequently spray whether the disease is present or not. "This model also is allowing researchers and farmers to evaluate alternative control methods to using insecticide."

The researchers studied population movements of the insect in lettuce fields near OARDC's Muck Crops Branch in Celeryville, Ohio, by capturing thousands of them, marking them with fluorescent paint, releasing them at a single point, and then recapturing them 24 hours later. Using the pattern of leafhopper movement and such variables as field shape and spatial patterns, time and location of insecticide applications, the number of immigrating leafhoppers, and wind direction, the researchers were able to predict aster yellows epidemics for an entire growing season.

"One thing we found was that keeping fields separated from each other by 60 meters cut down a lot on leafhopper dispersal rates from field to field," said Hoy. The study predicted a 22 percent reduction in aster yellows incidence when such a distance separated the fields.

The study also pointed to the crucial timing involved in the harvest. "The percentage of the crop showing symptoms at harvest depends on how long it takes for the leafhoppers to get in and infect the crop," said Hoy. "If farmers plant a crop that will mature faster or that will express symptoms more slowly, we predict a significant decrease in the disease and in the need to spray for the leafhoppers."

Hoy said aster yellows has the potential to wipe out 100 percent of a lettuce crop. The disease causes the crop to turn yellow, making it unmarketable, and eventually die.

Other OSU researchers involved in the project include OARDC Associate Director L.R. "Skip" Nault and OARDC Plant Pathologist Sally Miller. Funding for the project was supported by grants from the U.S. Department of Agriculture Cooperative State Research, Education and Extensive Service (CSREES) North Central Region Integrated Pest Management Grants Program, the USDA CSREES National Research Initiative Assessing Pest Control Strategies Program, and the Ohio Small Fruit and Vegetable Research Foundation.