Monitoring System Counts Insects, Identifies Species

Look out, grain-munching insects! A new, enhanced version of the world's first automated insect-monitoring system recently hit the market—and it's looking for you.

Developed by ARS and patented in 1997, the original Electronic Grain Probe Insect Counter (EGPIC) was a major improvement over other grain probe traps used to detect insect infestations in grain bins. It used infrared beam sensors to quickly and accurately count insects and record the time of day as they dropped through the probe trap. Grain managers no longer had to enter bins and collect grain samples or empty traps to determine insect population densities.

Dennis Shuman, an electrical engineer in the Postharvest and Bioregulation Research Unit, Center for Medical, Agricultural, and Veterinary Entomology, in Gainesville, Florida, invented EGPIC with ARS colleagues. He says the newest version of EGPIC, now named "StorMax Insector," helps managers make even better decisions when monitoring infestations.

Developed through a cooperative research and development agreement with a Canadian grain-management company called OPI Systems, Inc., StorMax Insector is now commercially available. The easy-to-use system allows companies to avoid or reduce use of insecticides by using them or nontoxic alternatives only when indicated by monitoring, rather than scheduling preventive fumigations.

Catch Them As They Fall

Depending on their geographical location, grain managers may only be concerned with about a dozen insect species. A previous EGPIC revision identified insects by size and shape. As an insect fell into the system's trap and interrupted the infrared beam, EGPIC registered its body before it plunged through a funnel and into a receptacle. The amount of light blocked from the beam determined how large a signal was generated. The system interpreted this signal to identify the insect's species. But the accuracy of this feature depended on the insect's position, so Shuman got the idea to put in a second beam—at a right angle to the first.

This additional beam provides a second viewing perspective. A microcontroller chip built directly into the new system's probe analyzes the two infrared beams' signals to determine the insect's species. It also reports the time of activity and the current temperature. These details give valuable insight into the nature and extent of an infestation.

"Insect behavior is affected by many factors," Shuman says. "For example, if it's cooler, insects don't move as much. We want to estimate the size of a given population in the grain bin by the number of electronic counts caused by insects entering the probes. Knowing the temperature and identifying the species is essential to making this calculation."

STEPHEN AUSMUS (K10502-3)

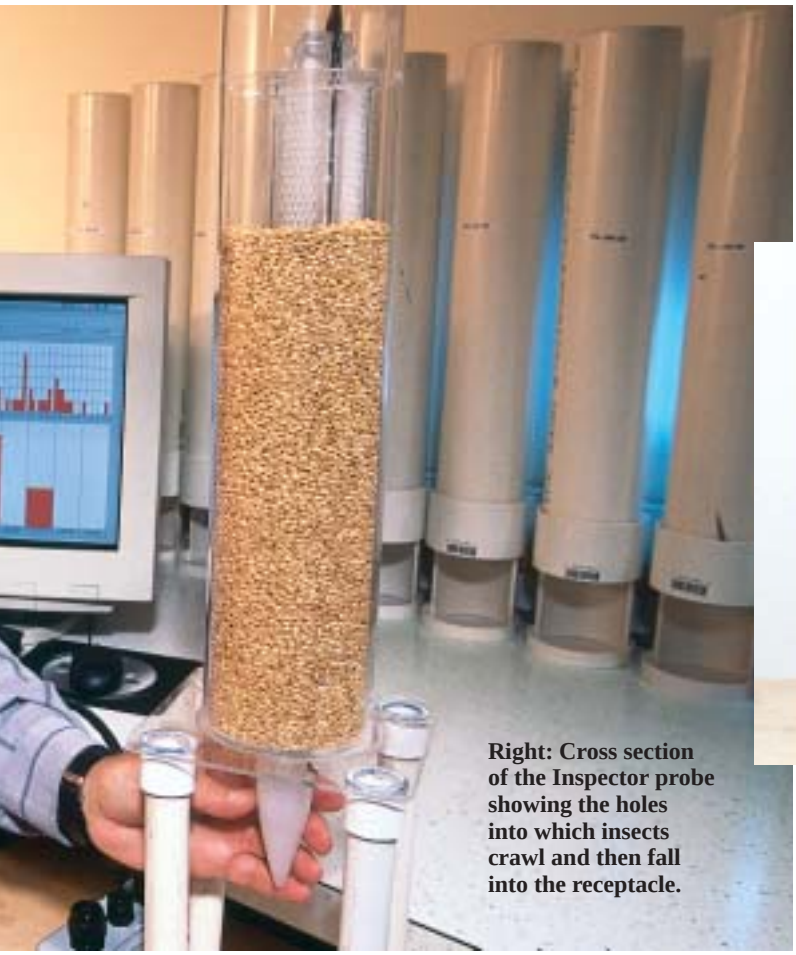
In a test of grain inside mini-silos, electrical engineer Dennis Shuman removes an Insector probe receptacle. He'll count the insects caught in the receptacle to determine the probe's accuracy.

You Found Bugs. Now What?

There are several control options available to storage managers to keep insect populations at acceptable levels. These methods are sometimes combined, a strategy known as integrated pest management. One common method used by managers is called aeration. Aerating grain with fans reduces grain temperature, which slows insect activity. Another control is phosphine, the main fumigant used in the United States to treat bulk-stored grains. But there are concerns about phosphine's toxicity, and some evidence suggests that insects are acquiring resistance to the fumigant.

Shuman says the purpose of the Insector is to monitor insect infestations, not to eliminate them. For managers to apply the right treatment, they first have to know where and when they have a problem.

"Knowing the species helps managers use incoming insect counts—combined with knowledge of the individual species'



STEPHEN AUSMUS (K10505-19)

Right: Cross section of the Inspector probe showing the holes into which insects crawl and then fall into the receptacle.

behavior and damage potential—to make control decisions," Shuman says.

An Insector probe is vertically inserted into bulk-stored grain. Insects find their way to the probe and climb one of many slanted, ramplike openings that were designed to keep grains from inadvertently entering and interfering with the count. Hundreds of probes can be used in the system, sending data from different sites to a handheld monitor or to the manager's office-based desktop computer. The recommended number of probes in each bin depends on its diameter as well as other factors.

The system comes with two receptacle options. One receptacle holds the insects until a manager collects them; the other has holes near the bottom where the insects are released. The percentage of insects collected is only a representation of the larger population present in a bin. Shuman says managers might prefer to use the collection receptacle initially to verify that the system is accurate. After that, they might choose to use the receptacle with the holes, which requires less maintenance and fewer trips to the bin to collect trapped insects.

Monitoring Success

Shuman established the EGPIC Working Group to further validate the performance of his invention. ARS entomologist James Throne at the Grain Marketing and Production Research Center in Manhattan, Kansas, is working with Shuman to coordinate large-scale EGPIC/Insector field tests with researchers from around the world to gauge its performance in different commodities and different environmental conditions.

Scientists at Montana and Oklahoma State Universities and Purdue University are validating the Insector's performance in commercial facilities that store wheat and corn. Shuman is also collaborating with ARS entomologist Paul Flinn at the Grain Marketing and Production Research Center to integrate the Insector system with ARS' Stored Grain Advisor (SGA). That system interprets information from standard sampling procedures to aid the storage manager in making pest management decisions in stored wheat. (See "Computer Figures Stored-Grain Insect Risk," *Agricultural Research,* June 1995, p. 22.)

Flinn is modifying the SGA software so it can automatically read Insector insect count data, interpret it, and then make recommendations about pest management to the storage manager.

Shuman envisions that commercial Insector systems will be installed in grain bins and elevators, data will be sent from the probes to computers in storage managers' offices, and the SGA program will automatically notify the storage manager when action is required.

This technology will benefit the U.S. grain industry and improve the quality of U.S. grain by lowering pest numbers, pest control costs, and pesticide residues. It will also improve safety at grain storage facilities by reducing the need for workers to enter the bins.—By **Jim Core,** ARS.

This research is part of Crop Protection and Quarantine, an ARS National Program (#304) described on the World Wide Web at www.nps.ars.usda.gov.

Dennis Shuman is at the Postharvest and Bioregulation Research Unit, Center for Medical, Agricultural, and Veterinary Entomology, P.O. Box 14565, Gainesville, FL 32604; phone (352) 374-5737, fax (352) 374-5781, e-mail dshuman@gainesville.usda.ufl.edu. ★