Put Insect Control on Automatic Pilot

Scientist explains how insect monitoring system protects stored grain

Dr. Dennis Shuman, a former scientist (now retired) with the USDA's Center for Medical, Agricultural, and Veterinary Entomology in Gainesville, FL, has developed Insector, a system for automatically counting insects associated with stored grain. What follows is an interview with Dr. Shuman regarding this system, which is now commercially available for use by grain managers.

Pest Management

Dr. Bhadriraju Subramanyam

Subramanyam: What is the importance of automated monitoring for insects in stored grain?

Shuman: Each year in the United States, post-harvest grain losses exceed $1 billion, and the worldwide annual cost of protecting bulk-stored agricultural commodities from infestations and direct losses caused by insects is far greater.

To address the shortcomings of traditional monitoring practices, Insector, the world's first commercially available automated stored-grain insect monitoring system (see **Figure 1**), continuously provides time-stamped insect counts on a hand-held monitor or office computer without entering the bins or storage facilities.

Graphical analyses of these real-time infestation data then can be used to reduce fumigations by performing them only where and when they are needed. This targeting of control measures can also enhance the viability of pesticide alternatives such as aeration, modified atmospheres, and biological control.

Since the probes can remain operational during and after pest management, the system can provide real-time evaluation of pest management intervention. The Insector technology is presently available from OPIsystems, Inc., Calgary, AB (800-661-1055/www.opistormax.com/ipm003.htm), a manufacturer and worldwide distributor of stored-product management systems for grain quality optimization.

Subramanyam: Describe how the

commercial system works.

Shuman: Insector electronic grain probe traps are deployed in bins and elevators after the grain is loaded. Dual infrared-beam sensors in probes detect each insect that falls into a probe's receptacle and relays each time-stamped electronic insect count back to a central display. Sophisticated algorithms applied to the sensor data at the probe and computer level result in one count for each insect captured despite unpredictable insect behaviors and the harsh environmental conditions encountered in the field.

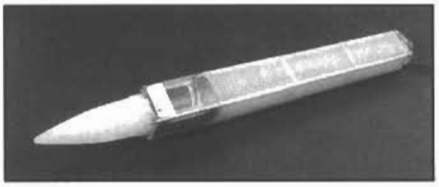

Figure 1. *Insector monitoring-system probe.*

Subramanyam: Briefly comment on the performance of the commercial system in stored wheat.

Shuman: A field test was conducted at the Central Agricultural Research Center of Montana State University, Moccasin, MT, in two concrete-floor, 3,000-bushel steel bins during the 2003 – 04 storage seasons. In each bin, five probes were checked weekly for captured insects.

The counting accuracy was greater than 94% over the 103 probe-weeks of the field test (detailed in the paper "Performance of an Analytical, Dual Infrared-Beam, Stored-Product Insect Monitoring System," by Shuman, D.; Weaver, D. K.; and Larson, R. G.; 2005. *Journal of Economic Entomology*. In press.).

Subramanyam: Does the commercial system have the ability to capture and count major stored grain insect species?

Shuman: The commercial system is designed to detect and count the full range of stored grain insects of various sizes, from flat grain beetles to rice weevils. In fact, based on how much of the infrared beams are blocked by each insect dropping through a probe, the system gives a probabilistic indication of the species. Another advantage of the sizing capability is that a small percentage of counts caused by incidental species such as psocids or mites, as well as by grain or dust particles, can be screened out so as not to confuse the system.

Subramanyam: How is the commercial system installed in commercial storage facilities?

Shuman: After grain is loaded into a bin, a number of probes (based on the cross-sectional area of the grain) are inserted vertically just below the surface of the grain. The probes are daisy-chained together or joined to a central collecting station using cables with snap connectors so that a single cable emerges from the bin.

Each probe has its own unique address, which is automatically transmitted back to the central computer or hand-held monitor when the system is turned on for the first time. The link from the bin back to a central computer can be accomplished by cable, radio links, or a combination thereof.

Subramanyam: How user-friendly is the automated system?

Shuman: The Insector system is plug-and-play with graphical charts and color-coded data display for individual probes. One bar chart shows the number of ▶

counts as a function of time (with a user-selectable time axis), while another bar chart shows the distribution of insect sizes captured over the selected time interval. The system is extremely user-friendly.

Subramanyam: What environmental variables influence the performance of the system?

Shuman: All probes are calibrated at the time of manufacture so that they have identical performance. While the probes are operational in the grain, they are automatically recalibrated at regular intervals to maintain identical performance over varying environmental conditions.

Anything that might disturb the grain during monitoring such as walking on the grain or aeration could result in false counts due to grain debris entering probes, and therefore, the time of occurrence of such events should be noted, so that data acquired during those times can be deleted. This process can be automated when aeration is controlled by OPIsystems software.

Subramanyam: Is this a standalone system, or can it be integrated with existing OPI systems for grain quality management?

Shuman: An Insector system can be a standalone system or part of a larger OPIsystems grain management system including temperature cables, environmental monitors, and automated aeration controllers.

"To address shortcomings of traditional monitoring practices, Insector continuously provides time-stamped insect counts on a hand-held monitor or office computer, without entering bins or storage facilities."

Dr. Dennis Shuman, Insector developer

Subramanyam: What is your vision for the future, as this technology is embraced by the grain industry?

Shuman: First, this technology can be used across the full spectrum of on-farm through commercial storage facilities. Second, we envision Insector as an integral component of professional pest management providers delivering grain-care services. Third, we see Insector partnered up with existing practices such as fumigation or new technologies such as ozonation to evaluate efficacy of these technologies.

Fourth, we see Insector fitting into value-added processes such as traceability, whereby insect/temperature probing is utilized at numerous points along the producer-customer continuum, from on-farm storage through to commercial facilities and in-transit rail, barge, and ship movements, then ultimately on through to processing and food warehousing.

And finally, we see Insector opening the door to a whole new field of real-time measurement, data-collection, and transmission technologies, from various forms of bulk commodity management to field crops, orchards, and forestry, as well as food warehousing and retail.

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