EVALUATION OF A MANUFACTURED ELECTRONIC GRAIN PROBE INSECT COUNTER

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Grain probes are commercially available traps that are used for detecting adult insect populations in stored grain. Traps are pushed into the grain and insects moving through the grain enter the holes in the perforated trap body, fall through and are captured in a collection receptacle. Traps must be periodically inspected to determine the number of insects that have been captured. This is labor intensive, limits the temporal availability of data, and restricts placement of the probe traps to easily accessible locations. The Electronic Grain Probe Insect Counter (EGPIC) System (United States Patent No. 5,646,404) uses a modification of a commercial grain probe trap that includes an electronic sensor in the probe head to detect insects that have entered the trap (Shuman et al. 1996). The prototype EGPIC system contains eight electronic probes, each of which has an infrared sensor that is triggered when a captured insect falls through the beam. Interface circuitry is used to transfer sensor output to a computer, which continuously displays cumulative capture and records the actual time of capture per probe. This information can be used for off-site monitoring to determine the need to initiate control activities in stored grain, as well as to assess the efficacy of control measures that have been implemented.

Field trials were conducted in 1996 in Florida to test the performance of the EGPIC system (Weaver et al. 1996). Information on number of insects captured per probe, increase in population over time and location of insect infestations within the grain bin were obtained. Several modifications to the EGPIC system were made to further increase accuracy and dependability of the system under field conditions (Shuman et al., in press). Additional field trials and tests of the EGPIC system under a variety of field conditions are needed to move the EGPIC technology toward commercialization as a detection and monitoring device. The limiting factor in this step is the small number of EGPIC systems available.

All components of the EGPIC system to date have been produced in-house at the USDA/ARS laboratory in Gainesville, Florida. There are several labor-intensive steps needed to produce the components for the electronic probes, but some are amenable to commercial manufacturing processes. The probe head contains two funnels that direct the falling insect into and through the infrared beam (Shuman and Weaver 1996). The surface of the top funnel is sufficiently steep so that insect landing on it continue to fall through. The function of the lower funnel is to prevent insects from crawling up from the bottom of the sensor head to the infrared-beam. The electronic probes are the critical components in determining the system's performance. Ability to precision mill the probe head and funnels using commercial manufacturing processes has allowed small-scale replication of the EGPIC system. Reported herein are tests of the manufactured prototype EGPIC systems.

Replications of the EGPIC system were produced by Analytical Research Systems, Inc., Gainesville, FL. Tests were conducted to determine if the materials and manufacturing procedures used produced electronic probes that accurately counted the number of insects that were captured. Baseline accuracy of the manufactured probes was determined with drop tests using dead insects. Ten sets of ten insects were dropped through a probe, and number of insects counted was recorded. Accuracy was based on the electronic count per 100 insects. Rusty grain beetles, sawtoothed grain beetles and red flour beetles were used for these tests. Production specifications required > 85% accuracy in tests with the smallest insect, the rusty grain beetle, with accuracies > 90% preferred. Accuracy of the probes was also determined in laboratory tests using live insects. A single probe was placed in the center of a cylinder (10 cm diam by 50 cm), 100 insects with 2 kg of wheat grain were added, and percent accuracy was determined after 24 h.

Six EGPIC systems were produced and 54 electronic grain probes have been tested. Baseline accuracy ranged from 87 - 100% accuracy drop tests with rusty grain beetles, with an average accuracy of 93.4%. In tests with red flour beetles, baseline accuracy ranged from 97 -100%, with an average accuracy of 99.5%. Availability of manufactured EGPIC systems will aid in technology transfer of the EGPIC system by expanding its use in research, validating its potential as a stored-product pest management tool, and increasing its availability to the agricultural industry.

References Cited

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