

STORED PRODUCTS RESEARCH & EDUCATION CENTER

SPREC Newsletter



OSU TIP\$ on STORED GRAIN

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Summer 2004

Welcome to the Summer Issue of the SPREC Newsletter, bringing you the latest in stored product management tips, research findings, and upcoming events.

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SPREC News

- The stored products team at OSU has a new Web site: <http://ipm.okstate.edu/ipm/sprec>. This is a combination of the previous site for stored products and the newer site just for SPREC. But since “Stored Products Research and Education Center” is more than just the building, it was time to combine them into one. Visit our site sometime soon and find the mission of SPREC, ongoing projects, contact information for the team, calendar of events, publications, and links relevant to the stored grain industry.
- Tom Phillips and Edmond Bonjour will be attending the International Conference on Controlled Atmosphere and Fumigation in Stored Products, in Gold Coast, Australia, on August 8-13, 2004, where Edmond will present a paper on "Evaluating a remote monitoring device for stored grain insects in a commercial facility" (see article on page 4 of this newsletter). They will also attend the XXII International Congress of Entomology, in Brisbane, Australia, on August 15-21, 2004, where Edmond will present a paper on "Efficacy of spinosad and chlorpyrifos-methyl for controlling insects infesting stored wheat."

Summertime and the livin' is easy....for bugs!

Summertime temperatures don't just feel good to us, but bugs love 'em too! This is the season when insect populations of all sorts can explode. For grain managers, this is serious business. Insects that were still in the bottom of the bin when you filled that bin with new wheat, and insects that find access into the bin from the outside, are basking in the heat, eating, mating, laying eggs, hatching babies, and potentially eating their way through your profits! Before you can get control of those critters, you need to be familiar with their habits. On page 7 is a quick-glance chart of insects you could find and what they are up to! The next few articles are about using traps to monitor these insects, a new way to control moths, and new information about using phosphine.

Using Traps to Monitor Insects

Why should we care about insects in our stored products? Because insects decrease profit when they damage the raw grain or the finished product, and when money must be spent on pesticides. The best way to manage insects, of course, is to prevent their arrival by thoroughly cleaning bins and equipment before harvest and between product milling cycles, and sealing bin openings. See the Spring 2004 SPREC Newsletter for more information on preventing insect invasion. However, once the grain is in storage, a successful manager should monitor for the presence of insects and the size of their populations. Managers who measure insect abundance only when they see insects flying around their facility and those who rely on routine fumigant applications are losing money!

What insects are living in grain storage and food processing?

The important insects recovered are beetles and moths (see chart on page 7). Beetles, especially the rusty grain beetle, are often quite abundant in both elevators and food processing facilities. However, the most important beetles to keep an eye out for in raw grain storage are those that cause IDK, specifically the lesser grain borer and the rice weevil.

In food processing, almost 100% of grocery stores and food processing facilities can find Indianmeal moths. Stored product beetles are also readily recovered, including merchant grain beetles and drug store beetle.

What trap type should I use to monitor for insects?

Probe traps are a good way to keep track of the types of beetles infesting stored grain, and can provide a rough idea of the number of beetles present in the grain mass. A commonly used probe trap (right) is cylindrical, made of plastic, with holes drilled all along the sides. It has a funnel at the bottom and a screw-on piece over the funnel to catch the beetles as they crawl through the grain, into the holes, down the funnel, and into the bottom piece. The most commonly trapped beetle is the rusty grain beetle because they are the most active and can build up to very high populations over the summer. These beetles DO NOT cause IDK, and are of a concern primarily at time of sale, when live beetles can result in an "infested" designation. The lesser grain borer is less active in the grain mass and are less likely to be caught in a probe trap. Consequently, any lesser grain borers caught in a probe trap are of a concern because these beetles cause IDK.



Sticky traps are used in food processing facilities and where finished product is stored (e.g., warehouses, distribution centers, and grocery stores). These traps are made of folded cardstock with the inner surfaces coated by a sticky substance; any insect that flies into the trap will get stuck and can then be identified and counted when the trap is checked. Usually, a pheromone lure (synthetic version of the chemical insects

use to find mates) is placed in the trap to attract the pest insect into the trap. Indianmeal moths are easily monitored in this fashion (see the article on page 5 about a new way of trapping and killing these moths).

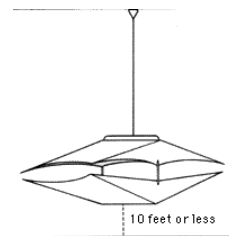
Pitfall traps can be used by food processors as well. This trap is shaped like a miniature volcano, with sloping ridged sides; the top edge and inner “crater” are smooth; an insect (specifically beetles, such as red flour beetles, merchant grain beetles, etc.) that climbs up the sides and reaches the smooth top cannot keep its footing and will fall into the crater. A small quantity of food oil is placed in the crater, both to lure in the insect and to suffocate those that fall in. A pheromone lure can also be used with pitfall traps. These traps need a snug cover to decrease flour and grain dust accumulation, which make the crater easy to climb back out of.

How many traps should I use and where should I put them?

The most important factor is consistency: Use the same number of traps every time and check them at the same intervals. There are no hard and fast rules here; you’re watching for relative changes in the number of insects trapped rather than absolute numbers.

Probe traps in grain storage. We recommend five per bin to maximize accuracy and minimize sampling time. Traps should be buried in the grain about 1-2 inches deep—be sure and tie off the traps to the top of the bin, both to be able to find them later and to keep them from migrating too deep in the grain mass to be checked. Place one trap in the center of the bin; the fines accumulated in the center are very attractive to most beetles. Next, place a probe trap about 1-3 feet from the side walls, in each cardinal direction (north, south, east, west). Keep track of how long a trap is kept in place, then routinely check traps at the same interval. We suggest traps be checked once per week during the summer and early fall when grain temperatures are warm, and less often when grain temperatures are cool later in the season.

Sticky traps. We recommend three per facility to maximize accuracy and minimize sampling time. The pheromone is quite strong and will draw moths (no beetles) for over 100 feet. Place traps next to the wall or shelf, and hang 6 feet or higher in a building. Change the pheromone lure every two weeks, and the entire trap whenever it loses its stickiness because of insect bodies or debris. Place the traps near pest access points, such as near doors or windows, but remember to keep the doors and windows closed or you will attract insects into your facility from the outside!



Pitfall traps. There are no specific rules for the number of pitfall traps to place in your facility. Generally, you should put them on the floor next to the wall (and out of the way of forklifts!), particularly around your processing equipment.

What factors influence how many insects I capture in a trap?

Key factors to consider when using traps include:

- **Duration.** The longer the trapping period the greater the catch. Our standard recommendation is to check traps weekly when the grain is warm and less frequently once grain cools in late fall.
- **Temperature.** Temperature is critical because traps measure insect activity, which occurs above 60°F for most insects. The higher the temperature, the more active the insect, and thus the more insects that will be caught in a trap.
- **Grain moisture** is not important in trap catches, though moisture is critical in stored grain risk and management.
- **Commodity type.** The commodity does not influence the trap catch. Commodities (corn, wheat, processed grains) have little influence on trap catch, though smaller grains can get into probe traps.

What does it mean if I catch insects in these traps?

Unfortunately, probe traps can only serve as a rough guide of how serious the insect infestation has become. Thresholds have been developed to give grain managers at least some idea of what insect numbers they should worry about. Remember, the most important insects are those that damage the kernel itself, specifically the lesser grain borer and the rice weevil.

Insects trapped per week above which discounts occur.

Species	Threshold Levels Number of beetles trapped per week
Rusty grain beetle	3,000 – 5,0000
Lesser grain borer	5
Rice weevil	5
Red flour beetle	1,000

A New Electronic Probe Trap for Monitoring Insect Populations

The Evolution of Insect Detection

Before the StorMax Insector, there was no way to get a real-time "picture" of insect levels in grain storage. Manual sampling provided a "snapshot" at best, bringing with it a number of problems: manpower time and costs, safety due to exposure to hazardous environments, and difficulty in interpretation of data. OPIsystems, a Canadian company, teamed up with a group of USDA scientists to commercialize the patented "EGPIC" technology. The result is the StorMax Insector, a cost-effective tool for accurate real-time measurement of insect activity.

How the StorMax Insector Works

Simply insert the StorMax Insector into your storage environment. The probe body is perforated with a series of upwardly angled holes which migrating insects find their way into. Insects are then "registered" as they fall through and interrupt an infrared beam. With its built-in microprocessor, each StorMax Insector probe can store up to 1,000 time-stamped counts, complete with species identification (to a certain extent) and temperature. Multiple Insectors can be joined in series for retrieval of data by either the hand-held StorMax Monitor or the PC based OPIGIMA/C software system.

StorMax Insector as a Management Tool

Insect management starts by managing temperature as well as the balance between temperature and moisture content. Real-time insect detection will enable you to view population trends over time and so decide which specific zones require attention, and when. Early detection and zonal treatment will result in savings through the reduced use of fumigants, electricity, manpower and contract services. Active management of your product's environment will ensure:

- The highest quality yields
- The lowest possible cost
- The maximum possible profit.

An Integrated Monitoring System

You can use a single StorMax Insector, link several in series within a bin or between bins, or combine Insector probes with other StorMax devices such as temperature cables or automated aeration fan controls.

With Mike Rosen's cooperation, this system was tested last fall in Kingfisher. The system worked well after installation and provided valuable information on insect populations. This summer, the StorMax system is being tested at SPREC for automated aeration fan control. Stay tuned for results in a subsequent newsletter!

New Approach for Controlling Moths

Insects of all sorts rely on odors to find mates and food. The odor that attracts a male moth to a female of the same species is called a pheromone. The pheromone attractant for male Indianmeal moth (*Plodia interpunctella*) was identified in the early 1970s and has been used since as a method of monitoring for the presence of this grain pest. Recently, Dr. Tom Phillips and colleagues at Oklahoma State University discovered the scent that attracts the female Indianmeal moth. The chemical mimics the odors from the food needed by growing moth larvae to lure pregnant females of the species into a pest control device. The result of this discovery is a new commercial product distributed by Insects Limited Inc. under the trade name MOTH SUPPRESSION.

"Pheromones used to lure and kill male moths have been around for decades, but it only takes a single male moth to impregnate up to six females, and a pregnant female can lay 200 to 400 eggs during her short life," Phillips said. "Once the eggs hatch, it's the worm-like larvae that do most of the actual damage to food or grain."

Do the math. One trap designed to catch 200 males might still leave enough males to mate all the female moths. But catch one female that might lay 400 eggs and 400 feeding larvae have effectively been removed from the population. Given that Indianmeal moths have a sex ratio of about 50:50, the larvae removed potentially could reduce the eventual adult moth population by approximately 200 males and 200 females.

Researchers at Insects Limited tested the new chemical in retail, seed warehouses, and under laboratory conditions. After many replications in various settings, they discovered that the new compound could attract as many as 44% of the female moths.

The chemical in combination with the trapping device cannot completely control Indianmeal moth populations by itself, but along with other pest management practices, such as cleaning up spilled product and torn product containers, it has the potential to lower the population to an acceptable level. Insect Limited, Inc., sums it up by saying, "The closer you get to the end consumer the more important it becomes to monitor and capture every pest. Zero tolerance in a package of food is the goal of all food companies. If you can capture egg laying moths before they infest a finished product, you now can start lowering customer complaints. Customer complaints are the ultimate monitoring tool for any company. Zero tolerance is possible when good prevention, monitoring, and control programs are put in place."

Phosphine Applicator Manual

We attended a meeting of industry, registrants of phosphine, EPA (DC folks) and state regulatory agencies on June 29th. This meeting was to discuss the phosphine applicator's manual and concerns state regulatory agencies had/have about the applicator's manual.

There were three main issues that were agreed upon. First, each and every type of fumigation with phosphine (any formulation) must have a Fumigation Management Plan. Second, there is disagreement on who can and cannot open railcars that are fumigated in transit. A number of state lead agency personnel say it must be a certified applicator while industry and phosphine registrants say a person trained on the applicator manual can open the railcar under fumigation. The result is the third issue. EPA and the phosphine registrants are creating a mechanism for Questions & Answers. People will be able to submit questions concerning the phosphine applicator manual and EPA (and we suspect interested parties)

will post an answer. This was done with EPA's Worker Protection Standard. For the most part, it worked quite well. It is not clear to date who and where to post questions. Once we receive the official notification, we will provide that to the industry.












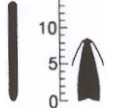
Now back to railcars. A number of state regulatory agencies are going to inform their fumigators that if railcars are to be shipped out-of-state under fumigation, the fumigator should contact the receiving state regulatory agency to determine who can legally open the railcars. It was also mentioned that if a train of railcars under fumigation was broken up to different destinations, the fumigator needs to ensure that the railcars are properly placarded and that the applicator manual accompanies the railcars to their destinations or the applicator manual is sent to each destination.

As for Oklahoma, the Oklahoma Department of Agriculture, Food & Forestry has informed us they agree that a Fumigation Management Plan is required for any fumigation. ODAFF has also stated that a fumigator treating shipping vessels that will be sent out-of-state under fumigation should contact the receiving state regulatory agency to determine what is required to open those vessels.

We also have learned that the Texas Structural Pest Control Board has issued a letter stating that for railcars received in Texas under fumigation, it is the fumigator's responsibility to open those railcars. If the fumigator is out-of-state (not in Texas), SPCB will turn the complaint/case over to Region VI EPA for enforcement actions. It is our understanding this will only apply to processed products. It is our understanding SPCB does not regulate raw grain fumigation – that is under Texas Department of Agriculture. We have not seen nor heard of a ruling on this by TDA. Feel free to contact us for further information or to provide us with information you receive on this or other issues.

Research Briefs

- The Phillips laboratory recently received a grant from USDA-CSREES to investigate alternatives to methyl bromide use in stored commodities. They will be researching the effect of low pressure (vacuum) on insects infesting stored products, specifically for this study, cowpea weevil. The results of this study will have much broader applications on a great number of the insect pests of many stored products, including fresh and / or damageable products. Stay tuned for results as this study progresses!
- Experiments are now underway at SPREC to investigate reduced-risk grain protectants in small experimental bins. Preliminary results from both studies should be available in about six months.
 - The first study is looking at applications of diatomaceous earth (DE) for preventing infestation. DE is a naturally occurring, non-toxic dust that kills insects by causing them to dry out. A big drawback with DE use is that it causes reduced test weights in treated grain. The SPREC study is comparing whole-bin DE treatments to two different layering treatments in which the DE is applied to certain layers of the grain.
 - The second study, we (along with researchers from Kansas) have set up a study in the 500-bushel bins at SPREC to determine the effects of aeration and / or an insect growth regulator on controlling insect pest populations. The insect growth regulator methoprene is very safe for food but disrupts the development of insects in grain.

Name	Life Cycle ¹ in days	Food	Damage	Picture ²	Comments
Lesser Grain Borer*	25 at 93°F	Intact kernels	Larvae feed inside kernels – causes IDK		Resistant to malathion, mildly resistant to Reldan
Rice Weevil	25 at 86°F	Intact kernels	Larvae feed inside kernels – causes IDK		Requires minimum of 12% moisture
Rusty Grain Beetle*	23 at 91°F	Broken kernels, grain dust	<u>Does not</u> cause IDK		Most numerous grain insect in Oklahoma
Red Flour Beetle*	20 at 95°F	Broken kernels, grain dust; cannot feed on intact grain	<u>Does not</u> cause IDK		High infestation gives the grain a pungent bad odor; resistant to malathion
Sawtoothed Grain Beetle*	20 at 91°F	Flour, cereal products, fines, damaged kernels	<u>Does not</u> cause IDK		
Flat Grain Beetle	23 at 93°F	Broken kernels, grain dust, grain products	<u>Does not</u> cause IDK		Closely resembles the rusty grain beetle
Hairy Fungus Beetle	21-33 at 77°F	Fungi growing on moist grain	<u>Does not</u> cause IDK		Presence is an indication of moldy grain; often seen after rain
Foreign Grain Beetle	22 at 81°F	Fungi growing on moist grain	<u>Does not</u> cause IDK		Presence is an indication of moldy grain; often seen after rain
Warehouse Beetle	27 at 90°F	Almost any dried plant or animal material	<u>Does not</u> cause IDK	 Larva adult	Adults are short-lived, but the larvae can survive harsh conditions for long periods
Booklice	21 at 86°F	Fungi, grain dust	<u>Does not</u> cause IDK		Can build up to high numbers
Mites	8.5 at 90°F	Wheat germ, broken kernels, and fungi; some species are predators, feeding on other mites	<u>Does not</u> cause IDK		Predatory mites are faster moving and seen before the plant mites
Indianmeal Moth*	30 at 86°F	Broken kernels, wheat germ, milled grain products	Larval webbing blocks grain aeration, increases grain heating and mold growth, decreases fumigation effectiveness	 Larva adult	

¹ Life Cycle is optimal range

² Pictures are life-size; the scale is in millimeters (mm). Five mm is just under ¼ inch

*Common in Oklahoma stored wheat

Upcoming Workshops

Oklahoma

- Fumigation Workshops at SPREC, Stillwater, OK, September 21-23, 2004. Contact Pat Bolin, 405-744-9420, for more information (or visit the SPREC Web site, <http://ipm.okstate.edu/ipm/sprec/calendar.htm>).
- Fumigation Practical at SPREC, Stillwater, OK, October 5, 2004. Contact Jim Criswell, 405-744-5531, for more information (or visit the SPREC Web site, <http://ipm.okstate.edu/ipm/sprec/calendar.htm>).
- AgExpo in Oklahoma City, OK, November 10-11, 2004. CEUs pending in 7c Fumigation. Sponsor is the Oklahoma Grain and Feed Association and the Oklahoma Agribusiness Retailers Association. Contact Tammy Miller, 580-233-9516 for more information.

Missouri

- Recertification Seminar in Kansas City, MO, October 19, 2004; 5 CEUs for 7c Fumigation, 6 in 7d Food Processing. Sponsor is Industrial Fumigant Company; contact Paul Lauthlin, 913-782-7600 for more information.

Hawaii

- PestWorld 2004 in Honolulu, HI, October 20-23, 2004; 2 CEUs in 7c Fumigation, 4 in 7d Food Processing. Sponsor is the National Pest Management Association; contact Cindy Kennedy, 800-678-6722, for more information.

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The pesticide information presented in this publication was current with federal and state regulations at the time of printing. The user is responsible for determining that the intended use is consistent with the label of the product being used. Use pesticides safely. Read and follow label directions. The information given herein is for educational purposes only. Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement by the Cooperative Extension Service is implied.