E-912, Stored Product Management
Chapter 23

How to Use Insect Traps in a Warehouse:

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A tool to determine the presence or absence of potentially harmful pest insects is needed where stored commodities are held for extended lengths of time. Pheromone-baited traps are excellent tools for this purpose.

All pheromone-baited traps were not created equal. Traps for moths may act differently than beetle traps (Figures 1 and 2). One cannot treat all stored-product pests the same when it comes to recommending an effective trapping program. Long-lived insect adults (e.g., flour beetles) tend to be less attracted to pheromone-baited traps than short-lived insect adults. A flour beetle adult that lives for 12 to 18 months does not react as dramatically as an Indianmeal moth adult that may only live in this stage for one to two weeks.

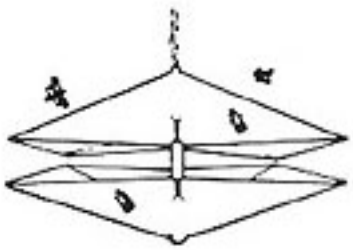

Figure 1. Moth Trap. **Figure 2.** Beetle trap.

Figure 3. Trapping systems are significant tools to use in an integrated pest management program in warehouses.

Pheromone-baited traps can be used in a variety of ways to assist in a warehouse pest management program:

1. Inspection of bagged commodities,
2. Identification of pests or the potential for pest infestation,
3. Determination of the extent of the problem, and
4. Evaluation of a particular treatment or control method

Know the Pest:

Knowing the pest is half the battle in controlling it when establishing and managing a grain, bulk commodity, or bagged product pest management program. This holds true when one tries to interpret the results and data from such a trapping program.

Common Insect Pests in Grain and Processed Food:

Tables 1 and 2 summarize the results of surveys conducted in 1980 and in 1988, and show the frequency at which stored-product insects were found in raw grain and processed food (Mueller 1988, 1989).

Table 1. Most frequently found stored-product insects in raw grain in the United States.

Rank	Species	Number of States Responding	
		1980	1988
1	Indianmeal moth*	27	30
2	Sawtoothed grain beetle	20	23
3	Red flour beetle*	16	26
4	Rice weevil	19	19
5	Confused flour beetle*	17	11
6	Flat grain beetle	7	18
7	Granary weevil	8	13
8	Foreign grain beetle	7	11
9	Lesser grain borer*	8	10
10	Angoumois grain moth*	10	3

*A pheromone lure is commercially available for this stored-product insect pest.

Table 2. Most frequently found insects in processed food in the United States.

Rank	Species	Number of States Responding	
		1980	1988
1	Indianmeal moth*	29	40
2	Sawtoothed grain beetle	33	38
3	Red flour beetle*	24	24
4	Dermestids*	24	23
5	Confused flour beetle*	15	20
6	Cigarette beetle*	13	15
7	Drugstore beetle*	6	11
8	Foreign grain beetle	0	3

9	Rice weevil	0	2
10	Granary weevil	0	2

*A pheromone lure is commercially available
for this stored-product insect pest.

Traps:
It is important to recognize that there is not always one type of trap that is best to use in a pest monitoring program in warehouses. It is important to match the specific trap to the environmental conditions in each particular situation. Some examples of this would be: 1) dusty areas vs. areas that are not dusty, 2) hot vs. cold temperatures, and 3) outdoor vs. indoor use.

Too much dust can cause sticky traps to be ineffective. In this situation, alterations to the sticky trap can prevent an excessive build-up of dust or a pitfall-type trap could be incorporated (Figure 4). The Barak pitfall-type trap is shown in Chapter 23.

Figure 4. Sticky traps can be ineffective
where dust levels are excessive.

Dusty warehouses offer challenges for conventional sticky glue traps. In these extreme conditions, a sticky trap may become useless after several days, or even after several hours. The selection of a trap that can deflect the dust or a pitfall-type trap that does not include glue as the entrapment mechanism will need to be implemented.

Placement of traps will depend on the temperature in the warehouse. In the spring, the ceiling of the unheated warehouse offers optimum conditions for the growth and development of stored-product insects. As the temperature gradients in the warehouse change during the summer months, the harsh conditions near the top of these facilities may hinder the capture of insects in a monitoring program.

Outdoor Trapping:
Trapping for stored-product insects around the outside of a stored-product warehouse can offer several advantages in an overall pest management strategy. The trap selected for outdoor trapping must be able to withstand the weather (e.g., plastic construction) and should not be prone to becoming saturated with insects quickly.

By placing pheromone-baited traps on the outer perimeter of a storage facility, potentially destructive insects can be intercepted or lured away from stored food and grain. A feral population of many of the most common stored-product insect pests is available outdoors throughout the United States and Canada (Vick 1988). Thus, the outdoor pheromone trapping technique can help the modern pest manager predict the arrival of indoor populations of insects and prevent many from causing an infestation (Cogburn 1988).

Trap Placement:

There is no exact number of traps that should be placed in a warehouse to detect the presence or absence of pest insects. The number of traps needed can change according to several factors determined by the trained person implementing and re-evaluating a trapping program. Some factors to consider are:

1. quality assurance standards by management,
2. seed vs. finished goods,
3. pharmaceutical vs. raw intermediate products, and
4. popcorn vs. field corn.

Important questions to ask are:

- What is the goal of a sanitation program? Is the goal zero insect tolerance?
- Is an attempt being made to mass trap out a population, or to just monitor a pest population?

Figure 5 illustrates a situation where one trap per 100,000 cubic feet is placed in a finished grocery product warehouse. The pest management inspector checks each trap weekly. A record of the results is kept in a separate log away from the physical trap itself. A map should be made of each trapping location. Each trap in this practical example contains two lures: 1) *Plodia* complex (Indianmeal moth), and 2) *Trogoderma* complex (warehouse beetle, *T. glabrium,* furniture cabinet beetle, khapra beetle). An optional lure for the cigarette beetle could be placed in each trap in some situations.

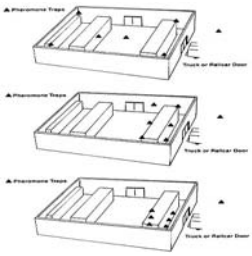

Figure 5. Monitoring for stored-product insects in a finished foods warehouse.
(Click on above image for enlargement.)

After determining that this warehouse contained little or no detectable target pests in half of the facility, the traps were moved to the half of the warehouse where insects were found in the pheromone-baited traps. Another approach that can be used instead of moving the traps is to employ more traps in a uniform grid pattern in the suspect areas of the warehouse. After several days or a week, these traps are checked and recorded again. At this point, there is one trap per 50,000 cubic feet. If the pest management inspector has more time, the grid can be tightened even further to pin-point this infestation (one trap per 10,000 cubic feet). The inspector can then

start visually searching for signs of an active infestation in the areas where the most insects were captured. This could be caste skins of *Trogoderma* larva; odor distinctive to certain insects (e.g., flour beetles and roaches); webbing on bags, flaps of the bags, or the surface/side-walls of a grain bin; pupa casing in corrugated cardboard; or actual live insects on finished product.

In this actual warehouse, old code-dated rolled oats were found to be infested with Indianmeal moths, sawtoothed grain beetles, and flour beetles. Some nearby dog food also contained large stored-product insects that could have entered this warehouse from the often opened dock door. The cost of this program for pheromone-baited traps/lures would typically run about $250 to $300 per year. The time needed to count and record seven traps each week would be about 30 minutes.

Interpreting Trap Catch:
A common misconception in a strategy used to manage grain, bulk commodities, and bagged products using pheromone-baited traps is that there is a set numerical threshold for action or reaction. There is no magic number for determining action. A trained pest management inspector must weigh all factors before making a decision. The key to interpreting trap catch is to look for increases in numbers of insects from one trapping period to the next (e.g., 1 - 5 - 30).

It is often easy to see when an outbreak occurs. At this time, the pest management inspector can recommend appropriate corrective action (e.g., chemical, non-chemical, sanitation, discarding product).

Limitations:
Pheromone-baited traps have some limitations in the management of grain, bulk commodities, and bagged products. These traps are very sensitive to the target insects being monitored. However, other insects often are present and go undetected because of a lack of effective or efficient trapping systems. In one field situation, cigarette beetles were extensively monitored and managed with limited applications of chemical insecticides only to find that several pallets of oats were highly infested with a hidden population of flour beetles. The entomologists' and chemists' inabilities to duplicate the exact chemical messenger or messengers have not given us a complete choice of effective pheromones with which to work. The beetle pheromones seem to be much harder to identify than the moths. However, results demonstrated by the lesser grain borer aggregation pheromone hint that when the components are discovered and mixed in commercial pheromones in the correct combinations, they can work well to detect the presence or absence of a target insect pest. Advances in biotechnology and the potential cloning of these precise chemical messengers will overcome some of these limitations.

Conclusions:
The use of pheromone-baited traps to determine the presence or absence of a pest population in storage facilities is an exciting new step toward a total pest management program. The interest in pheromones in recent years has been fueled by their potential to modify the behavior of pests and to attract them to traps. By monitoring the change in trap catch over time in warehouses containing stored products, action levels can be decided and the judicious use of control methods can be prescribed when population growth is observed in one or more areas of a facility. The practical application of pheromone-baited traps to alter insect behavior and prevent reproduction is helping provide the grain, bulk commodity, and bagged product industries with the option of a total pest management strategy.

A Plan for Pest Management for the Popcorn and Seed Industry:

Purpose: To establish an on-going, year-round pest management program to eliminate any

damage incurred by insects, rodents, or birds. This would include both physical damage to the popcorn and the defacing of the packaging that contains the popcorn.

History of the Problem

The popcorn and seed industries in the United States are making rapid advances in the manipulation of the genetic structure of plants in order to create varieties that are more productive. However, even with the amount of technology available, most seed companies are years behind other processed food disciplines in the protection of their stored commodities from stored-product insect pests and rodents.

I. Monitoring and Inspection

- A. Pheromone traps
  - 1. Indianmeal moth traps
  - 2. Angoumois grain moth traps
  - 3. Grain probes in bulk bins
  - 4. Recordkeeping is essential
  - 5. Replacement of traps and lures
- B. Glue boards and Ketch-alls / rodent inspection
  - 1. Dock and loading areas
  - 2. Critical points in the operation
- C. Visual inspection
  - 1. Insects
    - a. Inbound packaging materials
    - b. Webbing from moths
  - 2. Rodents
    - a. Blacklight inspections / inbound
    - b. Fecal pellets
  - 3. Birds
    - a. Nests
    - b. Feces

II. Building to Keep Out Pests

- A. Insects
- B. Rodents
- C. Birds

III. Non-chemical Control

- A. Cold storage
  - 1. 50°F with 50 percent R.H.
  - 2. Insect activity in cold temperatures
    - a. Reduces activity
    - b. No reproduction
- B. Anticipation of winter storage / fumigate before winter
- C. Mice in cold storage
  - 1. Insulation, be aware
- D. Lighting / placement is critical
  - 1. Indoor
  - 2. Outdoor
- E. Beneficial insects (non-food areas)

IV. Chemical Control of Bulk Seed Storage

- A. Timed pyrethrin dispensers *(replacing vapona strips)
  - 1. 32-day aerosol cans of two percent natural pyrethrin
  - 2. Top dress with Actellic, Reldan, or Dipel
- B. Pheromone traps
  - 1. Moth trap / every fourth bin (outside the bins)

2. Grain probes in the bins (one per 5,000 bushels)
3. Check every two weeks / July-November
4. Critical check before processing

C. Routine fumigation of bulk bins
1. Phostoxin Tablets /45 to 60 tablets per 1,000 cubic feet
2. Phostoxin Pellets / 165 to 300 pellets per 1,000 cubic feet
3. New Degesch Mini-Ropes (one per 4,000 cubic feet) *retains the dust in the commodity

D. Empty bin treatment
1. Beneficial insects
2. Chemical residues
a. Tempo®
b. Reldan
3. Fumigation; Chloropicrin

E. Perimeter control
1. Weeds
2. Bare ground herbicides
3. Gravel or blacktop
4. Tempo or Reldan
a. Where to spray / one foot up side and two feet away from bin
b. How to use / see label instructions
c. How often to spray / twice a summer
5. Spillage clean-up / important

V. Chemical Control in Seed Warehouses and Processing Areas

A. ULD Treatments (Ultra Low Dosage); *replace vapona
1. Check pheromone traps / once per week and record catch
2. Minor threshold: if total catch exceeds 10 moths per week
a. Apply remotely if possible (timer)
b. Particle size; 15 to 30 micron
3. Three percent pyrethrin
4. Types of ULD equipment; Micro-Gen
5. Safety equipment to use
a. Proper respirators
b. Draeger detection tubes before re-entry

B. Fumigation with metal phosphide (Phostoxin)
1. Trained, certified, and experienced
2. Safety
3. Proper storage / cool, dry, well ventilated, locked
4. Cold temperature fumigation
a. Magnesium phosphide
1. Degesch Fumi-Strip
2. Degesch Fumi-Cel
5. Inert gases
6. Aerate to safe level
7. Proper safety equipment available
8. Draeger detection equipment

VI. Rodent Control Program

A. Outdoor
1. Bait stations / tamper proof
2. Rodenticide
a. Grain based / Talon Weatherbloc, Vengence
b. Liquid bait, summer
c. Safety
3. Building them out

B. Outdoor perimeter control

1. Weed abatement
2. Bait stations, every 60 feet
3. Ditches and standing water
4. Rats need water every day
5. Gravel 24 inches perimeter
6. All doors should fit tightly

VII. Bird Control

A. Cooperative venture with surrounding groups
1. City
2. Grain companies

B. Farm machinery sheds

C. Warehouses
1. Close doors
2. Plastic strips
3. Rid-A-Bird perches (restricted use pesticide)
4. Avicides
5. Bird netting
6. Sticky Bird Repellent

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References:

Cogburn, R. R. 1988. Detection, distribution and seasonal abundance of *Sitatroga cerealella* and *Ryzopertha dominica* as indicated by pheromone-baited adhesive traps. Proceedings 18th International Congress of Entomology, p. 444.

Mueller, D. K. 1988. Stored-product insects in the United States: a survey. Fum. & Pheromones. 15:3-5.

Mueller, D. K. 1989. Stored-product insect survey; 1988 vs. 1980. Fum. & Pheromones. 20:4-5.

Vick, K. W., 1988. Route of entry of stored-product moths into food distribution warehouses as determined by sex pheromone-baited traps. Proceedings 18th International Conaress of Entomology, p. 443.

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