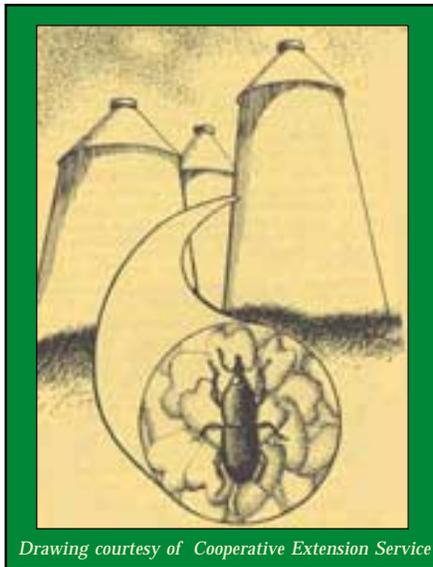


By **Preston Sullivan**
NCAT Agriculture Specialist
July 2002

INTRODUCTION



Effective control of stored-grain pests with minimal pesticide use requires an IPM approach combining sanitation, monitoring, and other preventive practices. Sanitation involves cleaning bins, elevators, and other conveyers before new grain is put in storage—the goal being to eliminate insect eggs, pupae, and dormant adults that will eat and grow in the stored grain. Traps are excellent for monitoring pest levels. Many traps contain pheromone (sex scent) lures. At least one company supplies insect traps for monitoring insects in stored grain (1).

Proper identification of pests is essential for effective control. For assistance with insect identification, contact the Cooperative Extension Service or visit the websites listed at reference 2.

“Stored Grain Advisor,” a computer program for stored-wheat management, is a decision-support software program used to identify pests, predict infestations, and recommend preventive or remedial action. The program can be down-

loaded from the website of its developer, the Grain Marketing and Production Research Center in Manhattan, KS (3).

NON-TOXIC TREATMENTS

Among the non-toxic treatments that can be used on stored grain is diatomaceous earth (DE), a silica product composed of the fossilized cell walls of ancient sea algae. This material is mined, ground into a flour, and used as an insecticide against a variety of pests. The sharp edges of DE cut the pest’s cuticle covering, resulting in death by dehydration. One stored-grain DE product, Insecto™, is used to top off a grain bin filled with fresh grain. The suppliers recommend cleaning out the bin prior to filling it with new grain, then also dusting some Insecto through the fan system. The top dressing of Insecto™ prevents new infestations from entering the grain. Insecto™ is a formulation of DE plus a feed ingredient to attract the insects to their death. I have enclosed information on the use of Insecto™ for controlling stored-grain pests.

Three more methods for controlling stored-product pests are cooling, heating, and using carbon dioxide as a fumigant. Because many of the pests originated in the tropics, they are susceptible to cold temperatures. Most require temperatures above 60°F to reach damaging population levels;

some need temperatures above 70°F. Therefore, storing grain in a cool place will slow pest development. Very cold temperatures can be used to kill pests; storage at 0°F for 4 days will destroy some species. Heating is also effective; exposure for 30 minutes at 130°F will kill many species. Two of the enclosures (Fields, 1999; Gannon, 2000) provide more details on using temperature for pest control.

Carbon dioxide can be used to fumigate over a period of two to five days; it kills the insects by dehydration by causing their breathing apparatus to stay open. See the two enclosed articles “Throwing Out the Garbage” and “Of Bugs and Borders.” The use of carbon dioxide to kill stored-grain pests can be more effective and more economical than other fumigants.

Research is underway on the use of botanical products. To date, chamomile, dill, elder, and wormwood have all shown promise (4).

Oklahoma State University (5) has published the *Proceedings of the 4th National Stored Grain Integrated Pest Management Workshop* (circular E-946). It can be ordered directly through the entomology department for \$6.00. Finally, most state and county Extension offices offer publications on stored-grain pest management.

BIOLOGICAL CONTROL

Biological control using natural enemies is another option. The enclosed articles, “Bring on the Bugs” and “Replacing Fumigants with Beneficial Insects,” detail the use of beneficials for controlling pests of stored products. You might wish to contact Biofac Crop Care, Inc. (6) for specifics on using beneficials for stored-grain pest control. Biofac sells several species of beneficial insects that attack the major pest insects in stored grain, including granary weevil, rice weevil, maize weevil, rusty grain beetle, lesser grain borer, confused flour beetle, sawtooth grain beetle, Angoumois grain moth, and Indian meal moth. More information on these pests and the beneficials that control them can be seen at the Biofac website and in the enclosure from their website.

The bacterial pesticide *Bacillus thuringiensis* (*B.t.*) can be used during grain storage to kill moth caterpillars that hatch after the grain is stored. *B.t.* is effective only against the larval stage of insects in the moth family, such as grain moths and Indian meal moths. Eggs, pupae, and adults are not affected. The product must be ingested by the caterpillar in order to work. *B.t.* kills caterpillars by damaging their digestive tract over a period of two or more days. There are several product formulations of *B.t.*, including Dipel™ and Javelin™.

In summary, there are several viable alternatives to pesticides for managing stored-grain pests. These include beneficial insects, temperature extremes, carbon dioxide fumigation, and diatomaceous earth. These intervention methods, coupled with sanitation and monitoring, can comprise a successful stored-grain IPM program.



From left to right: Confused Flour Beetle, Angoumois Grain Moth, Granary Weevil, Lesser Grain Borer.

Photo courtesy of Agri-Marketing Services

REFERENCES

- 1) Insects Ltd.
16950 Westfield Park Road
Westfield, IN 46074-9374
800-992-1991
317-896-9300
<http://www.insectslimited.com/insects.htm>
<http://www.insectsltd.aol.com>

- 2) Stored Grain Identification Web Resources
<http://entweb.clemson.edu/cuentres/cesheets/grain/index.htm>,
http://www.jamestownnd.com/vectorcontrol/principal_stored_grain_insects.htm
<http://www.biofac.com/storegrainusgmrl/storegrainusgmrl.shtml#effectivebeneficials>

- 3) Grain Marketing & Production Research Center
Stored Grain Advisor
Dr. Paul Flinn, Research Biologist
1515 College Avenue
Manhattan, KS 66502
785-76-2707
<http://bru.usgmrl.ksu.edu/flinn/index.html>
e-mail: flinn@gmprc.ksu.edu

- 4) Anon. 1995. Stored product protection, volume 2. The IPM Practitioner. September.
p. 18.

- 5) Oklahoma State University Cooperative Extension and USDA. 1994. Proceedings of the
4th National Stored Grain Integrated Pest Management Workshop. Circular E-946,
172 p.

Order this publication for \$6 from:
Oklahoma State University
Department of Entomology
127 Noble Research Center
Stillwater, OK 74078
405-744-5527

- 6) Biofac Crop Care, Inc.
Beneficial Insectary
Box 87
Mathis, TX 78368
361-547-3259
1-800-233-4914
<http://www.biofac.com>

ENCLOSURES

- Anon. 2000. Throwing out the garbage. *Fumigants and Pheromones*. Spring. p. 1.
- Fields, Paul G. 1999. The control of stored-product insects and mites with extreme temperatures. *Fumigants and Pheromones*. Fall. p. 8-9.
- Gannon, Bobbie. 2000. Heat treatment checklist. *Fumigants and Pheromones*. Spring. p. 2.
- Kinzel, Bruce. 1991. Replacing fumigants with beneficial insects. *Agricultural Research*. February. p. 14-16.
- Anon. No date. An Insecticide for Control of Grain Insects. 4 p. Accessed June 2002. <<http://www.insecto.com>>.
- Olkowski, William. 1989. Update: New developments in non-toxic pest control for stored food products. *The IPM Practitioner*. February p. 1-9.
- Powell, David. 1992. Of bugs and borders. *Synergy*. Winter. p. 27-30.
- Shirley, Christopher. 1991. Bring on the bugs. *The New Farm*. July-August. p. 10-13, 16, 17.

By Preston Sullivan
NCAT Agriculture Specialist

Edited by Richard Earles
Formatted by Ashley Hill

The electronic version of **Stored Grain Pest Management** is located at:
HTML
<http://www.attra.ncat.org/attra-pub/storedgrain.html>
PDF
<http://www.attra.ncat.org/attra-pub/PDF/storedgrain.pdf>

CT 174