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EC 58-1590 Control of Insects of Farm Stored Grain

Robert E. Roselle
University of Nebraska-Lincoln, rroselle1@unl.edu

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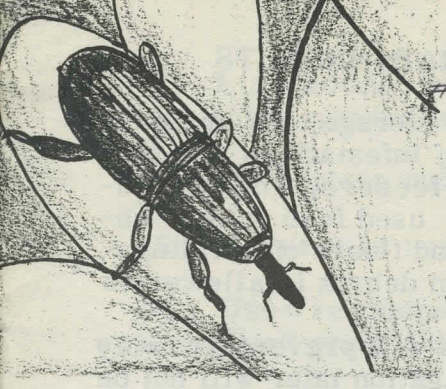

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control of insects of farm stored grain

by ROBERT ROSELLE,
Extension Entomologist

Nebraska grain is free to stored grain insects when it is harvested. All major insect infestations occur after the grain is placed in storage.

It is very important that grains, especially wheat, be kept free from insect infestations. Insects destroy grain, cause heating and increased moisture which may result in spoilage, and can contaminate grain to such an extent that Federal Food and Drug inspectors may declare it unfit for human consumption. Food grains seized by the Federal Food and Drug Administration must be sold as livestock feed or for other uses at substantial losses.

The primary stored grain insects are granary weevils, rice weevils, and lesser grain borers. These are internal feeding insects which attack sound kernels.

The secondary grain insects are cadelles, flat grain beetles, confused and red flour beetles, saw-toothed grain beetles, dermestids, spider beetles, meal worms, fungus beetles, Indian meal moths, grain moths, grain mites, psocids and several other kinds. These usually feed on the external parts of grain, broken kernels, or grain dust.

Cadelles, flat grain beetles, and larvae of Indian meal moths feed on the germ and often reduce viability to such an extent that the grain is not good for seed. Grain insects often cause heating and increased moisture in grains which lowers the grade and causes off odors.

EXTENSION SERVICE
UNIVERSITY OF NEBRASKA COLLEGE OF AGRICULTURE
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PREVENTING STORED GRAIN INSECTS

Most infestations come from the storage bins or nearby areas. The common sources of infestations are feed rooms, poultry feed, seed, hog feeders, empty combines, trucks, grinding equipment, used feed sacks, under buildings, from double walls and floors of buildings, and all other places grain or grain debris is allowed to accumulate.

Adequate sanitary procedures will prevent or delay infestations so that expensive fumigation later will not be necessary. A few inexpensive precautions should always be taken before grain is stored at the time of storing, and after storing. Remember that prevention is the most important step in control of stored grain insects in Nebraska. The following steps must be followed to keep grain clean:

1. Clean combines, truck beds, conveyors, and other equipment used for harvesting and transporting grain after each use.
2. Store wheat in metal, concrete or well constructed wooden bins.
3. Bins should be separate from other farm buildings, especially buildings where feed is stored or livestock housed.
4. Avoid using bins which have double walls or floors.
5. Clean the bins at least 4 weeks before storing new grain. Remove all traces of old grain and debris from the bins and the area around the bin. Use a vacuum cleaner if possible.
6. Spray the entire inside, outside, and ground surrounding the bin with one of the following:

Insecticide	Amount	Application
Malathion, 57% premium grade	1 gallon to 25 gallons water	Spray all surfaces until run - off occurs. Force spray into cracks.
Methoxychlor, 50% wettable powder	1 1/2 cups to 1 gallon water	"
Pyrethrum - piperonyl butoxide	Follow package directions	"

7. Line wooden bins with heavy paper to facilitate fumigation if needed later.

8. Be certain rain or snow cannot blow into bin.

9. Never mix new grain with old grain.

10. Use a recommended grain protectant on new grain and untreated grain if it is turned after storing.

11. Provide for aeration.

12. Store grain with moisture content of 12% or less. If moisture is above 12%, grain should be dried for safe storage. Insects develop much more rapidly in moist grain.

13. Cool grain as soon as possible. Insects do not develop rapidly where temperatures are below 70 degrees F.

14. Store grain free of dockage. Grain containing cracked kernels, weed seeds, straw, stems and other trash will require more fumigant than clean grain. Trashy grain encourages insect infestations and spoilage.

15. Paint bins glossy white to help keep temperatures lower during the summer.

16. Inspect grain for hot spots, insects, rodents, and moisture every 3 or 4 weeks.

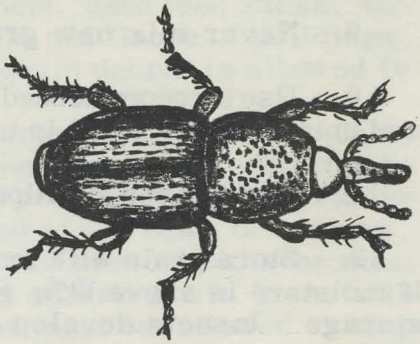
GRAIN PROTECTANTS

Grain protectants are insecticides which are mixed with the grain at the time it is harvested, or when it is turned, to prevent stored grain insects. They are not recommended for control of infestations already present. Malathion and pyrethrum + piperonyl butoxide mixtures are recommended grain protectants.

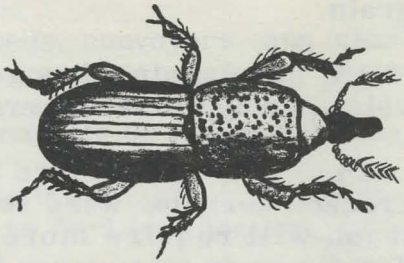
Malathion is applied at the rate of 1 pint Premium grade 57% emulsifiable concentrate in 2 to 5 gallons of water to each 1,000 bushels of grain. The dust form of malathion can also be used. If the dust form is used apply 60 pounds of 1% Premium grade malathion wheat flour dust to 1,000 bushels of grain.

Principal Store

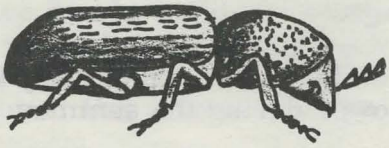
RICE WEEVIL



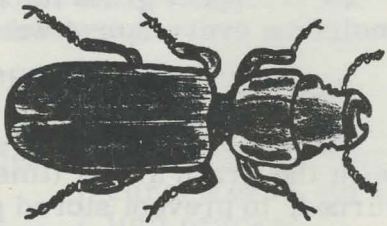
GRANARY WEEVIL



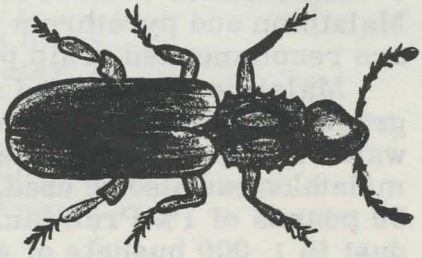
LESSER GRAIN BORER



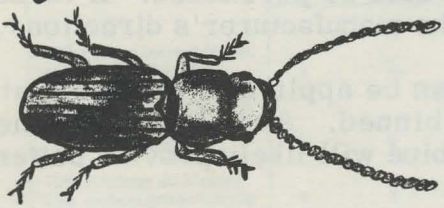
CADELLE
OR FLOUR WORM



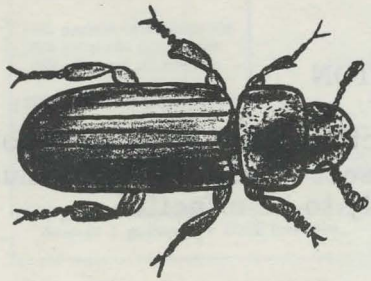
SAW-TOOTHED
GRAIN BEETLE



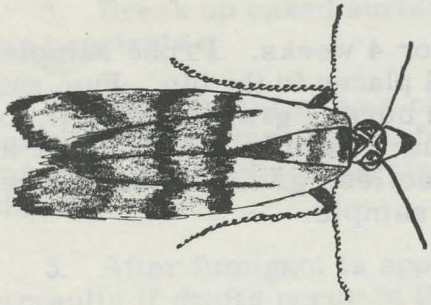
d Grain Insects



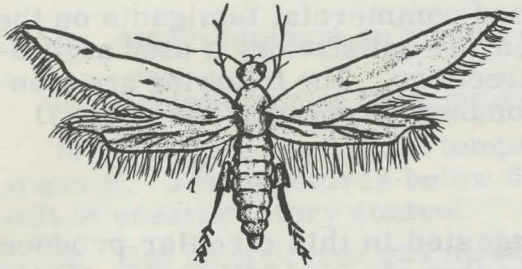
FLAT GRAIN BEETLE



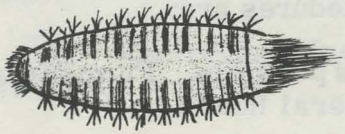
RED FLOUR BEETLE



INDIAN-MEAL MOTH



ANGOUMOIS GRAIN MOTH



DERMESTID BEETLE

The pyrethrum and piperonyl butoxide mixture is available in a ready-to-apply form already dissolved in a suitable liquid. Other formulations are available in emulsifiable concentrate forms to be mixed with water. Wheat flour dust forms can also be purchased. If these materials are used, follow the manufacturer's directions.

Both sprays or dusts can be applied to the grain at various times before it is binned. Applications at the time it comes from the combine will likely provide better distribution in the grain.

FUMIGATION

Fumigation is the only practical method of controlling established stored grain insect infestations. It must be done correctly and thoroughly to be effective.

When To Fumigate

Examine grain every 3 or 4 weeks. Probe samples should be taken from several places in the bin. Fumigate at once if one lesser grain borer, granary weevil, or rice weevil is found per quart sample of wheat, or as many as 5 flour or grain beetles, grain moths, or cadelles are found per quart sample.

Recommended Fumigants

There are many good commercial fumigants on the market, and most of them are satisfactory if used according to manufacturers directions. The following are standard fumigants and recommended dosages: (See page 7)

How to Fumigate

The fumigants suggested in this circular produce gasses which are heavier than air, and will escape if bins are not tight. The fumigation procedures are:

1. Seal bins as completely as possible. Fumigants must be held in the grain for several hours.

2. Level the surface of the grain in the bin.

Fumigant *	Gallons Per 100 Bushels**					
	Wheat		Shelled Corn		Sorghum	
	Wooden bins	Metal or concrete bins	Wooden bins	Metal or concrete bins	Wooden bins	Metal or concrete bins
80% carbon tetrachloride 20% carbon disulfide	4	2	6	5	8	6
80% carbon tetrachloride 15% carbon disulfide 5% sulfur dioxide	4	2	6	5	8	6
75% ethylene dichloride 25% carbon tetrachloride	6	3	8	6	10	8
60% carbon tetrachloride 35% ethylene dichloride 5% ethylene dibromide	4	2	6	5	8	6
100% carbon tetrachloride	6	3	8	6	10	8

* These fumigants are available under one or more commercial brand names. Labels on containers should be examined carefully before using.

** If grain moisture is 13% or above, or grain temperature is below 70 degrees, increase dosage 1 gallon per 1000 bushels.

3. Break up caked surface of grain so that fumigant can penetrate.

4. Apply fumigant as a coarse spray evenly over the surface. Small bins can be fumigated with a knapsack or garden sprayer by enlarging the opening in the spray disk.

5. After fumigant is applied, cover the grain with a tarpaulin if drafts occur in the bin.

6. Apply fumigant on a calm day.

7. Apply fumigant from outside the bin.

8. Fumigate when grain temperature is above 70 degrees F. Temperatures below 60 degrees F. may result in unsatisfactory control.

9. Use an approved gas mask when fumigating large bins, or if it is necessary to enter bins while fumigating.

10. Recirculate fumigant with aeration equipment if possible.

11. Continue periodic checks of grain after fumigating.

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Cautions

Fumigants will kill man and animals as well as insects. They must be handled with the utmost caution. Extreme care must be taken to prevent breathing fumes, spilling on clothing or skin. If spilled on skin, wash immediately, if spilled on clothing change at once. Never fumigate alone, always work with at least one other person. Apply the fumigant from outside the bin to avoid exposure. If a number of bins are to be fumigated, wear an approved gas mask equipped with an approved canister for the fumigant being applied. The canister should be changed after 30 minutes exposure to the fumes of the fumigant being used. Follow all directions and warnings on the label.

SURFACE SPRAYS

Indian meal moths infest the surface of stored grains. They are easily detected by the mass of webbing the larvae spin over the grain. Fumigation often fails to control Indian meal moths. Other insects will come to the surface during fumigation and some will escape lethal concentrations of the fumigant. These can be controlled with surface applications of malathion, pyrethrum and piperonyl butoxide mixtures, or mineral oil.

Premium grade malathion 57% emulsifiable concentrate can be used by mixing 1/2 pint in 1 to 2 gallons of water for application to each 1,000 square feet of grain surface. Premium grade malathion 1% wheat flour dust can be applied at the rate of 30 pounds to each 1,000 square feet of grain surface.

Pyrethrum and piperonyl butoxide mixtures can be used as a commercially prepared solution. It is available as a dust or as an emulsifiable concentrate to be mixed with water. Directions on the label should be followed. Pyrethrum plus piperonyl butoxide can also be used as a space spray against Indian meal moth adults

Unsulfonated, technically white or refined mineral oil which is free of objectionable odors can be used at the rate of 2 quarts per 100 square feet of surface grain, for Indian meal moths. Kerosene or similar petroleum products should not be used because of the odor imparted to the grain.