

# Insects in Farm-Stored Grain



## Prevention and Control

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*Charles R. Patrick, Professor, Entomology and Plant Pathology*  
*Angela Thompson, Assistant Professor, Plant Sciences*

## Insects damage stored grain in two ways:

1. Direct feeding damage, resulting in loss of weight, loss of nutrients, reduction in germination, reduction in grade and a lowering of market value.
2. Deterioration and contamination by their presence, resulting in downgrading of grain and lowering of market value because of foreign matter in grain (insects and insect parts), odors, molds and heat-damaged grain.

## Commercial Grain Storage

The factors involved with insect control in commercial grain storage facilities are varied and complex. You should obtain the services of a reliable grain fumigation company to solve or prevent insect and sanitation problems in the facilities.

## Prevention of Insect Damage in Farm-Stored Grain

Several steps must be followed to keep grain free of insect damage:

1. Practice good housekeeping.
2. Apply residual sprays on empty bin walls (inside).
3. Fumigate empty grain bins.
4. Use recommended grain protectants.

## Good Housekeeping

Prior to filling the bin, clean the bin thoroughly. **NEVER ADD NEW GRAIN ONTO OLD GRAIN.** Use brooms, hoes and shovels to clean out all the grain. You may even want to vacuum the residue of old grain. Be certain to clean behind partitions, between walls and clean out cracks and crevices. Check outside and under the bin for grain that may have leaked out; if any is found,

clean it up. Plug all holes in the bin so rodents and birds cannot get in. Make sure the roof is in good repair so rain and snow cannot leak or blow in. Get rid of rats and mice by using proper traps and other methods approved to rid the rodents from the bin area. If any baits are used to get rid of mice and rats, be certain that the proper legal methods are used.

Check moisture before storing grain. Do not store grain with a high moisture content. Grain insects thrive in high-moisture grain. High moisture also promotes heating and rotting of stored grain. Molds and fungi also grow better in high-moisture grain. This situation could increase the chance for aflatoxin production.

The maximum moisture content for long-term storage of grains is as follows:

	Percent
Shelled Corn	13
Soybeans	11
Wheat	12
Barley	12
Grain Sorghum	12
Oats	12

## Residual Sprays

After the bin has been thoroughly cleaned and emptied, spray all inside surfaces with a residual insecticide such as Tempo 20WP or 2.0 (Bayer) or Tempo SC Ultra. A new product called Insecto may be used in empty bin preparation. Do not use it on any grain.

Be sure to spray removable doors and behind false partitions.

**Caution!** Do not put Tempo directly on the grain.

Indian-meal moths have become resistant to malathion in certain locations. Use Tempo at the rates given in these problem areas. Use a compressed air garden sprayer and spray surfaces until runoff. One gallon of spray will cover about 750 to 1,000 square feet. Do not use any of the sprays in bins where soybeans are to be stored. There are no residuals labeled for soybeans.

## Empty Grain-Bin Fumigation

Prior to filling the grain bin with grain and after the residual spray has been applied, fumigate the empty bin. This can be done more safely than fumigating a full bin.

Cover the outside aeration fans with a plastic bag. Tape the bag with duct tape to hold the bag in place. Seal any openings, such as holes or tears in the bin walls at the base of the bin.

The fumigant that was labeled for empty grain bin fumigation was chloropicrin. This product is no longer available for use since the Department of Transportation has stopped shipment of the quart containers. It will not be available in the future. Another product that is being used in warehouses as a fog to rid insects is being looked into at this time to determine if it can be used on farm grain bins before they are filled with any grain. Presently, the only other fumigant that could be used in the empty bin fumigation process is phostoxin. This product is quite toxic. You would have to have special detectors to determine ppm levels in the bin prior to reentry. The other product called Vapona is being looked at as a substitute for chloropicrin in empty bin fumigation. We will keep you abreast of the situation as we get more data on its use.

## Grain Protectants

Dry, insect-free small grain and shelled corn can be protected from most insect damage by using Actellic 5E or Reldan 4E. Actellic 5E is labeled for use on corn and grain sorghum. Reldan 4E is labeled for use on small grains and grain sorghum.

The grain protectant is applied to the grain before or during binning. Mix the recommended gallons of water with each grain protectant and apply it with a calibrated grain applicator device. Grain protectants are labeled for use per 1,000 bushels of grain except when using Actellic 5E. Use the recommended amount of Actellic 5E for each 1,071 bushels of grain (Table 1). A new material for small grains is storcide from Gustofson. However, it is only cleared for use in the United States at this time and not for export of any treated grain.

## Summary

As a pre-bin treatment use Tempo 2.0, 20WP or Tempo SC Ultra on bin walls and floors. Use at label rates. Use Insecto only in empty bin preparation.

The grain protectants are not very effective on corn in the husk, since poor coverage results in such situations.

Actellic 5E and Reldan 4E have no restrictions to feeding the grain after it has been treated, provided the label directions are followed. Storcide is now labeled for use on grain in the U.S. only.

**Table 1. Grain Protectants**

<b>Protectant</b>	<b>Crop</b>	<b>Rate/1,000 bu.</b>	
Reldan 4F	Small grains, grain sorghum	9 - 11.7 ozs. See label for specific crop.	
Storcide (New)	Small grains	Wheat	12.0 oz.
		Barley	9.0 oz.
		Oats	6.4 oz.
		Rice	9.0 oz.
		Sorghum	11.2 oz.
Actellic 5E	Corn, grain sorghum	9.2 - 12.3 oz./5 gal. water/1,071 bu.	

*Insects controlled: Rice weevils, meal moths, grain weevils, flour beetles, cadelle and grain beetles.*

## **Control of Insects in Farm-Stored Grain by Fumigation**

If a grain protectant is not used, a grain fumigant may have to be used to rid the grain of insect pests. Sometimes even after using a grain protectant, insects will still invade the grain mass.

Grain fumigants should be used only by certified applicators. Due to the hazard created by fumigants, those not trained to properly use a fumigant could be seriously injured or even killed. Even trained applicators are sometimes injured using fumigants. No one is immune from the danger. You are required to have a fumigant management plan. See new Phostoxin label.

## **Farm Fumigant Application**

Use only the amounts on the labels of the fumigant containers. Fumigate on a mild, still day. Grain temperatures should be 65 degrees or above. Grain temperatures generally lag six to eight weeks behind air temperatures. Level the surface of the grain and make sure the bin is airtight. Seal all cracks. If the bin has too many openings that cannot be sealed, it is doubtful if fumigation will be effective. Leave at least 2 feet of space between the top of the leveled grain surface and the top of the bin so the fumigant will not “spill over” the sides. Allow more head space if you plan to go inside the bin to fumigate. If the surface is uneven, the low spots will collect most of the fumigant, while the high spots will remain unfumigated. Spray the fumigant as uniformly as possible over the grain surface. If using a solid fumigant, probe the fumigant

pellets or tablets down into the grain at the number and depth recommended on the label. Do not scatter the solid fumigant contents over the surface of the grain. Poor fumigant action will occur.

The fumigated bin should have warning signs placed at every entrance to the bin. The signs should include the fumigator's name and address, name of the fumigant and concentration. A fumigant detector must be used to determine the concentration of any fumigant if the fumigator enters the bin during or after fumigation. Action to insure a safe fumigation must be taken and all safety regulations must be followed according to the label.

Fumigants labeled for use on stored grain come in different physical concentrations. A fumigant may be a gas, solid or liquid. All fumigants work well if they are applied correctly and according to their labels. New regulations now require a fumigant management plan. See labels for procedures.

**Table 2. Grain Fumigants**

<b>Material</b>	<b>Type</b>	<b>Products</b>
Phostoxin	Solid	Corn, grain sorghum, popcorn, wheat, oats

## **Precautions**

Use of fumigants should be done only by certified applicators. Never fumigate alone. Have all safety equipment available, such as self-contained air supply and proper gas masks approved by the U.S. Bureau of Mines. Follow only the label directions when using any pesticide.

## **Precautionary Statement**

To protect people and the environment, pesticides should be used safely. This is everyone's responsibility, especially the user. Read and follow label directions carefully before you buy, mix, apply, store or dispose of a pesticide. According to laws regulating pesticides, they must be used only as directed by the label. Pesticides recommended in this publication were registered for the prescribed uses when printed. Pesticide registrations are continuously being reviewed. Should registration of a recommended pesticide be canceled, it would no longer be recommended by the University of Tennessee. Use of trade or brand names in this publication is for clarity and information; it does not imply approval of the product to the exclusion of others that may be of similar, suitable composition, nor does it guarantee or warrant the standard of the product.



# Stored Grain Insects and Molds



1. Rice weevil



2. Granary weevil



3. Confused flour beetle



4. Red flour beetle



5. Larger black flour beetle



6. Flat grain beetle



7. Sawtoothed grain



8. Hairy fungus beetle



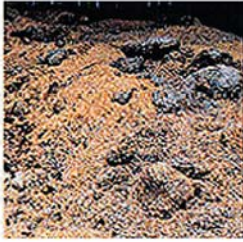
9. Rusty grain beetle



10. Lesser grain borer



11. Indianmeal moth



12. Grain spoilage due to molds



13. *Aspergillus flavus* L. ear rot; C. growing on a corn kernel; R. under a black light



14. Blue eye (L) due to *Aspergillus glaucus*



15. *Fusarium moniliforme* L. ear rot; R. white streaks under seed coat



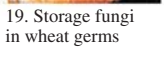
16. *Fusarium* (above), *Penicillium* (below)



17. Blue eye (*Penicillium*)



18. Split kernels with dock damage



19. Storage fungi in wheat germs

*Acknowledgment: This plate was purchased from the University of Illinois College of Agriculture.*

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