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GUIDE

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Insects in Farm Stored Grain—Prevention and Control

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Insects damage stored grain in two ways: 1) direct feeding resulting in loss of weight, loss of nutrients, reduction in germination, downgrading by grain graders, and lowering of market value; and 2) deterioration and contamination by their presence resulting in downgrading of grain and lowering of market value due to foreign matter in grain (insects and insect parts), odors, molds, and heat damaged grain.

A large supply of food is available in a grain bin and the environment is relatively uniform and stable, but in properly managed bins there is a shortage of water. Only a few species of insects have adapted themselves to these conditions, although individuals of these few species may be present in extremely large numbers. (See UMC Picture Sheet No. 1 for color illustrations of the principal stored grain insects.)

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 insect control and sanitation problems in these 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, and (3) use grain protectants.

Good Housekeeping. Before putting grain into a bin, thoroughly clean the bin. *Never add new grain on top of old grain.* Use brooms, hoes and shovels to clean out all of the grain. Be sure to clean behind partitions, between walls and in cracks and crevices. Check outside and under the bin for grain that may have leaked out, and if any is found clean it up. Plug all holes in the bin so that rodents and birds cannot get in. Make sure that the roof is in good repair so that rain and snow can't leak or blow in.

Get rid of rats and mice by using one of the anticoagulant rodenticides, and make granaries as rodent-proof as possible.

Check moisture before storing grain. Don't store grain with a high moisture content. Take a sample to your elevator and have the moisture content checked. Moisture content of corn should be less than 15 per cent and other grain less than 13 per cent.

Residual Sprays. After the bin is thoroughly cleaned, spray all inside surfaces with malathion or methoxychlor about two weeks before storing grain. Be sure to spray removable doors, behind false partitions, etc.

Use 2.5 per cent premium grade malathion, made by mixing ⅓ pint 57 per cent premium grade malathion emulsifiable concentrate per gallon of water.

Or use 2.5 per cent methoxychlor, made by mixing ¾ pint 25 per cent methoxychlor emulsifiable concentrate per gallon of water.

Indian-meal moths have become resistant to malathion. In bins where this insect has been a problem use: (1) the methoxychlor dosage given above, or (2) 0.1 per cent pyrethrin plus 1 per cent piperonyl butoxide for the residual treatment.

Use a compressed air garden sprayer, and spray surfaces to the point of run-off. One gallon of spray will cover 750 to 1,000 square feet.

Caution—Premium grade malathion, methoxychlor, and pyrethrin plus piperonyl butoxide are registered for use on stored barley, corn, oats, rice, rye, sorghum and wheat, *but not on stored soybeans.*

Grain Protectants. Dry, insect-free small grain or shelled corn can be protected from most insect damage by using malathion as a grain protectant. (Indian-meal moth has developed resistance to malathion, however.)

Use only premium grade malathion, formulated specifically for use as a grain protectant.

The insecticide is applied to the grain before or as it goes into the bin. Mix one pint 57 per cent premium grade malathion with two to five gallons of water, and apply this mixture to each 1,000 bushels of grain. Dust formulations containing 1 per cent premium grade malathion, specifically labeled for use on stored grain, may be used at the rate of 50 pounds per 1,000 bushels of grain. Apply to grain stream as it comes out of the combine or as it is being elevated into the bin.

Caution—Premium grade malathion is registered for use on stored barley, corn, oats, rice, rye, sorghum and wheat, *but not on stored soybeans.*

"Cap Out" Treatment. After binning is completed, level off the grain and "cap out" (treat top 3 or 4 inches) with a protectant.

The grain protectant "cap out" acts as a barrier preventing insects from entering the grain mass and from feeding on the surface grain. Each time the surface grain is disturbed, such as when probing for moisture samples, the barrier is broken. Retreat disturbed areas with a grain protectant.

Use ½ pint 57 percent premium grade malathion emulsifiable concentrate in one to two gallons of water per 1,000 square feet of grain surface area, or use 30 pounds of 1 per

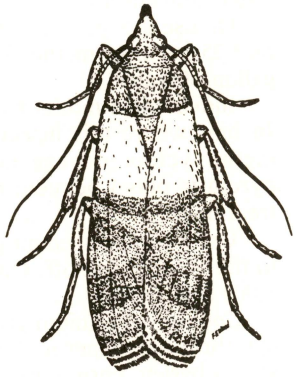
cent premium grade malathion dust per 1,000 square feet of grain surface area.

If past history indicates you have a malathion resistant Indian-meal moth infestation, it is strongly suggested that a "cap out" insecticide or a treatment other than malathion be used. Use 0.3 per cent pyrethrin plus 3 percent piperonyl butoxide in 1 to 2 gallons of water per 1,000 square feet of grain surface, or use the biological insecticide *Bacillus thuringiensis* (Dipel). This is a bacteria that attacks insects. Apply Dipel into the grain stream as the top 4-inch layer of grain is being augered into the bin. Or, apply it to the surface of a filled bin and mix thoroughly into the top 4 inches of grain. Follow label instructions.

Since malathion is the most economical material, has a longer residual period, and still controls the insects found in the grain mass, the use of another insecticide for the "cap out" treatment is desirable only where Indian-meal moths are a problem.

Caution—Premium grade malathion and pyrethrin plus piperonyl butoxide are registered for use on stored barley, corn, oats, rice, rye, sorghum and wheat, but not on stored soybeans. *Bacillus thuringiensis* (Dipel) can be used on all stored grain and soybeans. Grain treated with malathion, pyrethrin, or *Bacillus thuringiensis* (Dipel) can be fed or sold safely any time after treating.

Indian-Meal Moth



Indian Meal Moth

The adult is a moth about ⅓ to ½ inch long. The tips of the wings are dark red or brown, with the inner third light gray. Full grown larvae are about ½ inch long, are dirty white in color, sometimes have a pinkish or greenish tinge, and have a dark brown head.

The larvae feed only in the upper portion of the grain mass, unlike other stored grain insects that feed throughout the bin. The top 1-2 inches of the grain is often webbed together by Indian-meal moth larvae. Where the infestation is severe, a crust of webbing and trash will be very obvious. This crust hinders fumigant penetration and protects the larvae from contacting a "cap out" grain protectant. The crust and damaged grain should be removed before treatment or before the grain bin is emptied.

The larvae prefer to feed on cracked or broken seeds, or weed seeds, but will feed on the germ of whole kernels.

Control. Indian-meal moth larvae have become resistant to malathion. Therefore, a "cap out" insecticide, other than malathion, should be used where these insects are present.

Use a fumigant containing 1 to 2 per cent chloropicrin (tear gas). Following fumigation and aeration, spray the surface of the grain with 0.3 per cent pyrethrin and 3 per cent piperonyl butoxide, in 1 to 2 gallons of water per 1,000 square feet of grain surface area. If a crust has formed, be sure it is removed before the insecticide is applied.

Malathion can be used as a "cap out" treatment if a biological insecticide, *Bacillus thuringiensis* (Dipel), is added according to label instructions. *NOTE: Bacillus thuringiensis* (Dipel) will only control Indian-meal moth and not the other grain infesting insects.

Caution—Pyrethrin plus piperonly butoxide is registered for use on stored barley, corn, oats, rice, rye, sorghum and wheat, but not on stored soybeans. *Bacillus thuringiensis* (Dipel) has no restrictions on grain or soybeans.

Control of Insects in Farm Stored Grain by Fumigation

If a grain protectant is not used, fumigate grain six to eight weeks after putting it in the bin.

During warm weather, check bins every two to four weeks for insect damage. Infestations usually begin near the surface in warm weather, so samples taken near the surface then will indicate whether or not insects are present. During cold weather, infestations start near the center of the bin, so samples have to be taken in the winter by probing the grain mass and determining if insects are present in these samples. Probes usually can be borrowed from your local elevator.

If insects are found, fumigate.

Farm grain storage fumigants are mixtures, usually carbon tetrachloride mixed with carbon disulfide, ethylene dichloride, or ethylene dibromide, or combinations of the above plus methyl bromide*. Carbon disulfide should not be used alone because of its extreme fire and explosive hazard. Two per cent chloropicrin (tear gas) or 1-2 per cent sulfur dioxide are sometimes added to the mixtures as warning agents.

Caution—All of the above fumigants and warning agents are registered for use on stored barley, corn, oats, rice, rye, sorghum and wheat, *but not on stored soybeans.*

Fumigant Application. Use the amounts suggested on the labels of the fumigant containers. Use the maximum amounts suggested.

Fumigate on a mild, still day. Grain temperatures should be 65° F or above. Grain temperatures generally lag six to eight weeks behind air temperatures. Level the surface of the grain and make sure bin is tight. Seal all cracks. If the bin has many openings that cannot be sealed, it's doubtful that fumigation will be effective. Leave at least 6 inches 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.

If the grain surface is uneven, the low spots will collect most of the fumigant, while the high spots will not be fumigated. Spray the fumigant as uniformly as possible over the surface of the grain.

A bucket pump will be best to use in farm stored grain. The pump should have bronze fittings and a plastic or plastic lined hose because some of the materials are very corrosive. If possible, stay on the outside of the bin. Tarpaulins placed over open bins, such as those found in barns, may help hold the fumigant in the bin.

The fumigated bin may be opened up and aired out after 72 hours. The grain may be fed at any time after complete aeration.

Cautions–Use a gas mask approved by the National Institute of Occupational Safety & Health for the particular fumigant you are using. Never enter a bin undergoing fumigation without an approved gas mask.

Never fumigate a bin by yourself. Have someone else around to help if you should get into trouble.

If fumigant spills on your clothes or shoes, remove them immediately and wash the skin with soap and water. Otherwise, severe blistering may result.

Don't take chances. Fumigants can kill *you* as well as the insects.

*An asterisk (*) preceding any pesticide means that all or some uses of the product have been restricted by the Environmental Protection Agency. Applicators must be certified before they may purchase restricted products.

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