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# Fumigation of Farm-stored Grain

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In recent years, the amount of grain stored on Idaho farms has increased — increased to the point where the majority of grain produced in some areas is now stored on the farm for several months. Accompanying increased farm storage has been an increase in bin size. Larger bins tend to have greater storage problems such as insect infestations. During the 1979-80 storage season in southeastern Idaho, more than 80 percent of nonaerated farm-stored grain in 4,000 bushel and larger bins was infested with insects.

If you find an insect infestation in your farm storage, the best option is often to sell the grain for feed purposes. This is particularly true if the infestation is severe and extensive damage to the kernels has already occurred. On the other hand, fumigation of infested grain can temporarily eliminate the insect problem. It must be emphasized, however, that even though fumigation can destroy or reduce an insect infestation, it should not be considered a permanent control method.

Fumigants for farm-stored grain come in two forms — liquid and solid. Most are restricted use pesticides; therefore, an individual must have a private or commercial applicator's license to purchase and use them. Companies that sell the solid form require that growers be trained before using the product.

## Liquid Fumigants

Liquid grain fumigants are a chemical or combination of chemicals which, when exposed to air, change to gas. The resulting gas is slightly heavier than air and sinks slowly through the mass of grain. The air between the kernels is replaced, killing those insects present. All individual insects are killed, including every stage or kind of insect presently known to be resistant. The limiting factor is the insect's exposure to a killing concentration of gas

for a long enough time to kill it. After treatment, the residual gases slowly dissipate by natural air movement with no residues remaining on the product. Several liquid fumigants are available for farm use.

## Solid Fumigants

Solid fumigants are aluminum phosphide and ammonium carbonate pressed into hard tablets or pellets and then coated with paraffin. Atmospheric moisture reacts with the tablets resulting in the release of hydrogen phosphide (phosphine) gas. The reaction takes 1 to 2 hours to initiate. Because hydrogen phosphide gas is approximately the same weight as air, the pellets are inserted into the grain bins with a specially designed probe at different depths to fumigate the entire bin. If rainwater or moisture from spills comes in contact with the tablets, a violent reaction will occur.

This is the only fumigant that can be used on containers in transit; however, some terminals or depots will not unload any fumigated, unaired containers. One active ingredient is formulated and sold under the trade names of Phostoxin or Detia.

## Grain Temperature

Normally, grain should not be fumigated when its temperature is below 60 degrees. The label on most commercial fumigants will state the minimum temperature for that product to be effective. Do not guess; use a thermometer to determine grain temperatures. Take temperatures at several locations and depths because grain temperature will normally vary from one area of the bin to another.

If grain temperature is on the cool side of the range for the fumigant being used, increasing the dosage by about 20 percent is advisable when the label allows. Or, choose fumigants with high vapor pressure. These are more effective than fumigants



having low vapor pressures. For example, ethylene dichloride has a low vapor pressure and should not be used on cooler grain, but it is a good selection for smaller bins or grain that is warm.

## Grain Packing

Grain packing can be influenced by grain moisture, fine material, weed seeds or use of grain spreaders. Because fumigants are gases, sufficient void space between the kernels must be present for the gas to move. If grain is packed, it may need to be mechanically turned for fumigation to be effective.

## Dockage

Dockage such as chaff, weed seeds and dust can fill the center core area of a bin. This core area can be impervious to penetration of fumigation gas. This is of particular concern because it is the core area which normally has higher temperatures where insect infestations are the most severe. If the amount of fine dockage is not extreme, its presence can be overcome by increasing the fumigant dosage. If too much dockage is present, the grain will have to be cleaned before fumigation.

## Grain Moisture

High moisture in grain can result in moisture condensation, mold growth, sprouting and/or heating. Any of these conditions can hinder penetration and distribution of the fumigant gases. All surface crust and spoiled grain should be removed before chemical application. If the grain in the entire bin is "out-of-condition," it may need to be "turned" before fumigation can be effective. During the grain moving process from one bin to another, a solid fumigant can be applied. In general, the higher the moisture content the higher the fumigant dosage required. Grain with a moisture content of 20 percent or more usually should not be fumigated.

## Steps in Fumigation

1. Read and follow instructions on container label.
2. Have someone work with you so that help will be available in case of an accident.
3. Level the grain to 6 inches below the top of bin sides, and remove any crust that is present.
4. Check the grain temperature. Do not treat if the temperature of the majority of the bin is less than 60°F.
5. Do not fumigate on windy days. Wind can disperse the fumigant.
6. Do not fumigate above 90°F. The fumigant will be too volatile to penetrate the grain.
7. Seal the bin as gas tight as possible.

8. Adjust fumigation rates for type of bin, air and grain temperature, tightness of bin or dockage present.
9. If it is necessary to enter the bin to apply fumigant, use the proper gas mask with a canister approved by U.S. Bureau of Mines for the fumigant you are using.
10. Apply liquid uniformly over the surface of the grain. Use a coarse droplet spray or solid stream. For example, a 3 gallon sprayer can be used by loosening the nozzle. If a solid fumigant is used, it should be probed in a uniform pattern.
11. When applying a solid fumigant under conditions where the grain temperature in the bins is cool on the outside and warm in the center, best results are obtained by placing the pellets close to the bottom of the bin.
12. If you spill a liquid fumigant on your skin or clothing, immediately remove contaminated clothing. Wash with soap and water.
13. Do not feed treated feed or grain to livestock until it has been aired enough to remove all fumigant odor.

## Fumigants for Farm-stored Grain

Common fumigant mixtures	Trade names
1. Carbon disulfide Carbon tetrachloride	FIA 80-20 Premium Grain Fumigant No. 2
2. Carbon disulfide Carbon tetrachloride Ethylene dibromide	Tetrakill
3. Ethylene dibromide  Ethylene dichloride Carbon tetrachloride	Grain Conditioner and Weevil Killer Weevil Killer Fumigant Iso-Fume
4. Ethylene dichloride Carbon tetrachloride	Formula 72
5. Methyl bromide Chloropicrin	Brom-O-Gas
6. Chloropicrin	Larvacide
7. Aluminum phosphide	Phostoxin Detia

## Chemical Recommendations

The recommendations given here are based on the best information currently available for each chemical listed. If followed carefully, residues should not exceed the tolerance established for any particular chemical.

## Trade Names

Trade names are used to simplify the information presented. Use of these names neither implies endorsement of products nor criticism of similar products not mentioned.