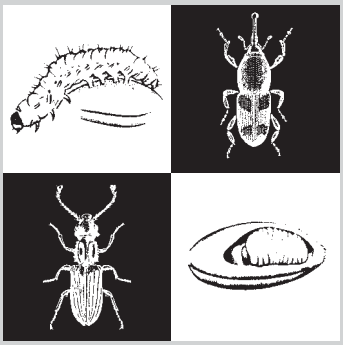
MF-917

Management of Stored Grain Insects, Part III

Structural Sprays, Pest Strips, Grain Protectants and Surface Dressings

Kansas State University Agricultural Experiment Station and Cooperative Extension Service



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Many chemicals are marketed to protect stored grains from insect attack, but they should not be considered alternatives to proper stored grain handling procedures. When chemicals are chosen to supplement other management tactics, careful attention to application procedures and rates are needed to avoid illegal and potentially harmful residues.

Remember that labels change as laws and experience with the product develop. Always consult the label attached to the product under consideration.

With the recent announcement of the pending withdrawal of Chlorpyrifos-methyl (Reldan 4E), and with known resistance problems occurring with all protectants, there may be new grain protection products in the near future. We recommend checking with suppliers for information on new products before selecting a management plan for your stored grain. Continued changes in application procedures and required safety equipment are expected. Check current labels carefully before making applications.

The label carries the force of state and federal law. Deviations from label instructions may result in unsalable grain, civil or criminal charges, personal injury, or even death.

Before applying chemicals, always check labels carefully for grains that can be treated, rates to use, application procedures and safety considerations.

Structural Sprays or Bin Preparation Sprays

Structural sprays are designed for use four to six weeks before the grain enters storage. After cleaning the structure thoroughly, walls, roof, and floor should be sprayed to the point of run off – approximately 1 gallon of mixed spray per 500 to 700 square feet of surface – or as directed on the label. Use a coarse spray at a pressure of at least 30 psi. Cleaning and treating are most effective if accomplished immediately after the structure is emptied of grain if temperatures are warm enough to support insect activity.

Bin-wall treatments are designed to eliminate insects that remain in the cleaned structure. Post-treatment waiting intervals before binning the grain are suggested to allow eggs to hatch and hidden insects to cross the toxic barrier and die. If more than three months elapse from initial treatment and filling of the bin, a second wall treatment may be useful if applied at least two or three weeks before harvest. Labeled products include the following:

Cyfluthrin (Tempo 2)

Apply to empty bin surfaces only, not to grain.

Chlorpyrifos-methyl (Reldan 4E)

May not provide control of lesser grain borer. (Reldan is being withdrawn by the manufacturer. Final sales date is expected to be December 31, 2003.) Reldan is recommended for use in bins where barley, oats, rice, sorghum or wheat will be stored. Future labels may place further restrictions on treating bins with this product, so read the label carefully.

Malathion (several products by various manufacturers)

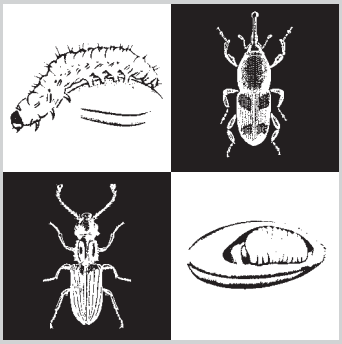
Some labels continue to carry label directions for treating empty grain bins. However, efficacy on many important stored grain pests may be questionable because of widespread resistance. Grains that can be stored after treatment are wheat, oats, corn, rye and barley. (Some labels don't list corn.) Many liquid formulations of malathion now carry the statement: "Do not apply directly to grain."

Inert dusts (diatomaceous earth, etc.)

Some products may carry directions for use as empty bin and equipment treatments.

(S) - Methoprene (Diacon II)

Diacon II protects stored grains



Safety Considerations

Grain protectants are not **Restricted Use Pesticides**. This means the user must follow all label directions, but does not have to become certified by the Kansas State Board of Agriculture before purchasing or using the products. If the protectant is applied as directed on the label, illegal residues and unwarranted health risks to animals and humans should be avoided. Goggles or face shields and chemical-resistant gloves should be worn when handling or applying these products. Avoid breathing vapors, mists and dusts. Special respiratory protection may be required.

from damaging insects by interfering with the normal process of insect development. Unlike traditional pesticides, *Diacon II* is not an adulticide, but its residual activity prevents the development of larvae into adults. *Diacon II*, when used according to the label directions, prevents regeneration of the following insects: almond moth, Indianmeal moth, cigarette beetle, lesser grain borer, sawtooth grain beetle, merchant grain beetle, red flour beetle, and confused flour beetle. Treat existing insect populations with an adulticide before applying *Diacon II* for residual protection. Do not treat at extremely dusty sites.

Where stored grain was infested previously or where contaminated areas cannot be thoroughly cleaned and treated, an empty bin fumigation treatment by a trained and certified professional applicator might be warranted.

Slow-Release Pest Strips and Indianmeal Moth Prevention

Dichlorvos slow release insecticide strips (For example, Alco No-Pest Strip, EPA Reg. 5481-338, and StarBar Insect Strip, EPA Reg. 5481-344) can be hung in the grain overspace to reduce adult Indianmeal moth numbers. Strips should be hung at the rate of one strip per 1,000 cubic feet of overspace and be replaced every three to four months during warm periods when the moths are expected to be laying eggs. The insecticide released from these polyvinyl strips is not usually effective against larval stages located beneath the grain surface. Effectiveness against the adults is reduced where gaps in the structure permit ready air movement, decreasing local buildup of toxic vapors.

Grain Protectants

As a group, grain protectants are insecticides designed to be placed on the surfaces of grain as it first enters storage. Grain protectants are developed and formulated to retain their insect-toxic properties for an extended time. They are not highly volatile, and penetration into infested kernels is limited, so they may not destroy all life stages of some stored grain insects. In particular, eggs and internally feeding insects may not absorb fatal amounts of insecticide immediately after exposure. For this reason, performance expectations should be different than for grain fumigants. If applied properly, grain fumigants rapidly kill all life stages, although not all individuals, but provide no residual activity against reinfestation.

Using grain protectants

In general, a grain protectant is probably not necessary if fall-harvested grain will be used or sold before temperatures warm the next spring. In this case, protectants are probably an unnecessary expense provided the structure was cleaned and treated with a residual insecticide before the grain was stored and the structure is equipped with aeration fans, which will be used to cool the grain below 60° F as soon as possible. In contrast, grain entering long-term storage may benefit from being treated with a protectant. A conservative definition of long-term storage would include summer harvested winter wheat that will remain in storage through the fall, and fall-harvested grains that will remain in storage into the next summer.

Pirimiphos-methyl (Actellic 5E) is labeled for use on shelled corn and grain sorghum. Actellic is effective in controlling Indianmeal moth and other stored grain insects, including many malathion-resistant strains. Lesser grain borer is not listed as a target pest on the label. Grain treated with Actellic at the rates indicated on the label may be used immediately for any food or feed purpose. Do not make more than one application per crop. Avoid severely dusty application sites. Actellic is not labeled for use as a structural or bin-wall treatment.

Chlorpyrifos-methyl (Reldan 4E) is registered for use on wheat, oats, barley, rye and sorghum. It is effective against Indianmeal moth and many other stored grain insects, but lesser grain borer has been removed from the list of insects for which control is indicated. (Reldan is being withdrawn by the manufacturer. Final sales date is expected to be December 31, 2003.)

Malathion has been used for years as a grain protectant, but the number of products labeled for treating stored grain has declined greatly over the last few years, and the list of grains that can be treated has become more restricted. It has been marketed in both dust and liquid formulations, but many liquid formulations of malathion now carry the statement: “Do not apply

directly to grain." Grains that can be treated are wheat, oats, corn, rye and barley. Some labels do not list corn. Malathion should only be applied to dry grain, because it breaks down rapidly when moisture levels are above 13 percent, especially if temperatures are above 80° F. In addition, several insect species within Kansas have demonstrated significant levels of resistance to malathion, which means it may not always provide the desired level of protection. Because of resistance problems, concerns over organophosphate residues on grain, and the availability of temperature-management systems, treating grains with malathion should only be considered if no other options appear to be available.

Inert dusts (diatomaceous earth, etc.) have been promoted for use as protectants against grain storage insects. Inert dusts may greatly increase grain-handling machinery wear due to their abrasive characteristics. There also has been some indication that test weights may change following the application of an inert dust to some grains. Inert dusts must carry a specific label mention of stored grain treatment to be used this way in Kansas.

(S) - Methoprene (Diacon II)

Diacon II this material was labeled in the spring of 2002 for treating barley, corn, grain sorghum, oats, peanuts, rice and wheat. *Diacon II* is a growth regulator that prevents the development of larvae into adults. When used according to the label directions, it prevents regeneration of the following insects: almond moth, cigarette beetle, lesser grain borer, sawtooth grain beetle, merchant grain beetle, red flour beetle, and confused flour beetle. Dilute *Diacon II* with water or FDA approved food grade oils* or soybean oil and apply to the moving grain stream as a coarse spray. Apply *Diacon II* grain protectant only to grain of known treatment history, apply no more than once per crop. Use diluted spray solution within 48 hours of mixing. Agitate before each use.

Application Techniques

Although even distribution of treating the product during application is desirable, treatment of every kernel may not be necessary. Each product label carries specific application instructions.

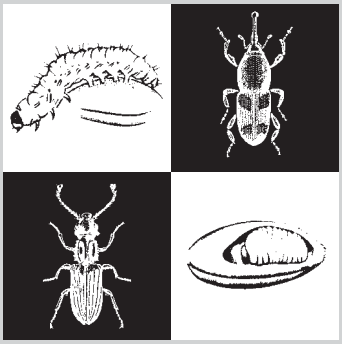
Most labels of liquid formulations advocate application as the grain is entering the auger for delivery to the final storage site. Low pressures and large droplet sizes are recommended where pressurized spray systems are employed. Periodic agitation is required to keep some products evenly distributed in the drip or spray solution. Because some products breakdown with prolonged contact with water or sunlight, do not mix more product than will be used in a single day. Keep the material well shaded. Check labels and distributors for recommendations for equipment that can be used to apply the various products, and for directions on how to calibrate the application. Dust formulations may be applied with mechanical applicators designed for the purpose or (if so labeled) by spreading the proper amount of product on the grain before binning. Mixing the product in as much as possible with a scoop shovel is advised. Final distribution is achieved as the grain and product leave the truck through the unloading gate and travel up the auger together.

Fresh dust formulations should be used. Try to not carry over product from year to year. There are indications that the persistence and effectiveness of many of these products are severely reduced if they are applied before high-temperature drying. The Reldan 4E label specifically prohibits such an application.

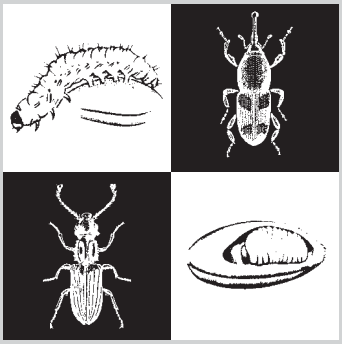
Surface Dressings or Cap-Out Treatments

With this approach, the protectant is only applied to exposed surfaces of the grain mass to a depth of approximately six to 12 inches. (See exception under Bacillus thuringiensis). One method for obtaining a uniform distribution at the surface is to apply the product to the last truckload of grain before it enters the auger. The topdressing application will not substitute for a treatment of the entire amount of stored corn or grain sorghum. But because it is not always possible to treat grain as it enters storage or move grain to treat the entire mass, a surface treatment may help prevent the establishment of migrating pests.

Pirimiphos-methyl (Actellic 5E) is labeled for use on shelled corn and grain sorghum. It should not be used if grain has previously been treated with Atellic.



The use of a grain protectant is not a substitute for continued, thorough, and frequent sampling of grain for the presence of living insects.



Chlorpyrifos-methyl (Reldan 4E) is registered for use on wheat, oats, barley, rye and sorghum. Do not use it as a top-dressing treatment on grain where Reldan was used as a protectant. (Reldan is being withdrawn by the manufacturer. The final sales date is expected to be December 31, 2003.)

Bacillus thuringiensis is an insect pathogen derivative that will kill Indianmeal moth larvae upon consumption. Treating exposed grain surfaces with this product should reduce Indianmeal moth infestations. It should be mixed into the top 4 inches of the grain surface. It is marketed under several product labels including Dipel, Thuricide, Javelin, Xentari, and others. Many products with similar or equivalent active ingredients or brand names do not have stored grain treatment listed on the label, so be certain the product purchased is labeled for the intended use.

Application rates vary with the formulation strength and product. Grains that can be treated may vary by label, but generally include most common grains plus soybeans and sunflowers. Bacillus thuringiensis is not effective against adult moths, weevils, lesser grain borers or other beetles that infest grain. There is evidence that Indianmeal moth larvae could develop resistance to this product within three generations. Thus, it should be used in conjunction with other management practices and should not be used excessively at any one location.

(S)- Methoprene (Diacon II)

Diacon II can be applied as a top-dressed to stored products that have already been placed into bins or storage areas (barley, corn, grain sorghum, oats, peanuts, rice and wheat.)

Diacon II applied to the surface of the grain, should disrupt the development of Indianmeal moth larvae and other immature insects feeding on the surface of the grain mass.

Surface Dressings

Remove any webbing that may be present before applying the chemical. Split applications seem to perform more consistently than applying surface dressings all at once. If allowed by the label, divide the product to be applied into three lots. Spread the first lot on the surface of the grain. Then mix it thoroughly with a rake or scoop shovel to the depth indicated by the rate used. Spread the second lot and do as before. Apply the third lot evenly to the surface and minimize further mixing unless the label recommends otherwise.

Fumigation

Fumigants rapidly form toxic gases when released from the container used to transport them. These gases readily penetrate into infested kernels and should eliminate all insect life stages if applied properly. *Fumigants do not provide residual protection, so re-infestation can occur immediately after the grain has been aired out and gas concentrations fall below lethal levels.*

Fumigation is relatively complicated, requires specialized training and well-maintained application, monitoring, and safety equipment. It can be fatal to the user if recommended procedures are not followed closely. Unless the grain storage manager is willing to invest the time and money necessary to acquire the equipment and knowledge needed, this job should be left to specially trained, reputable professionals.

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