



EXTENSION

Grain Protectants and Top-Dress Treatments for Stored Grains

May 2023

Edmond L. Bonjour

Associate Extension Specialist - Stored Products Entomologist

Oklahoma Cooperative Extension Fact Sheets
are also available on our website at:
extension.okstate.edu

Introduction

Protecting grain in storage is important to maintain the grain quality for the best economic gain. Preparing storage structures prior to harvest is important. There are multiple steps to ensure that grain quality is preserved. Sanitation through cleaning equipment that will be in contact with new grain is essential. This includes storage structures, grain handling equipment and transportation vehicles. It is also necessary to keep the area surrounding storage structures free of vegetation and spilled grain. Maintenance of equipment is critical to safeguard that all equipment is functioning properly, and the storage structure is sealed to prevent moisture and insects from entering. Insecticides for the treatment of empty-structures and surrounding perimeters aid in controlling insect activity and minimize initial insect infestations. More information can be found on these topics in fact sheet BAE-1112, Preparing Grain Bins and Flat Storages Prior to Harvest or Incoming Product Storage.

In Oklahoma, insect populations will gradually increase in grain stored after harvest if the grain is not protected. Stored grain insect pests have a maximum rate of population increase when the grain temperature is 77 to 90 F. Populations will continue to grow during the summer, reaching a peak number of insects in the fall before temperatures begin to cool and the temperature of the grain lowers. Grain protectants will eliminate or at least minimize the amount of insect population growth. The earlier the insect population growth can be delayed, the better.

Grain Protectants

The cleaner the grain is when being stored, the fewer problems there will be in the future. Grain quality never improves with storage, so the goal is to maintain grain as near to harvest quality as possible. Grain protectants help in preserving the grain from insect damage. Grain protectants are insecticides that are applied to the grain as it is being loaded into the storage structure to protect it from insect infestation. They are not designed for disinfecting grain that already contains insects. Applying the insecticide to a moving grain stream at the bottom of the bucket elevator, auger or belt will ensure the insecticide encounters as many grain kernels as possible while the grain is moving to its final destination. Table 1 shows a list of insecticides labeled for use as grain protectants.

Most grain protectants are applied to the entire grain mass. However, a few products allow for an alternative treatment where the insecticide is only applied to certain layers of the grain mass. One method is to treat only the top 2-3 feet of grain. Another method is to treat only the bottom and top layers of the grain mass. The last method is to treat the bottom layer of grain, then every fifth load and then the top layer, if the structure is large enough to accommodate multiple loads of grain. Please read the label carefully to see if the product allows for layer treatments. Products labeled for the option of layer treatments are noted in Table 1.

It is important to note that high temperatures, especially during the heat of summer, may affect the success of these products. Products containing pyrethrin are especially sensitive to heat and will not provide long-term protection.

Top-Dress Treatments

Many of the grain protectants can also be used as a top-dress treatment, where the insecticide is applied to the grain surface to prevent insect infestation from occurring from the top of the structure. In most cases, the insecticide is incorporated into the top 4 inches of grain but one product requires mixing the product to a grain depth of 1 foot from the top surface. A few insecticides are applied to the grain surface without mixing. Some insecticides are applied in two stages, where the first half of the calculated amount of product is applied and incorporated, and then the second half is applied to the grain surface and left undisturbed. A list of insecticides labeled for top-dress treatments is found in Table 2.

Effectiveness

Some insecticides are more effective in controlling certain stored grain insects than others. It is critical to know what insect species you are targeting when treating grain, and choose the correct product. Insect resistance to phosphine fumigants has been documented. Therefore, using a grain protectant may be an effective alternative treatment to overcome this resistance.

Insecticide Application

Reading and following label instructions is required by law. Not all products listed in Tables 1 and 2 are to be used on every type of stored grain. Only apply the appropriate insecticide on the listed commodities with the proper rates, as instructed on the label. Always wear personal protective equipment, as per the label when mixing and applying insecticides. Safety is a critical component when using insecticides.

Table 1. Grain Protectants

Product (Active Ingredient)	Application	Notes
Actellic 5E Insecticide (pirimiphos-methyl)	9.2 -12.3 fl oz/5 gal water/30 tons grain	Only for use on corn and grain sorghum.
Centynal EC Insecticide (deltamethrin)	5.15 - 19.20 fl oz/3 - 5 gal water/1000 bu	Rates vary depending on type of grain and desired concentration of insecticide.
Centynal Synergized Insecticide (deltamethrin and piperonyl butoxide)	20.38 - 38.0 fl oz/3 - 5 gal water/1000 bu	Rates vary depending on type of grain.
D-Fense SC Insecticide (deltamethrin)	4.88 - 9.14 fl oz/5 gal water/1000 bu	Rates vary depending on type of grain.
Diacon IGR ((s)-methoprene)	1.0 - 7.0 fl oz/5 gal water/1000 bu	An insect growth regulator that will not kill adults but prevents development of larvae into adults. May apply as a tank mix with Centynal. Rates vary depending on type of grain and desired concentration of insecticide.
Diacon IGR Plus (deltamethrin and (s)-methoprene)	5.15 - 19.20 fl oz/3 - 5 gal water/1000 bu	An insect growth regulator plus adulticide. Rates vary depending on type of grain and desired concentration of insecticide.
Diacon-D IGR ((s)-methoprene)	8.0 - 10.0 lbs/1000 bu	An insect growth regulator that will not kill adults but prevents development of larvae into adults. Wear dust mask and protective gloves.
DiPel DF Biological Insecticide Dry Flowable (Bacillus thuringiensis)	1/20 lb/gal water	Apply 0.6 pint of this mixture per bushel as the last (top) 4-inch layer of grain is augered into bin. Only controls moths.
DiPel ES Biological Insecticide (Bacillus thuringiensis)	1.45 fl oz/gal water	Apply 0.6 pint of this mixture per bushel as the last (top) 4-inch layer of grain is augered into bin. Only controls moths.
Dryacide 100 (diatomaceous earth)	28.0 - 56.0 lb/1000 bu	Wear respirator. Optimal performance is achieved with low grain moisture (<12%). Layer treatments are an option.
EverGreen Crop Protection EC 60-6 (pyrethrins and piperonyl butoxide)	1.0 qt/7.5 gal water and apply at 4 - 5 gal/1000 bu	Thoroughly mix the emulsion.

Table 1. Grain Protectants (cont'd)

Product (Active Ingredient)	Application	Notes
EverGreen Pyrethrum Concentrate (pyrethrins)	30.0 fl oz/5 gal water/1000 bu	Thoroughly mix the emulsion.
Gravista Insecticide (deltamethrin, (s)-methoprene, and piperonyl butoxide)	20.38 - 38.0 fl oz/3 - 5 gal water/1000 bu	Rates vary depending on type of grain.
Insecto (silicon dioxide from diatomaceous earth)	1.0 - 2.0 lb/ton	Wear respirator. Layer treatments are an option.
PBO-8 Synergist (piperonyl butoxide)	0.43 - 0.91/100 lb	Rates vary depending on type of grain. Usually applied in mixture with an insecticide registered for use on stored grains.
Protect-It (diatomaceous earth and silica gel)	9.6 - 18.0 lb/1000 bu	Rates vary depending on type of grain. Optimum effectiveness when grain is below 14.5% moisture content with relative humidity at 70% or less. Layer treatments are an option.
Pyronyl Crop Spray (pyrethrins and piperonyl butoxide)	1.0 pt with 3 gal 5 pts water and apply at 4 - 5 gal/1000 bu	Thoroughly mix the emulsion.
Sensat (spinosad)	5.9 - 10.5 fl oz/5 gal water/1000 bu	Rates vary depending on type of grain.
Suspend SC (deltamethrin)	4.88 - 9.14 fl oz/5 gal water/1000 bu	Rates vary depending on type of grain.

Table 2. Top-Dress Treatments

Product (Active Ingredient)	Application	Notes
Actellic 5E Insecticide (pirimiphos-methyl)	3.0 fl oz/2 gal water/1000 ft ²	Only for use on corn and grain sorghum. Apply one-half of mixture evenly across grain surface and rake into the grain to a depth of 4 inches. Apply remaining half to the grain surface and leave undisturbed.
Diacon IGR ((s)-methoprene)	1 ml (1/30 fl oz)/1000 ft ²	Do not flood top-dress area.
Diacon-D IGR ((s)-methoprene)	8.0 lbs/1000 ft ²	An insect growth regulator that will not kill adults but prevents development of larvae into adults. Wear dust mask and protective gloves. Rake into grain to a depth of 1 foot.
DiPel DF (Bacillus thuringiensis)	0.5 lb/5 - 10 gal water/500 ft ²	Mix into top 4 inches of grain.
DiPel ES (Bacillus thuringiensis)	15.0 fl oz/5 - 10 gal water/500 ft ²	Mix into top 4 inches of grain.
Dryacide 100 (diatomaceous earth)	2.0 - 3.0 lb/1000 ft ²	Wear respirator. Optimal performance is achieved with low grain moisture (<12%).
EverGreen Crop Protection EC 60-6 (pyrethrins and piperonyl butoxide)	1.0 qt/19 qts water and apply at 1 - 2 gal/1000 ft ²	Mix into top 4 inches of grain.
EverGreen Pyrethrum Concentrate (pyrethrins)	1.0 qt/14 qts water and apply at 2 gal/1000 ft ²	Mix into top 4 inches of grain.
Insecto (silicon dioxide from diatomaceous earth)	4.0 lb/1000 ft ²	Wear respirator. Apply at monthly intervals with the first appearance of moths and continue until early fall.

The pesticide information presented in this publication was current with federal and state regulations at the time of printing. The user is responsible for determining that the intended use is consistent with the label of the product being used. Use pesticides safely. Read and follow label directions. The information given herein is for educational purposes only. Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement by the Cooperative Extension Service is implied.

Oklahoma State University, as an equal opportunity employer, complies with all applicable federal and state laws regarding non-discrimination and affirmative action. Oklahoma State University is committed to a policy of equal opportunity for all individuals and does not discriminate based on race, religion, age, sex, color, national origin, marital status, sexual orientation, gender identity/ expression, disability, or veteran status with regard to employment, educational programs and activities, and/or admissions. For more information, visit <https://eeo.okstate.edu>.

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Director of Oklahoma Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma. This publication is printed and issued by Oklahoma State University as authorized by the Vice President for Agricultural Programs and has been prepared and distributed at a cost of 20 cents per copy. May 2023 KG.