

2016 Insect Pest Management Recommendations for On-farm Stored Commodities

(adapted with permission from Extension Publication IPM 0330 developed by Kathy Flanders, Extension Entomologist, Professor, Department of Entomology and Plant Pathology, Auburn University and Michael Toews, Associate Professor, Department of Entomology, University of Georgia)

All the expense and effort of making a crop can be wasted if not enough attention is paid to storage. The key to storing grains and other commodities on the farm is to make storage conditions unfavorable for the survival of stored-grain insects and molds. The following steps are designed to reduce the initial number of insects in the bin, slow the development of any remaining insects, and apply corrective measures to reduce insect populations if necessary. Following these steps will also greatly reduce stored-grain molds and associated mycotoxins.

- Clean the storage bin thoroughly inside and out to eliminate starter colonies of insects. Remove any weeds, crop debris, or clutter where the insects can hide. Clean the bins as soon as they are emptied.

- It only takes a month in warm weather for most stored grain pests to complete a generation.
- Seal any gaps or holes in the sides of the bin, using caulk or polyurethane foam. Check to make sure the bottom seal is intact and effectively preventing water from flowing underneath the bin.
- Apply an EPA-approved insecticide (Table1) on the floors and sides of bins to eliminate insects hiding in cracks and crevices and to create a first line of defense against any insects that do find their way into the bin. The following insecticides are labeled for this empty bin treatment:

NOTE – The label is the law. Be sure to read the label before making any pesticide applications and observe all label restrictions

Table 1. Insecticides for Use for Empty Bin Treatments¹

Insecticide	Rate	IRAC	Remarks
TEMPO SC ULTRA (beta-cyfluthrin)	0.27–0.54 fl. oz./gal./1000 sq. ft.	3A	Apply to all interior surfaces of storage bin and allow to dry before filling bins.
CENTYNAL (deltamethrin)	0.25–1.5 fl. oz./gal./1000 sq. ft.	3A	Apply to wall and floor surfaces of grain bins and warehouses prior to storing or handling grain.
D-FENSE SC (deltamethrin)	0.25–1.5 fl. oz./1000 sq. ft.	3A	Apply to wall and floor surfaces
INSECTO (diatomaceous earth)	Dust: 1 lb. /1000 sq. ft.		Apply at least 2 to 3 days before filling bin. Use aeration fan or other air supply to apply dust.
NYGUARD IGR Concentrate (pyriproxyfen)	0.8–2.4 t./gal./1500 sq. ft. 4–12 ml/gal./1500 sq. ft.	7C	This product will not kill adults but will control immatures; may be mixed with an adulticide

¹ The use of residual insecticides by themselves does not constitute an insect management program. Appropriate programs should also include incoming product inspection, product rotation, sanitation, monitoring with traps, properly sealing doors and windows, and sealing cracks and wall voids. Exterior premises should be maintained by draining water away from the facility, directing light away from the building, removing vegetation near the structure, and promptly cleaning up spilled grain.

- Eventually, insects will build up under the bin floor. Bins with false floors should be fumigated if the grain debris cannot be removed (Table 2). Cover with plastic tarp (6 ml or thicker) to contain the gas. Place the fumigant below the floor if possible, or scatter it over the empty floor under the tarp. These materials are **RESTRICTED USE** pesticides. Fumigation should only be conducted by trained and licensed applicators. Read the label and the applicators manual. You will need to prepare a fumigation management plan before you fumigate.

Table 2. Fumigants for Controlling Insects Beneath the False Floor

Insecticide	IRAC	Remarks
ALUMINUM PHOSPHIDE	24A	See fumigant section below for more information . Use rates as indicated on label.

- Clean harvesting and loading equipment, such as combines, trucks, and augers, at the end of each harvest season. Insects can reproduce in the small amounts of grain left in the equipment.
- Store the grain at the appropriate moisture content (Table 3). Insects and molds require moisture to survive:

Table 3. Recommended Maximum Moisture Content for Grain in Aerated* Storage Conditions

Crop	Planned storage time before marketing		
	6 months	6 to 12 months	more than 1 year
Corn and grain	14%	13%	12%
Soybeans	13%	12%	11%
Small grains	12%	11%	10%
Edible beans	14%	12%	10%

*Decrease each moisture content percentage by 2 percent if storing grain without aeration

- Store clean grain. Removing excess fine particles and other foreign debris will increase the effectiveness of grain protectants and grain fumigants and increase aeration efficiency.

The following steps each contribute to clean grain:

- Effective in-season weed control
- A properly adjusted combine
- Use of a grain pre-cleaner
- Coring the bin after it has been loaded

- Apply an approved protectant insecticide to the grain as it is loaded into the bin (Table 4). The insecticide can be applied in the loading pit, or it can be introduced into the elevator stream at the coolest point after the grain leaves the drier. Heat breaks down grain protectants, so do not apply a grain protectant to hot grain.

Table 4. Insecticides for Applying Directly on the Commodity as a Protectant Treatment^{1,2}

Insecticide	IRAC	Rate per 1000 Bushels	Remarks
CENTYNAL (deltamethrin)	3A	Dilute in 5 gal. of spray 7.31 fl. oz. (barley) 8.53 fl. oz. (corn) 9.14 fl. oz. (wheat) 4.88 fl. oz. (oats) 8.53 fl. oz. (grain sorghum) 8.53 fl. oz. (rye)	Labeled for use on barley, corn, oats, popcorn, rice, rye, grain sorghum, and wheat.
D-FENSE SC (deltamethrin)	3A	Dilute in 5 gal. of spray 7.31 fl. oz. (barley) 8.53 fl. oz. (corn) 9.14 fl. oz. (wheat) 4.88 fl. oz. (oats) 8.53 fl. oz. (sorghum)	Labeled for use on barley, corn, oats, popcorn, rice, rye, grain sorghum, and wheat.
DIACON IGR ((s)-methoprene)	7A	Dilute in 5 gal. of spray 1.75 to 7 fl. oz. (wheat, corn, grain sorghum) 1.5 to 6.0 fl. oz. (barley) 1.0 to 4.0 fl. Oz. (oats, sunflower)	Labeled for use on wheat, corn, grain sorghum, barley, rice, oats, peanuts, and sunflower; will not control weevils. Diacon IGR is an insect growth regulator that interferes with the development of insects. It will not kill adult insects. Treat existing insect populations with an adulticide before or at the same time as applying Diacon IGR. Apply only once to grain of known treatment history. Use highest rates for maximum residual. Lowest rate provides shorter residual.
INSECTO (diatomaceous earth)		1 lb./ton 1–2 lb./ton (if grain is infested)	Apply uniformly as a dust on grains, soybeans, peanuts, popcorn, and others (see label). See note above.
STORCIDE II (deltamethrin + chlorpyrifos-methyl)	1B + 3A	Per 5 gal. of spray: 12.4 fl. oz. (wheat) 11.6 fl. oz. (grain sorghum) 6.6 fl. oz. (oats) 9.9 fl. oz. (barley)	Dilute with water or an FDA-approved food grade mineral oil or soybean oil. Wheat, barley, oats, rice, and grain sorghum

¹Do not apply before sending the grain through a grain drier or immediately after coming out of the drier as the heat will quickly degrade the insecticide. Grain protectants should only be applied to cool grain that is of proper storage moisture with minimal dockage and fines. It is best to apply protectants at the bottom of the auger so the insecticide can thoroughly coat the kernels as they are conveyed.

^{**}Surveys consistently show that stored grain insect populations are resistant to malathion.

- Once the grain is in the bin, make sure that the surface is level and that the bin is not overfilled. Leave a few feet of the straight side of the bin as air space to facilitate aeration and monitoring. If your bin does not have a spreader, unloading some grain will help level the central peak as well as remove many fine particles that accumulate in the center of the bin.
- If grain will be stored for more than a few months, you may want to apply a top dress treatment (Table 5).

Table 5. Insecticides Labeled for Top Dress Treatments

Insecticide	IRAC	Rate per 1,000 sq. ft. of grain	Remark
INSECTO (diatomaceous earth)		4 lb.	Apply Insecto as a dust to surface of binned grain (see instructions on the label). For grains, soybeans, wheat, barley, corn, oats, rye and others (see label).
Bacillus thuringiensis (various products including BIOBIT HP, DIPEL DF, and JAVELIN WG,		See label. Check Labels for Labeled Crops as well as Use Rates	Controls Lepidopteran pests only. Apply evenly over the surface immediately after loading and mix into a depth of 4 inches with a scoop or rake.

- If you have had problems with Indian meal moths in the past, you may want to consider a headspace treatment (Table 6).

Table 6. Headspace Treatments

Dichlorvos pest strips e.g. PROZAP INSECT GUARD or other labeled products	1B	check label for use instructions	Polyvinyl strips impregnated with dichlorvos can be hung in the bin headspace to help control Indianmeal moth adults.
---	----	----------------------------------	---

- Stored grain insects thrive in warm grain. The hotter it is, the faster insects feed, grow, and reproduce. Stored grain insects quit feeding and developing when temperatures are below 60 degrees F.
- Aerate the grain to cool it to within 20 degrees F of ambient temperature. As nights get cooler in late summer and fall, cool the grain at 10-degree intervals until the temperature is 60 degrees F. But if there is too much of a differential between the inside and outside air, the grain can sweat. Temperature cables, moisture sensor cables, and automated aeration controllers make this easier to do, but you can do this manually.
- Initiate a systematic and thorough insect-monitoring system. Check the grain every 20 days from spring to fall and every 30 days in winter for the presence of insects. Five trier samples or probe traps should be sufficient on each sampling date.
- If you begin to find insects sell the grain, move the grain to another bin and apply a grain protectant as you move it, or fumigate the grain. **Before you fumigate, read the fumigant label and applicator guide carefully. In addition, you will need to check with the Department of Agriculture for currently labeled products and any restrictions.** Follow the instructions provided because the label is the law. Aluminum phosphide is the most frequently used on-farm fumigant. It requires the preparation of a fumigation management plan before any fumigant is applied. If there are too many leaks in the bin, the fumigant may never reach a lethal level. Seal all openings before loading the bin, including the aeration fan, top vents, eaves, roof entry door, and side door. Many fumigation attempts end in failure. Be sure to leave the fumigant in the bin long enough to be effective. Read the fumigant label to determine how long it will take the fumigant to reach a lethal level. It may take a day or two reach the desired concentration; therefore, leave the bin sealed for the recommended time. A closed-loop fumigation can make fumigation more efficient and safe. In this method, fumigant is circulated in a pipe outside the bin from the top to the bottom and then drawn up through the grain to the surface.