



BEST MANAGEMENT PRACTICES

Chapter 42:
Stored Grain Pests of Soybeans



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Monitoring and managing grain pests doesn't stop until the grain has been sold, delivered, and accepted. Problems can be minimized by cooling the grain as quickly as possible. The feeding by insects, rodents, and other animals on stored grain can significantly impact its quantity and quality. Insect pests that attack field crops are not the same ones that threaten stored grain. Roosting birds or other animals may not directly feed on the stored grain, but can contaminate it with their waste products. For example, fecal dropping can promote the presence of molds that degrade the quality and condition of the grain. Therefore, sanitation and preventative actions are critical.

A regular pest monitoring program should be continued right up to when the crop leaves the farm. The purpose of this chapter is to discuss grain maintenance, structural management, and treatment options for stored grain. Key grain storage components are provided in Table 42.1.

Table 42.1. Key components to consider when storing grain.

Structural

- Insure that the storage bin facilities are weather tight and rodent proof.
- Screen ventilation openings to prevent entry of rodents and birds.
- Build the bins on moisture-proof base.
- When the bin is filled, seal any holes.
- Check the roof for leaks.
- Do not seal roof aeration exhaust or inlet vents except during fumigation.

Maintenance

- Sanitation is very important.
- Do not mix new and old grain.
- Clean up spills outside the bin.
- Keep the area (10 feet) from around the bin free of vegetation and trash.
- Clean the bin wall, ceiling, ledges, floors, sills prior to filling with new grain.
- Insure proper aeration management.

Pesticides

- Consider an insecticide treatment after cleanup and two weeks prior to filling.
- Insure insecticidal treatments are targeted to susceptible stages of the pest.
- Use preventative applications where a history of problem exists.
- Try to choose options that promote applicator safety and pose the least environmental risk.
- Following labeled instructions is critical when using rodent baiting stations outside the bin.

Storage considerations

Environmentally sound pest management is essential to maintain the quantity and the condition of stored grain (Table 42.1). Storage conditions play an important role in controlling storage pests and a pest monitoring program should be established for their grain bins. Schedules will vary depending on stored product, pest history, environmental conditions, control options used, length of storage and other factors.

There is no one schedule to fit all needs. Insuring a pest-free environment should be the first step in preventative management. This is true whether a new or previously used storage bin is involved. In cases where used bins were infested with pests, use a residual insecticide treatment in bin cleanup. As always, follow labeled directions. Maintenance should include treating: 1) all bin surfaces including removable doors, 2) around partitions, and 3) under floors with an appropriate insecticide two weeks before reusing the bin.

After grain is placed in the bin it should be checked routinely (Table 42.2). A good monitoring schedule would be a minimum of once a month during the winter (November through April) and at least two times a month during the rest of the year.

Fall-harvested grain it should be safe until May or June without insecticide treatment. If you plan to store the grain after May or June, a labeled grain protectant treatment is recommended. Grain protectants kill insects as they crawl on or feed on grain and grain fragments. These products generally are applied as the grain is being augured into the bin. The moisture of the grain is critical in preventing stored grain problems. A rule of thumb is that for long-term storage the moisture content should be less than 12% moisture.

Table 42.2. Steps to follow when monitoring grain.

1. Climb up the grain bin, open the door, and smell exhaust air as someone turns the fan on. If the air smells musty, there may be a problem.
2. Check the temperature at several locations on the top of the grain. If the temperatures are different, collect a sample and have it tested for moisture and inspected for pests.
3. Run the unloading auger. Check the grain for moisture and inspect for pests.
4. Periodically monitor the grain mass. Monitoring can be conducted through the side access panel. This is conducted using plastic tube traps, probe traps, and sticky pheromone traps. These traps are inserted for a period of time and then retrieved.
5. Collect and inspect grain samples for temperature and pests. Equipment needed for grain sampling includes a deep bin compartment probe, deepcup probe, vials, and temperature probe. The deepcup grain probe is a brass or plastic cup about 8 to 12 inches long. A handle and extension rod allows for the probe to be pushed into the grain. This is accomplished by standing on the grain surface and pushing the probe into the grain mass at a slight angle. Collect samples from representative areas in the bin. Check the temperature of the sample and inspect the sample for insects. It may be necessary to use a magnifying glass to see small insects. For assistance contact an expert at <https://extension.sdstate.edu/about/our-experts> When inside the bin, follow safety protocols (Table 42.3).



Figure 42.1. Grain bins need to be inspected regularly for pests.

Table 42.3. Follow safety protocols.

It is important to be aware of the potential hazards of sampling inside a grain bin. Suffocation can occur in grain bins, and sampling should be done with caution. Bridged grain, resulting in a cave-in and subsequent worker suffocation, is a serious problem. Bridged grain is caused when grain mats together forming a false floor. Where possible:

1. Break up crusted grain with a long pole.
2. Wear a harness attached to properly secured rope when entering a grain bin.
3. Stay near the outer wall of the bin and keep walking if the grain starts to flow. Get to the bin ladder as quickly as possible.
4. Have another person outside the bin in case there is a problem.

Maintaining aeration

Proper aeration of the grain will help to maintain uniform temperatures and will prevent moisture buildup and mold growth. Mold will affect grain quality and can serve as an alternative food source for some grain insect pests. Be sure to level off the grain in the bin once it has been filled. This will improve air movement by preventing airflow along the bin walls. If the grain is not level, grain in the peak can become moist, moldy and heated, providing a good area for insect outbreaks to occur.

Chemical management

Applicator safety should be a primary consideration when considering pesticide treatment options (Table 42.4). It is very important to remember that pesticides are poisonous. Be sure to read and follow label directions. Handle all pesticides carefully and store in original labeled containers out of the reach of children, pets, and livestock. Dispose of empty containers right away following recommended procedures.

If bin fumigation is required, remember these products are highly toxic and restricted use. Extensive technical knowledge and special applicator certification is required for their legal use. Never fumigate alone. Always have at least two trained people when using fumigates. Follow all safety regulations and precautions for fumigating application. Chemical treatment options are provided below (Tables 42.5, 42.6, 42.7).

Table 42.4. Pesticide treatment options.

- Empty-bin treatments.
- Chemical grain protectants.
- Top dressings.
- Air or headspace treatments.
- Fumigation.

Table 42.5. Insecticides labeled for empty grain bin treatments intended to be applied four to six weeks before grain enters storage.

Insecticide* (active ingredient)	Comments
Tempo® SC Ultra (beta-cyfluthrin)	May not fully protect grain against weevils.
Storcide® II (deltamethrin + chlormethylfos)	Bin and warehouse applications should only be applied from outside with a downward spray. All openings, except for the point of application must be closed during applications. This product may only be applied to empty grain bins using automated spray equipment.
Suspend® SC (deltamethrin)	Do not allow dripping of run-off to occur.
6% Malathion dust, Malathion 5EC or 57EC, other exist	Select a product specifically labeled for treating grain storage facilities.
Diacon-D® and Diacon II® (S-methoprene)	Insect growth regulator that only affects immature life stage.
Dryacide® and Insecto (silicon dioxide)	Select a product specifically labeled for treating grain storage facilities.

*Mention of a trade name neither constitutes endorsement of the products mentioned nor criticism of similar ones not used or mentioned.

Table 42.6. Common protectants applied to grain stored longer than 12 months; applications should be made to clean, dry grain.

Insecticide* (active ingredient)	Comments
Dipel® DF or ES (Bacillus thuringiensis kurkstaki)	Labeled for all crops. Will only control moth larvae, such as the Indian meal moth. Slow to kill existing infestations. Some Indian meal moth populations may be resistant to Dipel®.
Storcide® II (deltamethrin + chlormethylfos)	Labeled crops included wheat, barley, oats, sorghum and rice. Product effective against a broad spectrum of insects.
Diacon-D® and Diacon II® (S-methoprene)	Labeled crops into barley, corn, grain soghum, oats, peanuts, and wheat. Insect growth regulator what only affects immature life stages. Dilute DIACON II® with water or FDA-approved food grade oils and apply to the moving grain stream as a course spray.
Dryacide® and Insecto (silicon dioxide)	Labeled for all crops

*Mention of a trade name neither constitutes endorsement of the products mentioned nor criticism of similar ones not used or mentioned.

Table 42.7. Top dressing insecticides for stored grain pests.

Insecticide* (active ingredient)	Comments
Dipel®DF or ES (<i>Bacillus thuringiensis kurstaki</i>)	Labeled for all crops, including soybeans. Mix into the top four inches of grain surface. Will only control moth larvae, such as the Indian meal moth. Slow to kill existing infestations. Some Indian meal moth populations may be resistant to Dipel®.
Diacon-D® and Diacon II® (<i>S-methoprene</i>)	Labeled crops into barley, corn, grain sorghum, oats, peanuts, rice and wheat. Insect growth regulator that only affects immune life stages.
Dryacide® and Insecto (<i>silicon dioxide</i>)	Labeled for all crops. Some products carry instructions on use as top dressing treatments either alone or in combination with treatment of rest of the grain mass.

*Mention of a trade name neither constitutes endorsement of the products mentioned nor criticism of similar ones not used or mentioned.

Fumigation

A rescue treatment may be required to effectively control or eliminate some insect pests and to safeguard grain quality. In these instances, fumigation should be conducted by trained, experienced, registered pesticide applicators using the required safety gear. When insects are higher than the suggested thresholds, fumigation is suggested. The toxic gases will penetrate into cracks, crevices, and grain in the bin. The goal is to maintain a toxic concentration of gas long enough to kill the insect population. Fumigants do not provide residual protection. There are several types and formulations of fumigates available. The common products include methyl bromide and phosphine producing materials such as magnesium phosphide and aluminum phosphide. Always remember to read and follow all label instructions.

Common stored grain insects

There are a variety of insects that can be found in stored grain. These can include the Indian meal moth, red flour beetle, confused flour beetle, flat grain beetle, sawtoothed grain beetle, lesser grain borer, rice weevil, granary weevil, and mealworm. Of these, one of the most common pests is the Indian meal moth (Figs. 42.2 and 42.3).



Left: Figure 42.2. Indian meal moth adult. (Photo courtesy of Mark Dreiling, Bugwood.org)

Right: Figure 42.3. Indian meal moth larvae. (Photo courtesy of Whitney Cranshaw, Colorado State University, Bugwood.org)

Indian meal moth adults can be distinguished from other stored grain moths by the reddish-brown color and copper luster on the outer two-thirds of their wings. The remainder of the wing is whitish-gray and will have a wing span of about $\frac{3}{4}$ inch. The fully grown larvae are about $\frac{1}{2}$ inch long and have a dirty white color. However, these moths can have a greenish to pinkish tint depending on diet. Young larvae are difficult to detect. Heavy infestations can completely web over the grain surface, which protects the young larvae and can make insecticide applications difficult.

The most favorable temperature for Indian meal moths is about 80°F, but they can become active when the grain or air temperature reaches 60°F. Check insecticide labels for the types of grain products treatments can be used. Soybeans are only approved on a few product labels. Malathion is no longer effective against most populations of Indian meal moth. To protect against Indian meal moth infestations, rake in applications of Bt on the grain surface. Diatomaceous earth would be an example of an approved treatment for organic production. These applications can also be done as the bin is filled and the grain is leveled, or apply by May of the following year.

References and additional information

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