

Insect, Nematode, and Disease Control in Michigan Field Crops

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**This bulletin contains information on the management of field crops insects, nematodes, and diseases, including recommendations for pesticide use. Every attempt is made to verify product names, formulations, use rates, and other important information, but products and labels may change before the field season begins. Always read the label of a product to reconfirm rates, precautions, PPE, and other important information before use.

Stored Grain Management

Insect Management in Stored Grain

Insect feeding creates fine matter, shed skins, dead insects, and webbing that reduce airflow through the bin. Insect feeding also produces “hot spots”. Reduced airflow and hot spots, combined with moisture, lead to growth of fungi, some of which produce toxins. The best way to manage an insect infestation in grain is to prevent one in the first place. Sanitation should be part of your routine prior to storing grain at your facility or farmstead.

- Clean grain-handling equipment = augers, combines, wagons, scoops, trucks, rail cars.
- Clean the bin, especially beneath floors. Seal all cracks and crevices.
- Clean up spilled grain (food for both insects and rodents) and debris around the bin. Remove weeds from a six to ten foot border.
- Cover fans when not in use.
- Treat with a registered sanitary (bin) spray

Sanitary (Bin) Sprays

Sanitary sprays are used in and around structures after cleaning, but before adding grain to the bin. A sanitary spray kills insects still in the area and creates a barrier to infestation. Treat floors, walls up to six feet, the foundation, and the ground directly around the bin. The following is a list of products registered as bin sprays. Application rates for individual products are not included because of the wide variation in use directions. Please read the product label to determine the correct rate for your particular crop or purpose.

| Insecticide | Registered for use in: | Precautions and Remarks |
|--|--|---|
| Tempo 20WP Tempo Ultra WP Tempo SC Ultra | all indoor warehouses, bins, and surrounding areas, grain-handling equipment, trucks, rail cars | NOT registered for direct application to grain, food, or feed. For general surface, spot, crack, and crevice treatments. Mix in sufficient water to cover area being treated without runoff. |
| Storcide II | Bins, trucks, and wagons that carry or store barley, oats, sorghum, or wheat | Bins should be thoroughly cleaned and insect-free before application. |
| Reldan 4E | bins, trucks, and wagons that will carry or store barley, oats, rice, sorghum, or wheat | Do NOT use in bins that will contain corn, rye, or soybean. |
| diatomaceous earth (DE) (for example, Insecto, Protect-It) | bins that will contain barley, birdseed, corn, dry beans, oats, peas, popcorn, rye, sorghum, soybean, sunflower, wheat | Apply 2 weeks before filling bins. May be applied dry (using blowers or fans) or wet as a spray. See label for specific directions. |
| Malathion 5, 8 Aquamul, 8F | bins, trucks, railcars, etc. that will carry or store barley, corn, oats, rye, and wheat | Do NOT use in structures that will contain soybeans. Do NOT apply directly to grain. Note – due to concerns about pesticide residue, some millers will not accept grain treated with malathion. Check before making an application. |

Grain Treatments - Protectants

If a bin is well cleaned, sealed, and sprayed with a sanitary treatment and the commodity will be used or sold within 6 months (by spring), a grain treatment is usually NOT needed. However, if the grain or bin is not clean, or the commodity will be stored for a longer period, insecticides should be applied directly to the grain mass as a protectant or surface treatment. Protectants are applied directly on the grain stream entering the bin, and control infestations throughout the grain mass

| Insecticide | Registered for use on: | Precautions and Remarks |
|---|--|---|
| Reldan 4E and 3% dust | barley, oats, rice, sorghum, and wheat | For control of weevils, Indianmeal and angoumois grain moths, mealworms, confused flour beetle, saw-toothed grain beetle, etc. |
| Actellic 5E | corn and sorghum | For control of weevils, Indianmeal and angoumois grain moths, confused flour beetle, saw-toothed grain beetle, numerous other beetles. |
| Storcide II | Barley, oats, sorghum, wheat | For control of weevils, Indianmeal moth, angoumois grain moth, mealworm, confused flour beetle, sawtoothed grain beetle |
| diatomaceous earth (DE) Insecto, Protect-It | barley, birdseed, corn, dry bean, oats, peas, popcorn, rye, sorghum, soybean, sunflower, wheat | DE is a chemically inert dust that abrades the insect outer shell. Treat the bottom 5 ft and top 5 ft of grain mass, or entire grain mass. See label for specific directions. |

Grain Treatments - Surface Treatments

If the grain entering the bin is clean, and is not being stored over older grain, a “top dress” or **surface treatment** is usually sufficient. A surface treatment is applied directly on the surface of the grain immediately after the bin is filled; once in place, the grain mass must not be disturbed, as this ruins the barrier. Surface treatments protect against insects entering from the top of the bin, but will not control insects present lower down in the grain mass (for example, insects moving into new grain from older infested grain). Do not apply a surface treatment to grain that was treated with a protectant at bin-fill.

| Insecticide | Registered for use on: | Precautions and Remarks |
|---|---|--|
| Reldan 3% | barley, oats, rice, sorghum, or wheat | Apply to the surface of clean or infested grain to control Indianmeal moth and protect against other insects. See label for specific directions. |
| Actellic 5E | corn and sorghum | Apply to the surface of clean or infested grain to control Indianmeal moth and protect against other insects. See label for specific directions. |
| diatomaceous earth (DE) | barley, birdseed, corn, dry bean, oats, peas, rye popcorn, sorghum, soybean, sunflower, wheat | Apply to the top layer of grain to control Indianmeal moth. |
| <i>Bacillus thuringiensis</i> (Bt) Biobit, Dipel, Javelin | grains, soybeans, sunflower, birdseed | Controls Indianmeal moth larvae. Will NOT control weevils and other beetles. Mix into top 4 inches of grain. See label for specific directions. |
| pyrethrins + PBO | barley, beans, birdseed, corn, oats, rye, sorghum, and wheat | Apply to surface of grain to control Indianmeal moth. |
| Malathion 6% dust | corn, oats, and wheat | Apply to the top layer of grain to control Indianmeal moth and protect against other insects. Note – due to concerns about pesticide residue, some millers will not accept grain treated with malathion. Check before making an application. |

Infestation during storage

The key to grain management is prevention. But if infestation occurs several months into storage, you must consider the following:

- ◆ *Type of insect:* Some insects are primary pests, i.e., they attack undamaged grain and develop inside kernels. This includes several weevils (rice, maize, granary) and the lesser grain borer. Primary feeders cause direct damage and provide holes into kernels and fine material so that secondary pests can infest the grain. Most other stored grain pests are secondary pests. Thus, the presence of weevils in your grain is of extra concern.
- ◆ *Location and density of insects:* Where is the infestation - in the top layer of the grain mass, or throughout the bin? How many insects are there? Answering these questions requires you to sample with a grain trier or a set of probe traps. An infestation that is throughout the mass requires a different management strategy than an infestation in the top layer of the grain.
- ◆ *Environmental conditions:* Some infestations can be managed with temperature, by pulling cool air through the grain mass. At temperatures of 60 degrees or less, reproduction of grain insects drops off. Moving air through the grain also removes moisture pockets and hot spots that favor insect and fungal growth. However, care must be taken not to reduce grain moisture too much
- ◆ *Plans for the grain:* Grain destined for livestock feed can contain more insects and damaged kernels than grain destined for human consumption

When a bin is infested, one option is to move the grain into a clean, empty bin if one is available, applying a protectant during the transfer. The other option is to fumigate the bin. Unfortunately, there are no easy rules to decide when to fumigate because there are few good thresholds. Federal guidelines say that wheat is “infested” if two or more live stored grain pests are found in a sample. Barley, corn, oats, and sorghum are “infested” if two live weevils, or one live weevil plus five secondary pests, or ten secondary pests are found in a sample. Another suggestion is that if one live primary pest is found per trier sample or if several insects are collected within 24 hours in a probe trap, then fumigation is justified.

Some additional notes about fumigation - Fumigation penetrates the grain and kills even primary feeders inside kernels. But fumigants dissipate quickly, and thus reinfestation of the grain can occur if the bin is not well sealed to prevent insects from getting inside. Fumigation can be dangerous. Aluminum phosphide, the most common grain fumigant, is very toxic and requires special handling, protective equipment, and application procedures. In Michigan, a commodity fumigation standard is required in addition to your private or commercial applicator license to do fumigation. If you don't have the training, don't do the fumigation.