

# PROTECTING STORED GRAIN

IGRs are an effective, long-lasting strategy and another tool for controlling insect infestations in grain facilities.



Saw-toothed  
Grain Beetle



Granary Weevil



Indian Meal Moth



Confused Flour  
Beetle



Rice Weevil

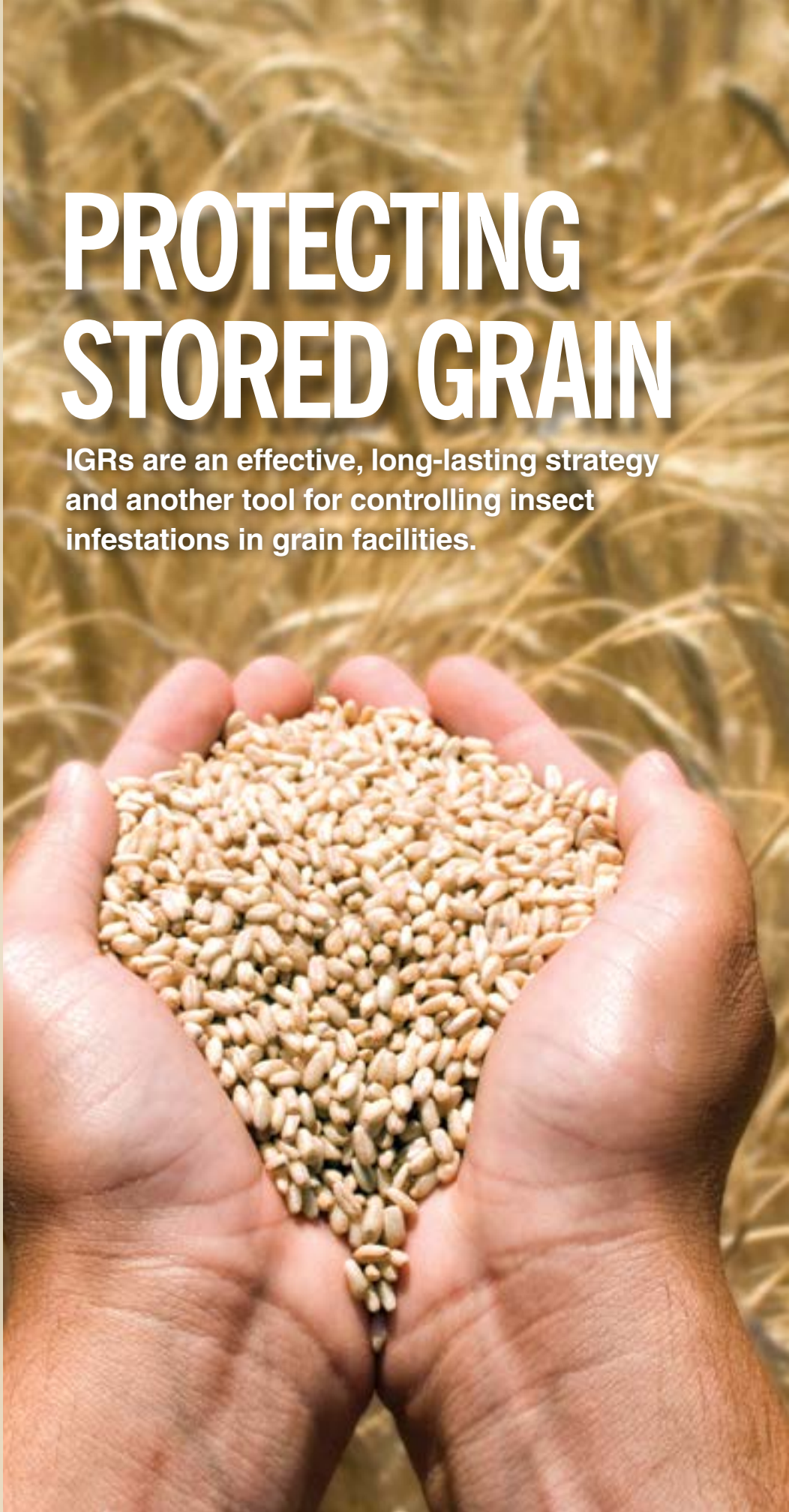


Lesser Grain Borer

**BUG FREE**

**GRAINS**

*Stored Product Solutions*



# PROTECTING *STORED GRAIN*

IGRs are an effective, long-lasting strategy and another tool for controlling insect infestations in grain facilities.





**F**armers have been storing grain for centuries — since the beginning of agriculture some 10,000 years ago — and since that time, they have been concerned about protecting their harvest. Today’s agricultural professionals continue the practice, and while they benefit from technological advances in farming, the grain they store is the same and so is the threat of insect infestation.

No farmer wants insects to make a home in their grain facilities. No agricultural professional wants to lose profits because of an infestation, or sell a bounty for less because of a compromised crop.

Preventing insects from destroying or degrading the value of stored grain is a priority for agricultural professionals. An estimated 80 percent of all human food comes from grains and beans, from wheat and corn to soybeans and peanuts. Pest infestations result in direct losses to farmers and consumers.

“Insects have been involved with human grain growing since the beginning of civilization,” says Dr. Thomas Phillips, an entomology professor at Kansas State University specializing in stored grain protection and stored product insects.

“Concentrated in modern grain elevators in a region, we have the harvested grains from thousands of acres of cropland that are being stored for sale and eventual processing into food,” Phillips says. And the chances of insects visiting those stores are significant, especially if grain will be stored for longer than a few weeks.

Phillips notes that a research project involving grain elevators in a Midwestern region of the U.S.

revealed stored grain insects in just about every facility that manages grain. “Stored grain insects are common,” Phillips says.

Doug VanGundy, senior director of research and development at Central Life Sciences, points out that stored grain is a significant economic world commodity. When insects interfere with grain quality and the ability to move that grain into the market, agricultural professionals sacrifice revenues and their return-on-investment, and the country’s population loses food. “For farmers and grain storage managers, if insects get a hold of the grain, and some can be very voracious, they can eat up all the profits,” VanGundy says.

The estimated annual cost of stored grains lost to insect infestation is upwards of \$2.5 billion, according to United States Department of Agriculture (USDA) research.

As a result, agricultural professionals need a tool kit of strategies and products to manage stored grain pests, beginning with best practices centered on proper sanitation, loading, aeration and monitoring of grain storage facilities. On top of that are products for protecting grain, and for killing adult insects that infest stored harvest. Fumigation has been a go-to remediation technique used by the industry for decades — but with tightening regulations, zero residual control, resistance concerns and the danger associated with applying these products, agricultural professionals need an alternative.

That’s why cutting-edge technology like Diacon® IGR with the active ingredient (S)-methoprene is a game-changer. As a “clean” protectant with an 18-month to two-year residual, Diacon® IGR





protects stored grains and raw agriculture commodities from damaging insects by interfering with the normal process of insect development. When insects can't develop, they do not proliferate — and so the few insects that might get into grain stores will not multiply exponentially into an infestation.

“If you can stop insects from laying eggs, and prevent them from maturing into adults, you can stop the insect population right there,” says Randy Scott, market development manager for specialty products, Central Life Sciences.

**Economic Impact.** Up to 10 percent of the U.S. grain crop gets destroyed each year because of post-harvest insects, Scott says. And the longer grain stays in storage, the greater the risk of infestation, or damage that can compromise the return on investment for farmers.

The commodities market dictates how long grains will stay in storage. And, quality standards also come into play. For example, when wheat prices are low, markets are stricter about what they will accept. Mel Gerber, who has a farm in Versailles, Mo., says, “I used to lose anywhere from a nickel to 15 cents a bushel, then lose even more if I had to treat [the wheat].” He began using Diacon® IGR as a supplement to storage best practices. This strategy has helped prevent infestations in grain stores, he says.

Another market condition impact-

ing stored grain insect risk is shipping delays. Gerber says that the June wheat he once moved in July is now being held until September.

VanGundy says some grain is stored for a year, or even up to two years. “In the summer, insects are more active, so there is more of a chance of damage,” he says.

When insects infest stored grain, they consume bits and pieces of it. Government guidelines dictate what's acceptable for market. “If anyone marketing grain were to deliver a load of wheat to a buyer, and the buyer evaluates that wheat using the government guidelines and subsequently finds living grain insects or insect-damaged wheat, that buyer can ‘dock’ the seller. The price will be lowered due to the insects and damage, and/or there may be fees for fumigation to kill the pests,” Phillips says.

“Costs and benefits are weighed all along the way. Farmers put a lot of money into their grain from the time it is planted until it goes to market,” he adds. In worst-case scenarios, grain may be so badly infested or damaged that it is deemed unfit for human consumption, Phillips says.

Reducing the risk of stored grain pests is critical for protecting the investments of farmers and grain merchants. An added value to protecting the grain is maximizing the amount of grain that enters into the food supply. “It's economics: If you're going to be storing a lot of

grain for some period of time, you have to understand what is needed to store that grain in good condition so the risk of insects is very low while profits are also maximized,” Phillips says.

**S.L.A.M. Best Practices.** The foundation of a stored grain pest prevention strategy is S.L.A.M., an acronym for Sanitation, Loading, Aeration and Monitoring. When grain managers implement S.L.A.M. to ensure the best conditions for grain storage, they decrease the likelihood of infestations. “These cultural practices have been used by farmers for generations to keep storage clean, dry, and cool, and to keep out insects,” Scott says.

Sanitation refers to keeping storage facilities clean and repaired — fixing holes and cracks, and cleaning out all grain from previous years. During sanitation, elevator walls, chutes, belts, and other structures should be treated with an insecticide such as Centynal™ Insecticide.

During the loading process, grain should be evenly spread as it enters the grain bin to improve air circulation. Aeration is critical to lower the harvested grain's temperature. In fact, one indication that there could be a pest problem in storage is when one sensor on a vertical temperature cable gets hot, and stays hot week after week. “You might have a mold problem there, and mold problems tend to be associated with insect problems,” Phillips says.

“It's economics: If you're going to be storing a lot of grain for some period of time, you have to understand what is needed to store that grain in good condition so the risk of insects is very low while profits are also maximized.” — **Dr. Thomas Phillips, Kansas State University**



## Maximize Grain Quality and Profits Using the S.L.A.M. Post-Harvest IPM Strategy

The S.L.A.M. post-harvest IPM strategy is a systems approach to maximize grain quality. Its success depends on the proper selection of crop varieties, production and harvest practices, grain handling equipment, drying systems, and storage management. S.L.A.M. represents four simple steps — sanitation, loading, aeration, and monitoring. Grain storage never improves grain quality! Thus, it is the objective of S.L.A.M. to maintain maximum post-harvest quality by protecting stored grains and oilseeds from weather, rodents, insects, self-heating, molds, mycotoxins, and pesticide residues. In addition, minimizing the deterioration process prevents spoilage, quality discounts, and storage costs, thus maximizing the return on every bushel harvested, dried and stored.

*(Source: Purdue Extension Bulletin ID-207, Linda J. Mason, extension entomologist, Charles P. Woloshuk, extension plant pathologist.)*



“Also, at higher temperatures insects will reproduce faster,” Scott adds, “so you want to cool down grain as fast as you can once it is loaded.”

Maintaining a temperature of 60 degrees Fahrenheit or below will slow the life cycle of insects, Phillips says. Moisture plays an equal part in the storage environment, which is why an aeration system is important. “If you put the grain in storage and it’s not dry enough — and it’s warm when harvested and insects find that warm, moist grain — that’s when things go bad,” Phillips says.

Ongoing monitoring of grain elevators and storage areas is essential for sustaining an integrated pest management (IPM) program for controlling stored grain insects. Scott recommends regular probing and screening of grain, or insect traps, to identify pests.

Agricultural professionals can supplement S.L.A.M. with effective grain protectant products that kill adult insects and prevent new populations from forming. “A metho-

prene product is another tool in the toolkit for IPM,” Phillips says.

**Re-Assessing Fumigants.** Fumigants have traditionally been the go-to remedial solution for controlling stored grain insect infestations. But farmers, grain managers and buyers are taking a closer look at fumigants’ efficacy and safety for a number of reasons. There are reported resistance issues with fumigants, particularly with phosphine. And, fumigants are highly toxic gases that can knock out an existing pest population in a grain elevator, but there’s no residual control. Once the gas dissipates, the grain is actually more susceptible to infestation.

“Fumigants are under [regulatory] pressure all over the place, and now phosphines are under a re-registration process by the EPA, which can take up to five years,” Scott says. “Who knows what the label will look like at the end of that process? Now, people are looking for alternatives.” Just how toxic are fumigants? Their LD<sub>50</sub> is 11.5

milligrams per kilogram of body weight, while the LD<sub>50</sub> of Diacon® IGR is greater than 34,000 milligrams per kilogram of body weight. In reference to LD<sub>50</sub>, the higher the number the less toxic the material.

Still, there is a place for fumigants. If an infestation is severe, grain must be fumigated before it can be considered for market. And sometimes, fumigation can preserve a grain’s value, killing off insects before they damage the grain to the extent where the commodity would get “docked” by a buyer or, worse, rejected.

As for potential resistance, “that is known to be occurring all over the U.S.,” Phillips says of phosphine gas, noting that agricultural professionals who are experiencing “fumigation failures” should consider stopping that chemical and switch to another active ingredient with a different mode of toxicity. One fumigant that shows no cross-resistance with phosphine is sulfurlyl fluoride fumigant. “And, there are grain protectants, residual in-

secticides such as pyrethroids and IGRs that will cause an impact on phosphine-resistant insects,” Phillips says.

Ultimately, agricultural professionals need alternatives to the old standard fumigants. IGRs present an opportunity to extend the period of control for up to two years, and a preventive element because of the way (S)-methoprene causes insects to behave.

“We used to rely on fumigation as a silver bullet, but they are being constantly scrutinized by regulatory agencies, and they’re a one-shot deal,” VanGundy says. “They do a good job of ‘cleaning up the mess,’ but then the mess can re-start the day after that fumigant is gone. Diacon IGR gives you longer protection, and some studies show that it lasts up to two years.”

By using Diacon® IGR, an agricultural professional can reduce or eliminate the number of fumigations required to keep grain clean. “Diacon IGR can cut down on fumigations, and farmers might not have to fumigate at all if they use it,” VanGundy says.

**How IGRs Work.** IGRs break insects’ reproductive cycle, stopping adults from breeding so an infestation does not build up in the grain store. What’s confusing about IGRs for some users is that IGRs do not outright kill insects; they are not acutely toxic. Instead, they alter insect development. So there’s a learning curve for new users regarding what to expect.

“Insects go through different life stages, and they molt their skin and grow to the next stage,” Phillips says, relating how a caterpillar sheds its skin and grows to a pupa then an adult. “Molting is regulat-

## Stopping Persistent, Destructive Weevils

**W**eevils are a real pest for agricultural professionals, and their chewing mouthparts can tear through a grain facility’s product. Because of the way weevils develop and reproduce — all within a grain kernel — they can cause damage and ruin the integrity of the grain. This translates to lost profits.



Weevil

A combination of Diacon® IGR and Centynal™ Insecticide provides long-term control of stored grain insects and knocks out weevils, which are killed on contact by Centynal™ Insecticide, says Randy Scott, market development manager for specialty products, Central Life Sciences.

“If you live in a part of the country where weevils are prevalent, we recommend pulling a sample of your grain, if any weevils hatch out after a month, treat the grain with Centynal Insecticide and PBO-8 Synergist,” Scott says.

Ronald Ferrell, a branch manager of Farmers Grain Terminal, Belzoni, Miss., has used various products during his 40-year career to combat granary weevils that infest his facility’s 3 million bushels of stored corn. Diacon® IGR and Centynal™ Insecticide was a winning combination.

“We literally saw no weevils in the treated corn, but still had a large infestation in the untreated corn stored in grain tanks,” Ferrell says of the sample results. “Treating only half of the corn storage was a great visual check for our facility and prompted us to confidently make the complete switch to Diacon IGR and Centynal Insecticide.”

ed by hormones, and if a chemical that mimics that hormone can fool the body of the insect into staying in the larval stage without molting properly, it will keep eating or keep wandering around. While it might try to molt, that won’t work and it will eventually die.”

Diacon® IGR affects the insect’s ability to grow beyond the larval stage. Since the insect can’t molt to a reproducing adult, it means a next generation of insects never gets started in the grain. This is critical, because fumigants and other contact pesticides focused on killing adults do not provide the same long-lasting effect that an IGR can.

“The best time to treat grain is before it ever becomes infested,” VanGundy says. “Treating the grain straight from the field as it enters

into the elevator will reduce the chances of getting an infestation that affects your economic threshold.”

Stored grain insects can reproduce at alarming rates, Scott says. One or two insects aren’t a problem, but one quickly goes to 300, then multiplies to 45,000, which escalates to 7,000,000 and quickly explodes into billions. “The growth curve of the population is practically a straight line up,” Scott says. Ideally, grain managers want to stop those “first eggs” from becoming adults at all so they never breed.

**A Prudent Approach.** Safety is a chief concern any time you add a chemical to a food store. “For any protectant added to foods, these products require an EPA registra-



tion. As part of the registration process, they go through a battery of toxicological evaluations and are given a ‘food tolerance,’ but the nice thing about Diacon IGR is the active ingredient has been exempted from the need for a food tolerance,” VanGundy says.

EPA found during its risk assessment that (S)-methoprene did not pose a risk when applied to food to control insect larvae. “There is sufficient evidence for the EPA to decide that (S)-methoprene is not going to be a concern except to the target pest,” Scott says. “And, the molecule mimics naturally-occurring bio-chemicals in insects.”

So far, no resistance issues have been discovered with (S)-methoprene in field use, Scott says. And, the IGR is serving as a real crop-saver for elevator managers like Melissa John-

son, manager for Farmers Alliance in Corsica, S.D., who says after the first year of using Diacon® IGR there was no evidence of insect activity.

Scott says, “You save yourself from those huge losses that can occur from insects by having a proactive strategy ahead of time. By getting ahead in the game you’re set to be bug-free even if it has a few bugs when it goes into storage.”

**A Long-Lasting Approach.** Insect infestations can result in direct losses for agricultural professionals. Stored grain insects drive up control costs, result in shut downs, increase safety equipment costs and degrade grain value. Now more than ever before, farmers and elevator managers need alternative solutions to support their sustainable S.L.A.M. strategies for protecting stored grain.

If we can reduce post-harvest loss by 50 percent across the world, enough food would be available to feed the present world population, according to The Food and Agriculture Organization of the United Nations. And, stored product insects are not just a farmer’s problem. Food processors that receive infested grain can face serious regulatory repercussions.

Stopping stored grain insect infestations while grain is in storage is a critical step toward protecting food commodities. IGRs are an important tool in an overall IPM strategy to give agricultural professionals better pest prevention and longer-term control. VanGundy says, “The use of Diacon IGR can cut insect control costs, increase profitability, and increase the amount of food that goes into the food chain.” ●

Now more than ever before, farmers and elevator managers need alternative solutions to support their sustainable S.L.A.M. strategies for protecting stored grain.



# CONTROLLING COSTS, STOPPING INFESTATIONS

**T**he cost of insect damage to wheat is staggering. Just ask Melissa Johnson, an elevator manager for Farmers Alliance in Corsica, S.D. She has seen crop infestations delay shipments, reduce crop value and even result in buyer rejection. Specifically, insect damage can cost up to \$0.50 per bushel, adding up to

\$75,000 on the wheat the alliance holds into late spring.

The saw-toothed grain beetle was causing the biggest problem at Farmers Alliance. In less than a month's time, these pests would invade wheat storage facilities. The alliance had been using malathion-based products, but was unhappy with the odor. "We could even taste

it after application," Johnson says.

Seeking an alternative to fumigants, Johnson focused efforts on prevention rather than treatment. She learned about Diacon®-D IGR and began using the product. After the first year, there was no evidence of insect activity. "We recommended that all of our growers start using it," Johnson says. ■

### How Diacon® IGR Works

Diacon® IGR is available in a dry formulation and a liquid. These products are food tolerance-exempt IGRs used to control stored product insects by breaking the insect life cycle and preventing larvae from maturing into adults. The dry formulation can be applied directly to grain or as an empty premise treatment. Diacon® IGR can be applied directly to grain or used in fogging applications, and it is approved for virtually everywhere stored product insects are a problem: farm storage, large silos, peanut bins, food processing facilities and more.

### How Active Ingredient (S)-Methoprene Works

The active ingredient in Diacon® IGR interferes with insect development. It is effective against a range of insects, including: almond moth, Indian meal moth, lesser grain borer, saw-toothed grain beetle, merchant beetle, red flour beetle, confused flour beetle and more. Use Diacon® IGR to treat grains, seeds, spices, pet food, animal feedstuffs, birdseed and more.

Fight stored product insects by applying a tank mix of Diacon® IGR and Centynal™ Insecticide. It can be applied to the grain stream or used as an empty bin treatment to help reduce the need for costly fumigation,

which makes for a safer work environment. It's an easy-to-implement solution that can be utilized at any facility. Best of all, it can reduce insect infestation damage and maintains the quality of your stored grain.

**To get Diacon® IGR and Centynal™ Insecticide for your stored grains contact your distributor, call 800.248.7763 or visit [bugfreegrains.com](http://bugfreegrains.com).**



Always read and follow label directions. Centynal, Centynal with design, Diacon, Diacon with design and PBO-8 are trademarks of Wellmark International. © 2015 Wellmark International.