

The background of the slide features a top-down view of various grains, including yellow corn cobs and smaller golden-brown grains, scattered on a white surface. Several small, dark, elongated insects, likely grain beetles, are visible crawling among the grains, illustrating the problem of grain infestation.

Taking Advantage of Grain Protectant Technology

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General Sanitation



Integrated Pest Management (IPM)

- IPM is a sustainable approach to pest control that integrates biological, cultural, physical, and chemical control into systems which minimize economic, environmental, and social risks.
- Goals of an IPM program typically include reducing pesticide input, reducing insect pest numbers, and maintaining high grain quality.
- From IPM Characterization survey for grain elevators, Oklahoma State University

S.L.A.M. – Use Available Cultural Practices

- **S**anitation
 - Thoroughly clean and repair the storage area
 - Use residual sprays or fogging
- **L**oading
 - Proper loading equals good air circulation
 - Add protectant chemical to the grain
- **A**eration
 - Cool the grain
- **M**onitor
 - Watch for early signs of problems

Sanitation

- Clean up any equipment that handles grain.
- Thoroughly clean out bins of old grain and discard it.
 - Pay particular attention to plenums, false floors, augers, and crevices.
 - If you can tell what commodity was previously stored, it is NOT clean enough.

Sanitation (continued)

- Patch all holes and cracks in floors, walls, and roofs.
- Clear weeds and spilled grain from around structures.

Sanitation (continued)

- Spray inside bin or warehouse and up to 3 feet on the foundation outside of the structure with Diacon[®] and Centynal[™] EC or Diacon[®] IGR *PLUS*
 - Carefully read and follow label instructions

Sanitation (continued)



Result of Water Leaks



Outside Sanitation is Also Important



Preventative Exterior Treatments do Help!

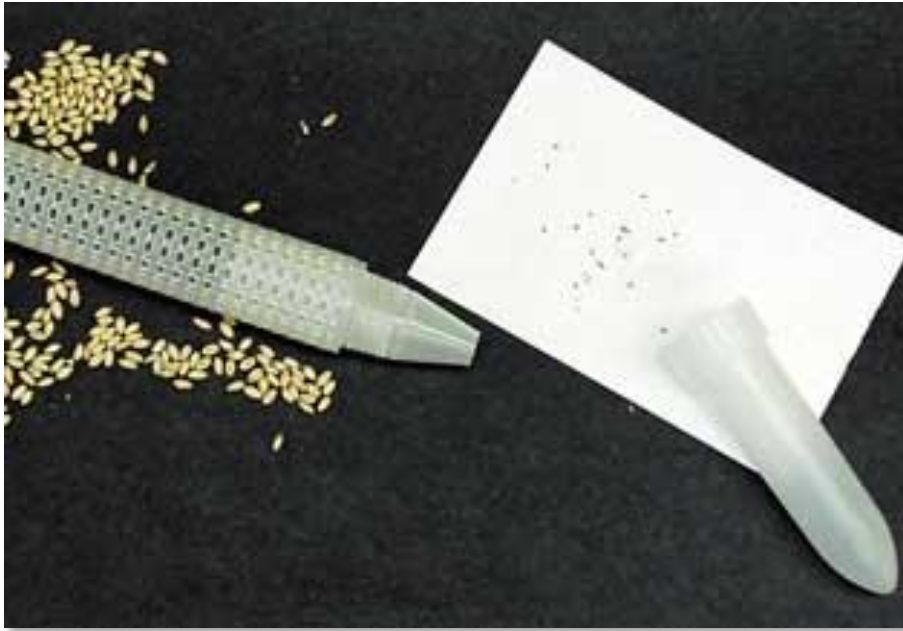


- Dead Weevils due to a good exterior treatment program using Centynal™ EC

Sanitation Around the Bins



Monitoring Equipment



Grain Sieve

- Insect ID via Bugs in the Pan



Grain Pests: Insect Identification



Internal Feeders



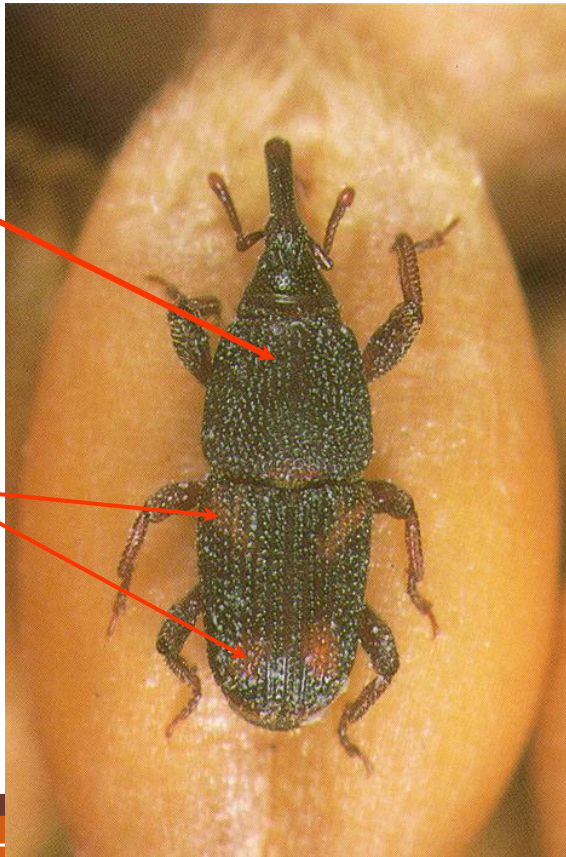
Rice Weevil & Granary Weevil

Sitophilus oryzae

Sitophilus granarius

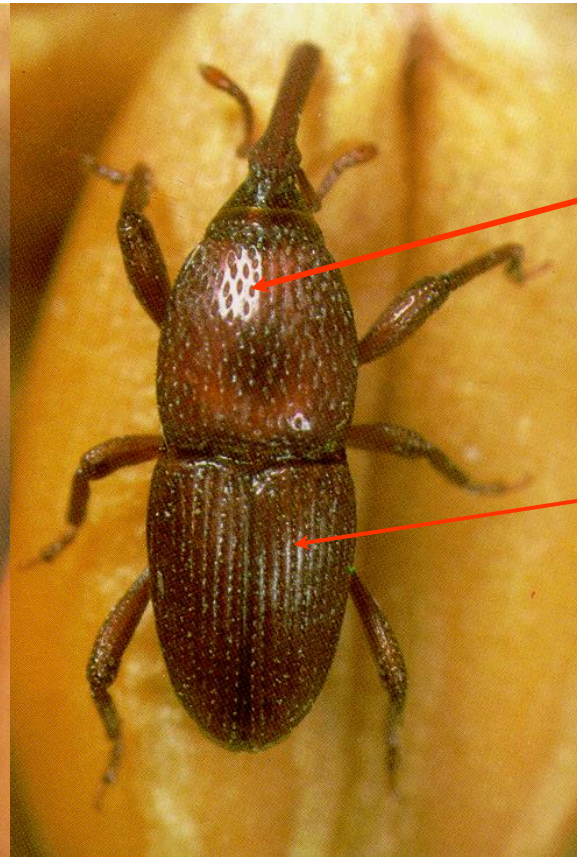
Round pits on thorax

Four light colored areas on elytra



Oval pits on thorax

Uniform brown elytra



Destructive internal feeders of grains

Stages of Rice Weevil Infestation



Treated
Rice



Unprotected
30 days



Unprotected
60 days



Unprotected
90 days



Unprotected
120 days



Unprotected
150 days

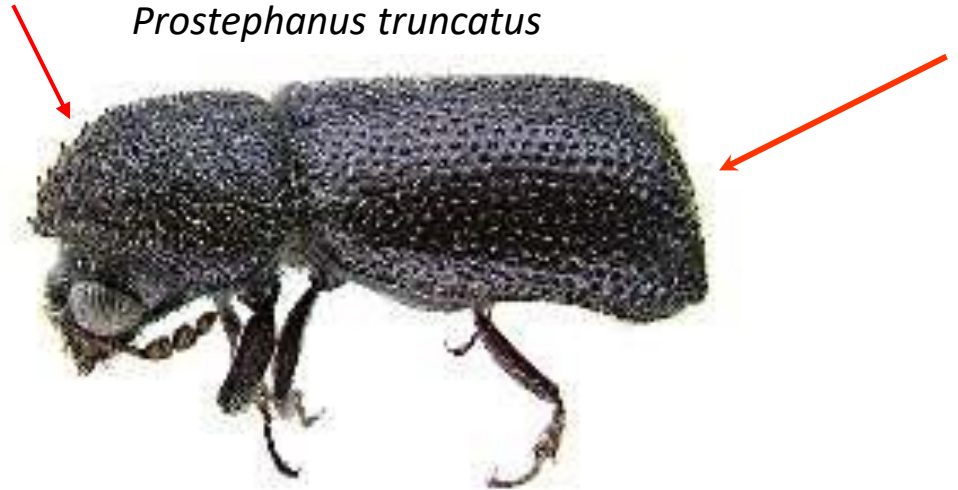
In lab setting

Lesser & Larger Grain Borer

Rhyzopertha dominica



Prostephanus truncatus



Lesser Grain Borer Signs!



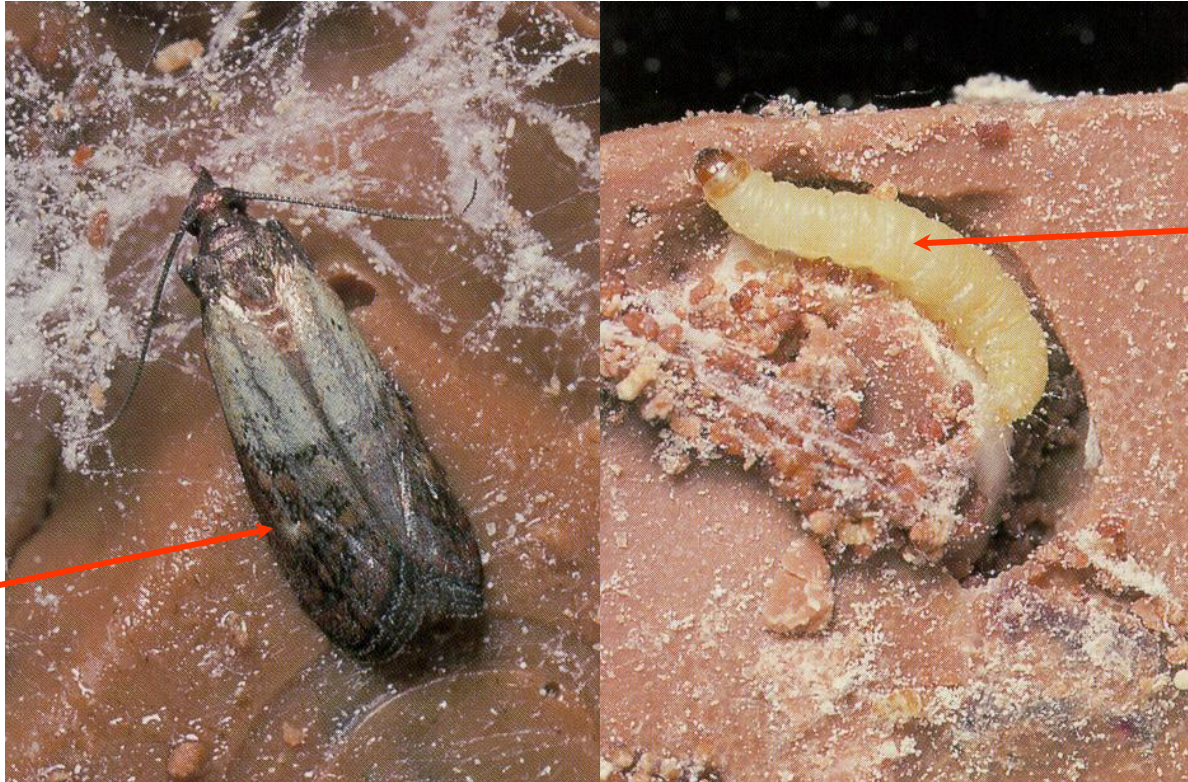
External and Secondary Feeders



Indian Meal Moth

Plodia interpunctella

Coppery
brown
colored
wing tips



Uniformly
light cream,
pink or
greenish
color (no
spots)

Notice webbing next to adult moth

Indian Meal Moth Webbing on Cocoa Bean Bags

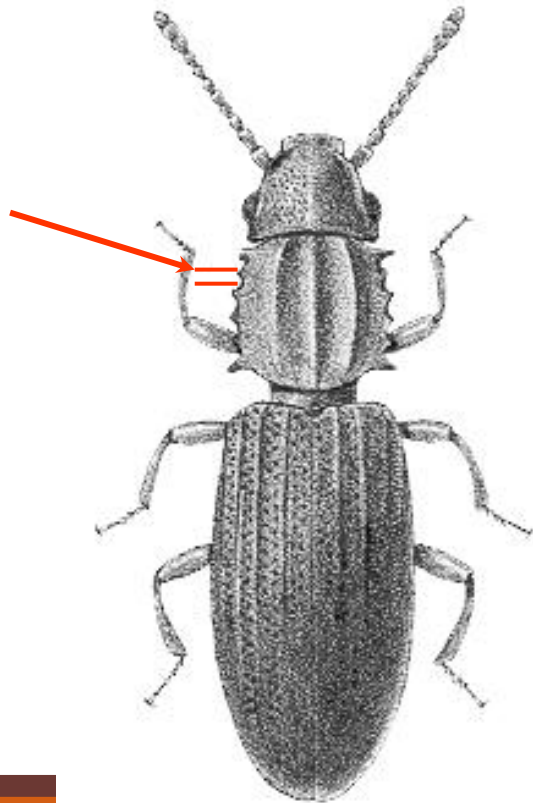


Saw-Toothed & Merchant Grain Beetles

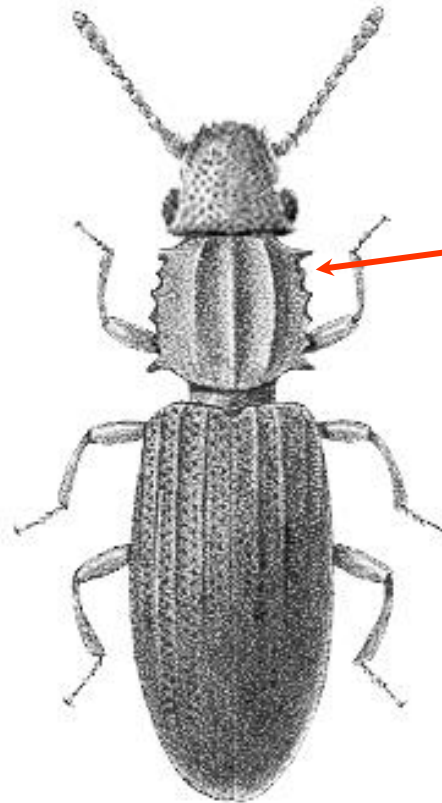
Oryzaephilus surinamensis

Oryzaephilus mercator

Temple behind eye is nearly as long as diameter of the eye



Temple behind eye is much smaller than diameter of the eye



Often misidentified due to similarities

Saw-Toothed & Merchant Grain Beetles

Oryzaephilus surinamensis

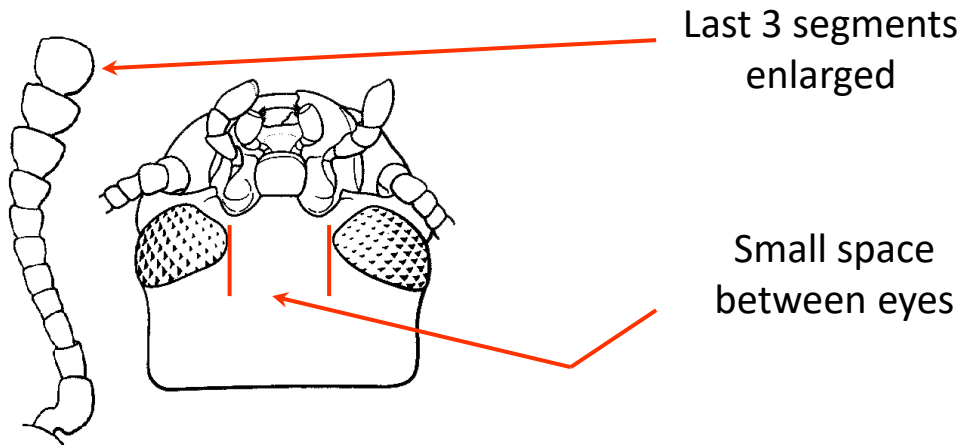
Oryzaephilus mercator



Red & Confused Flour Beetles

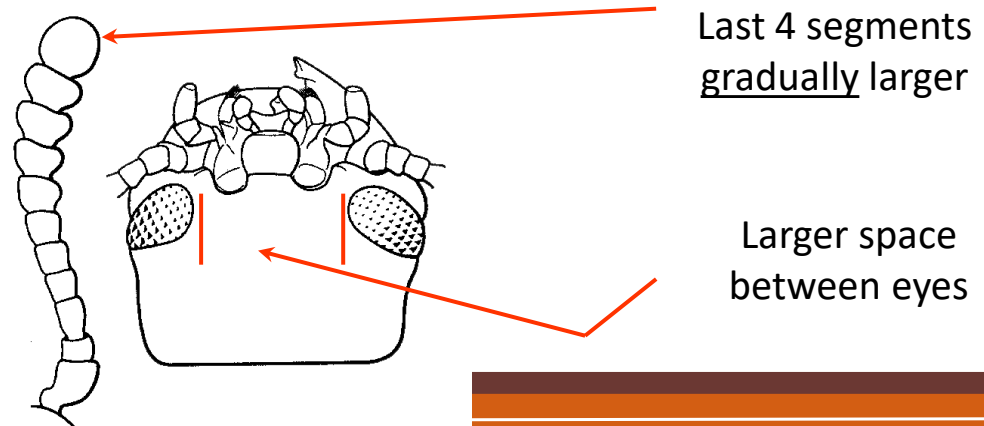
Red Flour Beetle

Tribolium castaneum



Confused Flour Beetle

Tribolium confusum



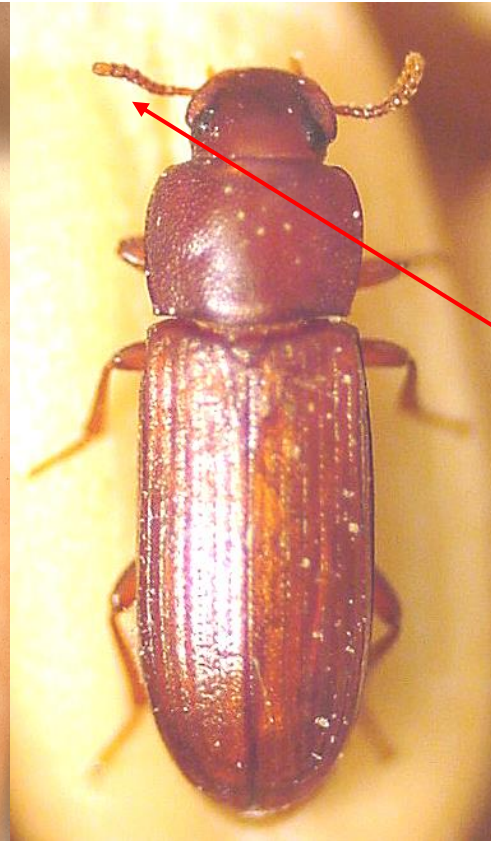
Antennae and underside of head

Red & Confused Flour Beetles

Tribolium castaneum



Tribolium confusum



Flour Beetle Trails in a Mill



Available Solutions Preventative Strategies



Chemical Control Options

- Fumigants – kills all life stages but require special certifications and provide no residual control
- Protectants – residual control properties
 - Malathion, OP-Pyrethroids (Storecide® II), OP (Actellic®), Bio-pesticides (Bti), Centynal™ EC (pyrethroid), Pyronyl™ Crop Spray (natural pyrethrin)
 - Some w/o Codex MRL, limited crop label
 - Insect growth regulators (IGRs)
 - Diacon® IGR and Diacon®-D IGR
 - Combination products
 - Diacon® IGR *PLUS*
 - Synergists
 - PBO-8® Synergist

Stored Grain Protectant Comparison

	Pest Efficacy					
	LGB	RFB	CFB & STGB	IMM	AGM	RW / GW
Malathion	*	*	*	0	0	*
Actellic®	*	**	**	**	**	***
Storicide® II	***	***	**	***	***	***
Diacon® IGR ^{1/}	***	***	***	***	***	0
Centynal™ EC/ PBO-8®	***	***	***	***	***	***
DE ^{1/}	**	**	**	*	*	**
Diacon® IGR <i>PLUS</i> /PBO-8®	***	***	***	***	***	***

^{1/}EPA tolerance exempt *** = Excellent ** = Good * = Poor 0 = None

Stored Grain Protectant Comparison

	Commodity					
	Wheat	Barley	Corn	Grain Sorghum	Oats	Sunflowers
Malathion 6% dust	Yes	Yes	Yes	NO	Yes	NO
Actellic®	NO	NO	Yes	Yes	NO	NO
Storicide® II	Yes	Yes	NO	Yes	Yes	NO
Diacon® IGR ^{1/}	Yes	Yes	Yes	Yes	Yes	Yes
Centynal™ EC	Yes	Yes	Yes	Yes	Yes	NO
DE ^{1/}	Yes	Yes	Yes	Yes	Yes	Yes
Diacon® IGR PLUS/PBO-8®	Yes	Yes	Yes	Yes	Yes	NO

^{1/}EPA tolerance exempt

Stored Grain Protectant Comparison

	Residual months	Light Stability	Temp Stability	Label Signal	Re-entry
Malathion 6% dust	< 12	High	< 130	Caution	Until ventilated
Actellic®	12 -18	Mod	< 150	Danger	Spray dries
Storcide® II	12 - 18	Mod	< 150	Danger	Spray dries
Diacon® IGR ^{1/} Diacon®-D Diacon® IGR <i>PLUS</i>	18+	Low	< 325	Caution	None
Centynal™ EC	8+	Low	< 220	Caution	None
DE ^{1/}	Stable	High	Stable	Caution	None

^{1/}EPA tolerance exempt

Grain Treatment Strategies

- Don't treat = lost profits!
- Long Term – 8 months or longer. Look at treatments with Diacon[®], Diacon[®] *PLUS* and PBO-8[®] Synergist.
- Short Term – Less than 8 months. Consider using only Centynal[™] & PBO-8[®] Synergist.

What is Diacon® IGR?



A **highly effective** insect growth regulator
that inhibits the life cycle of insects.



Diacon® IGR

- Available in two formulations
 - Diacon®-D – a dry formulation
 - Diacon® IGR – a convenient liquid



Diacon® IGR

Insect Growth Regulators (IGR's)

- Many IGRs mimic insect biochemicals which are responsible for “telling” the insect to stay in its immature stage
- Exposure to insect biochemicals “tricks” the insect into staying in its immature stage, and not transitioning or going through metamorphosis to become an adult

Diacon® IGR Features

- **BROAD-SPECTRUM** control
- Labeled for all stored commodities and food
 - [http://www.bugfreegrains.com/-/media/files/bugfreegrains-na/us/specimen labels/diaconigr specimen label pdf.pdf](http://www.bugfreegrains.com/-/media/files/bugfreegrains-na/us/specimen%20labels/diaconigr_specimen_label.pdf)
- Application rates to fit storage parameters
- Approved application **EVERYWHERE** stored product insects are found
- **A LONG RESIDUAL**
- Protection against re-infestations

Contains the IGR (S)-methoprene

- Is EPA approved
- Is tolerance exempt to control insect larvae in food commodities
- Has low environmental concerns
- Has an excellent toxicity profile

Uses for Grain Elevators & Farmers

- Diacon[®] IGR liquid is ideal for wheat storage where weevils are not a concern.
- Used in animal feeds to prolong shelf life and control Indian meal moth and saw-toothed grain beetles (both liquid and dry formulations)
- Added to fogging concentrates to prolong residual properties
- Diacon[®]-D is ideal to treat bin floors, plenums, and as a top dressing in bins

Untreated vs. Treated



What is Centynal™ EC Insecticide?



An effective **insecticide** formulation
from the makers of Diacon® IGR.



Centynal™ EC Features

- Effective knockdown
- Enhanced EC formulation
- Water or oil dilutable
- For preventative control and rescue treatments
- Miscible in dust controlling oils
- CODEX approved



Centynal™ EC

- Sodium Channel Modulators
- Pyrethrins are naturally occurring compounds from members of the chrysanthemum family.
- Pyrethroids are synthetic versions of pyrethrins designed to be more environmentally stable.
- They both act on insect nerve channels through which sodium is pumped to cause excitation of neurons.
- Prevent sodium channels from closing – continual nerve impulse transmission, tremors, and eventual death.

Centynal™ EC

- Centynal™ EC Insecticide
 - Deltamethrin 4.75%
 - Provides effective knockdown and control of stored product insects
 - For use on wheat, corn, rice and other grains
 - Enhanced emulsifiable concentrate formulation reduces need for agitation
 - May be diluted with water or oil
 - Miscible in dust controlling oils
 - May be tank mixed with Diacon® IGR and PBO-8® Synergist



Centynal™ EC

- Centynal™ EC Insecticide
 - Low-toxicity profile
 - Broad-use pattern
 - CODEX approved
 - Non-Restricted Use Pesticide (RUP)
 - Feed tolerance established
- Protects stored grains and seeds against damage from
 - Indian meal moth
 - Saw-toothed grain beetle
 - Red flour beetle
 - Rice weevil
 - Maize weevil
 - And more!

Uses for Grain Elevators & Farmers

- Ideal to control weevils in corn and other grains
- Most effective if paired with PBO-8® Synergist
- Used as an exterior perimeter spray as a barrier for outside invading insects in warmer weather.
- Best if repeated every 3 weeks to prolong effective barriers.

What is Diacon[®] IGR *PLUS*?



A combination of an **insect growth regulator**
PLUS an **adulticide**. Provides control of stored
product insects from start to finish.



Features

- One product for use on grain as well as sanitation needs
- Helps eliminate stored product insects
- May be diluted with water or oil
- Miscible in dust controlling oils



Features

- May be tank mixed with other products
- Long-residual control
- Reduces rebound of infestations
- CODEX approved for cereal grains



Application Methods

- Directly to grain stream
- Empty bin treatment and crack-and-crevice treatment
- Exterior treatment – bin perimeter and areas adjacent to bins

Refer to label for application rates



Diacon® IGR PLUS

- Broad spectrum insect control
 - Granary weevils
 - Rice weevils
 - Lesser grain borers
 - Indian meal moths
 - And many more



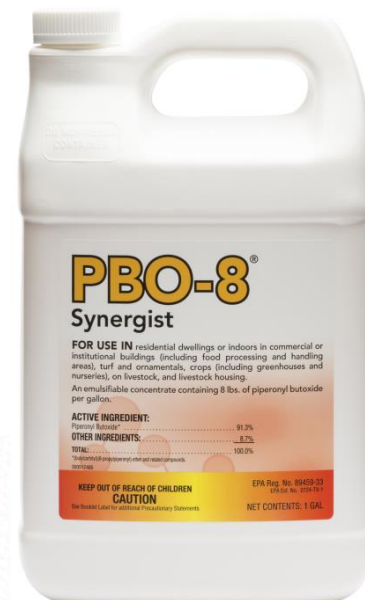
Application to Empty Bin



Uses for Grain Storage Structures

- Perfect bin prep product providing residual properties up to one year inside bins, flat storages, and some warehouse applications
- Convenient quart size is perfect for retail locations and to sell to farmers.
- Combination product paired with PBO-8® Synergist providing lasting control for weevils and secondary feeders (corn, wheat, milo, sorghum, and other cereal grains)

What is PBO-8® Synergist?



A **synergist** that improves the **efficacy** of insecticides.



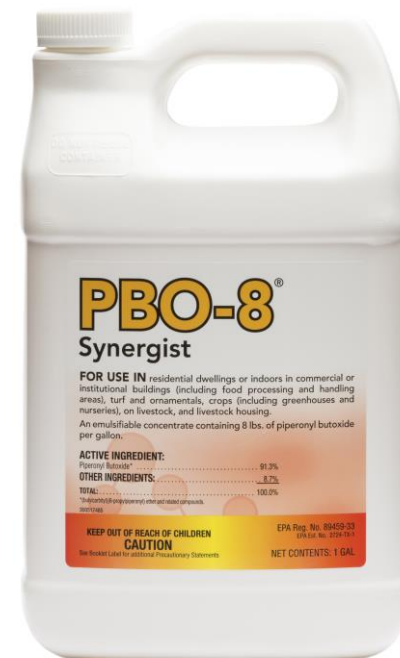
PBO-8[®] Synergist

- A perfect tank-mix partner with Centynal[™] EC Insecticide or Diacon[®] IGR *PLUS* to provide an extra boost for stronger stopping power



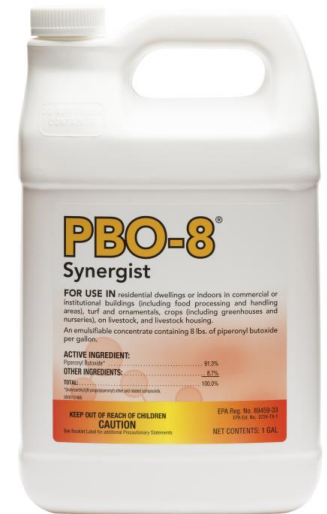
PBO-8[®] Synergist

- Active ingredient
 - Piperonyl Butoxide (91.3%)



Features

- Is an excellent resistance management tool
- Blocks insects' ability to metabolize pyrethroid based adulticides
- Synergizes many insecticides, including pyrethroids
- Works with most misting, fogging or spray equipment
- Presents a low risk to humans and environment



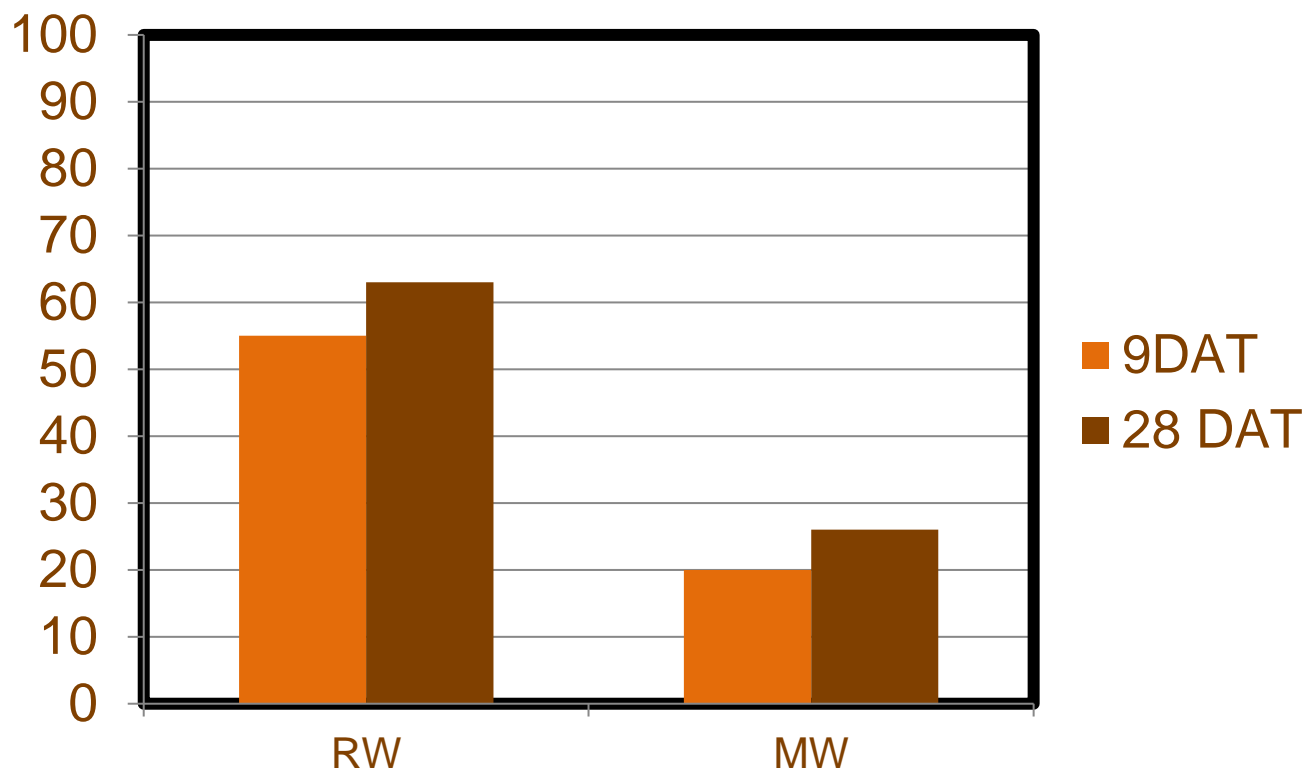
Resistance Management

- Should always be used with Diacon® IGR *PLUS* or Centynal™ EC to improve efficacy of the synthetic pyrethroid and reduce and/or eliminate the possibility of insect resistance.



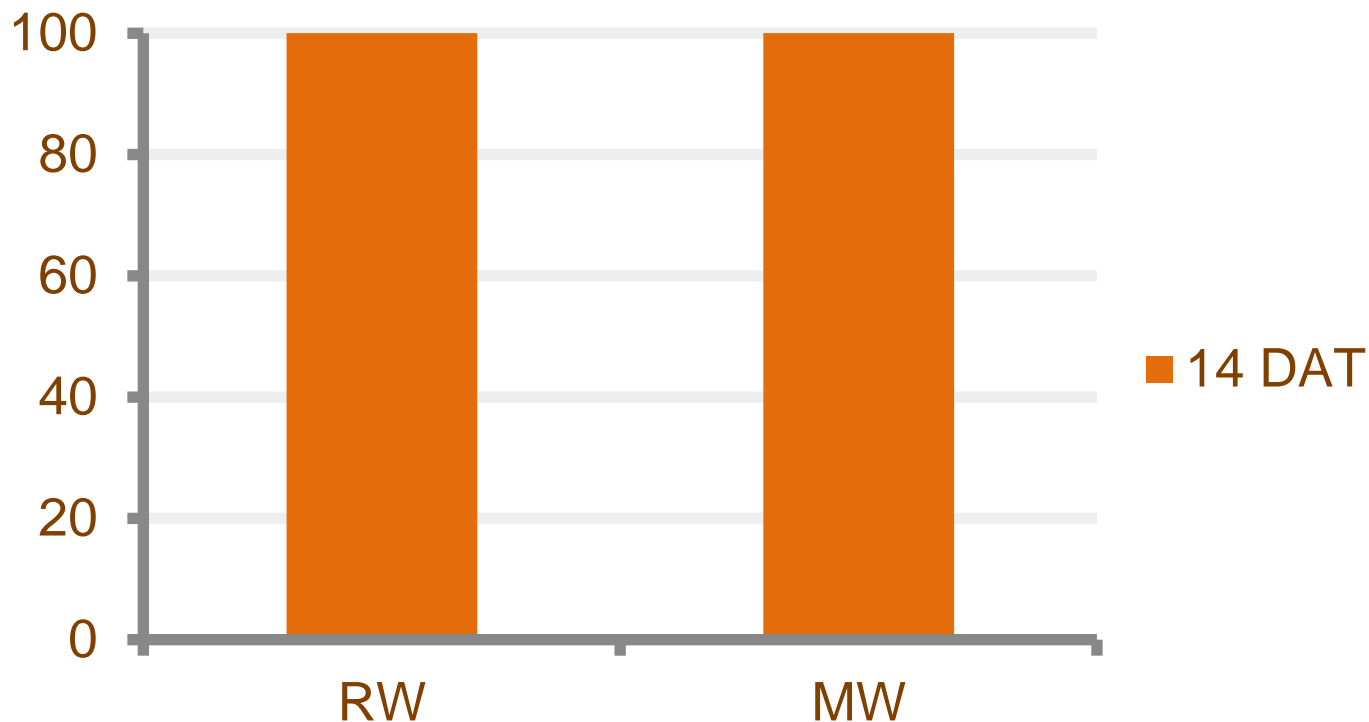
Centynal™ EC / Residual Grain

1 ppm Delta



Centynal™ EC / PBO-8® on Residual Grain

0.5 ppm Delta / 14 ppm PBO



Grain Protectant Programs

3 WAY PROGRAM FOR WEEVILS IN CORN/WHEAT/BARLEY

- DIACON® IGR PLUS 9-9.6 OZ
- PBO-8® 13.5-14.4 OZ
- Mixed in 5 gallons of water.
- Apply at 5 gallons solution per 1000 Bu.
- Spray on the grain stream using low PSI (20) and large droplets.
- READ AND FOLLOW THE LABEL

RESCUE TREATMENT FOR WEEVILS IN CORN/WHEAT/BARLEY

- CENTYNAL™ EC 9-9.6 OZ
- PBO-8® 13.5-14.4 OZ
- Mixed in 5 gallons of water.
- Apply at 5 gallons solution per 1000 Bu.
- Spray on the grain stream using low PSI (20) and large droplets.
- READ AND FOLLOW THE LABEL

Remedial/Rescue Strategies



Stored Corn a Problem in 2020?

- The 2019 crop was a challenge in many ways
- Late planting, late harvest, poor condition.
- Many elevators are keeping this grain to blend off with the new 2020 crop.
- With poor grain quality comes more chances for insect pressure.
- Poor conditioned corn and warm weather can be a problem!

Corn Woes



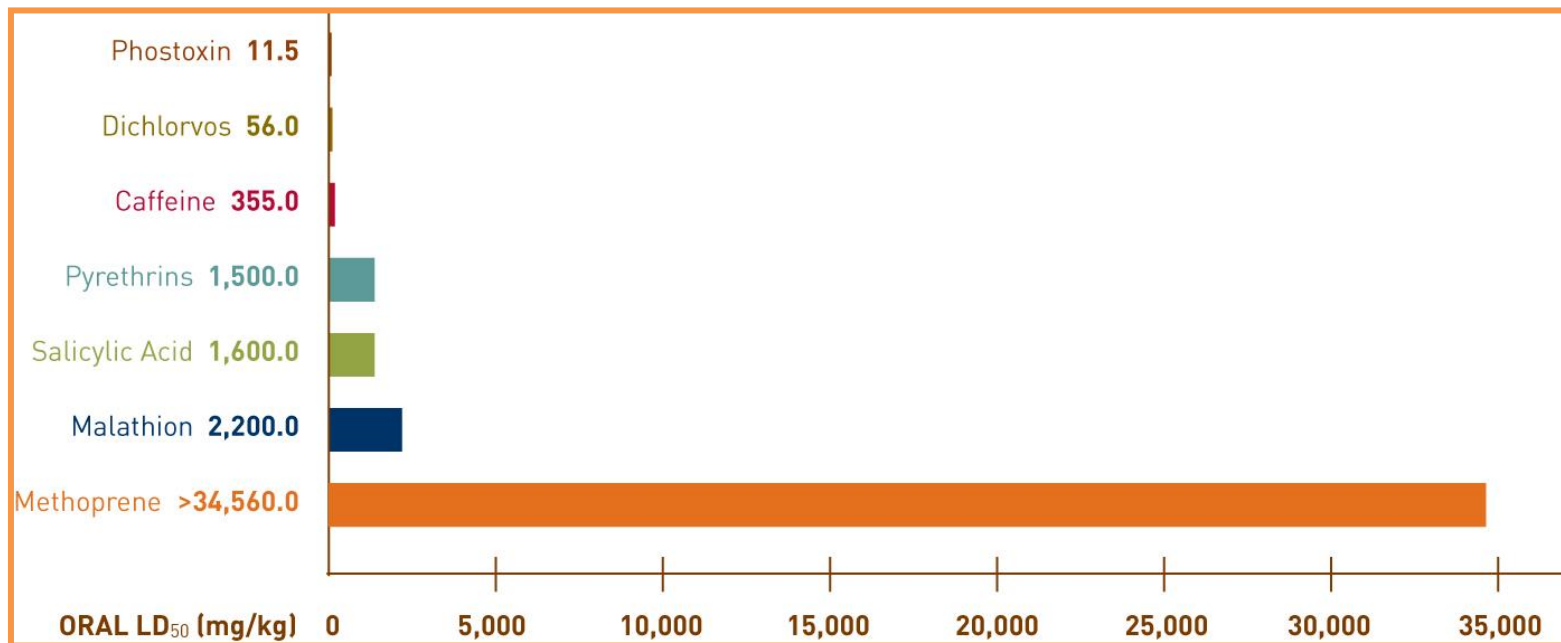


Time for a Rescue Treatment!

- Selling or moving corn soon and have weevils?
- Treating with Centynal™ EC and PBO-8® for a quick knockdown and residual control lasting 8 to 13 months.
- Does take time to work. One to three days, depending on grain temperature.
- Treat while moving grain from one bin to another.

Comparative Acute Toxicities

(LD₅₀ = The larger the value, the lower the toxicity)



Application Equipment



Diacon®-D Application Equipment



Liquid Applications

- Objective is to evenly distribute onto grain mass.
 - Don't need to treat every kernel!
- Best application locations are:
 - Confluence point of a belt & leg
 - Accessible belt prior to the leg
 - Accessible belt prior to the fall into bin
- Determine grain flow to plan application system and setup.
- Can be as simple or elaborate as one desires.
- Build your own or purchase a ready-to-go set up.

Application Equipment



Application Equipment



Application to Grain Stream



Nozzle Application Tips



Application Tips!

- Location of Tank & Pump?
 - Ease of mixing and loading.
- Volume of pump must include enough volume for recirculation.
 - All liquid products need agitation to keep them mixed
 - Volume of the tank needs to be “turned” a minimum of 3 time per hour
 - Example : Grain Flow is 10,000 bu / hour
 - 5 gallon of spray solution / 1000 bu
 - 250 gallon spray tank (recirculate contents 3X = 750 gallon
 - + 50 gallons of spray solution / hour applied to grain. (.83 gal per minute)
 - = 800 gal / hour total pump capacity or 13.3 gal / min
 - Can use a mechanical agitator in lieu of recirculation
- Only mix what you will use in a 12-hour period.

Application Tips!

- Some products can be mixed or injected into an oil dust suppression system.
- Location of the nozzle?
 - Accessible and visible!
 - Dust accumulation may cause issues. Inspect and clean often!
- Nozzle selection is key
 - Coarse droplet size
 - Best if applied at low side of the pressure range of the nozzle
 - Only spray the grain not the equipment (belt)
 - Suggest a Drift Guard or Air induction Nozzle
 - Nozzle height above grain flow needs to match desired grain flow width.

Benefits to You and Your Customers

- No dockage fees for live insects, IDK & odors
- Fewer losses in test weight due to insect damage
- No costly fumigations needed
- Higher profits when selling their grain
- Easy application without the need for a special license

All Products are General Use Labels and **do
not require a restricted use certification.**



Questions?

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