

## IPM For Stored Grain

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July, 2015

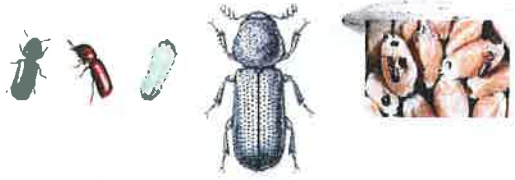
## HISTORY OF STORAGE

*There have been insect pests as long as grain has been stored*



## STORAGE INSECT LOSSES


*Worldwide, total losses are estimated at 2 billion dollars!  
These losses are due to combined insect feeding and spoilage.  
The lesser grain borer is a primary pest of cereal grains.*



*Primary storage pests attack sound grain; readily damage kernels*

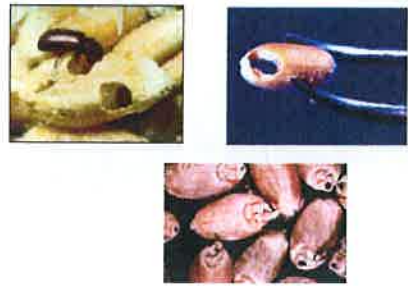
## MONTANA STORAGE LOSSES

*However, problems are not as bad as for more southerly climates.*



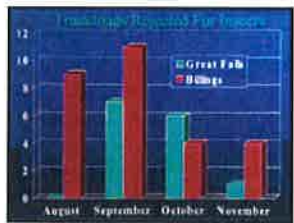
## IMPROPER STORAGE & INSECTS

*Also, most of our problems are not related to direct loss of grain –  
Insect Damaged Kernels (IDK) or major losses of quality.....*



## COSTS

*These data are truckloads rejected for the presence of live insects  
– this has little to do with damage*



Month	Great Falls	Billings
August	~5.5	~10.5
September	~7.5	~11.5
October	~6.5	~4.5
November	~1.5	~4.5

## REMOVE ALL GRAIN RESIDUE

1. AUGUR
2. TRUCK
3. SPILLS
4. COMBINE
5. FEED AREA



You need to be aware of all possible sources of contamination. The greatest challenge is faced by crop/livestock operations with grain-based spilled feed. Clean the feed storage area frequently.

## PREVENTION

### LOADING THE BIN

1. DON'T OVERFILL THE BIN.

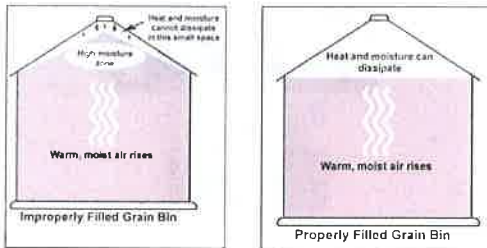
*Simply running the augur until the grain is ready to spill out is not practical. The roof volume in a bin is an important AIRspace.*

2. NOT SPREADING OR CLEANING THE GRAIN.

*You can concentrate your problems by not implementing these procedures.*

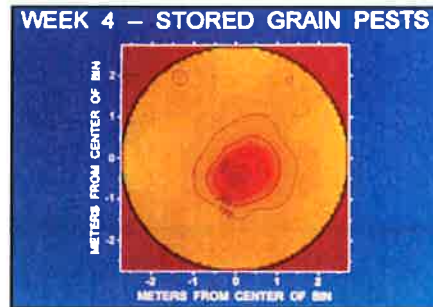
## PREVENTION

### OVERFILLING THE BIN



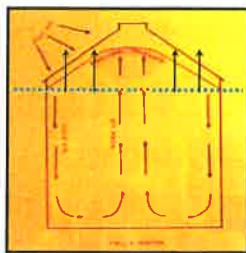
## WHY ARE THE INSECT NUMBERS HIGHEST IN THE CENTER OF THIS MAP?

*There are two reasons – food and warmth.*



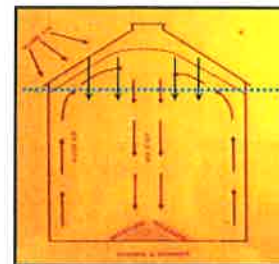
## PREVENTION

### CONVECTION CURRENTS & SPOILAGE HOTSPOTS – AT FIRST STORAGE



## PREVENTION

### CONVECTION CURRENTS & SPOILAGE HOTSPOTS – THE FOLLOWING SPRING



# CONVENTIONAL INSECTICIDES

## EMPTY BINS - EXAMPLE

**Tempo® SC Ultra Insecticide**

Crop	Application Rate (lb/acre)
Almonds	0.05 - 0.10
Apples	0.05 - 0.10
Avocados	0.05 - 0.10
Berries	0.05 - 0.10
Citrus	0.05 - 0.10
Grains	0.05 - 0.10
Oilseeds	0.05 - 0.10
Other	0.05 - 0.10

## INSECTICIDES - PROTECTANTS

Protectants are applied when the commodity is first stored. They provide residual protection against infesting insects.

Advantages

- highly effective when first applied
- relatively inexpensive

Disadvantages

- some loss of product over time, can't re-treat
- may not be totally effective; insecticide resistance
- control failures related to inadequate dosing, improper application
- other problems related to use and trade markets

## GRAIN PROTECTANT - EXAMPLE

**STORICIDE™ II**

Grain	lb/1000 bu	gal of 40% solution
Wheat	1.0	0.25
Barley	0.8	0.20
Oats	0.8	0.20
Rye	0.8	0.20
Grain sorghum	1.0	0.25

## DIACON™ II

AN INSECT GROWTH REGULATOR TO CONTROL STORED PRODUCT INSECTS IN FRESH FOOD COMMODITIES, SUCH AS CEREAL GRAINS, GRAIN PRODUCTS, PEAS, CORN, COBBLER, BEANLITS, K-PROCESSED SEEDS & TO CONTROL INSECT PESTS IN SEEDS.

**SPECIMEN LABEL**

ACTIVE INGREDIENTS:  
 Diaconin and Salt 1.00%  
 OTHER INGREDIENTS 99.00%

**Diacon & Centynal**

## DIATOMACEOUS EARTH (D. E.) - EXAMPLES

**INSECTO**

**Protect-It**

Concerns – Flowability, test weight loss (1.1 – 2.7 lb/bu)  
 Act slowly, work best under hot, dry conditions  
 Visually detectable as dust on kernels above 400 ppm

**FIXED TEMPERATURE CABLES**

*There are five cables in each bin.*



**REMOTE DATA CARD RELAYS TEMPERATURES**

*All cables feed into a single cable by using relay boxes on each bin; many bins can be joined.*



**SOFTWARE TO MANAGE AERATION**

*All inputs are relayed to an on-site computer.*



**WEATHER STATION INPUT**

*This attached weather station allows the computer to turn on the fans only when the air is cooler than the grain – until you reach the target temperature*



**FAN, SWITCH, CONTACTOR, & RELAY**

*The fan requires high power, the computer low ...*



**MONITORING**



INTERVENTION

FUMIGATION!!  
SALE - PROCESSING!!

**INSECTICIDES - FUMIGANTS**

*Fumigation is used when an insect problem is detected.*  
*Phosphine gas is evolved from aluminum phosphide tablets- Phostoxin® - uses atmospheric water vapor*

Advantages

- highly effective in properly-sealed structures
- relatively inexpensive

Disadvantages

- less effective at lower temperatures
- bins are typically difficult to seal
- no residual activity, may need to re-treat
- difficult to apply, especially under new label

**FUMIGATION CAUTIONS**

READ THE LABEL –  
FUMIGATION MANAGEMENT PLAN


- **DEADLY GAS** – *Gas released in contact with atmospheric water, temperature-dependent reaction.*
- **CAN CAUSE FIRES** – *In contact with free water*
- **PROPERLY CONTAIN THE GAS** – *To better maintain a killing concentration; ensure safety*
- **AERATE RESIDUE** – *To safely eliminate residual gas*

**FUMIGATION CONCERNS**

- REACTS SLOWLY WHEN COLD, DRY
- DON'T USE BELOW 50 DEGREES
- NEED TO PROBE THE MATERIAL INTO THE BULK
- USE THE PROPER AMOUNT OF MATERIAL
- BE WARY OF UNREACTED PRODUCT

**SAFETY ISSUES**

*Phosphine gas and unreacted residue are extremely toxic. Care needs to be taken in use!*



**STORED GRAIN IPM**

- The practice of stored grain IPM integrates
  - the use of preventive measures to avoid pest problems
  - monitoring insect levels and grain condition to aid in marketing and management decisions
  - temperature management to slow infestation
  - judicious use of chemical pesticides