

**STORED - PRODUCT INSECTS:**

**‘INTEGRATED PEST MANAGEMENT  
– A RESEARCHER’S VIEW’**

*David Weaver*

**DEPARTMENT OF ENTOMOLOGY**

**MONTANA STATE UNIVERSITY**

**BOZEMAN, MT**

# “INTEGRATED PEST MANAGEMENT – A RESEARCHER’S VIEW”

View IPM as the best possible management strategy, with the realization that at this time it is not used in most stored-product situations.

Specialty and organic markets have some degree of IPM.

# STORAGE PESTS AND DAMAGE



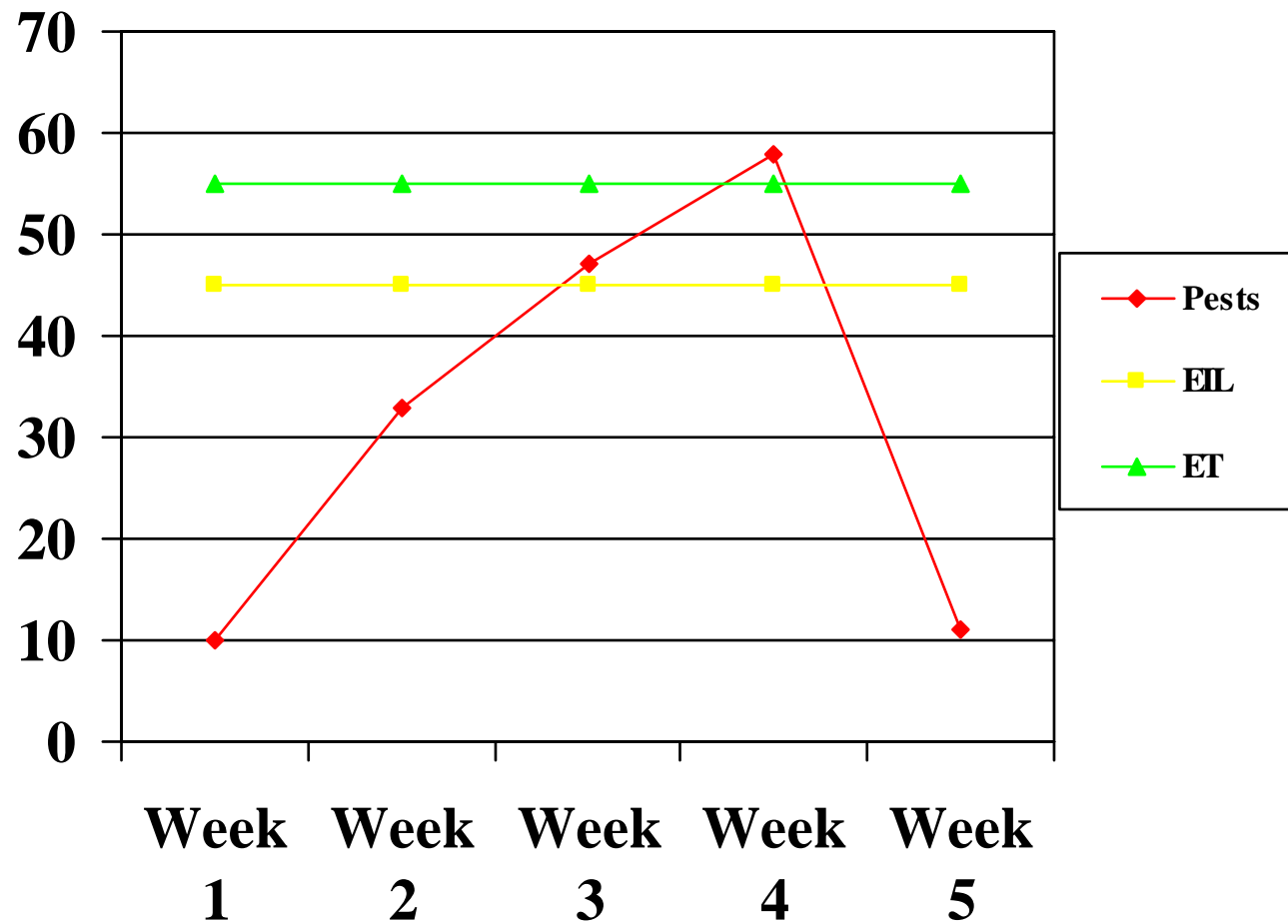
# INSECTS CAN FIND FOOD!!



# **HEAVILY-DAMAGED WHEAT: HOW TO PREVENT THIS?**



# What is IPM exactly?



# MONTANA BULK GRAIN EXAMPLE

Low insect numbers

Penalty for presence of live insects

IDK rare

\*Similar to low insect tolerances in  
processing and warehouses

# OUR STORAGE SYSTEM

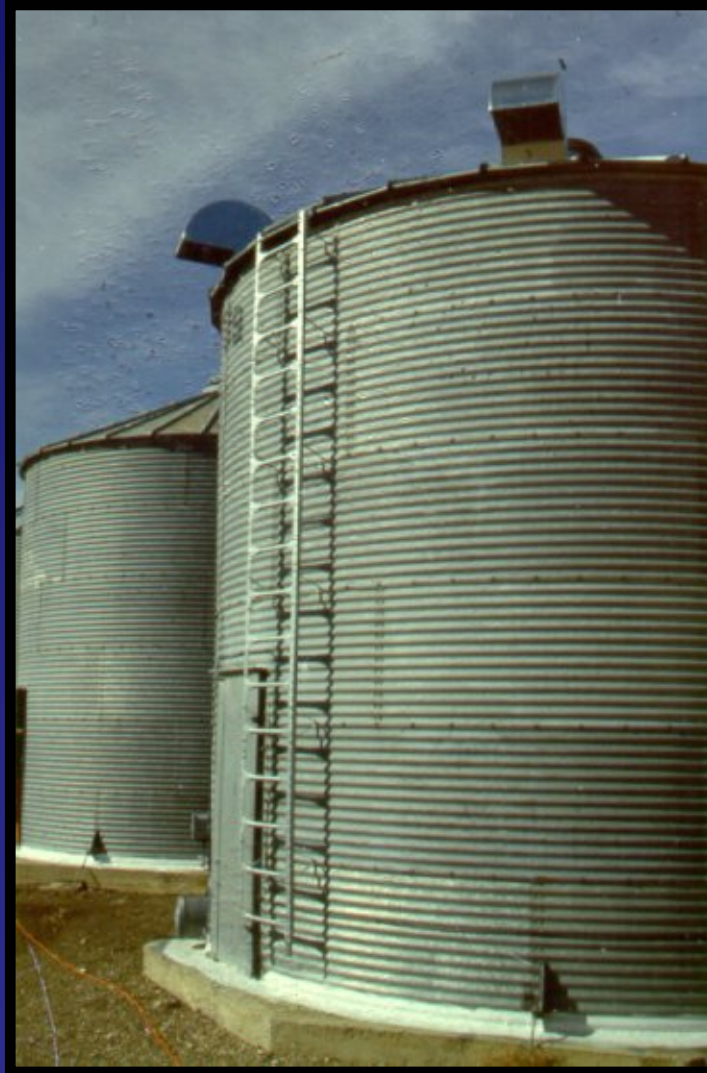




# SECONDARY PEST – MOST COMMON INSECT IN MONTANA GRAIN



**NEWLY-FILLED BINS CONTAIN A  
WARM, CONCENTRATED SUPPLY  
OF FOOD**



# FIRST STEP

## SANITATION

SPIILLED GRAIN, OR GRAIN  
RESIDUE

AS LITTLE AS ½ CUP CAN BE A  
SOURCE OF PROBLEMS,  
QUICKLY!

# CLEAN THE EMPTY BIN WELL



# CLEAN UP

1. AUGUR

2. TRUCK

3. SPILLS

4. COMBINE

5. FEED AREA

# SECOND STEP

## COMMODITY PROTECTION

ENSURE THAT GRAIN IS  
STORED AT 12% MOISTURE  
CONTENT OR LESS

TREAT WITH CHEMICAL OR D.E.  
PROTECTANT

# CONVENTIONAL PROTECTANT

GUSTAFSON  
**RELDAN 4E**  
INSECTICIDE

**ACTIVE INGREDIENTS:**

Chlorpyrifos-methyl (0,0-dimethyl 0-(3,5,6-trichloro-2-pyridyl) phosphorothioate) .....	43.2%
Xylene range aromatic solvent .....	46.0%
<b>INERT INGREDIENTS</b> .....	<b>10.8%</b>
<b>TOTAL</b> .....	<b>100.0%</b>

Contains 4 lb. chlorpyrifos-methyl per gallon

**KEEP OUT OF REACH OF CHILDREN**  
**DANGER**  
**SEE REMAINDER OF LABEL FOR ADDITIONAL**  
**PRECAUTIONARY STATEMENTS**

RELDAN is a Reg. TM of The Dow Chemical Company  
U.S. Patent No. 3,244,586  
EPA Est. No. 32761-MO-3  
EPA Reg. No. 7501-41

**Gustafson**   
1400 Preston Road  
Plano, Texas 75093

**PRECAUTIONARY STATEMENTS**  
**HAZARDS TO HUMANS AND DOMESTIC ANIMALS**  
**DANGER**

Corrosive, causes eye and skin damage or irritation. Do not get in eyes, on skin or on clothing. Wear goggles or face shield and rubber gloves when handling. Do not breathe vapors and spray mist. Keep container closed. Wash hands, arms and face thoroughly with soap and water after handling and before eating or smoking. Routinely shower or bathe after work and wash all clothing with soap and hot water before reusing. Keep away from food, feed stuffs and water supplies.

**STATEMENT OF PRACTICAL TREATMENT**

- If Swallowed: Do not induce vomiting. Call a physician immediately.
- If on Skin: Remove contaminated clothing and immediately wash with soap and water.
- If in Eyes: Flush eyes with plenty of water for 15 minutes and call a physician.

**NOTE TO PHYSICIAN:** Chlorpyrifos-methyl is a cholinesterase inhibitor. Treat symptomatically. Atropine by injection is the preferable antidote. Oximes such as 2-PAM may or may not be therapeutic, but it is recommended they not be used in place of atropine.

**ENVIRONMENTAL HAZARDS**

Gustafson RELDAN 4E insecticide is toxic to fish, birds and other wildlife. Do not apply directly to water. Do not discharge directly or indirectly into surface waters. Do not contaminate water by cleaning of equipment or disposal of wastes.

**PHYSICAL OR CHEMICAL HAZARDS**

Combustible—Do Not Use or Store Near Heat or Open Flame.  
Do Not Cut or Weld Container.

# EXAMPLE OF A D. E. PRODUCT

**Grain Storage**

**PROTECT-IT**

**Protect-It™**  
The Natural Choice  
STORED PRODUCT INSECTICIDE

**Now there's effective protection!**

The advertisement features a vertical banner on the left with the words 'Grain Storage' in white and 'PROTECT-IT' in large red letters, all set against a background of yellow grain. Several brown beetles are shown crawling along the edge of the grain. To the right, the 'Protect-It' logo is displayed, consisting of a stylized blue and white triangle with a yellow circle inside. Below the logo, the text 'The Natural Choice' and 'STORED PRODUCT INSECTICIDE' is written. At the bottom right, the slogan 'Now there's effective protection!' is written in blue and red.



# EMPTY BIN ONLY!!

Tempo SC Ultra

## Specimen Label

# Tempo<sup>®</sup> SC Ultra

## Insecticide

For commercial use only

For broad-spectrum control of crawling, flying, and wood-infesting insect pests for indoor and outdoor surfaces, as well as insect pests of trees, landscape ornamentals and residential and commercial lawns.

### ACTIVE INGREDIENT:

Cyano(4-fluoro-3-phenoxyphenyl)methyl 3-(2,2-dichloroethyl)-2,2-dimethylcyclopropanecarboxylate ..... 11.8%

INERT INGREDIENTS: ..... 88.2%

100.0%

Contains 1 lb cyano(4-fluoro-3-phenoxyphenyl)methyl 3-(2,2-dichloroethyl)-2,2-dimethylcyclopropanecarboxylate per gallon.

Six 240-mL Bottles per Carton,  
Two Cartons per Case

EPA Reg. No. 3125-498

**STOP - Read The Label Before Use**  
**KEEP OUT OF REACH OF CHILDREN**

## CAUTION

### PRECAUTIONARY STATEMENTS

#### HAZARDS TO HUMANS AND DOMESTIC ANIMALS

**CAUTION:** Harmful if absorbed through skin or inhaled. Causes moderate eye irritation. Avoid contact with eyes, skin or clothing. Wear long-sleeved shirt and long pants, socks and shoes. Chemical resistant gloves (such as Nitrile Butyl,

Neoprene, and/or Barrier Laminate). Wash thoroughly with soap and water after handling and before eating, drinking or using tobacco. Remove contaminated clothing and wash before reuse.

### STATEMENTS OF PRACTICAL TREATMENT

**If swallowed:** Call physician or Poison Control Center. Drink 1 or 2 glasses of water and induce vomiting by touching back of throat with finger. If person is unconscious, do not give anything by mouth and do not induce vomiting. **If on skin:** Wash with plenty of water. If symptoms persist, get medical attention. **If inhaled:** Remove victims to fresh air. If not breathing, give artificial

respiration, preferably mouth-to-mouth. Get medical attention. **If in eyes:** Flush eyes with plenty of water. Call a physician if irritation persists.

**Note To Physician:** No specific antidote is available. Treat the patient symptomatically.

### ENVIRONMENTAL HAZARDS

This pesticide is extremely toxic to fish and aquatic invertebrates. Remove from premises or tightly cover fish tanks and disconnect aerators when applying indoors where such containers are present. Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark.

Do not apply when weather conditions favor drift from treated areas. Drift and runoff from treated areas may be hazardous to aquatic organisms in neighboring areas. Do not contaminate water when disposing of equipment wash waters. Apply this product only as specified on this label.

# THINGS TO AVOID!!

OVERFILLING THE BIN!!!

\*MONITORING AND SAMPLING IS  
DIFFICULT IF BIN IS COMPLETELY  
FILLED

# LEVEL THE GRAIN

1. ALLOWS FOR WORKER  
MOVEMENT

2. ALLOWS FOR MONITORING

3. ALLOWS FOR AIR EXCHANGE

# MONITORING PEST POPULATIONS

Essential component of IPM

Allows for measurement of effectiveness

If economic threshold is exceeded,

Intervention (fumigation) is required

# GRAIN PROBE TRAPS FOR MONITORING



**Apparatus used**

# PROBE TRAPS FOR MONITORING



# INSERTING GRAIN PROBE WITH ROOM TO MOVE



# THIRD STEP

## TEMPERATURE CONTROL

USE AUTOMATIC AERATION TO

COOL GRAIN RAPIDLY

PREVENTS INSECT REPRODUCTION

\*REDUCES COSTS BY LOWERING

PROBABILITY OF “PRESENCE”

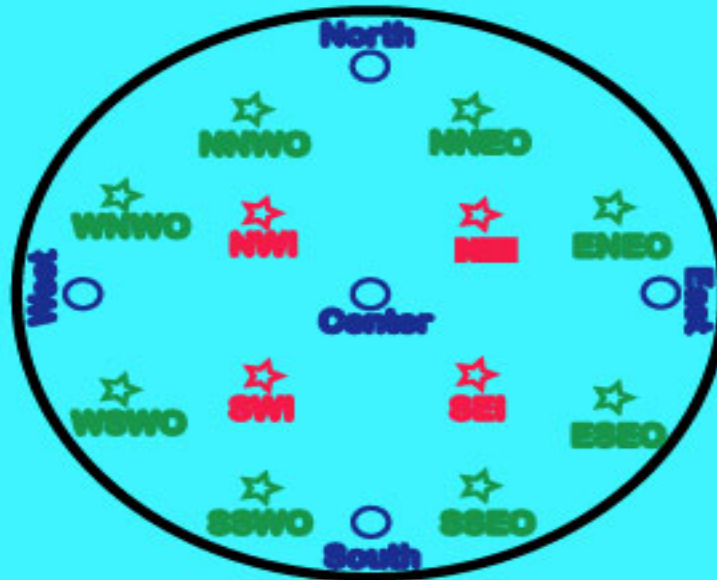
PENALTY



# AERATION STUDY



## Grain Bin Temperature Sensor Layout (Top View)



- Opi Cables
- ★ Inner Ring Supplemental Sensors
- ★ Outer Ring Supplemental Sensors

Diagram showing trap locations.

# 3 H.P. TURBINE FAN – 3000 BUSHEL



# AERATION DUCTING



# FIXED TEMPERATURE CABLES



# SOFTWARE TO MANAGE AERATION

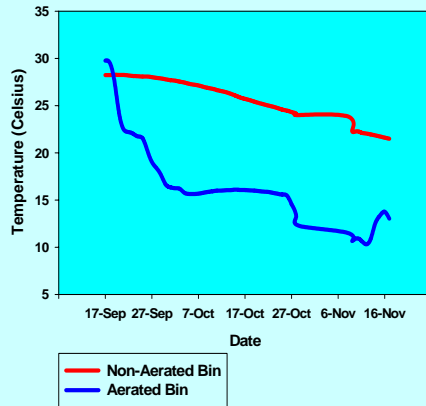


# WEATHER STATION FOR AERATION INPUT

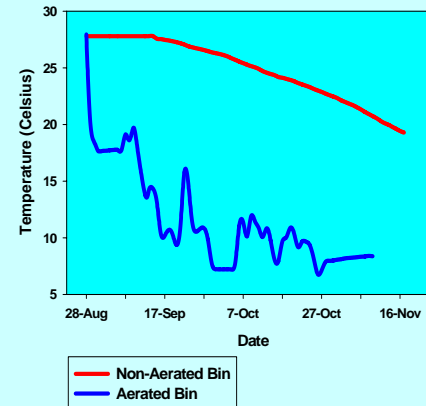


# AERATION RESULTS FOR TWO YEARS

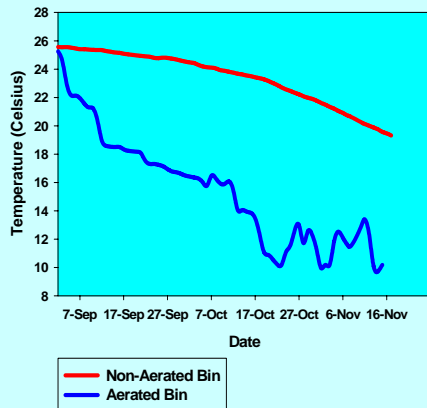
**Power Average Core Grain Temperatures  
Between September 17 and November 17, 1999**



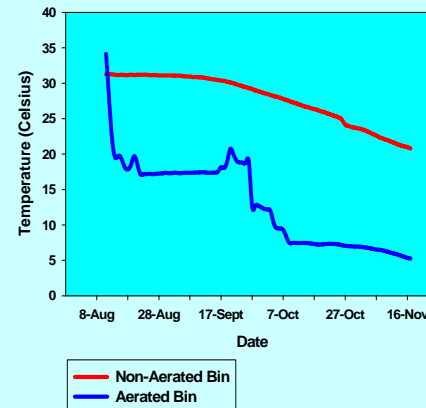
**Power Average Core Grain Temperatures  
Between August 28 and November 17, 2000**



**Moccasin Average Core Grain Temperatures  
Between September 2 and November 17, 1999**



**Moccasin Average Core Grain Temperatures  
Between August 11 and November 17, 2000**





TRAP CAPTURES 5/17 – 5/31, 2001  
Rusty Grain Beetles - Moccasin, MT

<u>TRAP SITE</u>	<u>CONTROL</u>	<u>AERATION</u>
NORTH	19	0
SOUTH	36	0
EAST	6	0
WEST	7	0
CENTER	523	1
<u>TOTAL</u>	<u>591</u>	<u>1</u>

# RESULTS

1. AERATION WAS EFFECTIVE

2. COSTS \$ 0.02/bu.

3. UNAERATED BULK – PENALTY  
+ FUMIGATION \$0.10/bu.

\*BUT WHY MONITOR?

\*CAN'T YOU JUST AERATE?

# ANSWER

TO SAVE MONEY!!

*IF THE AERATION FAILED, THE GRAIN MIGHT  
BE REJECTED AT THE ELEVATOR.*

*THEN, ADDITIONAL COSTS FOR TRUCKING  
AND FUMIGATION COULD AMOUNT TO  
\$0.15/bu.*

*IF AERATION FAILS, ON-SITE FUMIGATION  
BEFORE REJECTION ONLY COSTS \$0.02/bu.*

*IF AERATION WORKS THERE ARE NO  
ADDITIONAL COSTS*

# SUMMARY

IPM is a good idea!!

*This simple example shows that although the stored product environment often requires fixed inputs, the basic idea of monitoring to determine when action needs to be taken, and monitoring to evaluate the effectiveness of given procedures can be cost effective.*

*These concepts can be further applied to processing and milling facilities.*

*\*More research needs to be conducted on developing and integrating management strategies.*