Dealing with Store Houses

Stored food pests

- 80% of human food comes from grains
- 12% of harvest is lost to insects before harvest
- overall total food losses due to pests are about 20-30% destruction

Two Pest Categories

Primary – Cause initial injury

Secondary – Take advantage of injury.

Types of losses due to pests

- Direct
- Indirect

Direct losses

- Actual consumption
 - loss of weight,
 - loss of nutrients,
 - lower germination,
 - reduced grade
 - lower market value
- Contamination
- Damage to structures or containers

Indirect losses

- wet grain heating
- bacteria
- fungi
- alflatoxins
- parasites of humans
- control and application costs
- excessive pesticide residues
- loss of consumer confidence

Food contamination

- Insect infestation results in grain damage that cannot be repaired
- Food defect action levels for insect contamination
- Food exceeding those levels cannot be mixed with un-infested food to reduce levels of contamination
- Food processors can be fined or sent to jail for infestations found during inspections

Food Defect Action Levels

- Insect Filth: Ave. of 5 or more whole or equivalent insects (not counting mites, aphids, thrips, or scale insects) per 100 g sample
- Rodent Filth: Ave. of 4 or more rodent hairs per 100 g sample
- Significance: Aesthetic

Management of Stored Food Pests

Objective:

Prevent contamination from causing rejection

- Monitor Pest Population
- Control through non-chemical means if possible
- Use Chemicals as a last resort (they can cause rejection too).

IPM: Management Tactics

Judicious use of insecticides

 Examples of treatment plans, associated application equipment, formulations available and some products

IPM: Management Tactics

- Non-chemical control
 - Sanitation—
 - Physical—
 - Cultural—
- Many of the non-chemical control methods are PREVENTATIVE
 - Biological Control: ?

General Principles for an IPM Program

 Inspect incoming material (prevention) is the first line of defense against most stored product insects.

Inspect rail cars and trucks for spilled food and infestations



Flour in bags— examine seams of bags; check surface of bags, look under a few bags, look for holes in bags, check pallet



Inspection of incoming materials

- Look for trails in dust to determine presence of insects
- Boxes of grain products—
 - check surface of transportation vehicle and dust residues,
 - remove inner pack,
 - check box and bottom of box,
 - check pallets
- Inspect material before putting inside kitchen pantry
 - Check cereal boxes, flour bags, or any grain containing food

First In, First Out



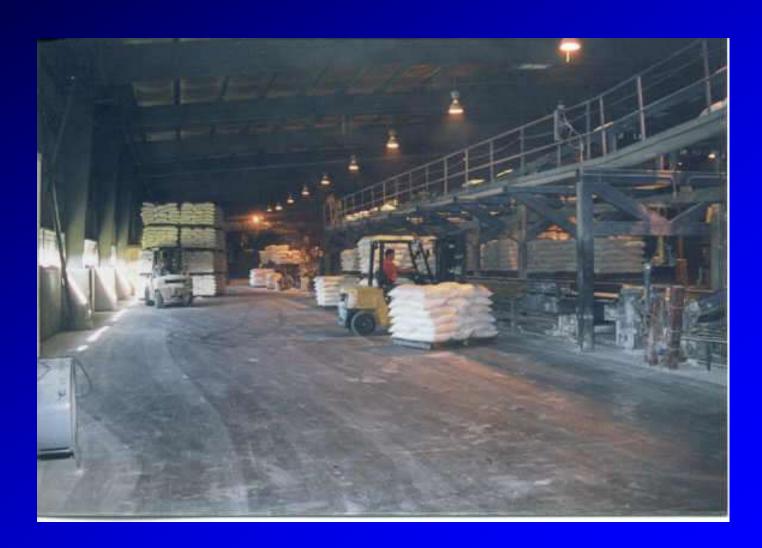
Sanitation

- It's one thing to clean out a kitchen pantry
 - Discard infested items
 - Vacuum
 - Wipe shelves down with warm soapy water

Sanitation

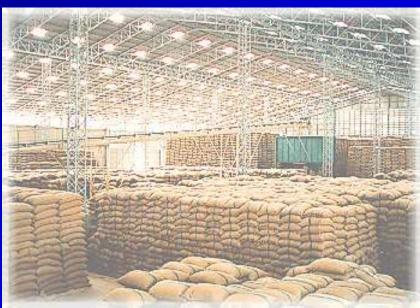
- Spilled food
- Flour dust
- Trash containers
- Broken packaging
- Equipment cleaning

Sanitation?



Sanitation?





Non-chemical controls

- Cold
- Heat
- Packaging
- Mechanical destruction

Cold

- Low temperature of product can retard or kill stored product pests (less than 5 °C)
- Grain storage silos usually have aeration equipment to pull cold air into grain in winter to kill or slow development of grain pests
- Storing susceptible materials in refrigerator will slow or kill pests
- Packages placed in refrigerator will kill most stored products pests if the cold penetrates to all areas of the package (4 days for a 5 lb bag of flour)

Heat

- Processing plants are often heated to 120-150°F for 24 hours
- Infested food can be placed in oven at 150°F for 20 minutes
- Infrared and microwaves are often used to kill pests in processing

Packaging

- Packaging can keep products free of insects
- Newly hatched larvae can penetrate cracks 0.12 mm wide
- Waxed paper and cardboard can be penetrated by stored products pests
- 75% of this kind of infestation occurs at folds and corners of a carton
- Foil laminates can prevent most insect infestation
- Glass jars and metal drums are virtually insect proof

Mechanical destruction

 High rpm (2,900 rpm) will kill insects and mites

 Milling and other processing equipment can mechanically destroy insect pests

Chemical control

- Much changed with loss of Methyl Bromide
- Contact treatments -- Ultralow volume (ULV) or Ultralow dosage (ULD) applications of pyrethrins or pyrethroids
 - Fogs, mists, and aerosols cannot penetrate food to kill insects
 - They kill exposed stages and can be used regularly to prevent infestations in the facility from attacking products
- Protectant insecticides
 - Placed in cracks and crevices where insects rest.

Protectants

- Inorganic dusts (diatomaceous earth) sometimes used to protect seeds and grains from insects
- Malathion---
 - has been registered for application to all major grains and has been used since 1958.
 - EPA tolerance is 8 ppm
 - in recent years most of the common pest species have developed resistance to malathion
 - Not widely used

Protectants

- Chlorpyrifos-methyl (Reldan),
 - Banned in 2003
- Pirimiphos-methyl (Actellic)-- expanded registrations for stored grain insects
 - Not widely used
- Spinosad
 - Registered for stored grain use in Jan. 2005.
 - Effective against all major insect pests.
 - Like Bt, it is a bacterial by-product so is considered "natural" and can thus be used on grain for any target market (including organic).

Protectants

- Hydroprene (Gentrol)-- can be fogged and sprayed for control of stored products pests
 - Gentrol Point Source
- Methoprene (Diacon II, Wellmark and DeGesch)
- Bacillus thuringiensis (Dipel)-- exempt from tolerance regulations. Can be applied as a surface treatment for control of lepidopteran pests

Fumigants

- Used to kill insects in raw and packaged food
- Leave very little residue







ProFume is replacing Methyl Bromide

- 2005 MeBr production/importation banned
- ProFume major player now.
 - Dow AgroSciences
 - Sulfuryl Fluoride old product, used for structural pest control for many years (Vikane)
 - Disrupts the glycolosis and citric acid cycles, works in 24-48 h
 - Cost similar to MeBr

Phostoxin, Gastoxin, or Magtoxin

- Can be used to kill insects in all kinds of grain, including seeds because phosphine has no effect on germination
- At 68°F, fumigation time is 3 days, at 40-53°F recommended time of fumigation is 10 days; therefore treated areas must be very gastight

Fumigation procedure for stored products pests



Sealing

- similar to structural fumigation, but usually the infested product is placed on a concrete slab and covered with a tarp held in place with sand snakes or tape
- Plastic tarp and tape is minimum required
- Placards must be placed before start of fumigation and must contain name of fumigant, date of release, name and phone of applicator
- If area around the fumigation is occupied, monitoring within 10 ft of the fumigated area is required and levels recorded

Fumigation procedure for stored products pests

- Release of the fumigant
 - 2 person teams responsible for release of fumigant.
 - Full face respirators with proper canisters must be available before release of fumigant