

**PEST MANAGEMENT OF STORAGE SYSTEM  
(ACCORDING TO THE WFP GUIDELINES)**

***Tajnuba Sharmin***

***Lecturer***

***Dept. of Nutrition & Food Engineering***

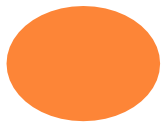
***Daffodil International University***

— PEST CONTROL SERVICE —



WHAT IS HE DOING?

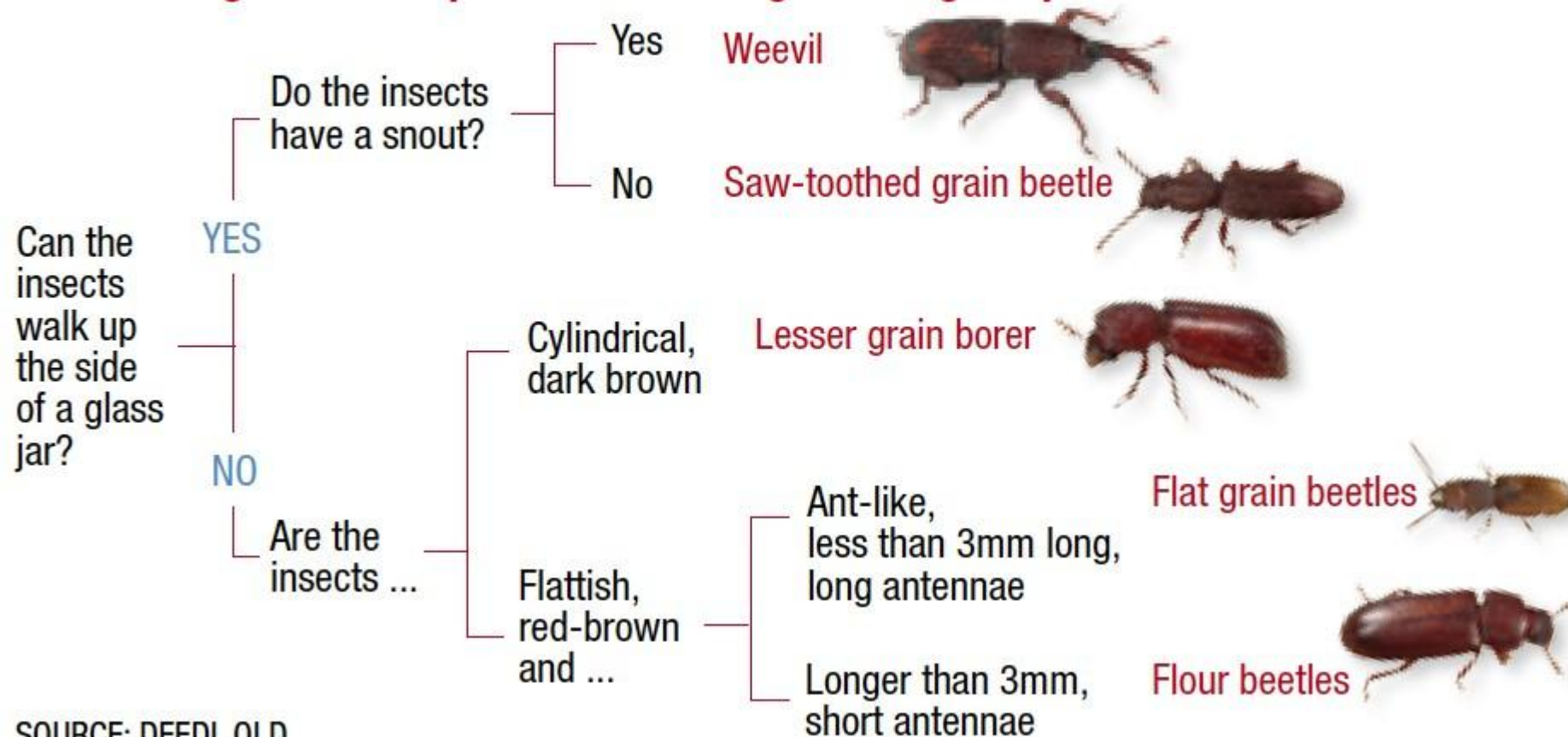
IS IT AN APPROPRIATE WAY OF DOING FUMIGATION IN STORAGE SYSTEM?



# IDENTIFICATION OF PEST

## IDENTIFICATION OF COMMON PESTS OF STORED GRAIN

The following flow chart provides a useful guide for grain pest identification.



SOURCE: DEEDI, QLD



# PRINCIPLE OF PEST MANAGEMENT

- The principal means of pest control in stored foods is by **fumigation**.
- This is the process of **holding the stored commodity with a poisonous gas** (phosphine,  $\text{PH}_3$ ) **in order to kill any infesting organisms**.
- **Two fumigant gases** were in common usage:
  - methyl bromide and
  - phosphine.
- Methyl bromide is a very effective fumigant, although somewhat **more dangerous to use than phosphine**.
- However, the World Food Programme (WFP) as a UN Agency has a policy **not to use methyl bromide** because, when released into the atmosphere, it depletes **stratospheric ozone**.
- For this reason WFP relies on phosphine alone.
- Fumigation in other situations, such as in **silos, rail cars, transport containers, barges and ships**.

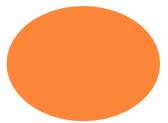


# HOW TO DECIDE WHEN PEST CONTROL IS NEEDED?

- Fumigation and spraying with contact **insecticides are expensive**, and decisions about whether or not to use them should not be taken lightly. In any particular situation, the need for pest control is affected by:
  - **the acceptability of the pest numbers present**
  - the suitability of the environment for the **multiplication of these pests**
  - **how long the commodity is to be held before being consumed**
  - for stocks that will be sent across borders, the **phytosanitary requirements of the importing country**.
- **Following an inspection** for pests, it is necessary **to decide whether the existing pest problem is sufficient to require immediate pest control**, whether a treatment is needed to prevent an anticipated pest problem, or whether no treatment is needed.
- Most insect pests under **humid tropical conditions** can be expected to multiply about **50-fold every 6 weeks**.



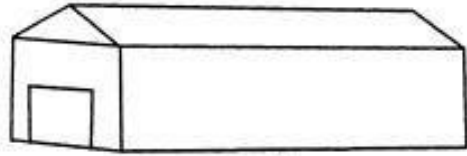
# PHOSPHINE TABLET



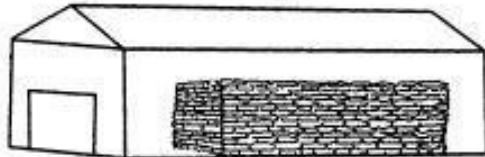
# FUMIGATION PROCESS

## Store condition

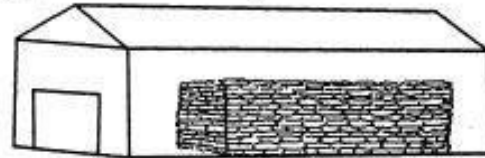
Empty store



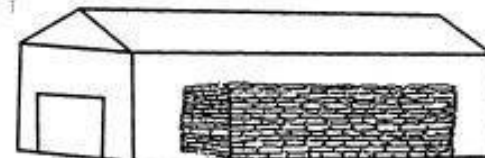
Stock moved in



Insects invade



Insects invade



## Pest Management

Prepare for entry of stock:

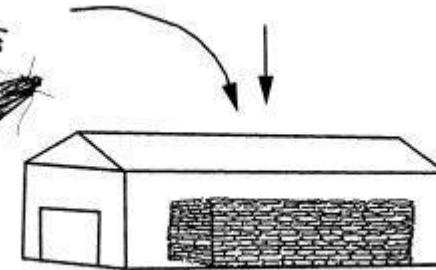
- Sweep and clean surfaces
- Spray insecticide on store surfaces

- Sweep and clean store surface
- Monitor for pest presence

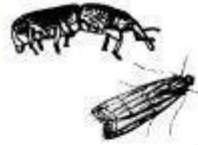
- Sweep and clean store surface
- Monitor for pest presence
- If commodity at risk, request a fumigation in good time

- Prepare for fumigation

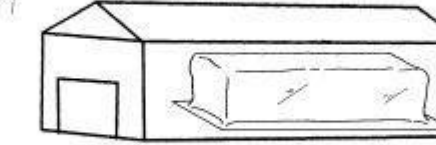
Insects invade



Insects invade



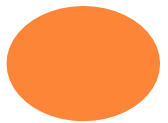
stock under fumigation



- If commodity at risk, request a fumigation in good time


- Prepare for fumigation

- Fumigate under gas-tight sheet
- Spray insecticide on store surfaces





# FUMIGATION WITH THE PHOSPHINE

- Phosphine **penetrates easily** into a commodity so that a good fumigation **will kill 100% of** the pests under the gas-proof sheet.
  - However, once the phosphine has dispersed, the grain has no protection against **re-infestation unless the gas-proof sheet is left** in place to act as a physical barrier.
  - Fumigation sheets are expensive. In some case **polythene sheet** also used.
  - Consequently, the sheets are normally removed so that they can be used in another fumigation. This gives insects the opportunity to migrate into the fumigated stock and re-infest it.
  - **Stocks held in stores for long periods** will probably need several fumigation treatments.
  - **Under tropical conditions** where insect activity is high, it may be necessary to fumigate as often as **once every 3 or 4 months** although, **with good hygiene practices** and good fumigation, treatment **once every 6 months** is achievable.
  - At the time of fumigation, to **ensure that when fumigation sheets are removed there are no live insects present** on the store structure that can re-infest the stock.
- 

## PROPERTIES OF PHOSPHINE GAS

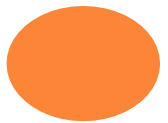
- **Phosphine gas** is generated from solid formulations of aluminium or magnesium phosphide, usually in the form of tablets or sachets.
- **Release of phosphine gas** when they come into **contact with the moisture** present in air.
- **Magnesium phosphide** formulations are **more reactive with moisture** and so will generate gas more rapidly.
- They are thus particularly useful in **cool climates** where aluminium phosphide may react too slowly.
- However, the **slower release from aluminium phosphide** formulations is preferred in **tropical and subtropical** climates as it gives safer and better fumigations.
- Release is also slower and more **uniform from sachets** than from tablets,
- so **sachets are generally preferred** unless conditions are exceptionally **dry** (relative humidity less than 40%) where lack of moisture can result in **incomplete decomposition** of the phosphide within the normal period of a fumigation.

## PROPERTIES OF PHOSPHINE GAS

- Pure phosphine is **colourless and odourless**.
- However, **impurities** result in a garlic-like smell.
- It is slightly soluble in water and **explosive at a concentration above 1.7%** in air.
- When the phosphide is in **contact with liquid water**, rapid generation of phosphine can occur so that **explosive concentrations are formed**.
- To avoid fire it is important that phosphide preparations do not **come into contact with liquid water, such as rain water** leaking in from the roof during a fumigation.
- Phosphine will also **combust spontaneously at temperatures above 100 °C** and at reduced pressures.



# EXPOSURE PERIODS AND DOSAGE



## EXPOSURE PERIODS AND DOSAGE

- Phosphine is **most effective** as a fumigant when used **at low concentrations over long periods**.
- The exposure period **is affected by temperature**.
- The **minimum temperature** for the use of phosphine is **about 15 °C**.
- **At temperatures below 20 °C**, long exposure periods of **up to 16 days** are recommended.
- Even in **tropical countries** where there are high ambient temperatures, exposure periods of less than **5 days should not be used**.
- There is no maximum exposure period, and if fumigations **can be extended to at least 7 days** then the chances of failure are reduced.
- For commodities held **under gas-proof sheets**, the recommended dosage of gas is **normally 2–3 g/tonne**.
- When fumigating with typical 3 g aluminium phosphide tablets, each tablet releases 1 g of gas. So normally there would be two or three tablets for each tonne of commodity.
- It is also possible to calculate dosage by **the volume to be treated rather** than the weight of commodity.
- Normally, there should be **1.5–3 g of phosphine for each cubic metre**.



# MEASURING PHOSPHINE CONCENTRATIONS

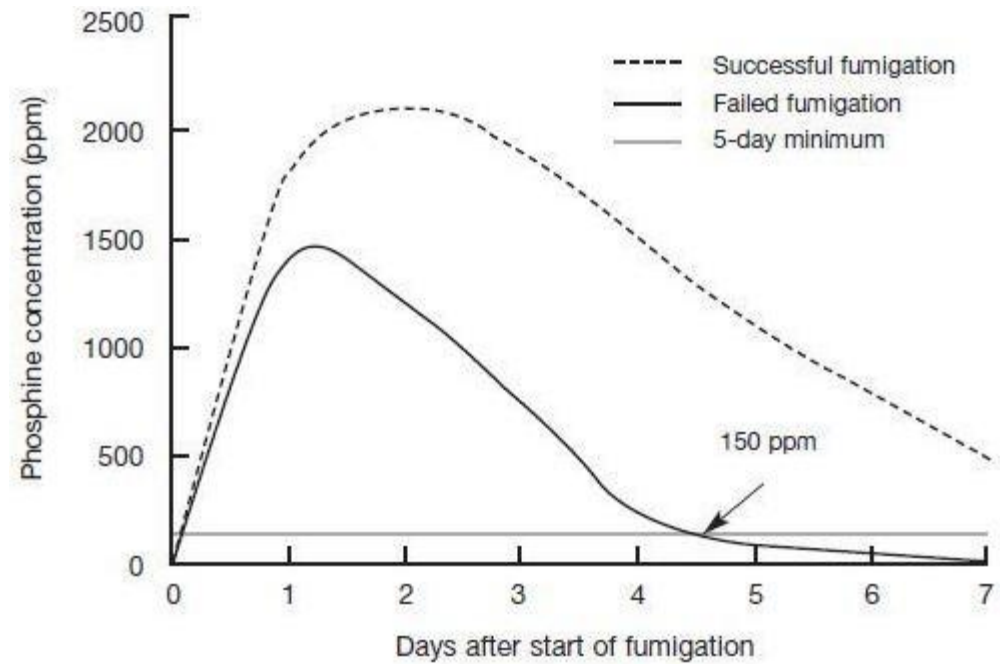


Figure 13.6 Phosphine gas concentrations recorded during a fumigation of grain at 30 °C (concentration fell below 150 ppm by day 5 in the failed fumigation)



## PHOSPHINE TOXICITY AND POISONING

- Depending on the degree of exposure, the symptoms of phosphine poisoning in humans may be delayed or occur immediately.
- Slight poisoning can result in fatigue, ringing in the ears, nausea, etc., and such symptoms may disappear on contact with fresh air.
- More severe poisoning may cause .....
  - vomiting, diarrhoea and difficulty with breathing, so artificial respiration may be needed.
- Severe poisoning may result in a bluish-purple skin colour leading to unconsciousness and death.
- After the removal of affected persons to fresh air, expert medical advice must be sought immediately.

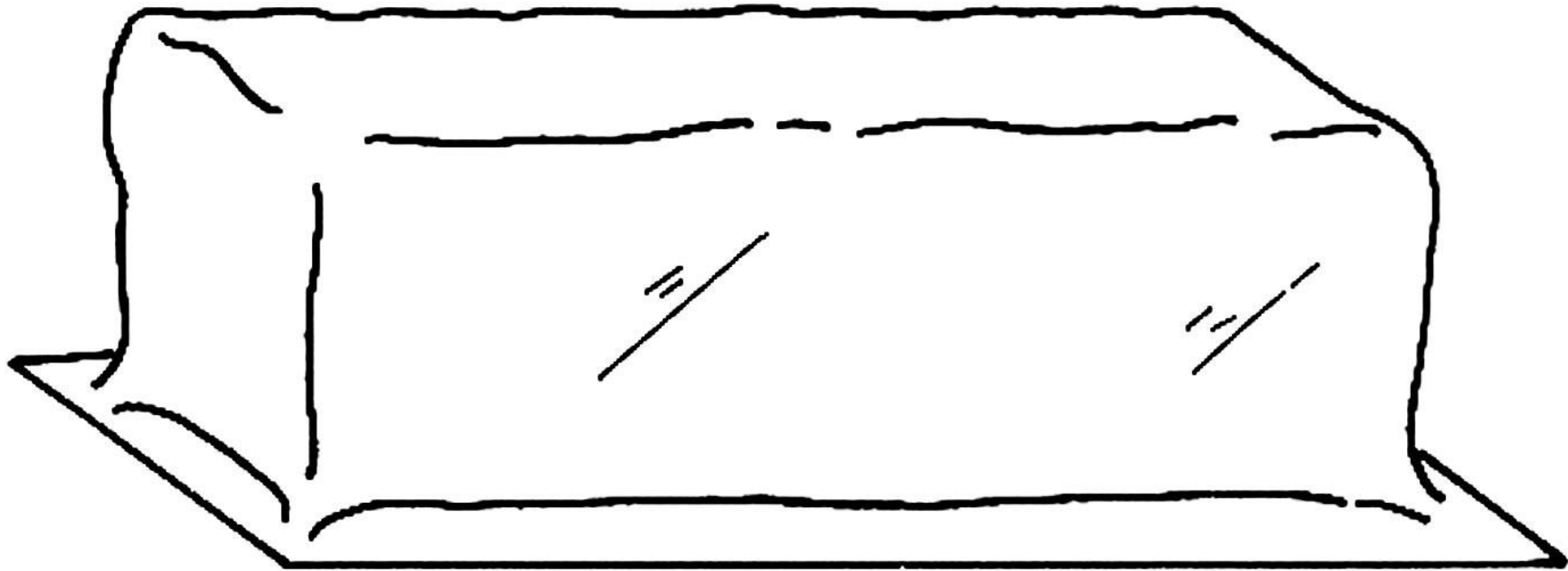


# CRITERIA FOR A SUCCESSFUL PHOSPHINE FUMIGATION

- For a successful phosphine fumigation, the gas concentration must not fall below a minimum value during the required exposure period.
- In a 5-day treatment it must not fall below 150 ppm before the end of the fifth day (Figure 13.6), or
- In a 7-day treatment not below 100 ppm before the end of the seventh day.







# QUESTION

