

## Integrated Pest Management of Stored Grain Pests

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### Introduction

Postharvest losses in India are caused by the unscientific storage, insects, rodents, micro-organisms etc. They account for about 20 % or more losses of total food grains in the developing countries. The major economic loss caused by grain infesting insects is not always the actual material they consume, but also the amount contaminated by them and their excreta which make food unfit for human consumption. About 500 species of insects have been associated with stored grain products and nearly 100 species of insect pests of stored products cause economic losses. Majority of stored grain pests belong to 2 orders, i.e., Coleoptera and Lepidoptera. Certain control measures to be adopted for the management of these stored grain insect pests. The control methods of stored grain pests can be categorized into preventive and curative measures.



### Preventive measures

- Brush the cracks, crevices and corners to remove all debris in the godown.
- Clean and maintain the threshing floor and yard free from insect infection and away from the vicinity of villages.
- Machines like harvester and thresher should be cleaned before their use.

- Clean the godowns/storage structures before storing the newly harvested crop to eliminate various bio stages of pest hiding.
- In order to prevent entry of rats, provide a metal sheet upto a height of 25 cm at the bottom of the wood in doors.
- Fix up wire meshes to windows, ventilators, gutters, drains etc., to prevent entry of rats, birds and squirrels.
- Remove dirt, rubbish, sweepings and webbings etc. from the stores.
- Close all the rat burrows found in godown with a mixture of broken glass pieces and mud plastered with mud/cement.
- Plaster the cracks, crevices, holes found on walls, and floors with mud or cement before storing of grains.
- Provide dunnage leaving gangway or alleyway of 0.75 to 1 m all around to maintain good storage condition.
- Rat and moisture proof storage structures must be used for safe grain storage.
- Storage structures must be sprayed with Malathion 50 EC with dilution of 1:100 and applied @3 litres/100sq. metres.

### **Curative measures**

#### **i) Ecological methods:**

- Manipulate the ecological factors like temperature, moisture content and oxygen through design and construction of storage structures/godowns and storage to create ecological conditions unfavourable for attack by insects.
- Temperature above 42°C and below 15°C retards reproduction and development of insect while prolonged temperature above 45° C and below 10° C may kill the insects. Dry the produce to have moisture content below 10% to prevent the buildup of pests.
- Kill the pests bio stages harboured in the storage bags, bins etc., light by drying in the sun.
- Store the grains at around 10% moisture content to escape from the insect attack. Manipulate and reduce oxygen level by 1% to increase the CO<sub>2</sub> level automatically, which will be lethal to all the stages of insects.

**ii) Physical methods:**

- Modify the storage atmosphere to generate low oxygen 2.4% and to develop high carbon dioxide (9.0 - 9.5) by adding CO<sub>2</sub>, to control the insects.
- Provide a super heating system by infrared heaters in the floor mills and food processing plants to obtain effective control of pests since mostly the stored produce insects die at 55-60°C in 10-20 minutes.
- Mix 1 kg activated kaolin for every 100 kg of grain and store.
- To protect the pulse grains, mix activated kaolin at the above dosage or any one of the edible oils at 1 kg for every 100 kg of grain or mix 1 kg of neem seed kernel for every 100 kg of cereals/ pulses and store.
- Mix 1 kg of activated kaolin or malathion 5D for every 100 kg of seed and store/pack in gunny or polythene lined bags.
- Synthetic insecticides should not be mixed with grains meant for consumption.

**iii) Cultural methods:**

- Split and store pulses to escape from the attack by pulse beetle since it prefers to attack whole pulses and not split ones.
- Store the food grains in air tight sealed structures to prevent the infestation by insects.

**iv) Mechanical methods:**

- Sieve and remove all broken grains to eliminate the condition which favour storage pests.
- Stitch all torn out bags before filling the grains.

**v) Biological control method:**

- It includes use of microbes and predatory insects to control stored grain pests.
- Some beneficial insects such as hymenopterans parasites are attacking and killing weevils, lesser grain borer, Angoumois grain beetle, sawtoothed grain beetle, and grain moths.
- Egg parasitoids like *Trichogramma spp.* are used to control lepidopteran, coleopteran and dipteran pests.
- Larval and pupal parasitoids like *Dinarmus spp.* are used for control of *Bruchus spp.*

**vi) Use of Botanicals**

- Botanicals deter feeding and oviposition of insects on plants, repel insects and cause disruption in physiology and behaviour of insects in various ways.

#### vii) Chemical methods

##### a) Treatment by Insecticides

- Treat the walls, dunnage materials and ceilings of empty godowns with malathion 50 EC in ratio of 1:100 with water @ 3 L/100 sq. metres for flying insects @ 1 L/ cu. metres.
- Treat the alleyways and gangways with malathion 50 EC @10 ml/L or DDVP 76 WSC @ 7 ml/ L(1 L of spray fluid/270 m<sup>3</sup>).
- Spray malathion 50 EC @ 10 ml/ L with 3L of spray fluid/ 100 m<sup>2</sup> over the bags.
- Do not spray the insecticides directly on food grains.
- Use knock down chemicals like fumigant strips pyrethrum spray to kill the flying insects and insects on surfaces, cracks and crevices.
- Use seed protectants like pyrethrum dust, carbaryl dust to mix with grains meant for seed purposes only.
- Decide the need for shed fumigation based on the intensity of infestation.
- Check the black polythene sheets or rubberized aluminium covers for holes and get them ready for fumigation.

##### b) Fumigation:

- Use fumigants like ethylene dibromide (EDB), ethylene dichloride carbon tetra chloride (EDCT), aluminium phosphide to control stored product grain pests effectively. Apply aluminium phosphide (available in 0.6 g and 3 grams tablets) @ 3 tablets (3 gram each) per tonne of food grains lot with help of an applicator. 3 tablets of aluminum phosphide 3 g each per tonne of grain. 21 tablets of aluminium phosphide 3 g each for 28 cubic meters. Period of fumigation is 5 days.
- Mix clay or red earth with water and make it into a paste form and keep it ready for plastering all around the fumigation cover.
- Place the required number of aluminium phosphide tablets in between the bags in different layers. Cover the bags immediately with fumigation cover. Plaster the edges of cover all around with wet red earth or clay plaster.

- Keep the bags for a period of 5-7 days under fumigation. Remove the mud plaster after specified fumigation periods and lift cover in the corner thus allowing the residual gas to escape. Lift the cover after few hours to allow aeration.
- Use EDB ampoules (available in different sizes of 11 ml and 22 ml. 11 ml/q for wheat and pulses but 15 ml/q for rice and paddy. Do not recommend EDB for fumigation of flour, oil seeds and moist grains.
- Use EDCT available in tin containers of 500 ml, 1L and 5L. For large scale storage, dosage is 30-40 L /100 cubic metres and 55 ml/quintal dosage for small scale storage.



### Conclusion

The severity of problems related to storage losses is very high in India due to lack of proper storage structures and integrated approach of insect pest management in these stored grain pests. Therefore, an integrated approach is required to be applied for effective control of these stored grain pests in godowns and other storage structures rather than adopting and applying an individual method approach.