

MANAGEMENT OF STORAGE PESTS

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Introduction

Grains under storage are damaged by storage pests such as insects, rodents, fungi and birds which cause both quantitative and qualitative losses in oilseeds.

Storage insect pests are classified in to two groups: 1. Major / Primary pests 2. Minor / secondary pests

Major pests: These pests can break the kernal and make them powder. They can cause huge damage and storage loss. They also contaminate the grains.

Minor pests: These pests cannot break the kernal. They feed on broken kernals and milled products. They contaminate the oil seeds and milled products.

During storage of grains and other agricultural commodities, considerable quantitative and qualitative losses are caused by the storage insect pests. At high moisture, their growth and multiplication is very fast. The optimum conditions of temperature and relative humidity for the rapid growth and multiplication of storage insect pests range from 25 to 35 °C and 60 to 65% respectively.

Management of Storage pests

1. Prophylactic measures:

"Prevention is better than cure". Hence the following preventive measures can be undertaken at storage places in order reduce the pest incidence

- i. Proper inspection and analysis of stocks received before acceptance
- ii. Hygiene or sanitation inside and outside the godowns
- iii. Aeration of godowns
- iv. Prophylactic spraying with insecticides

1.1. Proper inspection and analysis of stocks received before acceptance for storage

When the stocks are received at storage point or whichever the oilseeds that are going to be stored have to be thoroughly inspected before start storage of those commodities. Representative sample has to be taken and it has to be analysed for moisture content and presence of insects. The commodities beyond safe storage moisture content will deteriorate

quickly and prone to insect and mould attacks. Before accepting the food grain stocks, the godowns shall be inspected to check hygiene, cleanliness, storage worthiness and the godown is pest free.

Sampling	Random samples shall be drawn from the food grain bags with the help of <i>parkhi</i> on all sides of the lot received through wagon/truck
Visual Inspection	Visual Inspection shall be done at the time of receipt of food grains to ascertain the following points <ol style="list-style-type: none">Food grains shall be inspected for identifying damage, infestation, slack bags and cut & torn bags.Unsound bags shall be segregated and kept separately, duly identified and recorded.
Inspection process	<ol style="list-style-type: none">For food grains further inspection shall be carried out by testing the grains moisture followed by analysis, classification, categorization / grading. The maximum moisture percentage for safe storage of rice and paddy is be 14% and for wheat is 12%.If the food grains are found within the prescribed quality specifications the same shall be accepted for storage.In case of storage of FCI stocks, receipt of food grains with quality complaint shall be informed to the depositor or consignor in writing within 72 hours detailing the complete quality issueThe infested stocks shall be fumigated within 48 hrs hours to avoid cross infestation to pest free stocks

1.2. Hygiene or sanitation inside and outside the godowns

1.2.1. Sanitation inside the godowns

- Necessary repairs like arresting roof and cable wall leakage, replacement of damaged sheets, securing windows and ventilators with wire mesh shall be done to make the godowns storage worthy.
- Before storage of commodities inside the godown ensure that the godown is well cleaned. Godowns shall be cleaned thoroughly to avoid any residual infestation

- Empty godown shall be kept clean & tidy free from any harbouring insects, cobwebs, spiders and other pests
- Floor sweeping has to be done on regular basis and spillages has to be collected on day-to-day basis, cleaned and bagged to mother stack.
- Wall cleaning has to be done. No cracks and crevices should be there in wall to avoid harboring of pests.
- Cob webs removal has to be done regularly to improve the hygiene condition inside the godown
- Disposal of waste / damaged grains has to be done timely to avoid further deterioration and pest multiplication.
- Sacks / gunnies used shall be sound enough. The cut and torn portions has to be stitched and closed.
- Ventilators & windows secured with wire mesh to prevent the escape of insects during prophylactic spraying with insecticides
- Roof leakages and cable wall leakages have to be arrested immediately to avoid entry of rain water. The rain water can soak the grains leading to sprouting or decrease in bulk density of grains makes it unsuitable for storage.
- Proper Stacking is very much required to take up spraying and fumigation operations inside the godown.
- Sufficient gap should be given from the walls, stack to stack, Passage etc.
- Material should not be stored on the floor
- Proper Dunnage - timber pallets/Poly pallets/ or Bamboo mats or black polythene sheets can be used.
- Goods of different classes or grades or quality have to be stored separately and arranged in such a way that stock taking and verification becomes easy and effective.

1.2.2. Sanitation outside the godowns

- Clean platform – The platforms where loading and unloading operations happens has to be clean without any spillages. If there are spillages will attract storage insects and rodents and will result in damage of grains and pest multiplication.
- No steps should be kept in the platform for having entry to godowns. Keeping the steps will make the platform not rodent free. The rodents will have easy access and movement into the godowns.

- Clean roads – Keeping the roads inside the warehouse premises is an important measure to avoid harborage of pests and also for easy movement of trucks.
- Dumping wastes – No waste has to be thrown here and there in the warehouse premises. The wastes and damaged grains have to be disposed of safely by following laid down procedures.
- Vegetation free – The warehouse premises should not be occupied by green vegetation. Vegetative growth should be removed at periodical intervals to keep the depot premises free from insect breeding, reptiles, bird nests, rat burrows and to ensure overall hygienic condition. One can do away the control of vegetation by spray of Glyphosate SL.
- The vegetation like small trees that are growing on the top roof and side wall of godowns / building shall be periodically removed to avoid damage to the structures.
- No spillage should be on roads and platforms to avoid attraction of insects and rodents.
- Proper drainage system should be in place to avoid flooding of godowns and damage of stocks during rainy season.

1.3. Aeration:

Aeration is a process of passing air through stored grain at low flow rates. This can be achieved by keep opening the windows and ventilators and also all doors / shutters open during the day time. Aeration helps in excess moisture removal, temperature reduction inside the godowns, for quality maintenance in the commodities and highly useful when moisture content is high.

1.3.1. Objectives of aeration:

- Removal of generated heat and moisture inside the godown
- Maintenance of uniform condition inside the godown
- Removing/ reducing odour from grains which have higher moisture
- Removing dry heat generated by respiration of insects and grains
- Reduce moisture accumulation
- Helps in fumigant application

1.3.2. Aeration inside the warehouse / godowns

- Doors installed opposite to alleyways each other and has to be opened daily to ensure movement of air inside the godown
- 6% of wall space for ventilators should be provided while constructing the godowns for proper ventilation
- Doors shall be kept open during day
- Movement of natural air shall be ensured

1.3.3. Benefits of Aeration

- Reduces insect pest population in the godowns with food grains
- Grain quality is preserved
- There will be moisture reduction
- Temperature reduction can be realized
- Reduces the mould attack in food grains
- Colour and aroma can be maintained in spices by proper aeration.

1.4. Prophylactic spraying with insecticides

- Immediately on receipt of stocks spraying with malathion 50% EC can be done
- Prophylactic spraying can be repeated once in two weeks
- Air-charging inside the warehouse is done with DDVP 76% EC. However the insecticide DDVP will not be in Indian markets after 31st Dec 2020 as it will be banned.
- Prophylactic spraying helps to control flying / crawling insects
- Generally prophylactic spraying is done during the later part of the day preferably evening and in the week ends for more efficacy
- Before spraying godown should be cleaned and spillage collected and covered to avoid contamination by insecticides.

1.4.1. Effect of spraying sub lethal doses:

Sufficient care has to be taken to go with correct and required dosage of chemical while undertaking prophylactic spraying. Undertaking spraying operation with sub lethal dosage of insecticides is always harmful and results in

- Development of resistance to insecticides in insects
- Sudden increase in insect population

- Difficult to control the insects that got resistance
- Damages the commodities
- Storage loss will be high
- Public problems will come due to high population of insect pests inside the godown.

1.4.2. Procedure for undertaking prophylactic spraying inside the godowns:

Need identification	<p>Spraying shall be on the basis of requirement fortnightly prophylactic treatment</p> <p>i) air-charging of empty godown space before storage of food grains</p> <p>ii) post fumigation spray</p>
Preparation for spraying	<p>i) Identification of area / volume to be sprayed</p> <p>ii) Calculation of correct dosage of required pesticide</p> <p>iii) ensure availability of good spraying equipment (Knapsack/foot sprayer/power sprayer)</p> <p>iv) Prepare the pesticides with correct volume of water and ensure that the pesticide is mixed properly with water</p> <p>v) Sprayer should be of good one without any leakage and clear nozzle for effective spraying.</p> <p>vi) While using wettable powder formulation, uniform mixing shall be done to avoid accumulation of powder at the bottom of sprayer. This will lead to inefficient spray, patches on the bags and walls and is likely to induce resistance in insects.</p>
Spraying process	<p>i) Spraying shall be carried out by using appropriate pesticide as per the CIBRC recommendation with correct dosage. Uniform spraying shall be done.</p> <p>ii) Light and gentle spraying shall be done on bags without drenching which will lead to moisture increase in the food grains.</p> <p>iii) Spraying shall be resorted to evening.</p> <p>iv) For effective air-charging, the windows and ventilators shall be secured with wire mesh permanently.</p> <p>v) After spraying/air-charging, godown doors/shutters shall be closed for 24 hours. In order to achieve this spraying shall be</p>

	given regularly during week end so that transactions in the godown will not be affected.
Calculation of insecticide	<p>Deltamethrin 2.5% WP</p> <p>Frequency: once in 3 months</p> <p>Dilution: 120 g in 3 litre of water</p> <p>Dosage: 3 Litres/100 sq.m. for surface treatment on bags containing stocks, wall and alleways.</p>
Preparation for spraying	<p>i) Before undertaking spraying the area for treatment shall be swept, cleaned and spillage shall be collected to avoid contamination with insecticides.</p> <p>ii) The nozzle and delivery pipe of spraying machine should be checked for blockage and leakage.</p> <p>iii) Spray solution shall be prepared by mixing correct dosage of insecticide in required quantity of clean water</p>
Spraying process	Spraying shall be carried out by the experienced personal by using good sprayer preferably in the evening.
Post spraying activity	<p>The exit door shall be closed and sealed after spraying.</p> <p>ii) Excess/unused pesticide solution shall be used outside on platform/verandah or tree barks</p> <p>iii) The delivery pipe, tank, nozzle etc. has to be cleaned with running clean water</p>

1.4.5. Precautions to be taken:

- Personal protective equipment (PPE) like hand gloves, eye-shield, gum boots and nose mask should be used during handling and spraying of pesticides.
- Before spraying, the sprayer and its nozzle shall be checked thoroughly. Nozzle and lance should not be blown with mouth.
- Spraying should not be done alone
- Spraying against the direction of wind should not be done
- While spraying movement shall be backwards to avoid body contact with treated area
- Eating, chewing, drinking or smoking should be avoided while spraying
- Along with personal protective equipment, the person spraying should wear aprons.

- After spraying, hands and other parts of the body should be thoroughly washed with soap & water
- The empty pesticide containers should be crushed and disposed of as per insecticide act, 1968.
- Godowns should be kept open for few hours before entry so that accumulated chemical fumes are diffused out
- In case of giddiness/headache, the affected person shall be taken out in fresh air and shown to a physician if required.

2. Curative Measures

This is being done with using Aluminium phosphide 56% Tablets

Work Procedure:

	Activity	Description
2.1	Calculation of Aluminium phosphide Tablet	For cover fumigation – 9 g/MT (3 tab/MT) For shed fumigation – 360 to 420g /100 m ³
2.2	Exposure period	7 days for all storage pest 10 days for <i>Leamophloeus</i> sp.
2.3	Fumigation process	<p>a) Cover fumigation</p> <p>i) Take the required quantity of Aluminium phosphide tablets as per the dosage mentioned above.</p> <p>ii) Install monitoring tubes on top back, middle and front side of the stack and fold and clip the edges at bottom.</p> <p>iii) Distribute the pre-calculated dosage in 6 to 8 enamelled/paper plates of at least 9” diameter spreading the tablets in single layer and keep them at different locations including beneath the crates, sides & top of stack. 3 – 4 tablets can be kept in between the bags using paper bag/cloth bag.</p> <p>iv) Spread the fumigation cover on the top of stack and then cover the stacks. Ensure that the cover is a sound one</p>

not torn or having holes.

v) Seal the fumigation cover on the floor level using sand snakes to prevent leakage of phosphine gas. The cover shall be secured in such a way it should be in tight with stocks. Loose cover or oozing shall be avoided.

vi) Check the gas leakage on all sides using phosphine gas leak check detector.

vii) Monitor the phosphine gas concentration regularly by attaching the tubes fixed before fumigation at top, middle and front side of the stack, using Phosphine gas monitor.

viii) For effective control the phosphine gas concentration shall not be less than 760 ppm/m³

b) Shed fumigation

i) Take the required quantity of Aluminium phosphide tablets as per the dosage mentioned above.

ii) Seal all the window panes, ventilators and doors except exit door.

iii) Distribute the tablets on a paper plate and keep it at different places uniformly on the stacks

iv) After placing tablets, ensure that no one is present inside the shed. They come out and close the exit door and seal it.

- 2.4 Post fumigation operations
- i) Remove the cover after completion of exposure period and fold it properly
 - ii) Take representative sample from the stack and check for live insect, if any in order to ensure the fumigation is effective.
 - iii) Brush the bags thoroughly and clean the godown to remove dead insects and residual powder within 2 days.
 - iv) Spray with malathion at recommended dosage as post fumigation spray.

2.5 Precautions:-

- Personal protective equipment (PPE) like hand gloves, eye-shield, gum boots, face mask with canister etc., should be used during handling and application of fumigants.
- Check the fumigation covers for cut, holes etc., and resort to repairing, if needed before putting on the stack
- Leave the site of fumigation as soon as the process is over
- Display 'DANGER' symbols on the fumigated stack and exit door of the shed.
- Entire operation of fumigation should be carried out in the presence of technical in-charge and supervision of accredited fumigation operator under NSPM 22
- Fumigation should not be done alone
- Eating, chewing, drinking or smoking should be avoided during application of fumigants and while de-gassing
- The empty pesticide containers should be crushed and disposed as per I.A 1986 existing guidelines
- Godowns should be kept open for few hours before entry so that accumulated chemical fumes are diffused out
- In case of giddiness/headache etc., the affected person shall be taken out in fresh air given first and shown to a physician if required.
- In case of gas leakage indicated by characteristic smell, strengthen the sealing.
- Roof leakage should be avoided by appropriate sealing of leakage points there in the godowns where fumigation with Aluminium phosphide is undertaken.
- Always keep the firefighting equipment ready as the gas is inflammable during the process of fumigation.
- The fumigant should not be handled with empty hands.