Advanced of Stored Products Insects- 2024- Lec. 9- Master grad-

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Control Strategies

Chemical control:

Using chemicals is the most effective method of pest control in storage when immediate effect is needed. Chemical controls Among the existing methods of combating store grain pests.

Pesticides are any substance or mixture of substances intended for preventing, destroying or repelling any pest. "Pesticide" includes fungicides, insecticides, rodenticides, or any other substance used to control pests.

In respect to insect pests, chemical pesticides use various insecticides and fumigants.

A-Fumigants

Fumigants. are those chemical pesticides that by themselves or in combination with other substances become a gas or a mixture of gases in which a required temperature and pressure can exist in the gaseous state in sufficient concentration to be lethal to the storage pests because the gas can reach the pests in the most remote hiding place.

Fumigants kill or control pests and also are toxic to humans. Fumigants penetrate cracks, crevices, and the commodity being treated. They must reach the target pests as gases to be effective. Infestation can occur as soon as a fumigant diffuses from the target area. Fumigants must be applied in enclosed areas; the gas released must reach a lethal concentration in all parts of the infested storage environment and the concentration must be held for a minimum amount of time to be effective.

The fumigant is a gas or vapor which is taken into the body of insect through its respiratory system. After the exhaustion of oxygen and when the tracheal system is saturated with carbon dioxide, the insect would be forced to open the spiracles and allow the fumigants to enter the tracheal system. Then the fumigants diffuse further till they reach the whole body of the insect through hemolymph and paralyze the insect.

The range of safe fumigant chemicals that can be used is now restricted to phosphine and carbon dioxide.

1- **Phosphine fumigation**: is undertaken using tablets and pellets. These tablets and pellets release phosphine gas when they come into contact with humid air. Phosphine is toxic to all insects. When insects are exposed to fumigation in a sealed environment all stages of development from the eggs, larvae, pupae to adults are killed. Phosphine does not impair the grain nor leave residues that could be hazardous to the consumer when correctly applied and the grain aerated. Care must be taken when using phosphine as a gas as it is toxic to humans. Fumigation must take place in an enclosure that can be tightly sealed. Once the exposure time is ended, the grain must be aerated and the bin checked for residual phosphine gas before entry.

2-Carbon dioxide fumigation Insects need oxygen for respiration. With carbon dioxide fumigation, much of the oxygen in the storage bin is replaced by carbon dioxide that suffocates, dehydrates and also produces toxic chemicals in the blood of the insects. To be effective, elevated carbon dioxide levels must be maintained until all insects die. The required exposure time depends on the percentage of carbon dioxide and the temperature of the grain.

- Besides the ones mentioned above, some other most commonly used fumigants are ethylene dichloride, ethylene oxide, methyl bromide, chloropricrin, trichloroethylene, sulfur dioxide and trichloroacetonitrate.

Advantages

1- Toxic to many pests. Quick acting.

2- Can be applied by various methods. Only for infested commodities such as stored grain.

3- Some may be applied without disturbing the commodity.

4- Penetrate structures, commodities, and equipment.

5-Readily available and economical.

Disadvantages

1-Toxic to humans.

2-Require trained applicators.

3-Target area or commodity must be enclosed.

4-May injure seed germination.

5-Temperature requirements may be hard to meet, especially in northern climates

6- Control is temporary—no residual action.

7- May damage some commodities and/or equipment.

Several factors can change the efficiency of fumigants. Consider these when selecting a formulation and dosage.

1-**Temperature** The fumigant may not kill the pests if the product or space being fumigated is below 10˚C (50˚F) or above 46˚C (115˚F). The effect of temperature varies according to the specific fumigant being used.

2- Moisture As the moisture content of a commodity increases, it becomes more difficult for a fumigant to penetrate it. This makes fumigants less effective on insects.

3-Pests Susceptibility to fumigants depends on species, habitat and stage of development. During some stages of their life cycle, they are less susceptible than during others. Active insects are more susceptible than sluggish, diapausing forms.

4-Structure Consider the condition of the structure, the type of construction, and the product it contains. A wooden structure, even when sealed well, will not retain fumigants as well as metal, plastic, masonry, or concrete.

B-Contact Insecticide The insecticide is a poison that can penetrate the insect cuticle and enter the body tissue. Insecticides can be used on walls, floors, and ceilings as surface treatment or on jute sacks. This is usually aimed against flying insects but may kill the other insects crawling on the surface.

Malathion 50% E.C. at 0.5% or Pyrethrin 25% EC at 0.02% can be applied on bags but not directly on the grains. Also Deltamethrin 2.5% WP at 1.5g/L water can be used for dipping the bag.

Among the contact insecticides Malathion is a widely used chemical and is toxic to insects if it comes into direct contact with the pest. Malathion is considered one of the safest organophosphate insecticides as it is not highly toxic to humans or pets and breaks down fast under tropical conditions. Malathion will not penetrate piles of grain. Although it is not usually recommended, it is still legal to treat grain with Malathion at 8 parts per million concentrations. As a grain treatment, Malathion is applied at the time the grain is stored. Treated grain should not be sold for at least 10 days nor eaten within 60 days of treatment. Safety precautions must be observed when applying Malathion or any other chemical. If thorough cleaning of containers is not possible, the containers may need to be sealed and fumigated with phosphine. All second hand bags should be examined and where necessary treated with either a fumigant, insecticide or dipped in boiling water

Advantages;

Though Insecticides provide long-term protection against pests

Disadvantages;

1- Chemical residual remains on food substances.

2- Insect species might produce resistance against these chemicals.