Control of storage insect in maize by modified atmosphere methods

In Thailand, shelled maize is packed for storage in 100-kg jute bags. Stacks of jute bags are stored in the warehouse and kept uncovered for a certain period of time, exposing the maize grains to insect infestation.

Some important maize insects are: maize weevil, *Sitophilus zeamais* Motschulky; rice weevil, *Sitophilus oryzae* (L.); rust-red flour beetle; tropical warehouse moth, *Ephesia cautella* Walk; and *Tribolium castaneum* Herbst. These insect pests can cause heavy losses to stored maize.

To control insect infestation, two methods of modified atmosphere storage were developed. The first method involves removing the air from the sealed stack to immediately reduce oxygen concentration favorable to insect growth. The second method is removing the air from the sealed stack, then fumigating with CO$_2$ at the rate of 1 kg/MT.

**Modified Atmosphere Storage:**

- **Method 1**

  - Place bag stack on concrete floor (Fig. 1). Make each side of the stack as flat as possible. Volume of the stack is about 5-10 MT.
  - Cover the stack with a plastic sheet (Fig. 2). Carefully anchor the sheet to the concrete floor by using folded jute bags or sand snakes (folded jute bags or sand snakes should be placed in two rows overlapping each other) (Fig. 3).
  - Connect a flexible outlet tube to the vacuum machine and insert the other end of the tube into the bottom of the sealed stack (Fig. 4).
  - Remove the air from the sealed stack (Fig. 5). To do this, vacuum the air out of the sealed stack until the plastic sheet is fully stretched, and the vacuum pressure inside the pile has reached its maximum. Then, continue sucking the air out for another 15 minutes. Withdraw the tube carefully from the sealed stack, not allowing air to enter.
  - Keep the sealed stack for at least 10 days.

**Cooperating agency for this topic:**

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Modified Atmosphere Storage: Method 2

- Seal the stack and connect the vacuum machine to the stack (the same as in method 1)
- Place a CO₂ gas cylinder on the weight balance (to show how much gas is being used) next to the sealed stack.
- Connect a flexible tube to the cylinder and insert the other end into the bottom of the sealed stack.
- Remove the air from the sealed stack.
- Discharge the CO₂ into the sealed stack at a rate of 1 kg/MT (Fig. 6). Monitor the amount of discharged gas by checking the weight loss from the weight balance. Then, carefully withdraw the tube from the fumigated stack, not allowing the air to enter.
- Keep the sealed stack for at least 10 days or longer (Fig. 7).

Benefits from the Technology

The modified atmosphere storage can effectively control insect infestation. In highly infested grain, after keeping the sealed stack for 10 days, dead insects can be observed at the surface of the jute bags and on the floor around the stack (Fig. 8). However, the first method, which only removes the air from the sealed stack, may not completely kill the insects.

This technology is suitable for farmer groups and agriculture cooperatives that need to store their maize for a long period. The method is simple, low cost and safe.