

AERATION AND TEMPERATURE CONTROL

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Aeration system and Technology

- Seed aeration: process of moving air at ambient temperature through stored seed in order to control the temperature to the desired level.
- An aeration system includes a fan, an air supply duct, aeration ducts (or a perforated floor), and a controller.
- Aeration ducts are less expensive than perforated floor but course uneven distribution of air through the seed.

Aeration system and Technology...

- In small storage systems, aeration can be done by natural air circulation; allowing the wind to blow through the stored seed.
- In addition to temperature control, stored seed aeration also minimizes moisture migration within the grain bulk.

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Temperature of stored seed grains

- The temperature of the harvested grain establishes the initial temperatures of stored seed.
- These initial temperatures can be equal to or considerably higher than the atmospheric air temperature.
- In one case the temperature of freshly harvested seed was found to be 30°C when the atmospheric temperature averaged 23°C.
- Such high initial temperatures encourage rapid deterioration of the stored seed if cooling is not rapid. Changes in diurnal temperature affect seed temperatures in bins.

- Solar radiation incident on the bin wall causes its temperature to rise to a value much higher than that of the atmospheric air.
- Cases have been cited where when the atmospheric air temperature was 28°C, the temperatures of bin surfaces in contact with the stored seed varied from 37°C to 56°C,
- This varied depending on the material of construction and colour of the bin wall.

- Seasonal changes in atmospheric temperature cause changes in the temperature of stored seed.
- Weather conditions are in fact, the most important factors affecting storage seed temperatures.
- Changes in atmospheric air temperature and solar radiation have less effect on the temperatures near the centers of large bins than of small bins.
- However, heat in freshly harvested seed and heat generated in deteriorating seed are dissipated more rapidly from small bins than from large bins,
- This is because the distance from the centre of the bin to the wall is less in small bins than in large bins.

- As a result, temperatures will rise less above atmospheric air temperature and seed deterioration will be less in small bins than in large bins.
- Insulating a bin has a similar effect on the heat transfer in and out of the bin as increasing the bin size.
- Insulation reduces the temperature gradients throughout the seed bulk and therefore may reduce moisture migration within the bin.

- The rate of heat transfer into or out of seed stored in underground bins is slow and is similar to that in large bins and insulated bins,
- This is because soil is a good thermal insulator.
- If cold seed is stored in underground bins, it will normally remain at a low temperature if the soil temperature remains low.
- But in underground bins, as in large above-ground bins, heat in freshly harvested seed and heat generated in deteriorating seed is dissipated very slowly.
- Consequently, seed deterioration can occur very rapidly if the initial temperature of the seed is high or if the temperature of the seed begins to rise.

Moisture Migration

- Moisture may migrate from one part of the stored grain to another.
- migration is caused by differences in temperature in different parts of the bulk.
- Moisture in the vapor phase moves by diffusion along the vapor-pressure gradient caused by a temperature gradient in material of fairly uniform moisture content.
- Convection currents also contribute to moisture migration. When saturated air moves from a warm to a cooler region condensation of some water vapour occurs since the water carrying capacity of the air is reduced. The condensed water is absorbed by the grain in the cool region whose equilibrium relative humidity (water activity) thus increases. Deterioration may thus occur in stored grain even if it is stored at a safe and uniform moisture content. Diffusion is said to be the dominant mechanism of moisture transfer, assisted by convection currents.

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THANK YOU

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