

Feed Storage

Introduction

- A manufactured diet requires storage at least at the place of manufacture and on the farm
- Feeds are composed by perishable material which deteriorates with storage
- Therefore, it is always desirable to minimize storage time
- When feeds are stored for too long periods (or) under poor condition, serious problems arise.

- Losses occurring in feed stuffs during storage fall under 4 groups.
- Weight loss, quality loss, health risk, economics loss.
- These losses arise from cause of deterioration of feed during storage
 - Oxidative damage
 - Microbial damage
 - Insect/indent damage
 - Others chemical changes

Effects

- Oxidative damage: Oxidative rancidity
- Microbial damage
 - Reduced nutritional value
 - Non enzymatic browning
 - Poor flavour and appearance, making feeds lump and less palatable
 - Mycotoxins (*Aspergillus flavus*) (GNOC, cotton seed)

- Insect/indent damage: Produce heat and increasing moisture (for bacterial invasion)
- Others chemical changes: Chemical produced may reduce amino acid , vitamin availability

Losses and Deteriorative changes which occurs during feed storage

- Environmental factors, such as moisture, temperature, light, and oxygen influence deteriorative changes and losses in feedstuffs
- These affect the feedstuff either directly or by influencing the rate of development of insects and fungi, which consume the feed during storage

- The following are the major factors which affect the quality and weight of feedstuffs during storage:
 - Major losses due to human theft, fire and the consumption of scavenging animals such as rats and birds
 - Damage due to rain and condensation and to high temperatures
 - Damage by insects and damage by fungi
 - Changes in the quality of the feeds due to enzymatic actions and the development of oxidative rancidity

Physical loss

- Significant loss can occur as an accumulative effect of individually small, but regular theft.
- Less obvious are the losses caused by scavenging animals, particularly rats and mice
- Feed stores are flammable, particularly if they are constantly full of fine atmospheric dust from grinding processes within the store or adjacent areas.

Water and heat Damage

- High levels of moisture content and relative humidity cause direct losses by making it difficult to use the material in its original form.
- It may be too wet to mix if it is an ingredient, or its physical structure may be destroyed if, for example, it is in pelleted form
- Serious is the effect that high levels of product moisture and relative humidity have on insect infestation and the growth of fungi

- Generally, a safe moisture level for a specific product is that which develops at a relative humidity of 75 %.
- Cereals will store quite well at 10-12% moisture.
- Fungal growth increases moisture content also
- High temperatures also affect the rate of loss and damage in feeds
- Increase in temperature within large stacks of feed have been known to cause 'spontaneous combustion' followed by fire losses.
- Increase in temperature may reduce the availability of the amino acids in feeds

Insect Damage

- Feeds are attractive places for insects, including various species of moths, weevils and beetles, which consume the feed.
- All grow well at normal temperatures in feed stores.
- At temperature from 26-37°C, they can reach epidemic proportions.
- Insects cause damage through weight loss, the exposure of the feed to further damage by fungi and through oxidation and the introduction of contaminating bacteria

Fungal Damage

- Fungi grow at relative humidities above 65%, moisture contents generally above 15 % (although some mycotoxin producing fungi grow well at only 9-10 % moisture) and temperature which specific to the fungi species.
- Most fungal growth occurs at temperature above 25 °C and relative humidities above 85 %.
- Higher temperature and moisture levels favour increased growth.
- Fungal growth causes weight loss, increases in temperature and moisture, staleness (off-flavour), discolouration.

- Mycotoxins, the best known of which are called aflatoxins, are known to be toxic to some species of fish at least.
- Sorghum, maize and its by-products, groundnut, cottonseed, cassava, coconut and sunflower are ingredients especially prone to contamination with mycotoxins

Chemical changes during storage

The following deteriorative changes can occur in feeds during storage

- Lipids can break down into free fatty acids which make the feeds more prone to the development of rancidity.
- This breakdown can be caused by the damage resulting from insect infestation and fungal growth.
- High lipid ingredients are more susceptible to this type of chemical changes than others.

- Lipids undergo oxidation, causing rancidity.
- Materials with high levels of poly-unsaturated fatty acids and pure lipids are more prone to the development of rancidity than others.
- Fish meals, rice bran are particularly vulnerable.
- Grains have natural antioxidants which protect them from rapid deterioration
- Rancid fats reduce the palatability of the feed and contain toxic chemicals which may depress growth

- Vitamins potency decreases during storage particularly in premixes which also contain minerals
- Naturally occurring vitamin in feed-stuffs also deteriorates on storage.
- Vitamin C is particularly susceptible
- Good storage should give protection against high temperature, humidity, moisture, insect and rodents.
- Fresh fish should be used immediately or kept in frozen until use

Feed storage facilities

- Insulation
- Ventilation
- Storage hoppers and silos

Insulation

- Insulation is done to prevent heat or cold.
- Choice of materials for insulation should be with poor particle contact characters and poor condition
- Insulation materials should be waterproof and vapour proof

Ventilation

- Ventilation or air exchange should be provided to lower temperature and to control humidity

Storage Hoppers and Silos

- Bulk storage systems are widely used for storing dry aqua feeds, silages and binder meals. Silos used for storing dry feeds ranges and are typically prefabricated in galvanized steel in volume from 2-30m³. Silos used for storing silages are generally larger, upto 60m³.
- Silos are internally coated with acid resistant material in order to prevent corrosion.

Storage procedures

- Many problems can occur during feed storage
- Thus, ingredients should be stored for as short a period as possible and compounded feeds used quickly, especially in tropical conditions
- The method of storage depends on the type of ingredient

Vitamins

- Vitamins and vitamin mixes are extremely expensive ingredients and should be given special care
- Their volume is usually small because their inclusion rate is low, so storage space is not normally a limiting factors
- Vitamins should not be mixed with minerals before storage
- Vitamins and vitamin premixes should be kept either in the manufacturer's containers or in air-tight light-proof containers
- They should be kept in the coolest place available, preferably under air-conditioning
- Stocks should be turned over at least every six months

Moist and wet Ingredients and compounds

- These materials, such as ‘ trash fish’ must either be used fresh or they must be kept frozen
- The temperature of the cold store should not be higher than -20°C , preferably below -30°C .
- Moist compound feeds should be used on the day of manufacture within 2-3 hours

Dry compounded feeds

- Mixed feeds are more prone to damage than individual ingredients
- This is because of interactions between different ingredients and because of cross contamination with insects and fungi
- Mixed feeds which have undergone a heat treatment during production, such as steam pelleting, store better than other mixtures because many of the damaging factors will have been destroyed

- **Lipids:** Keep in sealed, preferably plastic, containers, in a cool dark place. Ensure that they have had antioxidants added to them when manufactured
- **Molasses:** No special care necessary in tropical countries but, in temperate zones, molasses may require heating in winter before this product can be used in a mixed feed