THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
February 2024 Vol.4(2), 711-716

Popular Article

Strategies for Effective Storage and Preservation of Feed Ingredients and Compound Feeds

Akash Rathod[1*] and Manish Kumawat[1]
PhD Scholar, Animal Nutrition Division
ICAR-National Dairy Research Institute, Karnal
https://doi.org/10.5281/zenodo.10680434

Abstract

This article discusses the critical importance of proper storage techniques in preserving the quality and value of feed ingredients and compound feeds. Separate storage facilities for raw materials and finished products are emphasized, along with the implementation of preventive measures such as cleaning, insecticide spraying, and fumigation to control infestations. Environmental factors like moisture, temperature, and oxygen levels are identified as significant contributors to deterioration during storage. Specific recommendations are provided for storing various feed ingredients, including vitamins, lipids, and molasses, to maintain their efficacy. Furthermore, the article highlights the challenges posed by physical damage, pests, and chemical changes, along with strategies for grain and silage storage to minimize losses. Overall, effective storage procedures are essential for ensuring the health and productivity of livestock by preserving feed quality and minimizing spoilage.

Keyword: Feed, quality, production, storage

1. Introduction

Proper storage is crucial for maintaining the quality and value of feed ingredients and compound feeds, as deterioration can occur if not handled correctly (Ebeneezar *et al.,* 2020). Separate storage facilities for raw materials and finished products are essential. Raw materials, often sourced from diverse places, may include food grains unfit for human consumption, increasing the risk of infestation. Preventive measures like cleaning, insecticide spraying, and fumigation can help control infestations. Careful storage of materials is necessary to minimize the risk of cross-contamination.

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 19.02.2024

Godowns are classified into following 3 categories:

Type of Godown	Capacity
Small sized godowns	less than 1000 MT
Medium sized	1000 MT - 5000 MT.
Large sized	Above 5000 MT

Raw materials and finished products are susceptible to deterioration from factors like high moisture content, rancidity, and mold or fungi growth. Immediate removal of damaged items from storage facilities can help prevent further deterioration of remaining stock. Certain raw materials, such as rice polish fine, rapeseed meal, and grains, are particularly prone to deterioration over extended storage periods. It's recommended not to store such materials in godowns or silos for more than a month, with a First In First Out (FIFO) system being advisable.

Raw materials with moisture levels exceeding 10 percent can result in dryage loss during storage, with longer storage durations leading to increased moisture loss. To offset moisture loss in filled finished product bags, additional feed should be included in each bag based on the season and duration of storage in the storage facilities (Garg *et al.,* 2013).

2. Losses and deteriorative changes which occur during feed storage

Environmental factors, such as moisture (both feed moisture content and relative humidity), temperature, light, and oxygen, are significant contributors to the deterioration and loss of feedstuffs during storage. These factors can directly impact the feed or accelerate the growth of insects and fungi, leading to spoilage.

Key factors influencing the quality and quantity of stored feedstuffs include:

- Losses from human theft, fire, and consumption by scavenging animals such as rats and birds.
- Damage caused by exposure to rain, condensation, and high temperatures.
- Infestation and damage by insects.
- Infestation and damage by fungi.
- Changes in feed quality due to enzymatic reactions and the onset of oxidative rancidity.

2.1. Physical loss

Loss due to theft can accumulate over time, even from seemingly minor incidents. Additionally, scavenging animals like rats and mice can cause less noticeable but still significant

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 19.02.2024

losses. Food storage areas often become breeding grounds for such pests.

2.2. Water and heat damage

Damage from water and heat can also lead to losses. High moisture content and relative humidity can make the material difficult to use in its original state. Cereals, for example, store well at moisture levels of 10-12%, but ideally, levels of 10% or less should be maintained. Fungal growth further increases moisture content. High temperatures accelerate the rate of loss and damage in feeds, especially in tropical regions where storage times should be shorter than in temperate areas. Elevated temperatures may result from environmental conditions, storage methods, or the heat generated by fungal and insect activity within feed stacks. Excessive heat can even cause spontaneous combustion and subsequent fire losses. Moreover, increased temperature can decrease the availability of amino acids in feeds.

2.3. Insect damage

Feeds serve as ideal habitats for insects, including moths, weevils, and beetles, which feed on the stored feed. These insects proliferate readily in typical temperatures found in feed storage facilities. At temperatures ranging from 26-37°C, their populations can quickly escalate. Ground materials provide a more favourable environment for insect growth compared to whole cereals or oil cakes, allowing these items to be stored for longer periods without infestation.

Insects cause damage by contributing to weight loss in the feed, exposing it to further deterioration by fungi and oxidation, and introducing contaminating bacteria.

2.4. Fungal Damage

Fungi grows in environments with relative humidity levels exceeding 65% and moisture contents typically above 15%, although certain fungi capable of producing mycotoxins can flourish with as little as 9-10% moisture. Specific temperatures conducive to fungal growth vary depending on the fungal species, but most growth occurs above 25°C, with relative humidity above 85%. Elevated temperatures and moisture levels encourage more rapid fungal proliferation. Fungal growth in feed results in various detrimental effects, including weight loss, increased temperature and moisture, development of stale or off-flavors, discoloration, and, notably, the production of mycotoxins. Ingredients like sorghum, maize and its derivatives, groundnut, cottonseed, cassava, coconut, and sunflower are particularly susceptible to mycotoxin contamination.

2.5. Chemical changes during storage

The chemical alterations observed during storage result from the increased activity of both

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 19.02.2024

endogenous and exogenous enzymes. These enzymes are responsible for causing quantitative and qualitative changes in the carbohydrates, proteins, and fats found in cereals. Additionally, they impact factors such as color, flavour, and texture.

2.5.1. Carbohydrate

In India, fluctuating temperature and humidity cause physical and biochemical changes in stored grains. Starch gelatinization and bursting occur, driven by moisture. Amylases break down starch into sugars, raising their levels. High moisture content in wheat increases sucrose, glucose, fructose, and raffinose. Additionally, high-moisture cereals emit a sour odor due to alcohol and acetic acid production.

2.5.2. Protein

High temperatures and chemical treatments in grain storage denature proteins, reducing their water dispersibility and degrading gluten quality. This process elevates free amino acid levels, leading to sulfur-containing amino acids that impart unpleasant odors. Free amino acids can also react with reducing sugars, causing browning. These changes occur at temperatures above 20°C and relative humidity between 60-70%.

2.5.3. Lipids

Lipid oxidation, especially of unsaturated fatty acids, leads to rancid flavor, odor, and taste. Hydrolysis of lipids increases free fatty acid levels, a sensitive indicator of grain deterioration (Garg *et al.*, 2013).

2.5.4. Micronutrient

Vitamin potency declines during storage and processing, especially in premixes with minerals. Natural vitamins in feedstuffs also degrade, notably vitamin C and thiamine (vitamin B1).

3. Considerations for storage procedures

Storage methods vary based on the type of ingredient. Here are some specific suggestions and general guidelines:

3.1. Vitamins:

- Store in manufacturer's containers or airtight, light-proof containers.
- Avoid mixing with minerals before storage.
- Keep in a cool, shaded area away from direct sunlight.
- Preferably store under air-conditioning.
- Rotate stocks at least every six months.

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 19.02.2024

3.2. Dry Compounded Feeds:

- Mixed feeds are more susceptible to damage than individual feed ingredient due to ingredient interactions and potential insect or fungal contamination.
- Heat-treated mixes, like steam-pelleted feeds, tend to store better.

3.3. Lipids:

- Store in sealed, preferably plastic, containers in a cool, dark place.
- Ensure antioxidants are added during manufacturing.

3.4. Molasses:

- In tropical climates, no special care needed.
- In temperate zones, heating may be required in winter before use in mixed feeds.

4. General Recommendations for animal feed storage

1. Store all feed and ingredients in cool temperatures, ideally below 77°F.
2. Keep feed dry to prevent fungal or bacterial growth.
3. Prevent entry of rodents or insects into feed.
4. Use antioxidants to preserve fats and oils in ingredients and feed.
5. Utilize stable forms of vitamins.
6. Ensure expiration dates are marked on containers:

- Canned food: follow expiration date on container.
- Prepared feeds: discard one week after experiment ends or 8 weeks post-mixing, whichever is shorter.
- Ground grain: discard one month after milling unless stabilized.
- Fats and oils: opened container - discard after one month, unopened or stabilized - discard after one-year post-mixing.
- Vitamin mixtures: discard after 6 months, unless stabilized with ethoxyquin, which extends shelf life up to one year. Vitamin C degrades more rapidly.
- Whole grain or seeds: discard after one year from harvest.
- Fat-free ingredients, protein meals, minerals: no specific expiration date, but maintain dryness and monitor for contaminants; note acquisition date.

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 19.02.2024

4.1. Grain storage and handling

- Grain-based rations typically comprise more than 80% cereal grains by dry matter, making infrastructure for grain handling, storage, and processing a primary focus of feed preparation facilities.
- Feedlots conducting on-site feed processing require bulk storage and grain handling facilities. Those utilizing commercially pre-mixed feed also need on-site bulk storage.
- Effective storage and handling of grains necessitate systems tailored to the specific characteristics of each grain type, whether whole, ground, or processed (Peter *et al.,* 2016)

4.2. Silage storage and management

- The process of making silage, as well as the design and management of storage, are vital to maintain the highest quality product and minimize losses during storage and feeding. Properly harvested and stored silage can retain its quality for an extended period. In situations where the local environment or feed processing equipment isn't suitable for silage production and handling, feedlots may opt to use hay instead.

Conclusions

Proper storage techniques are essential for maintaining the quality and value of feed ingredients and compound feeds. Separate facilities, preventive measures against infestation, and careful management of environmental factors are crucial. Effective storage procedures play a vital role in safeguarding livestock health and productivity by minimizing spoilage and preserving feed quality.

References:

Ebeneezar, Sanal, D. Linga Prabu, S. Chandrasekar, P. Sayooj, and P. Vijayagopal (2020). Storage and quality assessment of ingredients and formulated feeds. 10-16.

Garg, M. R., Sherasia P. L. and Bhanderi B. M. (2013). Quality control manual for cattle feed plants. https://www.dairyknowledge.in/section/part-01-quality-control-cattle-feed-plant

Peter, J. W., Rod, J. D., Orla, B. K., Mairead, M. L., Robyn, W. T., Ross, S. and Scott, J. (2016). FSA Consulting Stafford Adamson and Associates Thompson Longhorn Cattle & Livestock Stockyard Handling Beef cattle feedlots: design and construction. https://www.mla.com.au/globalassets/mla-corporate/research-and-development/documents/beef-cattle-feedlots---design-and-construction---web2.pdf