

A Comprehensive Approach to Animal Feed Quality

Executive Summary

Feed quality is a critical factor in livestock production because it affects nutritional value, animal performance, feed safety and overall production efficiency. However, feed quality is not determined only by the quality of the finished feed. It's influenced by multiple factors throughout the feed production and supply chain.

A feed quality issue can arise at any stage from initial journey of feed production to reaching it to the farm. Poor-quality raw materials, moisture exposure, mycotoxins, oxidation, microbial contamination, processing conditions and inadequate storage can affect the stability and nutritional value of feed. By the time an issue is identified in finished feed, the underlying cause may already have occurred earlier in the value chain.

This makes feed quality management a holistic approach than just quality testing. It requires a systematic approach that identifies potential risks, establishes appropriate controls and monitors quality throughout the production process.

This article focuses on how feed quality can affect across various stages of the feed value chain. Different key risks including moisture and mold growth, mycotoxins, oxidation, nutrient degradation, microbiological contamination, processing variability and poor storage or transport impact on feed quality.

This paper provides a stepwise framework for identifying, evaluating, controlling, protecting & monitoring feed quality. The paper also examines feed protection and nutrition solutions and their role in supporting animal health, productivity and farm performance.

The article concludes with Camlin Fine Sciences' technical approach to animal nutrition and its portfolio of solutions designed to support feed quality, protection, hygiene, nutritional efficiency and farm performance.

Introduction

Farm productivity highly depends on animal feed. The end products from animals, such as meat, eggs, and milk, depend on the animal's nutrition and health. Animal feed is a key source of essential nutrients for livestock, helping them to stay healthy and produce the best-quality end product. These nutrients include protein, fats, vitamins, minerals, fiber, and more.

A balanced feed formulation with stability, good physical quality and the right feed additives helps livestock build immunity, utilize nutrients, improve digestion, growth rates and even reproduction when practiced consistently. Feed quality determines how efficiently livestock utilizes feed to achieve desired high-quality outcomes, such as weight gain, improved milk production or egg production. Feed quality not only determines animal health but also input costs, farm productivity and potential human health associated with animal-based food products.

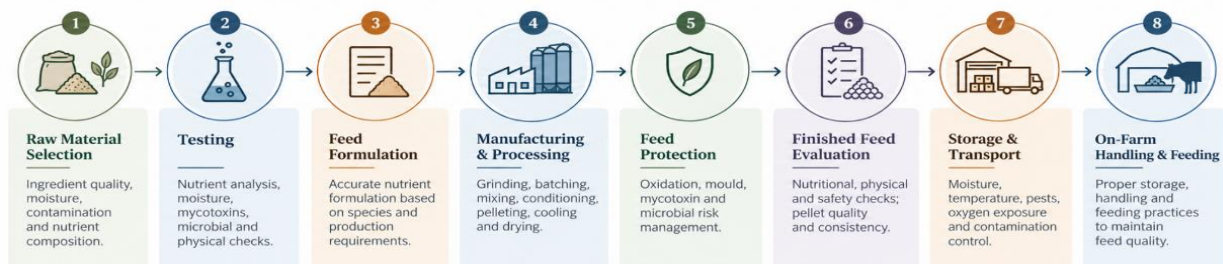
Delivering safe and nutritious animal feed requires attention at every step of production. The feed value chain consists of critical stages, from raw material sourcing to on-farm delivery. Managing the distinct quality and contamination risks within each phase is essential to ensuring optimal livestock performance and producer profitability.

Feed Quality Across the Value Chain

The production of high-quality animal feed involves 8 key steps, each with distinct challenges that determine overall feed efficiency.

- 1. Raw Materials:** Factors in raw materials, such as nutrient composition, physical condition, moisture content, microbial, mycotoxin risks and oxidative stability can affect feed quality and production outcomes.
- 2. Testing:** Contaminant screening and nutrient verification of raw materials is critical step before they enter production. As missed contaminants or inaccurate results compromise all downstream stages.
- 3. Formulation:** Nutritionists calculate ingredient quantities and develop a formulation tailored to livestock needs to provide essential nutrients at different growth stages.
- 4. Processing:** In this stage, the ingredients are cleaned, weighed and mixed according to the formulation. The Manufacturing process involves various steps includes receiving, cleaning, ingredient selection, batching, proportioning, grinding, mixing, conditioning, pelleting, cooling, drying (depending on the feed type), crumbling, screening, packaging, and labeling.
- 5. Protection:** At this stage, feed additives like antioxidants, liquid mold inhibitors and toxin binders are added to the feed to manage specific quality risks to prevent mold & microbial risk during storage.

6. **Finished feed:** The finished feed is checked again for nutrient composition, moisture, pellet quality, and potential contamination. This ensures the feed meets nutritional, safety, and physical quality standards before distribution.
7. **Storage & Transport:** During transportation and storage, there is a high risk of exposure to moisture, pest infestations, mold growth, and temperature fluctuations. Proper packaging, temperature management, and pest control help maintain quality during transport.
8. **Farm:** Proper feed handling and management help livestock receive safe, nutritious feed and support productivity.



Key Feed Quality Challenges

Feed quality can be compromised at any stage of production. The following risk categories represent the most common and consequential threats to feed safety, stability, and nutritional value.

Moisture and mold growth

Moisture levels above 12% and at temperatures above >25°C encourage mold growth, which consumes fats, protein, and carbohydrates. It also produces toxins that can affect animal health, reduce feed intake and farm productivity.

Mycotoxin contamination

These are toxins produced by mold, sometimes even without visible growth. Environmental factors, such as temperature, humidity and rainfall affect mycotoxin contamination. Regular exposure to these toxins can bring the risk of immunosuppression, organ toxicity and impaired fertility.

Oxidation of fats and oils

Unsaturated fatty acids in feed react with oxygen, degrade fat quality, reduce feed freshness, decrease nutritional value and cause a foul odor. Regular intake of oxidized feed can reduce palatability, animal performance and cause nutritional deficiencies.

Nutrient degradation

Excessive heat, moisture, oxygen exposure and prolonged storage can reduce the nutritional value of vitamins, amino acids and essential fatty acids even in high-quality raw materials. This influences the nutritional quality of feed and affects livestock growth, health, and productivity.

Microbiological contamination

Extended manufacturing timelines increase exposure to pathogens from environmental and process sources. These pathogens cause microbiological contamination, impact animal performance and feed intake and contribute to illness.

Processing and pellet quality

Inconsistent grinding, uneven mixing, incorrect moisture levels and improper conditioning can produce weak pellets, excessive fines, poor durability and uneven nutrient distribution.

Poor storage and transport conditions

Moisture, heat, pests, and oxygen exposure during storage and transport bring the risk of mold growth, nutrient loss, oxidation and cross-contamination. In addition, improper packaging and prolonged storage can also be reasons behind reduced feed quality.

These risks are often connected. For example, high moisture can create conditions for mold growth and increase the risk of mycotoxin contamination. Poor storage can also contribute to oxidation, nutrient loss and microbial contamination. This is why feed quality needs to be managed across the entire process, rather than treating each risk as a separate issue.

Integrated Feed Quality Management

Managing the risks above requires a systematic approach, one that identifies risk, controls the production process and protects feed from contamination and nutrient loss at every stage. The following six-step framework helps manage feed quality from production through storage and use.

Step	Focus
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Identify the quality risks	Identifying quality risks in livestock feed involves combining on-farm inspections, proper sampling, and accredited laboratory testing
Test the feed quality.	Use of reliable analytical methods for moisture %, mycotoxins, nutrients and harmful microorganisms to identify contamination and quality issues.
Prevent processing risks	Prevention of processing risks through strict quality control across raw materials, processing equipment, following the SOPs and maintaining storage protocols.
Moisture optimization, using mold inhibitors	Combine moisture optimization and the addition of evidence-based protective additives to maintain stability and safety and to avoid contamination.
Monitor hygiene and storage conditions.	Maintain feed mill sanitation and pest control and tracking humidity, temperature, ventilation during storage to avoid risk of contamination before it compounds
Review & improve	Use process data, test results and supplier performance to identify recurring issues and refine practice over time.

Feed protection & Animal Nutrition Solutions

The right feed solution depends on the ingredients, animal species, processing method and specific risks identified through testing. Here are a few animal nutrition solutions for the most common risks:

Solution Category	Function
Antioxidants	Slow oxidation process, supports fat stability and preserves the nutritional value, freshness, and shelf life of feed, premixes, fats, and oils.

Feed protection & feed mill sanitization.	Support hygiene and control microbial contamination in feed during manufacturing strictly in accordance with guidelines and safety requirements.
Mold Inhibitors	Control mold growth in formulations, support moisture optimization to protect feed stability during production, storage and transport.
Mycotoxin-management solutions	Reduce the impact of specific mycotoxins in contaminated feed by selecting the appropriate solution based on the type of contamination and feed composition.
Pellet Binders	Improve pellet strength and ingredient binding, reduce fines, and support feed handling and transportation while maintaining feed consistency.
Other nutritional solutions	Additional additives, such as enzymes, vitamins, minerals and other nutrients, help address specific nutritional requirements and ingredient limitations.

From Feed Quality to Farm Performance: How Feed Quality Supports Farm Performance

Animal feed is the foundation of overall animal performance. Although genetics, farm management, environment and animal health also influence results, feed quality plays an important role in how animals grow, stay healthy and produce.

Good-quality feed provides the nutrients to animals need for growth and production. Proper nutrition helps the animal maintain normal digestion, nutrient utilization and builds immunity. In addition, when animals get the required nutrition, it supports growth, milk production, egg production and reproductive performance. Therefore, maintaining feed quality improves animal performance and farm productivity.

Camlin Fine Science's technical approach

Camlin Fine Sciences applies a value-chain approach to animal nutrition, combining technical expertise, analysis facilities, Services and manufacturing capabilities to address

different feed quality and nutritional requirements across production, storage, transport, and farm-level use.

CFS evaluates customers' requirements with application laboratories and a collaborative development approach to recommend suitable solutions for specific feed, premix, aquafeed, pet food and more. Its testing and analysis capabilities support product evaluation, stability assessment and formulation optimization.

Its portfolio covers a range of solutions, including antioxidant protection through Xtendra®, feed mill sanitization through SalPlus Ultra P-50™, mycotoxin management through Glucosil®, Mycosil® and Topsil®, enzymes through Nutrinase®, Mold control through Novamold®, and liquid farm supplements through Vitafor®.

This broader approach reflects the need to address different risks at different stages of the feed-to-farm value chain, rather than relying on a single intervention.

Conclusion

Feed quality is a value-chain outcome, not a single-point measurement. Protecting it requires attention at every stage, from raw material selection and testing through formulation, processing, protection, storage, transport and on-farm handling.

A stage-specific approach allows feed producers and integrators to identify risks earlier, use appropriate testing and monitoring protocols and select protection solutions based on the specific quality risks involved. It also requires continuous monitoring of moisture, temperature, storage conditions, hygiene and supplier performance

Applied consistently, this approach can help reduce the risk of nutrient loss and contamination while supporting feed consistency, animal performance and the safety of the animal-based food production chain.

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