Quality Control In Feed Production

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Introduction

Quality control in feed production is of utmost importance in the overall success and profitability of animal enterprises. There is no other factor, directly or indirectly related to the proper nutrition and high performance of animals that is more critical than feed quality control and ration consistency. The degree of quality is the consistency in which feed is formulated, processed, mixed and delivered as compared to what is expected. Animals thrive on a routine and respond better if the feed is low in nutrient variation as offered to them; and is similar in moisture content, texture and rate of energy availability.

Quality has been defined as "any of the features that make something what it is" and "the degree of excellence which a thing possesses". Either definition may be acceptable if one recognizes that quality control means knowing the quantitative amounts of all components, good and bad, in a feed. Usually, quality is verified by comparison with a known standard. However, relative values of quality over time is extremely valuable and useful in many situations.

The relationship between feed quality and animal performance is important and encompasses not only the quantitative amounts of all feed components, but also the digestibility and metabolism of those components. Thus, the challenge for nutritionists and others involved in animal feed production is to consistently monitor all aspects of the feed production system being used and measure those variables that are good indicators of quality control. For the feed industry, a quality control system is the responsibility of management and involves personnel being properly trained to ensure a high level of organization, documentation, and the policing of various procedures and processes necessary to guarantee the basic quality of feedstuffs and feeds.

DETERMINING QUALITY OF INCOMING INGREDIENTS AND OUTGOING FEEDS

Quality control of incoming ingredients is crucial to predicting the quality of a complete feed, supplement, premix, etc. An important first step is accurate sampling and complete examination of the ingredient prior to unloading. Sampling and inspection procedures need to be in writing and kept in a Quality Control Procedures Manual.
The goal in sampling any lot of ingredients or finished feed is to obtain samples that are representative of the lot in question. A wrong answer -- which may arise from incorrect sampling, incorrect handling of samples, analytical error, etc -- is worse than no answer. Thus, it is our responsibility to know proper procedures and techniques for sampling to be sure that correct formulations can be made.

Below are some suggested sampling procedures for bulk ingredients and mixed feeds, bagged ingredients and mixed feeds, hays, and syrups and fats.

**BULK INGREDIENTS AND MIXED FEEDS**

- Take a minimum of three, five pound samples
- Each five pound sample should be the composite of several cores taken randomly from the delivery truck, bull storage bin or feed bunk, as applicable
- Duplicate determinations are recommended for all variables measured

**BAGGED INGREDIENTS AND MIXED FEEDS**

- Use slotted feed trier for sampling and take one pound samples
- For lots of one to ten bags, sample all bags
- For lots of eleven or more, sample ten bags
- Analyze a minimum of three samples and average the results

**HAYS**

- For chopped hay, take ten samples per lot
- For cubes, take forty cubes from a given population
- For bales, take one twelve to eighteen inch core from the end of forty bales in a given population

**SYRUPS AND FATS**

Use a continuous flour sampling procedure at the point of delivery, or a core liquidsampler

Establishment of a retention schedule is recommended for all ingredient and mixed feed samples.

Separate analytical analyses should be routinely performed on samples of the following for quality.

- Water
- Grains
- Roughages
- Silages
- Protein supplements
As a starting point for insuring quality in feedlot rations, all incoming feed ingredients should be quality checked for the following.

- Moisture
- Color
- Off odor
- Presence of foreign material
- Texture and uniformity
- Evidence of heating
- Deterioration due to biotoxins

More detailed analyses are performed on individual feed ingredients for the purpose of feed formulation, and sometimes before the purchasing of commodities if this information is not provided by the seller. Analyses that usually are considered to be routine for the different feed ingredients include:

- GRAINS - grade, moisture, protein, ash
- GRAIN BY-PRODUCTS - moisture, protein, ash
- DRY ROUGHAGES - moisture, protein, ash, acid detergent fiber
- SILAGES - moisture, pH, temperature, protein, ash
- PROTEIN SUPPLEMENTS - moisture, protein, ash, non protein nitrogen
- MINERAL MIXTURES - moisture, specific nutrients
- MOLASSES - moisture, ash
- FATS - moisture, free fatty acids, impurities, unsaponifiables

An overall evaluation of feed quality delivered can be derived by determining the variation in the four major areas that affect feed consistency. They are:

- Variation of incoming ingredients
- Variation in feed mixing efficiency
- Variation in efficiency of delivery of mixed feed from mixing point to the animals
- Variation in analytical procedures
USE OF CURRENT GOOD MANUFACTURING PRACTICES IN MAINTAINING QUALITY CONTROL

The management of a feedmill has an obligation to uphold Current Good Manufacturing Practices. The use and endorsement of appropriate and proper procedures and practices in the production of feeds does not cost the feed industry, they pay dividends. The feedmill manager is a key individual involved in the daily activities associated with the management of people, facilities and resources that ensure the procedures appropriate for the production of feed in his/her feedmill are enforced. The feedmill manager, as his/her supervisors and the people working under their direction, have an obligation to the animal food industry to maintain high quality standards in the production of feeds for animals -- to produce meat, milk, eggs, etc. for the consumer.

Good Manufacturing Practices (GMP's) were published by the Food and Drug Administration (FDA) in the November 30, 1976, Federal Register. Good Manufacturing Practices deal specifically with the manufacturing of any feed containing one or more drugs. If any feed obtains a drug, it is a medicated feed. The feedmill management should have written instructions that cover GMP's and quality assurance programs. Good Manufacturing Practices cover all areas involved in the production of feeds including personnel, facilities, feedstuffs, quality assurance checks, inventory control checks, processing methods, mixing procedures, finished feeds, and feed delivery. Although commercial feedmills that produce and sell a complete line of feeds to the general public have a somewhat greater task in assuring quality and prevention of cross contamination of drugs, the obligation and importance in all feedmills are still great. Outlines, checklists and procedures relevant to feedmill operations are presented below.

PERSONNEL TRAINING is essential and should be conducted periodically to assure compliance with procedures and insure quality of feed produced. These meetings usually are helpful in establishing and maintaining good morale and teamwork among employees.

THE FEEDMILL AND ADJACENT BUILDINGS must be of suitable construction to minimize access to rodents, birds, insects and other pests, and located in an area that will allow proper drainage. The building and grounds should be maintained as needed to assure a clean work place for employees and for the production of feeds. Litter, refuse, improperly stored equipment and supplies are hazards and should be removed. The building must also provide sufficient space for facilities and personnel to perform their job properly. Examples for the production of medicated feeds include:

1. Appropriate area for receiving and storing of ingredients and drugs
2. Adequate space for grain processing, etc.
3. Appropriate space for feed mixing
4. Reserved area for equipment maintenance
EQUIPMENT must meet safety standards and be properly installed. All scales and metering devices must be tested for accuracy upon installation and at least once per year thereafter. Equipment must be constructed and maintained to prevent lubricants and coolants from contaminating ingredients or feeds. Excessive spills, leaks and dust problems must be prevented.

INGREDIENTS should be systematically monitored for quality factors throughout the entire process of purchasing, receiving, sampling and handling. All ingredients should be inspected for any abnormality that may result in a quality risk when added to the feed, and representative samples taken for assays. During this handling of ingredients, care must be taken to prevent contamination.

DRUGS AND PREMIXES require special handling and record keeping. Records on drugs received must show the following information:
1. Name of drug, including potency
2. Date received
3. Amount in pounds
4. Supplier’s name
5. Supplier’s code for drug (if applicable)
6. Supplier’s lot or code number
7. Return of any damaged or unacceptable drugs

Other procedures that must be followed in the storage, handling and use of drugs include:

1. Check each drug for identification. Do not accept unless properly identified.
2. Keep all drugs and premixes stored in a neat and orderly manner for easy identification. It is preferable to store drugs in a separate room.
3. Each bag or drug container must be coded with the supplier or company code for that drug.
4. Packaged drugs in the storage area must be stored in their original closed containers.
5. Check bags for tears and any other abnormalities. Do not accept any drugs that are not in good condition.
6. Drugs in the mixing area must be properly identified, stored, handled and controlled to maintain their integrity and identity.
7. Clean up any spilled drugs immediately, dispose of properly and record in the Drug Inventory Record.
8. Use a separate scoop for handling each drug.
9. Drugs and premixes must be used on a first received basis.

A daily inventory of drugs and premixes is required. The Drug Inventory Record should be completed at the end of each 24 hour period. One should check usage of each drug against medicated feeds produced. The drug container should be weighed before it is opened and every pound of drug must be accounted for in usage or adjustment. (If a 50-lb. bag was purchased but the drug amounts to 49 pounds, then list 1.0 adjustment). Other adjustments could be due to improper weighing, spillage, and out of condition.
CLEANING PROCESSING AND MIXING of feed ingredients require that personnel involved be thoroughly trained and properly supervised. Considerations for proper GMP's include the following.

1. Screening of grains and use of magnets
2. The grind should be as uniform as possible
3. Flaking of grain should be accomplished with proper amount of steam, temperature and roll tolerance
4. Mixing directions should be standard for a feedmill. (Certain mixed feeds may require specific directions)
5. Prevention of contamination
6. Checking for accuracy for all scales used for weighing ingredients (including drugs) at least once per year as required by FDA.

FDA COMPLAINT FILES FOR MEDICATED FEEDS must be maintained for FDA inspection and include the following:

1. Date of complaint
2. Complainant's name and address
3. Name of feed
4. Lot or control number or date of manufacture
5. Specific details of the complaint
6. All correspondence
7. Description of investigation
8. Disposition of complaint

CONCLUSIONS

The production of livestock feeds is big business in the U.S. and deserves careful and professional attention. With this enormous opportunity comes the responsibility to produce quality feeds that are safe to feed and meet nutrient specifications. Following are three checklists that identify some of the areas needing attention by all involved in insuring quality control in feed production.

CHECKLIST FOR SOURCES OF HIGH OR LOW ANALYTICAL VALUES

- Formulation error
- Nutrient or drug instability
- Moisture pickup or loss
- Incorrect weights (batching errors)
- Dust losses
- Non-uniformity of ingredient, supplement or premix
- Insufficient mix time
- Residues and cross contamination
- Inadequate sampling methods
• Segregation in transit or of sample
• Analytical errors
• "Masking" effects of certain ingredients

CHECKLIST FOR OVERALL SYSTEM EFFICIENCY

• Selection of intelligent and responsible suppliers
• Selection of intelligent and responsible mill operators
• Selection of adequate mixer
• Adequate mixing times
• Proper ingredient formulation
• Use of appropriate feed binders
• Limit conveying of premix and finished feeds
• Accurate weighing equipment
• Emphasize cleanliness and good housekeeping
• Keep accurate records

CHECKLIST FOR PERFORMANCE EVALUATION

• Evaluate variation of incoming ingredients
• Evaluate mixer efficiency
• Evaluate efficiency of conveying feed from the mixer to the feed bunk
• Evaluate variation of analytical procedures
• Evaluate system efficiency (A+B+C+D)

REFERENCES


Heidebrecht, A.L. Good Manufacturing Practices. Proc. Feed Manufacturing Short Course, Texas Tech University, Lubbock, TX.
