TANUVAS
TECHNICAL REPORTER

An official publication of research and developmental activities of Tamil Nadu Veterinary and Animal Sciences University

IN THIS ISSUE

EDITORIAL OFFICE

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FEED QUALITY CONTROL – AN INVALUABLE TOOL TO MONITOR ANIMAL NUTRITION

Animal Nutrition is the science of preparing feed and feeding animals to produce safe human food and non food products. Feed is the single most important element of animal production irrespective of species and production system. Optimal use of available feed decreases feeding costs and increases economic viability of the livestock operation (Makkar and Beever, 2013).

The global demand for livestock products is likely to increase by over 60 % by 2060 (FAO). By 2020 itself, developing countries will be producing roughly half of the milk of the world with India leading the output. Hence livestock sector is under significant pressure to greatly increase the volume of safe and nutritious feed available to the animals to provide the animal products needed in the future. Therefore, ensuring the quality of animal feed alone will be able to really assist in achieving these objectives. Moreover, control of quality of feeds can play a vital role in the development of feed manufacturing industry and also will result in maximum exploitation of production efficiency of animals.

Feed Quality Control

Feed quality is defined as "any of the features in the feed that makes it what it is" and "the degree of excellence which the feed possesses." A good quality feed will supply all the nutrients in adequate quantity with high palatability and digestibility.

The objective of quality control of feeds is to ensure that a consumer obtains feeds that are unadulterated, true to their nature, provide the intended nutrients and produce desired results in animal production. In addition to maintenance of high quality levels, the cost of processing should also be minimised. To achieve this control in quality, the feeds have to necessarily undergo various steps of quality evaluation. Feed evaluation is the testing of feed quality, providing information on the composition of feed or feed ingredients as well as their suitability for livestock and poultry. Feed quality can be ensured by knowing the physical nature and the actual composition of the feed both in terms of nutritional and anti-nutritional constituents.

Generally feed is made up of many ingredients. Typically, cereals such as maize, wheat, sorghum provide energy; while meals and oil-cakes of soybean, groundnut, mustard, linseed, sesame and sunflower and animal byproducts like fishmeal, meat meal provide protein. Byproducts such as wheat bran, rice bran, rice polish, deoiled rice bran, maize gluten, gram husk, broken gram etc. are also used in animal feeds to provide the nutrients. These ingredients are then combined in such a way as to provide the energy, protein, vitamin and mineral requirements for animals through the process of feed formulation. In order to know what amount of these ingredients should be included in the diet, the ingredients are first evaluated, to see what nutrients they contain in what quantities. After the diet has been prepared, it may also be necessary to evaluate the complete product, to determine its suitability for the class of livestock and poultry that will be fed. Besides, deterioration of feeds during storage in godowns resulting in rancidity and associated protein degradation may

drastically decrease the nutritional quality of the finished feed. So, it may also be necessary to conduct random checks on the quality of stored feeds. Feed evaluation is a key process that provides different types of information, as required by nutritionists, farmers and traders.

Feed quality-control programs must blend the best possible and available modern tools to deliver feeds that consistently contain the formulated nutrients in an available form and contain minimal levels of toxic substances. Any good feed quality-control program contains four components:

- Ingredient quality
- Process control
- Finished feed quality, and
- Control of toxic substances, including pathogenic micro-organisms.

Why is feed quality evaluation important?

Feed quality evaluation is important because ingredients that belong to the same class contain different nutrients; for example, maize provides more energy than wheat while soyabeans contain more proteins than sesame and sunflower seeds. If feeds are not evaluated, it is not possible to tell if the material will be suitable for feeding livestock and poultry based on their nutrient requirements. Moreover, adulterants, contaminants, toxins should also be taken into account as their presence in feed ingredients render them inferior and harmful, adversely affecting the overall quality of the finished feed. To identify and avoid such low quality feed ingredients, feed quality evaluation is of paramount importance. Hence, it can be termed that feed analysis provides information for i) farmers to optimise nutrient utilisation in animal feeds, ii) feed compounders to prepare feed mixtures suitable for different animal production systems, iii) researchers to relate animal performance to feed characteristics and iv) plant breeders to optimise the nutritive value of new varieties of feed ingredients.

The direct and indirect benefits of reliable and accurate feed evaluation include :

i) Generation of reliable data on the chemical constituents of feeds.

ii) Ensuring more efficient use of available feed resources.

iii) Helping the producers to reduce the cost of inputs by identifying least cost rations thereby increasing the profitability.

iv) Promoting the use of locally available feed resources and creating employment thereby boosting local economy.

v) Helping researchers to develop more cost effective and sustainable feeding strategies.

vi) Promoting trade and economic growth not only involving livestock production but also the feed itself both regionally and internationally.

Measures of feed quality

Feeds and feed ingredients can be evaluated for quality by physical, sensory evaluation methods in the field as well as in laboratory adopting chemical methods.

i) Physical evaluation : The physical inspection and sensory evaluation of feed mostly provides preliminary information on the quality of the material and mostly useful to identify gross adulteration. This evaluation involves assessing physical qualities such as weight, colour, smell and whether the material has suffered from any contamination by other materials.

ii) Chemical evaluation: The chemical methods include laboratory analysis of the following:

Composition : Moisture, Crude protein, Crude fibre, Ether extract, Nitrogen free extract, Total ash, Acid Insoluble ash (Sand and silica), starch, salts, free fatty acids, urea, amino acids.

Antinutritional factors: Mycotoxins, insecticide, herbicide, fungicide, phytoestrogens, glucosinolates, saponins, tannins, ricin, sinapine, gossypol, lipoxygenase, trypsin inhibitor.

Others : Rancidity test, acid value, peroxide value of fats and oils and Protein quality tests like protein solubility, maillard reaction products, pepsin digestibility, amino acid digestibility.

iii) Apart from obtaining values of chemical composition, the extent of utilisation of these components by the animal, termed as nutritive value, is also measured by *in vitro* digestibility studies

iv) Chromatographic, mass spectrometric methods and immune assay are adopted for analysis of plant secondary metabolites

v) Analysis of whole feed samples for composition by Near infra red reflectance spectroscopy (NIRS), pyrolysis mass spectrometry, nuclear magnetic resonance and other spectroscopic techniques.

Among the new analytical techniques, NIRS is more promising and has many advantages over traditional methods of feed analysis (Givens and Deaville, 1999) viz.,

i) Rapid and on the spot analysis of whole sample being a non destructive technique.

ii) Minimal or no sample preparation is necessary.

iii) High precision of results.

iv) Allows simultaneous analysis of several parameter.

v) High throughput makes NIR a cheap technique on per sample basis.

However, there are few limitations in using NIR that are

i) Unsuitability for analysis of minor components in the feed.

ii) Great care is needed for developing calibrations that are time consuming.

iii) High initial investment is needed due to high instrument costs.

iv) Worthwhile only for analysis of large sample numbers.

Quality assurance in feed analysis

It must be understood that ensuring the quality of feed involves a multi pronged strategical approach and hence there is a need to establish an effective quality assurance system in feed analysis. Moreover, the feed testing laboratory needs to continually assess its performance against its own objectives and standards to strive for improvement. A comprehensive quality assurance programme includes proper and adequate training of the laboratory personnel, maintenance of ingredient specifications and traceability, a laboratory specific quality assurance manual, standard operating procedures, result reporting systems and review processes that will ensure production of safe and high quality feed (Charles Stark and Frank Jones, 2010). Moreover, adoption of these practices and procedures will assist laboratories in acquiring the recognition of competence required for certification or accreditation and will also enhance the quality of the data reported by feed analysis laboratories. In order to achieve valid and consistent data generation in feed analysis the following steps are necessarily to be taken into consideration.

i) Measurements should be made using properly validated and recognised methods that will have detailed information on the analytical techniques, accuracy, precision, ruggedness, operating range, selectivity and limits of detections.

ii) Quality assurance protocols should incorporate certified reference materials (CRM) to ensure traceability of measurements. It is always a good practice to include external CRMs or in house reference materials into all analytical procedures that will be really helpful in validation of analytical methods of feed analysis.

iii) The feed testing laboratory should participate in national and international proficiency testing schemes (PTS) which is a means of seeking independent assessment of their performance in particular analytical tests.

iv) The laboratory should get accreditation or licensing to a recognised quality standard. Only certain accreditation schemes are appropriate for laboratories performing chemical analyses of feeds.

To know the references for the article, first author may be contacted in the email: chellapandiyan.m@tanuvas.ac.in

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RESEARCH HIGHLIGHTS

(2015-16)

Insecticidal effect of *Azadirachta indica, Pongamia glabra* and *Madhuca longifolia* extracts on *Musca domestica*

- Application of various extracts of *Azadirachta indica, Pongamia glabra* and *Madhuca longifolia* on larvae of *Musca domestica* topically as a single spray caused mortality of larvae and prevented the normal development of the different life cycle stages of house fly by inhibiting larval biomass, pupation, fly emergence and induced morphogenetic effects and histopathological changes.
- Aqueous extracts at 5% level and solvent extracts at 1% level had highest toxic effects on house fly larvae. It is an eco-friendly and eco-sensitive alternate herbal method for killing house fly.

Principal Investigator: Dr. S. Bino Sundar
Assistant Professor,
Department of Veterinary Parasitology,
Madras Veterinary College, Chennai.

Identification of bluetongue virus and differentiation of its serotypes

- Detection of bluetongue virus (BTV) in clinical samples was carried out by RT-PCR for NS1 gene of BTV. Using unique set of primers, the virus was typed by a second round of PCR.
- PCR for detection and differentiation of BTV 1,2,10,16 and 23 was developed.

Research Scholar: J. Tavelin Trisha
Vaccine Research Centre - Viral Vaccines,
DCAHS, TANUVAS, Chennai.
Guide: Dr. K. Brinda

Morphological and molecular detection of Culicoides species, a vector for bluetongue virus

- Culicoides species were first categorized into three species based on morphological characteristics. Using non-destructive method, DNA was isolated and species specificity found by PCR.

Printed and Published by
Dr. S.A. Asokan, Ph.D., Director of Distance Education
on behalf of Tamil Nadu Veterinary and Animal Sciences University
and Printed at University Publication Division, Madhavaram Milk
Colony, Mathur Road, Ambathur Taluk, Tiruvallur District, Chennai -
600 051
Editor : Dr. S.A. Asokan, M.V.Sc., Ph.D., Phone : 044-2432 0411
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- DNA barcoding for three species of Culicoides namely, Culicoides imicola, Culicoides oxystoma and Culicoides peregrinus was developed.

Research Scholars: C. Vanathi and M. Sangeeth Kumar
Vaccine Research Centre - Viral Vaccines, DCAHS, TANUVAS, Chennai
Guide: Dr. K. Brinda

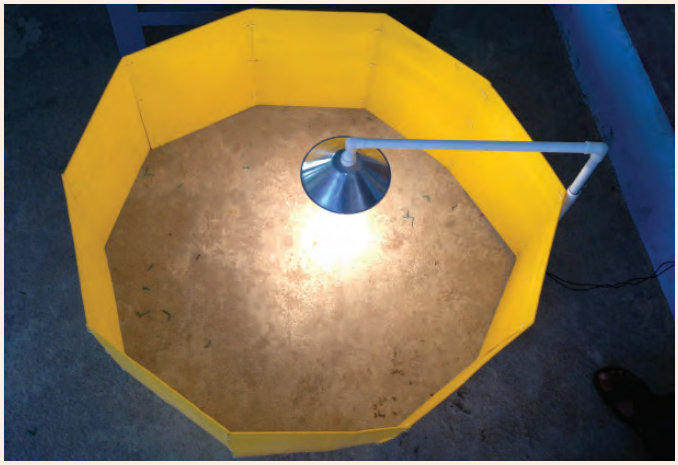
Analysis of dairy contract farming system in Namakkal district of Tamil Nadu

- About half of the respondents sold milk to milk vendors and shifted their marketing option from vendor to contract firm. More than two-third of the respondents informed that low price for milk was the main reason for stoppage of milk to previous procurement agency.
- Cent per cent of the respondents reported that there were no conditions to enter into contract firm except supply of milk and they had only oral agreement with the contract firm. Majority of them had direct contract with the contract firm and informed that the milk price was fixed based on fat and SNF content of milk. All the respondents reported that there was no restriction in supply of milk during flush season and had no dispute with the contract firm.
- Supply of concentrate feed and artificial insemination were the services available to the farmers. Higher price for milk was the major factor influencing the farmers to enter into contract farming system.

Research Scholar: S.R. Kalaivani
Department of Veterinary and Animal Husbandry Extension Education, VC&RI, Namakkal
Chairman : Dr. K.M. Sakthivel

Technology Developed at
TANUVAS Innovations and Instrumentation Centre

TANUVAS – ILFC - Portable Mini Poultry Brooder



- Brooder is an equipment used to provide warmth to day-old chicken of broiler, layer, turkey, guineafowl, Japanese quail chicks, etc upto 2 weeks in summer and 3 weeks in winter.
- TANUVAS - URF - Portable mini poultry brooder consists of a heat source (incandescent bulb) with height adjustment to increase / decrease the temperature based on the behavior of the chicks.
- Brooder guard is made of up of polypropylene flute board sheets which can withstand the brooding temperature.
- It is washable and can be disinfected and reused.
- The brooder guard height is 1 ft and 3 ft diameter.
- It can accommodate 100 chicks.
- It is portable.
- Cost per unit Rs.800.

Inventors : **Dr. P. Tensingh Gnanaraj, Dr. A. Sundaresan and Dr. S. Ezhilvalavan**