Review Article

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Ration Balancing for Sustainable Animal Production: Resources and Methodology

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Abstract

Ration balancing is prime consideration to uplift the animal husbandry sector. Balanced ration is the key factor to influence the productivity of animals as well as declines the cost of animal production. A large quantity of feed resources are available, those are fully capable to nourish the livestock sector. Various scientific methods viz. Thumb rule method, Pierson's square method, Algebraic method, computerized model etc. are available to formulate balanced ration, by implementing them on available feed resources. Thus, fully utilization of available feed resources and implementation of scientific feeding methodologies are key forecast for development in animal husbandry sector.

Keywords: Ration balancing, Animal production, Feed resources, Methodology

Introduction

The increase in total demand of animal products is forecast in next few decades for most developing countries because of larger populations and rapid population growth rates [1]. Livestock population is expected to grow at the rate of 0.55% in the coming years and the population is likely to be around 781 million by 2050 [2]. Therefore, we need to increase animal production by efficient utilization of feed resources with minimal impact on environment. In India and most developing countries, livestock are reared on crop residue based diets with nominal supplementation of concentrate feed sources, leading to improper utilization of feed resources which causes not only low in animal production but also contributes to environmental pollution through methane and ammonia emissions [3]. Gaseous losses constitutes around 6-10% of gross energy intake, or 8-14% of digestible energy intake [4]. Farmers fed available resources (Figure 1) to their animals with deficiency and/or excess of one or other nutrients in the ration resulting into inadequate feeding. This leads to

imbalanced feeding which adversely affects the health and productivity of animals in various ways and also reduces the net daily income from livestock rearing. Therefore, farmers need to be provided with necessary knowledge and skills for preparation of balanced ration and ration balancing techniques.

What is ration?

It is the fixed amount of feed for one animal fed for a definite period, usually 24 hours [5]. A balanced ration should provide all the essential nutrients (carbohydrates, protein, fat, vitamin, minerals and water) in such a proportion and quantities that is required for nourishment of the particular type of animals for a period of 24 h and also improves FCR, ruminal nutrients flow, enhances immunity and suppresses parasitic load and methane inhibition [6].

Ration Balancing

Ration balancing is the process to balance the level of various nutrients in ration, from the available

feed resources, for optimum utilization of feeds to meet nutrient requirements (Table 1) for a particular physiological stage of animals (maintenance, production and reproduction). It should also be cost effective with minimal impact on environment and have positive effects on general health and well-beings of animals.

Need for ration balancing: Increases efficiency of utilization of available feed resources Improvement in production performance viz. milk production, growth rate etc. Improvement in product quality viz. milk quality, meat quality Enhancing of net profit of animal rearing by reducing the feed cost Improves reproductive performance Improvement of overall health and well-being of animals by improving antioxidant and immunity status of animals Reduces environmental pollution by lowering enteric methane and ammonia emissions and excretion of nitrogen through faeces and urine by efficient protein utilization [7].

Steps for ration balancing

Assessment of nutritional status of animals: The nutritional status of animals needs to be assessed on the basis of feed intake, productive and reproductive performances, potentiality of breed etc.

Available feed resources: Feed resources available in a specific region such as gains, oil cakes, brans, agro-industrial by-products, crop residues, green fodders, grasses, tree leaves etc. need to be identified and their nutritional quality should be assessed in the laboratory or proximate composition from available database may be utilized.

Fixing nutritional requirement: The nutrient requirements of animals at different ages, physiological stages and production levels should be determined based on the available feeding standards in India. The requirement of Dry Matter (DM), Crude Protein (CP) and/ Metabolizable Protein (MP), Total Digestible Nutrients (TDN) and/ Metabolize Energy (ME), calcium and phosphorus are the basic things need to be considered.

Formulation of ration: For formulation of ration, following things to be considered:

DM intake of animals, which is to be 2-3% of BW depending on type of animals;

Ratio of roughages to concentrates: It depends on type of animals. For dry animals, calves and heifers,

roughage should be 60-70% and rest is concentrate mixture. However for milch animals, the roughage concentrate ratio should be maintained about 60:40 to 50:50 for milk production up to 15 l/d, for more milk production the ratio may be maintained up to 40:60 to 30:70. When more concentrate is to be fed, care should be taken to offer it several times a day with small quantities and suitable buffer may be included in the ration to prevent ruminal acidosis.

Choice of feed resources: Feed ingredients (Figure 1) used in animal feeding are broadly classified as, roughage and concentrate feed constituents and along with various critically important feed supplements, such as rumen modifiers. Roughage constituents are characterized by higher crude fibres (CF > 18%) and lesser amount of total digestible nutrients (TDN < 60%). However, concentrate ingredients are characterized by reverse nutritional values, as were compared with roughage ingredients i.e. < 18% CF and > 60% TDN. Such categories of feeding ingredients are obtained through vast natural resources grown all over the country, fruit wastes, animal wastes, crop residues etc. Feeding ingredients those are commonly utilized in animal's feeding are termed as conventional feed ingredients. However, some scanty distributed feed resources are also available, termed as unconventional feed ingredients.

Figure 1: Classification of feed stuffs used for animal feeding [8],[9].

Methodology

Thumb rule method

Most farmers are reluctant to calculate the nutritional requirements of livestock commodities. Thus, thumb rule of critically lesser importance may be applied for ration balancing in various stages of large ruminants. As per thumb rule, a concentrate mixture having 20% CP (14-16% DCP) and 68-72% TDN is formulated. The concentrate mixture along with wheat straw can be offered in below mentioned dose regimen [8],[9].

For maintenance

Gestation ration: In addition of maintenance requirements (Table 1), a further amount of 1.25 and 1.75kg concentrate mixture is recommended.

Production ration: In addition to above the maintenance requirements (Table 1), 1 kg additional concentrates for each 2- 2.5 kg milk production and 10-20 kg extra green fodder is recommended.

Table 1: Quantity of feed required on as such basis.

Item	For Indigenous cattle	For cross breed cows/ buffaloes
Straw	4 kg	4-6 kg
Concentrate mixture	1-1.5 kg	1-2 kg
Green fodder	1-2 kg	10-15 kg

Pierson's square method

The Pearson square or box method (Figure 2) of balancing rations is a simple procedure that has been used for many years. The procedure is designed for simple rations. In order for the square to work, specific directions are followed for its use. Nutrient contents of ingredients and nutrient requirements must be expressed on the same basis (i.e., dry-matter).

It is of greatest value when only two ingredients are to be mixed. In taking a close look at the square, several numbers are in and around the square. Probably one of the more important numbers is the number that appears in the middle of the square. This number represents the nutritional requirement of an animal for a specific nutrient. It may be crude protein or TDN, amino acids, minerals or vitamins [8],[9].

Figure 2: Schematic diagram of Pierson's square method.

Algebraic method

Fix the nutrient requirements for the feed to be formulated

Slack space for mineral mixture and feed additives

Fix level of animal origin protein source if it is going to be included max 10%

Fix level of cereal milling byproducts to be included (refer maximum inclusion level)

Calculate the total of the ingredients so far added and its nutritional contributions

Computerized software

It may be used for formulation of least cost ration with available feed resources.

Conclusions

Ration balancing has an immense impact on efficiency of feed utilization for increasing livestock production and reducing enteric methane emission under natural feeding and managemental conditions. Large-scale implementation of a ration balancing programme can help in improving the production efficiency of livestock with the available feed resources in an environmentally sustainable manner.

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