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Mini Review

An Insight on Feed Formulation for Livestock

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Abstract

Animal diets now a days contain a wide range of plant-based materials, as well as rendered animals and animal waste, antibiotics, and vitamins. Various feed components are utilised in the meal, depending on the animal. Animals will need to be supplemented during late pregnancy, early lactation, or rapid growth to ensure that requirements are satisfied. The required nutrients by each animal differs according on body weight, milk output, milk fat, and other factors. As an outcome, the feed formulation tool can now be developed using a variety of unique ration formulation methods, such as linear programming, stochastic programming, and goal programming. Many programmes exist that create rations for various livestock species using the most cost-effective feeds available. It will also help the farmer choose feeds that fulfil the ration's nutritional needs. ICAR-NIANP Smart Tools, Dairy cattle nutrition and feed calculator, Application for Least-Cost Ration Formulation, and Feed Chart are only a few examples.

Introduction

Cattle, swine, sheep, poultry, and fish-based food products account for a significant portion of our nutrition. Information from animal-production experts shows that animal feeding techniques significantly impact the quality of these products [1]. Consequently, due to the extensive use of animal-based foods, the nutrients used in livestock feed are crucial in terms of the quality of the subsequent foods and human health. On the other hand, farms and animal feed formulations have changed dramatically during the last 60 years. Animal feeds today include a variety of plant-based substances and additional ingredients such as rendered animals and animal waste, antibiotics, and vitamins [2].

Animal Feed Ingredients

Animal feed ingredients, which make up complete feed products, come from a variety of plant and animal-based raw materials, as well as medicinal and industrial sources (Table 1) [3].

Table 1: List of different types of feed.

Plant-Based Feed	Animal-Based Feed	Mixed Feed	Others
Forage, Plant protein products, Processed grain products, Molasses, Grains	Animal protein, Animal waste, marine by-products, Dairy products	Fats and oils, domestic food wastes, contaminated food	Antibiotics, salts, Minerals, Enzymes, Flavors, Preservatives

Figure 1: Freely grazing farm animals.

Depending on the animal, different feed components are used in the meal. In developing countries, farming is primarily dependent on an extensive grazing system (Figure 1). Therefore, it's crucial to get the diet right to avoid bodyweight loss or difficulties. Domestic feed, such as hay or silage, is relatively inexpensive and can be used in scarce grass or poor quality situations. To ensure that requirements are met, animals will need to be supplemented during late pregnancy, early lactation, or rapid growth Deficiency of one or more nutrient cause less production and lead to more production cost. Deficiencies in one or more nutrients result in lower growth and higher production costs. To overcome this challenge nowadays, feed formulations are utilised [4].

Feed Formulation

For many years, researchers have been studying how to optimise rations for cattle and other livestock animals. The amount of nutrients required by each animal varies depending on their body weight, milk output, milk fat, and other factors. As a result, many novel ration formulation methods, including linear programming, stochastic programming, and goal programming, are now available.

Linear programming

Linear Programming (LP) is a mathematical process for allocating, selecting, scheduling or evaluating restricted resources to find an optimal solution to a certain goal. Such resources could include raw materials, labour, feed composition, and manufacturing procedures, with low-cost or high-profit objectives. For example, LP models are employed to optimise feed ingredients to reduce ration costs. Specified feed ingredients were employed in an LP model to determine feed ingredient constraints, and an objective function was then constructed based on the price of each feed ingredient. It has gained widespread acceptance for use in low-cost feed formulation for livestock and poultry in most countries with a developed complex feed industry [5].

Stochastic model

A stochastic model portrays a situation with some degree of uncertainty. Even within the same batch of feed, nutritional feedstuff values vary. It is essential since some minimum nutrients are defined, such as protein, calcium, and phosphorus content in pregnant and nursing animal feed. If the nutrient content changes, using mean values for optimum composition will never ensure that the nutrient requirement is met. The Stochastic Model (SM) can control nutrient variance and increase the likelihood of fulfilling nutrient requirements [6].

Goal or multiple objective programming

The Goal Programming (GP) method is an excellent alternative to the traditional linear programming (LP) method. The GP model enables the resolution of several goals related to livestock performance by providing appropriate feed formulation solutions. When trade-offs between ration cost, minimum protein, and diet modifications were established, the GP model proved to be the best compromise choice for achieving several animals development goals. The GP model is a helpful tool for supporting decision-makers in solving and engaging with a series of linear and nonlinear programmes [7].

Feed formulation tool

Smartphones have gained considerable market share among many customer industries due to their utility, ease of use, and affordability. The number of new smartphone users is continuing to rise. They're helpful in agriculture because of their accessibility, which connects to farming, and the device's low cost and processing capacity, which allows for the manufacture of a wide range of commercial applications. Agricultural apps help farmers with disease identification and pesticide treatment rate computation. Farm management applications make it easy for customers to manage general farm resources and farming operations more efficiently to increase profit and production. Android is a mobile operating system based on the Linux kernel designed for touchscreens. It's a necessary platform for creating a mobile app with the Google Android SDK software. There are many programmes available that construct rations for various species of cattle using available feeds at the lowest cost. It will also aid the farmer in selecting feeds that meet the nutritional requirements of the ration. To name a few, ICAR- NIANP Smart Tools, Dairy cattle nutrition and feed calculator, Application for Least-Cost Ration Formulation and Feed Chart [8].

Conclusion

Feed accounts for more than 70% of the cost of production in the livestock industry. The farmer is faced with preparing the cheapest ration with the most nutrition. When you feed your child an unbalanced diet, one or more nutrients will be lacking, while one or more expensive nutrients will be oversupplied. Low productivity and increased production costs result from nutritional deficiencies in one or more nutrients. As a result, a well-balanced ration is essential for increasing milk production while reducing feed expenses. Ration balancing devices are gaining popularity among farmers. There are ration balancing tools for mobile and computer platforms that use LP, SP, and GP.

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