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THE USE OF COMPUTER IN RATION FORMULATION IN 2000 A.D AND BEYOND

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Commercial livestock production has continued to undergo structural changes brought about by various factors such as economic, environmental, marketing dynamics etc. The latest changes taking place are mainly due to economic recession which has affected the cost of feed thereby resulting in diminishing margins in livestock farming.

It is a general knowledge in the industry that feed is the single highest cost item in livestock production. Market reveals that it constitutes 70% - 80% of the total cost of production in any livestock enterprise. In view of this, farmers started exploiting various avenues to reduce cost and maximise profit. To meet the challenges of this time, most farmers embark on backward intergration by producing feed. While well capitalised farmers went into direct production in their farms. Others who could not afford the cost of installation of mills and bulk purchase of raw materials patronise toll millers for the production of their feed.

Increased efficiency and profitability in this period will therefore depend on the knowledge and application of improved feed formulation. While some commercial feed millers and toll millers have taken advantage of computer formulation to achieve this objective, other (millers and farmers) depend on amended computer formula.

However, in the years ahead, the urge for the use of computer will assume a higher dimension. This presentation will therefore address, the current status and what the years ahead hold in stock for feed formulation with the use of computer packages.

Feed Formulation

The process of feed formulation, involves a combination of feed ingredients in proportions that will provide all the nutritional requirements of an animal for maintanance, growth and productivity.Feed formulation therefore can be described as both an art and a science. The art being the animal know-how, experience and keen observation while the science is largely founded on mathematics, chemistry, physiology and bacteriology.

The method of feed formulation started with the completely manual system of formulation which was basically adapted from the pearson square method and this graduated into the programmable calculator system which was an improvement over the manual system with the introduction of programmable

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calculator. But now there is the latest system of computerised formulations especially those carried out by micro-computers using the least-cost concept.

Feed formulation Techinques

There are not less than five major methods of feed formulation. Whichever of the system is utilised, the following basic information is required:

1. The nutrient requirements of the specific animal to be fed.
2. The nutrient composition of the available feed ingredient
3. The prices of the available feed ingredients
4. The limitations of the various feed ingredient
5 The production objective of the farmer
6. The environmental factors - Rainy and dry season.

Methods

1. 2 x 2 Matrix
2. Simultaneous equation
3. Pearson square
4. Trial and Error
5. Linear Programming methods

Linear Programming

This is the current development in the field of feed formulation involving the use of micro-computer to obtain least-cost formulations. It is important to point out that inspite of its sophistication, the operators (producers and nutritionists) are more important than the computer itself. This is because the computer does not know anything about feed palatability, feed ingredient limitation, feed processing storage facilities etc.

The use of micro-computers non-the less has a number of distinct advantages over the conventional methods. These include:

- the use of inclusion of a greater number of feed ingredient
- ability to formulate with increased accuracy
- the study of more nutrient constraints
- ability to recost and reformulate diet immediately and within a very short time.
- multi-product formulatiom
- shadow pricing and raw material breakdown.

It is pertinent to note that the results obtained from the computer are only as good as the person who feeds the information into the computer.

Also it must be reteirated that the computer fromulates rations objectively from the information that is fed into it and what comes out of the computer may be the best solution to a mathematical problem but may not be practical or realistic.

Regardless of its short comings, the computer approach to feed formulation will remain the greatest thing that ever happened to the livestock feed industry.

Current Status

1. *Awarness*

The use of computer in feed formulation in Nigeria started in a small scale in research institutes and in 1983 Livestock feeds Plc. introduced the use of computer in commercial feed manufacturing. However majority of farmers are currently aware of the use of computer in feed formulation but less than 1% of farmers and feed millers have computers. Others depend on formular generated from these priviledged of few that have computers. The inability of farmers without computers to meet the challenges of reformulation due to various factors has resulted in formulation amended by trial and error. This constitute the majority of formula in use. The implication of this situation is the likely hood of these formula not meeting the recommended standard specification.

2 *Formulation Abuse*

(1) Assuming standard raw material specifications for feed formulation

In most cases, feed formulation is based on standard raw material specifications lifted from textbooks and guides given by feed manufacturers. It is therefore important to note that over the past five years, there have been significant deviation from actual (specification from standard) specifications due to processing, genetic and environmental factors etc. This is confirmed by the result of analysis of some major raw materials as follows:

Raw material	Standard Specification	Crude protein (%) Years				
		1994	1995	1996	1997	1998
Soya Meal	42%	47	47%	48	47	45%
72% fish meal	72%	68	69	69	68	68
Groundnut Cake	40%	42	43	45	43	44
Cultonseed Cake	38		42	43	42	40

Farmers and millers generally do not bother to subject their raw materials to laboratory analysis. The resultant effect of this action, is that either a sub-standard feed or an expensive feed is produced based on either a lower or higher standard of specification for formulation. A farmer who raises a substandard formula may easily be satisfied with his percentage production not knowing that the birds have not attain their maximum genetical potential.

(2) Enviromental temperature changes in relation to feed formulation

Farmers and millers have continualy ignored the relationship between feed nutrient specification and the environmental temperature prevailing in their respective localities. During rainy season/harmattan there is supposed to be a high energy (2500 - 2550 kcal) ration while in dry season, the energy can be reduced to 245 - 2500kcal. The practice in most farms, is that the same

formulation is raised throughout the laying period of a bird. The only adjustment could during secretary of raw materials.

(3) Non-compliance to formula/mixing instructions.

Raw materials scarcity, and high cost of some raw material at a particular time have led farmers substituting some ingredient on 1:1 basis. A very recent experience was during soya meal scarcity when farmers resorted to substituting it with other protein sources especially Groundnut cake, and cottonseed cake. The result was devastating for such farmers in terms of production and egg quality. What they intended to achieve through formula adjustment was lost due to lack of knowledge in animal nutrition.

Computer Operations

The industry is currently polluted with all sort of personnel formulating and selling formulas. These operators can be categorised into three:-

1. Farmers
2. Nutritionists
3. Other Agricultural Personnel.

(1) Farmers - These category of operators took the advantage of being well capitalised and their knowledge of the advantage of computer formulation to acquire computers. Despite their limited knowledge on animal nutrition, they depend on manufacturer guidelines to operate the computer.

The consequences of their action is normally reflected in their production. As earlier said they feel satisfied with the quality and cost of their feed, not knowing that there can be further improvement in these areas.

(2) Nutritionists- These constitute graduates of animal nutrition and biochemistry and animal science. By virtue of their technical know-how and training they stand a better chance of formulating a good ration. The industry operators have neglected this category of personnel who would have given them the best in this area of operation. What the computer lack in the area of raw material limitation etc, are easily taken care of by the qualified nutritionist.

(3) Other Agriculture Personnel - The highest percentage of computer operators in the industry originate from this category of operators. The implication of this situation is manifested in the quality of the formular produced. A recent analysis of some of the formular from this category of farmers show poor technical knowledge.

Therefore it is not a guarantee that once you can operate a computer, you are a competent and qualified nutritionist. It still requires technical knowledge in Animal Nutrition and Production. As earlier said, any formular is as good as the operator.

Expectations in the year 2000 AD

The recent transition from military to democratic governance in Nigeria points to the fact that we should expect a stable and improved economy. Indeed hope has continued to brighten for the economy as confirmed by various investors in different sectors of the economy. The livestock industry is not left out. At a recent agricultural exhibition in Lagos, a South Africa feed manufacturing company signified their intention to register their presence in Nigeria. Information available confirmed their presence in this country. We should expect more foreign and local investors in the livestock industry. Compilation will be on the increase and the challenges to be posed by these factors can only be met by efficient and cost improvement programmes in the industry. Computer usage will definitely be one of the tools to achieve this objective. Livestock industry computer application in feed formulation will be the focus of most farmers and millers.

(1) Increase in Computer Usage?

The urge for computer usage in the year 2000 AD will be on the increase. Well capitalised farmers and feed-millers will engage the use of computer for feed formulation to meet the challenges of the year 2000 AD.

(2) Response to Competitive Activities

The year 2000 AD will witness keen competition considering the expected influx of small scale farmers in to the industry coupled with expansion by the already existing forms. Quality and prices of feed will be one of the major determining factors for anyone to survive.

Therefore to effectively meet the demand of customers, it will be necessary for farmers and millers to engage the use of computer in feed formulation. I foresee a situation of even more toll millers resorting into use of computer for feed formulation to meet the challenges that will be posed by competition.

(3) Laboratory Facilities

The key hindrance to obtaining good quality and least cost feed from computer feed formulation is non-availability of actual specifications of raw material at the time of formulation. A positive response to competitive activities and good performance in the formulation of feed requires that actual raw-materials specification should always be used instead of the standard specifications currently used by most farmers.

While major commercial feed millers have laboratory facilities, toll millers are yet to install such facilities. This will still continue to constitute an obstacle in the year 2000AD in view of the fact that most toll millers whom majority of the farmers patronise do not have plans for such.

(4) Role of Qualified Nutritionists

The success of computer feed formulation depends on who operates the computer. Farmers' awareness with regards to employing qualified

nutritionist can only be achieved, if they are made to realise in Naira and kobo what they will gain. However the knowledgeable ones will shift from their previous position of using unqualified and inexperienced operators to qualified and experienced ones.

We should all rise up to face the challenges that will arise from the use of computer in feed formulation in year 2000AD. Effort should be made by key players in the industry to embark on the use of computer for feed formulation taking advantage of qualified and experienced nutritionists who will give them the value for the money they invest. Likewise toll millers should also embark on the installation of laboratory facilities to improve the quality of their services to farmers.

Computer Assisted formulation

The acceptance of linear programming (LP.) in the formulation of least-cost diets for livestock and poultry feeds has been extremely rapid and is fast becoming almost universal in its usage in the feed industry and Nigeria cannot be left out. The development of the micro computer has placed the capabilities of least cost programming within the reach of small to medium sized mills and individual producers who previously could not afford such a service.

Linear programming is a mathematical technique for determining the optimum allocation of resources (different feed stuffs) to obtain a particular objective (meeting nutrient requirements, reducing costs, optimum profits, explore changes in nutrient specifications of the diet or in the nutrient content of feed stuffs). Basically, L. P. is a system by which a number of linear equations are solved on a simultaneous basis. One must establish a series of equations which describe in mathematical terms the conditions or requirements of the formula. These requirements must be measurable in numerical terms.

Equipment and Programmes needed.

There must be access to a large main-frame or various small micro computers. Many excellent programmes are however available. The matrix capacity of the L. P. programme designed for the micro computer is limited primarily by the memory available. It is therefore recommended that at least 64K total memory be available to provide for adequate matrix size.

Information Needed:

In order to formulate a diet, one must supply the following to the computer.

1. A list of feed ingredients which are available for use in the diet and their current costs. Often the prices of feed ingredients fluctuate from week to week to greatly influence the ingredients selected by a computer in a least-cost formulation. These marked ration ingredient changes may affect animal performance. Therefore, it should be pointed out that only ingredients known to be palatable and biologically available to the animal

should be included.

2. The nutrient content of each ingredient. There are many sources of information on average nutrient content of ingredients and these may serve as a stand point for establishing matrix values. However, it must be emphasised that these values usually represent an average nutrient content. Effort should therefore be made to have values that accurately reflect the composition of ingredients actually available for use.
3. The nutrient requirements of the animal in terms of minimum, maximum or exact quantities needed. There are several sources of basic information on nutrient requirements (e.g. NRC, feed company brochures etc). When using any of these recommendations however, it must be understood that they represent average ingredient values and feeding standards for average or better growing conditions, mostly under temperate regions. Each user therefore must make proper adjustments for local conditions and quality of management:
4. Physical, non-nutritive or nutritive usage limitations on certain ingredients. The following may be taken into consideration:

- Toxic properties of certain ingredients allow only limited usage in a diet.
- Limitation of feeds containing undesirable properties which may reduce palatability or impart undesirable odours to the carcass, milk or egg.
- Limitation on quantity available in inventory.
- Adverse effects on physical texture and storage ability of ingredients such as fats or molasses which may be good sources of energy, but if fed at excessive levels may cause problems with bridging of feed in bins, ability of the feed to flow and other such problems.
- Excessive levels of certain nutrients in the feed. In swine or poultry diets, ingredients with high fibre content may hamper performance if fed at higher levels.
- Variation in nutrient content of certain ingredients. Limitations are often placed on the amount of some ingredients because of a high degree of variability. Animal by products are examples of this type of limitation.

The role of the nutritionist has changed markedly in view of the new millennium, as a result of the increased speed and capacity of the computer. Where once, the nutritionist spent many hours daily in the routine of formulating or revising feed mixes, this task can now be accomplished in a fraction of the time. This should allow the nutritionist to concentrate upon other aspects of feed formulation and manufacturing such as ingredient evaluation, establishing nutrient requirements, and quality control.