CHAPTER 1

INTRODUCTION

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1. INTRODUCTION

Milk is of basic importance in human nutrition. Due to its rich composition it plays a vital role in human diet. Dairy farming has very important role in providing regular income to farmer. Dairy farming is practiced either as a sole business or with Garble farming as subsidiary business. The main source of income in dairy farming is milk which is a basic need of all categories of people from child to old person. In India mixed farming crop-livestock integration has been a way of life since the( draw of civilization. It is widely realized that livestock production is recognized as one of the subsection of agriculture providing additional remuneration and employment to the small farmers and landless labour families. The livestock sector of late is an important allied sector of crop production in the Indian agrarian economy. In olden times the richness of a household was measured on the cattle strength. Among livestock based vocations dairying occupies a pivotal position.

A well planned and managed profession can generate profit and create truthful employment. Cattle farm and dairying is now regarded as industry in our country. The raw material needed are the feeds and fodders Dairy animals are the medium to convert it into milk.

About 70 per cent of the population of the country lives in 5.76 lakh villages cultivating over 145 million hectares of
land\(^{1}\). In India 41 percent households are landless, 45.0 per cent households are small holders and 13.40 per cent households own large holding. While 86.10 per cent of the total households consisting of landless labourers and small farmers from 64.8 per cent of the total households owning milk animals. India has the largest cattle, buffalo and goat population in the world.

India\(^{2}\) has breedable 7.5 million crossbred cows. 57.5 million local cows, 34 million buffaloes and 87 million goats and 26 having breeds of cattle\(^{3}\). Red Sindhi, Sahiwal and Gir has been considered an important milk breeds. Of seven buffalo breeds Murrah Surti and Nili-Ravi are important milk breeds. In exotic milk breeds Holstein – Friesian (HF) Jersey, Red-Dane and Brown Swiss are important ones. Total milk production in 1991-92, 92-93 and 93-94 was 56.30, 58.60 and 60.50 million tones \(^{4}\). Milk and Milk products being the second largest contributor next to agriculture produce, which play a vital role in the country's economy. In 2000-01 and 2001-02 total milk production was 81.43 and 84.57 million tone, respectively.

The country has achieved the objective of “Operations Flood” programme to increase milk production and to the end the necessity of important milk powder. In fact in 1992-93, India exports \(\text{US } 3\text{ million worth of dairy products. In 1993-94, the exports are expected to have touched US } 10\text{ million Indian major exports economist of butter, baby food and milk powder to west Asia, Bangladesh and Shrilanka.} \)
The investment on dairying programs showed that the great emphasis is given to this sector by the government for increasing the production and productivity. The expenditure at current prices in the dairy sector increased from Rs. 77.8 million in the first five year plan to Rs. 6034 million in the seventh plan.

The Indian Dairy Industry acquired substantial growth during the 8th Plan, achieving an annual output of over 69 million tones of milk. India’s milk output during the year 2000-01 was estimated to be 81 million tones and is expected to reach the level of 85 million tones during 2001-02. This has not only placed the industry first in the world, but also presents sustained growth in the availability of milk and milk products for the burgeoning population of the country. Most important, dairying has become an important secondary source of income for millions of rural families and for millions more, has assumed the most important role in providing employment and income. The per capita availability of the milk has also increased to a level of about 221 g per day, but this is still very low as compared to developed nations or the world average of 285 g per day. Government of India is making efforts to increase the productivity of milch animals and thus increase the per capita availability of milk. The efforts of the Department in dairy sector are concentrated on promotion of dairy activities in non-Operations flood areas with emphasis on building up co-operative infrastructure, revitalization of sick dairy co-operative federations and creation of infrastructure in the
States for testing the quality of milk and milk products. For pursuing these objectives, the Department has implemented 4 schemes in the dairy sector during 2001-02. The progress of these schemes is as: National Dairy Development Board (NDDB), an institution of national importance was set up by the Government of India to promote, plan and organize programs for development of dairy and other agricultural basic and allied industries along co-operative lines on an intensive and nationwide basis.

Operations Flood, an integrated dairy development programme, completed its third phase on April 30, 1996. The main thrust of the programme was to consolidate the gains already achieved, and to strengthen the dairy cooperative structure for sustainable development of the dairy industry in India.

After the completion of Phase 3 of Operations Flood, a Programme Implementation Agreement (PIA) was signed between the EEC and the NDDB to strengthen cooperatives at the grassroots level. The Agreement was endorsed by the Government of India on August 21, 1997 and are continuing during 2001-02.(5)

Traditionally milk production has only been incidental to provision of draught power by cattle but it is important source of supplementary income and nutrition to the farm family. Availability of regular plain cash from daily sale of milk not only
helps in dairy production through purchase of feed and other inputs but also helps in improving crop-production through purchase of off-farm inputs like improved seed, fertilizers and pesticides.

Manures from dairy animals provides a good source of organic material for improving soil fertility and crop yields. It was estimated that the livestock wealth of the country produces about 1200 million tones (6) of wet dung per year which has a potential of producing 70,000 million cu-meter gas annually, equivalent to about 10 million tones of fire wood. One third of the total dung in India is used on fuel in rural areas. This wasteful practice of burning dung for fuel may be checked by popularizing gobhar gas plants. This gas from the dung can be used on fuel and the slurry an manure to enrich the soil.

1.1 Economic management

A well planned and managed profession can generate profit and create fruitful employment. Cattle farm and dairying is now regarded as industry in our country. The raw material needed are the feeds and fodder. Dairy animals are the medium to convert it into milk of dairy farm hinges on the cost of production. The sale of milk depend on the demand and supply factors. Demand is primarily concerned with the behavior of consumers and the supply with the behavior of the producers.
Milk production in India is mainly concentrated on rural holdings as a subsidiary occupation to agriculture.

The units of livestock production are individual animals. The units of livestock breeding were male, female and progeny. These units of production system are interact with the environment and mating system often into a cryptic nonlinear manner so that all of the inputs and outputs of the entire system must be considered simultaneously in order to evaluate the production breeding value of individuals within a bounded production system. System analysis is defined as a method of conceptualizing a production system and modeling it in Mathematical terms so that animal functions and responses across time and space are closely simulated or predicted.

1.2 Need of statistics and Economics disciplines

Statistical analysis provides a method of more systematically organizing knowledge including ad-hoc research results in animal science. It is also a method of more effectively utilizing research information for current application to increase production efficiency for specific sets of conditions. Since the mathematical models are constructed so as to describe animal functions and responses, there is a feedback stimulus to the more basic sub disciplines. This process encourages an integration of the sub disciplines in animal science.
Agricultural statistics in research has become of crucial importance to the decision making both at the farm level and national level, in view of the emphasis now being laid on the rapid development of agricultural economy of the country. In agricultural economics francs, research depends heavily on physical input output data provided by agronomist and other agencies.

In understanding the human favor in agriculture, research studies in agricultural economics overlap with many other subject which study farmers wants and their satisfaction. Farmers culture influences has personal and material dealings with others. The usefulness of multidisciplinary research is gaining attraction of scientists to a large extent. The planners now recognize the gravity of food production, food consumption and population growth problems. They are now coming to realize that the progress in problem oriented research in agriculture is necessary for guidance in the optimum use of scare resources. Thus the situation represents a particular challenge to agricultural scientist and other social scientist engaged in rural development to analyze. The farmer behavior as a relationship between the limited resources which have alternative uses. Electronics and computers will have impact on agricultural science, irrigation, planting, fertilization, pesticides application and a large number of Operations can be accomplished by coupling to sensors. Better information system will influence the agricultural business.
Constraints on land, water, and energy, they would require an ability to shift agricultural production system to more reliance on science and technology and greater human skills. The approach to analyze the technological change will itself be a challenge. In shaping future agricultural research, the statisticians have to play a vital and innovative role.

It appears that the time has arrived for whatever reasons for a greater interest in the input output relationships and the interconnecting components of production systems. The slogan adopted by the performance Registry international comes to mind, “the most powerful thing in the word is an idea whose time has come” Victor Hango. This appears to be a general awareness of the genuine need for a systematic objective method of examining efficiency of livestock production system. Such an approach is often referred to as a systems approach or system analysis.

System analysis is seldom feasible in actual animal production systems. Therefore models are used. Modeling in system analysis research consists of developing a mathematic model of system suitable for Operations computer. Economics generally use “Monte Carlo” model for simulation process. Whereas for specific systems analysis problems such as “dairying” the possible type of models used are as follows.

i) Simulation models: (using differential equation, line tables)
ii) Optimization models (using linear programming)

iii) Statistical models (using regression models)

An attempt was made to devise and study a cattle production model, that could predict the productivity of the system under variable conditions. If dairying is now regarded as a business like other enterprises maximization of profit is its major goal. Hence optimum contribution of each raw material to the total cost and the size of the most profitable Operations should be known. Linear programming has been successfully used for achieving the profit maximization and cost minimization in different manufacturing units including dairy farming, particularly in animal feeding problem.

1.3 Importance of research topics

Operations research is mainly concerned with the techniques of applying scientific knowledge, besides the development of science. It provides an understanding which gives the expert / manager new insights and capabilities to determine better solutions in his decision-making problems, with great speed, competence and confidence.

Low productivity of agriculture at large along with the inefficient utilization of resources is the key factor giving set back to our developing planning. As such, the problem of economic development in India is connected with the problem of
development of the agricultural sector in the country. This is due to the fact our gross domestic product is to the extent of 45% from agricultural sector, alone. The above trend in agricultural sector is going to be continued in India because of the predominant agriculture based economy. The problem then it to become successful in optimizing the production accrued from this sector within the available resources.

Statisticians and planners have great scope to do more realistic research in the field of agriculture. As an interdisciplinary approach research statisticians can play an important role by using Operations Research Techniques in the field of agriculture and there by increase National income, employment and production. These new approaches for planning agriculture development will reduce regional and inter crop disparities, imbalance and instability.

For many years separate statistical and mathematical methods had been made to guide decision making in these fields, but it was impetus to the second world war that began to bring together teams of statistician, mathematician and other scientist to tackle problems demanding overall strategies of inquiries and application. Operations Research describe the application of specialized quantitative techniques to solve problem met in industry, in commerce and in administration.

Operations Research or Management Science, as the name suggest is the science of managing. As is known,
management is most of the time making decision. It is thus a
decision science which helps management to make better decision.
Decision is in fact, a pivotal word in management, rather all of us
make decisions. Operations Research help the management to
make better decisions. Thus in Operations Research the essential
features of decision namely, objective, alternatives and influencing
factors expressed in terms of scientific quantification or
mathematical equations. This gives rise to certain mathematical
relations termed as a whole as mathematical model. Thus the
essence of Operations Research is such a mathematical models.

On the other hand with the explosion of population
and consequent of shortage of food almost all the countries are
facing the problem of optimum allocation of land and various crops
in accordance with the available resources. An appropriate
technique of Operations Research can be adopted for getting
answers to such problems. Roughly speaking one can say that
Operations Research approach is equally applicable to small as
well as big farm situation.

1.4 Importance of linear programming

The existence of optimization method can be traced by
the days Newton, Langrange and Cauchy. The method of
optimization for constrained problem which involves the addition of
unknown multipliers become known by the name of its inventor,
langrange, canchy made the first application of the steepest
descent method to solve unconstrained minimization problem. In spite of their early contributions, very little progress was made until the middle of the twentieth century, when high-speed digital computers made the implementation of the optimization procedure possible and stimulated further research or new methods. Spectacular advances followed, producing a massive literature on optimization techniques. This advancement also resulted in the emergence of several well defined new areas in the optimization theory.

The method which seek optimization are also known as mathematical programming techniques and are generally studied as a part of Operations research. Operations research is a branch of mathematics which is concerned with the application of scientific method and technique to decision making problems and with establishing the best or optimal solution.

A linear programming problem has three quantitative components (a) an objective (b) process for attaining the objective and (c) resources or other restrictions. A problem which has these three components can always be expressed as a linear programming problem. The objective of linear programming study may be expressed in physical, monetary of other terms depending upon the problem being analyzed. A linear programming problem does not exists unless resources are restricted or limited.

In the last two decades a linear programming techniques has been used extensively in U.S.A. Developing
countries are using this techniques in agriculture planning. In agriculture, the resources like land, labour, capital, fertilizers, irrigation, etc are scare. Linear programming is one of such technique which comes to rescue the farmer in order to get the maximum farm income with the existing resources. In diet problem this techniques is famous. Linear programming models have been used to apply optimally the principle of nutrition to produce milk. Typical objectives are to maximize income over feed cost or minimize cost of nutritionally adequate rations for the dairy herd since feed is the major cost for producing milk. Optimal plans can be developed through linear programming techniques. It is an efficient way to determining how to use limited resources to obtain a particular objective such as maximizing net benefit or the minimizing production cost, maximizing labour employment, when resources have alternative use.

1.5 The diet problem

The diet problem is famous in the literature of linear programming because it is the first economic problem ever solved by the explicit use of this method\(^7\).

It was originally intended merely to serve as an illustration and test of the use of the method, but, like so many toy models, it has turned out to have unexpected but important practical applications. The essential issue in this problem is that a diet to be acceptable must meet certain quality specifications, such
as it must contain so many calories, so many units of riboflavin etc. Moreover the quality of a diet of its component parts i.e. of the food that comprise it these characteristic attention to quality specifications derived by addition from the qualities of components are the structural elements on which solution to the problem depends.

Problems in this structure have very important role in economics and Industries such as livestock feeding, gasoline, ice-cream etc. Thus these problems enter into many significant business decisions and a role in determining the shades of supply and demand curves in many industries.

1.6 Objectives of the study

Cattle farm and dairying is now regarded as an industry in any country. Like other industries maximization of profit is its major goal. Hence optimum contributions of each raw material to the total cost and the size of the most profitable Operations should be known, under our present cattle farming system. The management of cattle breeding farm is concerned with factors like number of animals, milk production, feeding, labour and day to day farming Operations and they play important role in determining the income from cattle farm. Management is concerned with the planned allocations of the resources judiciously. Various attempts have been made to quantify management since milk production is the ultimate objective, herd
average has often been used to denote the efficiency of management. But this does not take into account the various costs of production.

Economic returns from an animal represent the integration of several performance traits (economic indicators) such as milk production, age at first calving, days open, days dry, herd life, productive life and parity. A balancing of the net effects of each variable or trait is required to achieve maximum economic returns. This can be done quite effectively through optimization available through Operations research modeling. A model given a perspective picture of the whole problem and help in tackling it in a well organized manner. The optimal solution obtained from a model should be applied in practice to improve the performance of the system and the validity of the solution to be verified under changing conditions. Early studies made use of simple correlations procedures which did not furnish the relative values of each resource in explaining variation in net income. Simple regression techniques and multiple regression analysis aimed at ascertaining the relative importance as an individual factors did not fully reveal the nature of the production. Surface and type of mathematical equation needed in describing production process. A comparatively modern technique, known as linear programming technique, can be gainfully employed in the solution of the problems with confirmed resources Surendra Singh (1999). Therefore, the present investigation is undertaken to use linear
programming model to input and output data so as to determine income that, could be explained by specified firm management factors and various performance eras with the following objectives:

1. To device a crossbred cattle production model by estimating the productivity ratio cross under variable conditions.
2. To study the trends of expenditure and profit in a herd of crossbred cattle.
3. Use of Operations research technique to determine the amount of variation in net income in relation to the expenditure.
4. Optimization of production of crossbred cattle in relations to some economic traits.

1.7 Organization of thesis

The thesis has in all seven chapters. First chapter deals with an introduction of the thesis work need of economics and statistics discipline. Importance of research topic, usefulness of liner programming techniques and objectives of the study. In chapter second review of literature is given from the similar problem dealt with by the other scientists and research workers. In regard of linear programming and system analysis for maximizing net income from dairy farming and an economic analysis of milk production. Chapter third gives the source of secondary data, herd strength, feed requirement, cost of feeds and the
physiological data of the crossbred Gir cattle. An relevant information is given in this chapter. The necessary data is collected, tabulated, analyzed and presented in tabular forms. The availability of feeds and fodders, in different month were depending on location. Accordingly relative information is collected and prepared for further necessary analysis. The chapter fourth gives material and methods in detail. Firstly the flock strength, according to different physiological status is prepared. Then on the basis of this flock strength the nutrient requirement is calculated. Method of analysis L.P.P. model used for least cost ration and different notations used are discussed in details. The relevant important information regarding the nutritional subsystem, physiological system and information about all inputs which have fixed cost and variable cost were discussed. The formulae and method of analysis for productivity ratio, net cost, variable cost, and etc. are reported according to problem.

In chapter fifth the results and discussion, required data is analyzed and is discussed in detailed. The requirement of nutrient values and least cost ration calculated with the help of L.P.P are compared and discussed at a length, according to different month and season. The table comprising productivity ratio, net cost, total income were prepared and presented in the chapter for the three genetic groups, i.e. high genetic potential group, Average genetic group and poor genetic group. The analysis and result was repeated in the case of non-availability of
feeds and fodders and accordingly the least cost ration and other
tables prepared in that case also. The results and findings of the
research are discussed at a length in this chapter. Chapter sixth
deals with summary and conclusions. In chapter seventh
bibliography is given where the list of references, journals,
different Ph.D. thesis and books that are referred for the present
study are given in this chapter.

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