CHAPTER I

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Dairy cattle are among the earliest animals which have recorded history and have remained beneficial for the well being of human population. Indian cattle have not only been a symbol of wealth but an important source of milk and draught power. Over 41% of the annual national income is contributed by agriculture including dairying and animal husbandry (Statistical Abstract, India, 1979). India possesses 132.0 million cattle and 62.0 million buffaloes, which contribute approximately 18.1% of the world bovine population (F.A.O., 1932). Inspite of the large cattle population per capita milk consumption in India is very low because of the low milk production potential of zebu cows and high cost of milk production.

Different exotic dairy breeds are being used for crossing with the zebu cows with a view to evolve milk strains capable of producing more milk and suitable to different agro-ecological conditions. However, it is also essential to improve the genetic potential of certain native dairy breeds which are proposed to be maintained in purebred form as per the requirements of the National policy for preservation of native germ plasm. The rate of the genetic improvement in animal breeding depends upon three factors
(i) the accuracy with which we can estimate the breeding value of the animals, (ii) the intensity of selection, and (iii) the generation interval.

Genetic improvement can be brought about by judicious selection of both sires and dams. Selection of females is restricted because of low replacement rate required to maintain the size of the herd. A small fraction of males is required for breeding which greatly exceeds gains attainable through selection of females. Hence accurate and intensive selection of genetically superior sires is the key of all improvement programmes. The simplest and most direct way of breeding farm animals is by choosing them purely on their own phenotype and mating the chosen animals at random. The value of this practice is reduced since such selection cannot be practiced on males. Moreover the change from natural mating to artificial insemination has had great impact on dairy cattle breeding providing additional opportunities for genetic improvement.

Milk production is a sex limited character having moderate heritability. Breeding sires are judged on the basis of their pedigree, performance of collateral relatives and daughters. Young bulls are selected on the performance of the ancestors (dams, paternal and maternal grand dams yield) and from those thus initially selected, performance of their collateral relatives is considered for retention. Bulls selected on the basis of pedigree and collateral performance are put to use through artificial
breeding service, for obtaining enough daughters in lactation to have reliable estimate of breeding value. Top bulls are thus finally selected for replacement of older breeding sires, the rest being discarded.

Robertson and Hendel (1950) pointed out the opportunity of having genetic gain twice as high through artificial insemination compared to natural service in a closed herd. Possible genetic improvement in artificial breeding mainly comes from selection among bulls compared to earlier days when it used to be obtained by selection among females.

The apparent lack of correlation between an animal's breeding value and its phenotype resulted in the development of more complicated methods for judging the genotype. The accuracy of a dairy bull's genetic merit based on its daughters' lactation milk yield is more accurate than that based on other female relatives. The most popular of these is the progeny test. The main theme of the progeny testing rests on the performance of offspring, which measures his genotype, whereas an animal's own performance measures its phenotype. Progeny testing has two limitations - increased generation interval and requirement of large number of cows to be milk recorded. The generation interval can be reduced by using sires at an earlier age and also by using part lactation records. The accuracy of breeding value estimate increases with the increase in the number
daughters tested specially when the daughters are distributed over many herds. Further it is not feasible both physically and economically to record daily milk yields of number of cows spread over in small units over different villages with the farmers. Thus, periodic recording to estimate the production ability of a cow have received attention.

The science of genetics and its application to animal breeding has a great scope of marked gains through inheritance for improving milk production by adopting a well planned breeding programme. The most important parameters that are estimated to evaluate the genetic status of a herd for the desirable trait, e.g., milk production, are the estimates of genetic parameters and relative genetic progress in annual milk production, selection based on earlier traits such as part and cumulative part lactation milk records. The relative merit of selection efficiency obtained on the basis of various combinations of part lactation records for faster genetic improvement in cows have been advocated by various workers. Equally important is the need to start using selective breeding bulls of high genetic merit at an early date. This can be achieved provided accurate sire evaluation on early part and cumulative partial records relative to complete lactation records with a minimum number of unselected daughters per sire is possible.

High genetic correlations between some functions of part and cumulative milk records with total lactation yield
indicates that the genetic progress through selection of sires on the basis of these functions may be nearly as rapid as selection based on total yields thus reducing the generation interval to a certain extent.

Since the genetic correlation between part and complete records is not always unity, some error is introduced in the sire evaluation based on part records. This could, however, be compensated by increasing the number of daughters. When the testing capacity is limited, increase in the progeny size decreases the intensity of selection among young bulls and thereby decreases the genetic gain that can be achieved. Because of large discrepancy between the selection intensity among males in practice for the genetic progress, economic evaluation of different methods for increasing selection intensity or alternative breeding programmes becomes important. In cattle breeding we have limited resources in terms of number of animals, infra-structural facilities, capital etc., therefore, it is essential to evolve a suitable breeding plan to maximise the genetic gain using part records. The primary purpose of any cattle project is to improve the profitability of the enterprise, therefore, it is also essential to study the economics of such programmes for maximizing the net returns.

This study has therefore been planned in one of the important zebu breeds - Tharparker with the following
Objectives:

1. To estimate the genetic and phenotypic parameters of part and complete lactation yields.

2. To predict the lactation production and to study the relative efficiency of selection for milk production on the basis of part lactation.

3. To determine a suitable breeding plan by considering (i) progeny group size, (ii) proportion of cows to be mated to young bulls, (iii) number of young artificial insemination (A.I.) bulls in each batch on a single herd and on multiple herd basis for the genetic improvement.

4. To estimate the economic returns from the breeding plans formulated.