ADVANCES IN DAIRY CATTLE GENETICS AND BREEDING-
SYSTEM ANALYSIS OF ANIMAL BREEDING WORK IN TROPICS

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SUMMARY

Approach to animal breeding work in tropics has been discussed. The breeding parameters published pertain to the defined breeds and that no information on the non-descript cows is available. There is thus an urgent need to estimate breeding parameters from non-descript cows and define the farming systems under which they perform. Breeding objectives have been listed and results of various experiments discussed. Genetic gains in most single herds were negative or non-significant. Multi-herd co-operative progeny testing programme has been suggested as an alternative. Comparisons among breed groups have been made on the basis of individual lactation traits. The need to use all important economic traits together to study the overall merit of different genotypes in a given production system has been suggested.

INTRODUCTION

With the rapid inflow of information on various breeding parameters (growth, reproduction, culling and disposal pattern based on morbidity and mortality, productivity, longevity and feed conversion efficiency), it has become imperative that the information be used in a manner that the desired breeding objectives (maximum genetic gain/maximum profit etc.) in a production system are achieved within the identified constraints. This underlines the need for defining clearly the objectives, components of a system and using information on input-output including variability of environment over time to examine the efficiency of a production system and to choose the breeding plans to achieve the defined genetic goals.

Approach to animal breeding work in tropics has largely been to study the individual animal production or components of a production system (growth, milk production, reproduction, nutrition and management) in isolation and that the efficiency of entire system has never been studied. Most of the animal breeding parameters (population averages, genetic parameters, genetic gains, analysis of mating systems, estimates of heterosis, genotype x environment interaction and breeding value of sires) published pertain to the defined breeds selected and raised at organised farms (herd size 200-300 breedable cows) with the state/central government and research Institutes under ideal input conditions and that no information on non-descript cows, which constitute around 90% of cattle population, is available.

PRODUCTION SYSTEMS

Cattle in tropics are mostly owned by subsistence farmers and landless labourers with average holding size of 1-3 animals/farm household. These are raised on agricultural surpluses and crop residues with some grazing. Input availability varies from 0 to marginal supplementation depending upon the quality of animal and economic status of the farmer. Genetic potential of these cows is hardly exploited because the objective is to meet the limited milk requirement of the household and that there are no marketing facilities available for disposal of milk in rural areas except in countries like India where co-operative dairying set-up is now making available the milk collection facilities. Majority of the cattle are managed under insufficient input conditions with few being raised under intensive management. Field recording is absent and virtually no information on performance potential of these cattle
under their native environment is available. Change in cattle population dynamics (calves born, mortality, disposal pattern through sale of heifers and cows) in a village has never been looked into.

SELECTION STUDIES

Selection for higher milk yield in organised herds (culling of cows and selection of young bulls on dam's yield and body conformation) had been going on for quite some time. Although the objective means of assessing the overall effect of policy of breeding, feeding and management followed in a herd is through comparison of performance of cows in successive generations, such comparisons were not carried out at periodic intervals even in the Institutional herds. The genetic gains in most of the herds were negative or non-significant and had large sampling error. An analysis of genetic trend in Tharparkar herd at National Dairy Research Institute, Karnal, India from 1936 to 1971 which was under selection for higher milk yield revealed that there was no evidence of any statistically significant genetic gain in first lactation production (Gurnani, 1977). Appropriate analysis of breeding objectives from economic point of view in these herds had not been carried out, although detailed records of input and output were available at many of these farms.

CROSSBREEDING

Crossbreeding of indigenous breeds with improved European and American dairy breeds in various tropical countries to increase milk production has been going on for quite some time. Crossbreeding experiments have been evaluated to answer questions like relative importance of indigenous breeds in crossbreeding, level of exotic inheritance, estimates of heterosis, effects of interbreeding among crossbred populations, genotype x environment interaction etc. Intersire breeding among crossbred groups has been suggested as a method for stabilising crossbred populations. Differences in production performance of first and second generation crossbred populations have been attributed to the use of progeny tested sires in first and unselected sires to produce second generation crossbreds. These and the non-availability of contemporaries and time trends have biased estimates of heterosis (Taneja and Bhat, 1986). At military dairy farms in India, a comparison among alternate breeding with Friesian and Sahiwal to produce 5/8 and interbreeding among 5/8 as a system of mating is being attempted for subsequent use in synthesis of breeds.

Most of the workers have used individual first lactation traits to compare various indigenous and crossbred grades and that these have not been used together for comparison of breeds/breed groups. Taneja (1989) reported the lifetime milk yield to be significantly higher in Friesian x Hariana (12323 kg) than Brown Swiss x Hariana (9866 kg) and Jersey x Hariana (9531 kg) halfbreds. The differences, however, in number of lactations completed were non-significant (4.6-4.7). The survival rate up to age at first calving in Friesian x Hariana, Brown Swiss x Hariana and Jersey x Hariana halfbreds was 82%, 67% and 73% respectively. The average number of lactations completed and lifetime milk production (based on cows culled/died) in Karan Swiss (Brown Swiss x Sahiwal/Red Sindhi) cows was 3.58 ± 0.11 and 9538 ± 296 kg respectively (Singh and Tomer, 1988). Average profit/day of herd life in Holstein x Sahiwal crosses (Rs.4.88) was higher than Red Dane/Jersey x Sahiwal (Rs.3.28) crosses. This was because yield levels in Holstein x Sahiwal crosses were higher than other breed crosses (Reddy and Basu, 1985; Prasad et al., 1987). These results of survival rate, lifetime milk yield, number of lactations completed and herd life profit indicated that crosses of Holstein with various indigenous breeds were, in general, better than other breed crosses under ideal input conditions.

Divergence analysis and clustering pattern approach has been used to differentiate among the breed groups using traits of growth, reproduction and production

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pertaining mostly to first lactation. Taneja et al. (1979) based on divergence analysis of Sahiwal and 39 Holstein Friesian (H) x Sahiwal crossbred grades using 8 traits pertaining to first lactation showed that in cattle when two breeds of diverse origin, one of superior merit and other relatively inferior, were crosses in a scheme of forward crossing, there was no linear increase in production above 50% with the increase in genes of superior parent. The authors suggested that for developing breed types (1) Sahiwal and lower grades should be bred using Sahiwal bulls, (2) crossbred grades (16/64 - 55/64 H) should be bred to bulls with 50% Holstein inheritance and subjected to intense selection and (3) animals with 63/64 Holstein inheritance should safely be bred to purebred Holstein.

**PROGENY TESTING PROGRAMMES**

Progeny testing programme for crossbred bulls (Brown Swiss x non-descript) under field conditions under the Indo-Swiss project in Kerala (India) was initiated in 1977. A total of 180 young crossbred bull calves were produced from the mating of tested bulls with elite cows and 45 best males selected on growth and semen quality put to test each year. It is important to mention that between 45 and 73% of the crossbred bulls upto 6 years of age were culled on account of poor individual semen motility, poor or no libido, aspermia/oligospermia while that between 4 and 19% were culled due to other reasons. These data suggest that much larger number of crossbred males need to be produced to select the required numbers to be put to progeny test to have reasonable intensity of selection. Herd size with farmers varied from 1-2 cows. A total of 1500 test inseminations for each bull randomly distributed in 6 milk recording areas were arranged to harvest 50-60 completed first lactation records per bull. Under the field conditions in Kerala, out of total female calves identified and registered, 60% were lost by the time of enrolment for milk recording and 26% lost during milk recording period (Annual Report, 1985-86). Milk recording was done once in a month and records used for predicting 300 day milk yield. Genetic model with effects like AI centre, sire of cow, type of dam, month and year of calving, age of cow and sex of calf explained only 21% of the variation in milk yield. Lower variability accounted for due to the model was attributed to small herd size. It was suggested that animals should be grouped into herds according to feeding/production level (Chacko et al., 1984). Age at first calving in these crossbreds was between 30 and 35 months and calving interval 15 months. Bulls were put to progeny test at 3 years of age and got proven by 8-9 years. Almost similar observations were available from other areas where field progeny testing programmes have been attempted.

**DISCUSSION**

The breeding objectives in dairy cattle in tropics have been to increase milk yield through grading up of non-descript cows, selection within the improved/defined indigenous breeds, crossbreeding with various European and American dairy breeds to produce crossbred grades for commercial milk production and to evaluate breed groups for their suitability in tropical environment. Comparisons among various breed groups have been done on the basis of individual lactation traits and that these together have not been used to study the overall merit of a given genotype in a production system. Criteria like feed cost/unit of milk, maximum milk yield, milk yield/cow in life time and milk yield/day of life and net profit/cow/year etc. have not been used to define breeding goals.

Information on animal breeding parameters is available only from the defined breeds under optimum input conditions and that no information on non-descript cows which constitute around 90% of cattle population is available. There is, thus, an urgent need to study their performance in their native environment and define clearly the production systems under which these cows perform. Mortality and disposal pat-
tern of calves born also needs to be studied to devise breeding programmes for improvement.

Results of selection studies in single closed herds revealed that genetic gains either were negative or non-significant. This was because of the small herd size, selection of sires based on dam's yield and considerable variation in use of breeding bulls. These studies clearly revealed that in single closed herds of limited size, progeny testing programme was not viable and that multi-herd co-operative progeny testing programme should be adopted.

Comparisons of various crossbreed grades for number of lactations completed, lifetime milk yield and average profit/day of herd life revealed that Holstein crosses were better than other breed crosses. Information, however, on disease pattern, production losses and expenses on health cover etc. was not available. This needs to be generated and used along with other economic parameters to evaluate breed groups for overall economic efficiency.

Results of progeny testing programme under field conditions have not been encouraging mainly because of elimination of the large number of females before completion of their lactation, poor semen quality of a large proportion of crossbred bulls and longer generation interval coupled with poor accuracy of sires resulting from errors due to no corrections for age, exotic inheritance of dams and large differences between herds. Only viable alternative therefore, in tropical countries where field recording is almost absent, is to use multiple ovulation and embryo transfer (MOET) for production and testing of sires for effecting genetic improvement. System analysis approach may be used to study the efficiency of MOET schemes in a given genetic selection programme.

REFERENCES

ANNUAL REPORT, 1985-86. Kerala Livestock Development and Milk Marketing Board Ltd., Trivandrum, India.