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Cattle Development through Field Progeny Testing

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ABSTRACT

Livestock play a very important economic and socio-cultural role in human history especially for the rural households often contributing to multiple livelihood objectives. Livestock keeping also acts as an indispensable asset of the poor, their human capital, through its impact on their own nutrition and health. The world cattle inventory in 2019 is at about 989.03 million head. India's cattle inventory amounted to over 303 million in 2020. While the global cattle population stood at over 987 million, India had the highest cattle population followed by Brazil, the United States, and China that year.

Keywords: Cattle development, Field progeny testing, Livestock.

INTRODUCTION

The idea of progeny testing is not new, having been advocated 2000 years ago by Roman Varro. Robert Bakewell is reported to have used in the eighteenth century by letting out bulls and rams on an annual basis. Then he could later use those which proved to be outstanding transmitters [1].

1) Individuality tells us what an animal seems to be,
2) his pedigree tells us what he ought to be,
3) but the performance of his progeny tells us what he is."

In this context, India is blessed with a huge biodiversity of 50 indigenous cattle breeds and 17 Buffalo breeds that have survived over last hundreds of years in respect of their suitability for specific purposes in the concerned local environment. Cattle always recognized as important species of livestock due to its momentous contribution to the national milk pool and securing the economy of majority of rural farmers in our country. The Government is taking consistent efforts for genetic improvement of cattle through implementation of various cattle improvement programmes *viz.*, National Programme for Bovine Breeding and Dairy Development, National Dairy Plan, Rashtriya Gokul Mission *etc*., as a result, significant advancement has been achieved in increasing the milk production. The Govt. of India strategy is thus to enhance the average productivity of milk of select breeds from the overall available breed types (*e.g.* Gir for high milk productivity) from the present level of 4.85 kg per day to 6.77 kg per day per indigenous animal etc. The national milk production during the year 2019-20 was recorded as 195 million tonnes. As the human population increased, there was a corresponding increase in the need for more cattle to provide additional meat and milk, as well as other dairy products [2]. The increase in the consumption of meat and dairy products requires that increasing numbers of livestock be kept. The cattle breeding sector needs to address the emerging challenge that, while the increasing demand for livestock products should be met, the environmental effects of cattle breeding have to be kept in check [3].

To achieve the twin objectives of increased milk production and increased returns to the farmers, it is necessary that we provide the farmers with an efficient milk producing animal

with improved productivity. One of the key factors affecting productivity is the genetic ability of an animal for milk production, which is an inherited character and other being an enabling environment [4]. The breeding bull contributes significantly in enhancing the genetic potential of its progenies for economically important traits like milk production, fat and protein production, fertility, body conformation etc. Therefore, production and selection of breeding bulls with high genetic potential for milk production and other important traits and transmitting their genetic potential to maximum number of progenies is very important in any animal breeding programme. Progeny Testing is a method for accurately selecting such breeding bulls and producing future bulls [5].

Objectives

The main objectives of the Progeny Testing Programme are:

1) To produce the required genetically superior quality bulls for semen production stations through progeny testing.
2) To achieve a steady genetic progress in the cattle population for milk, fat and protein yield and type characters in the villages where the progeny testing programme is implemented.

Progeny Testing

The productivity of dairy animals influences by the genotype and the environment in which they maintained. Enhancing the productivity thus requires increasing the genetic potential of animals and providing an optimal environment to achieve the expected genetic potential. Systematic selection of parents, generation after generation, on a continuous basis, can achieve a steady increase in the genetic potential of animals in any population. The selection of males always assumes greater significance in any genetic improvement programme as their contribution to the next generation is significantly higher than females. A bovine female can produce only one progeny in a year, whereas a bovine male can breed around 100-150 females in the same period [6]. Besides, when artificial insemination (AI) is practiced as a breeding tool in place of natural mating, semen produced by a bull in a year could be used to breed thousands of females and therefore, the importance of accurately selecting male becomes even more critical. In absence of any selection programme for males, no significant genetic progress can be expected in any population. Absence of systematic selection of males for artificial insemination is the main reason for the low productivity of dairy animals in the country. Most of the bulls used for semen production are being picked up from villages or institutional farms based on their dam's morning-evening milk records or reported peak yields or lactation record and without verifying their parentage [6].

High levels of productivity in advanced dairy producing nations have been achieved primarily through continuous use of genetically superior bulls produced through field progeny testing programme and by bringing larger and larger proportion of breedable animals under Artificial Insemination (AI) services. In India at present hardly 10-15% of the total bulls used for semen collection have come from any systematic genetic improvement programme and not more than 20% of the total breedable cattle and buffaloes are being artificially inseminated [7]. This is one of the main reasons for low productivity of our animals. In fact, the primary focus of AI has been for crossbreeding and as crossbreds produced from any exotic bull had significantly higher milk yields than their local mothers, perhaps the emphasis required on selection of bulls was ignored. Many have not realized that

the drop in productivity of crossbreds in subsequent generations produced through *inter se* mating is due to the absence of selection programme for crossbred males [8].

Rationale of the Programme

The projected annual demand for milk is to reach around 200 million MT by 2021-22. Given the present productivity levels (176.3 million tonnes in 2017-18) of our bovines and the resource constraints, it is impossible to meet this demand through domestic production unless productivity of our bovines increases. A three-pronged strategy is planned to achieve this target. Increase the proportion of animals under AI from existing 20% to 50%, strengthen the frozen semen production infrastructure to produce quality semen to meet the requirement of this increased AI coverage, and produce bulls of high genetic merit for semen production. To produce the required bulls of various breeds and breed combinations, it is planned to set up progeny testing programmes in pockets where the best genetics and adequate number of breedable females are available and where a large proportion of breedable females are artificially inseminated [9].

In our country, are a very few agencies which have taken up field-based progeny testing programmes for large scale bull production. Kerala Livestock Development Board (KLDB) is the pioneer in this field and had been implementing a programme for crossbred bulls for the last few decades. BAIF Development Research Foundation is also involved in a programme for evaluation of HF crossbred bulls jointly with ICAR-Central Institute for Research on Cattle, Meerut for the last 15 years. Andhra Pradesh Livestock Agency is another agency which has been carrying out a field-based PT programme for Murrah and Jersey crossbred bulls. Other two agencies namely Sabarmati Ashram Gaushala, Bidaj and Mehsana District Coop Milk Producers' Union have also been implementing bull evaluation programmes for HF crossbred, Murrah and Mehsana buffalo bulls for more than 15 years under the technical guidance of NDDB [8]. Besides these, there are some institutions, which evaluate bulls at the farm level, but their scale of operation is very small. The above agencies, however, produce bulls for their own semen stations. So far, no effort has been made to work out country's requirement of breeding bulls for frozen semen production and plan genetic evaluation programmes for production of the required bulls. The situation in this country is complex. We require not only breeding bulls of different indigenous cattle breeds, indigenous buffalo breeds, crossbred bulls of Jersey and HF and pure HF and Jersey bulls, but they are required also in very large numbers as our annual semen requirement would be around 140 million doses by 2021-22 [9]. Also, we do not have AI infrastructure in breeding tracts of some of the local breeds of cattle and buffalo to take up a progeny testing programme. In such cases we have to depend on pedigree selection based on a systematic milk recording programme. Required pure Jersey bulls would have to be imported as we do not have pure Jersey herds in the field in the country for PT programme. A small number of pure HF bulls could be produced in some pockets of our country, rest required HF bulls may have to be imported for such activities [10].

Progeny Testing Programme at ICAR-CIRC

ICAR-Central Institute for Research on Cattle (CIRC) a nodal institute for Cattle Research, established at Meerut on November 3, 1987 (Formerly Project Directorate on Cattle) to monitor, coordinate and support all research and development activities for cattle improvement, by upgrading the status of erstwhile. All India Coordinated Research Project (AICRP) on Cattle where it was concluded that Holstein Friesian exotic breed with exotic inheritance of 50 - 62.5 % was the ideal choice for producing crossbred cattle in most regions of the country [11]. It was proposed to develop a new cattle breed "Frieswal" having 62.5%

HF inheritance and capable of producing 4000 litres of milk with 4% butter fat in a mature lactation of 300 days by utilizing a large population of HF x Sahiwal available at different Military Farms of the country [12]. Subsequently, keeping in view the importance of indigenous breeds known for their adaptability and disease resistance qualities, Indigenous Breeds Project (IBP) was initiated in the year 1989 in collaboration with the SAUs, State Govt. and Non-Government Organizations to conserve and improve the Indigenous breeds. Similarly, Field Progeny Testing (FPT) project undertaken in 1991 (8thfive-year plan) to bring genetic improvement in HF crossbred cattle in farmers' herd. The institute is also undertaking basic research work related to cattle husbandry at farm and field level [11]. The programme is running in collaboration with Kerala Veterinary and Animal Sciences University Thrissur, (Kerala) Guru Angad Dev Veterinary & Animal Sciences University, Ludhiana (Punjab), BAIF Development Research Foundation, Uruli-Kanchan, Pune, (Maharashtra) and G B Pant University of Agriculture & Technology, Pantnagar (Uttarakhand) India. The institute also has a well-established semen-freezing laboratory to produce and supply superior male germplasm of different indigenous and crossbred cattle to the needy stakeholders like Military Dairy Farms, Animal Husbandry Departments, Livestock Development Boards, Gaushalas, NGOs and commercial dairy farmers [12].

Technical Program

The modified field progeny testing program envisages testing of 30 Frieswal (HF × Sahiwal) bulls in each batch having 62.5% exotic inheritance and dam's minimum mature equivalent milk yield of 4,500 kg. The bull - dams should be of good conformation. This project covers about 32,000 test females in the field conditions at 4 different locations. Each time a new batch of 30 Frieswal young crossbred bulls has introduced into the cycle at 15-18 months interval [13]. The target is to record first lactation milk performance of at least 40 daughters per bull spread over KVASU, GADVASU, BAIF and GBPUAT. This will involve inseminating at least 300 cows/bull at each unit, thus a population of about 9,000 cows at each unit will be required for test mating with 30 bulls. Information on animal identification, its age, sire, dam, date of insemination, pregnancy result, date of calving, data on milk production and reason for loss of data are to be generated. Data are also to be recorded on farmer's socio-economic status, herd size, land holding, feeding, housing, and herd management practices. Trained milk recorders on contractual basis carried out the milk recording. Milk supervisors and senior officers of the project make regular checks to ensure accurate milk production and performance recording [14].

International Experience

In global context, the systematic information on progeny testing programe is available very less. However, some international agencies are working on the livestock development programs. The International Committee for Animal Recording (ICAR) is an International Non-Governmental Organization (INGO) which was formed on March 9th, 1951, in Rome. Presently it is composed of 115 Members from 57 countries. ICAR now strives to be the leading global provider of Guidelines, Standards and Certification for animal identification, animal recording and animal evaluation [14]. ICAR wants to improve the profitability, and sustainability of farm animal production by:

- Establishing and maintaining guidelines and standards for best practice in all aspects of animal identification and recording.
- Certifying equipment, and processes used in animal identification, recording and genetic evaluations.

- Stimulating and leading: continuous improvement, innovation, research, knowledge development, and knowledge exchange.
- Providing services essential to achieving international collaboration in key aspects of animal recording and animal breeding.

Food & Agriculture Organization (FAO) Rom, Italy and International Atomic Energy Agency(IAEA) Vienna, Austria, jointly working on selection and breeding of cattle in Asia: Strategies and Criteria for Improved Breeding Prepared under the Framework of an RCA Project with the Technical Support of the Joint Programme of Nuclear Techniques in Food and Agriculture. Other agencies like ABS Australia, International Livestock Research Institute (ILRI), Ethiopia etc. also involve in such type of activities. Moreover, in Bangladesh, Pakistan, Philippines, Shri-Lanka, African countries various breed improvement programme especially on production of proven bulls through progeny testing has been initiated to sustain dairy sector though the government and NGOs.

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