Rural experiences in implementing cattle and buffalo improvement programs.

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Unlike in European and American countries, milk production under Indian rural conditions, is viewed as one of the component of farming system and is valued not alone for milk and beef but to generate draft power besides earning a supplementary income to the farming family. Considering the ban on cow slaughter in very large part of the country, besides selection for milk production as a trait, other traits like longevity, reproductive fitness, feed conversion efficiency and other economic traits therefore need to be considered in the light of social context as well.

In order to understand the cattle and buffalo breeding situation under Indian rural conditions and their relevance to NDP-1 project, an attempt in this paper is made to present the experiences by grouping them in two aspects

- Comments on different aspects of existing infrastructure
- Views on Possible strategies for genetic improvement.

1. Comments on different aspects of existing infrastructure

1.1. Semen Stations :-

1.1.1. The very purpose of establishment of frozen semen production stations in the country is to produce the semen from high quality bulls for bringing about genetic improvement of either the breed or the species. Except for the few, generally the semen produced at the stations is mainly to cater to breeding service needs of the farmer at village level. Finding a mismatch between the type of animal presented for insemination and the type of semen offered (due to non availability of

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semen of required type at the semen station of the area) is a common experience. The farming community is thus forced to opt for natural service or accepting to whatever type of semen offered. This seriously affects the process of genetic improvement. While there could be honest reasons for doing so, it would be necessary to plan the procurement and ensure availability of required type of breeding bulls at the stations in line with the strategy for genetic improvement program to avoid the generation of nondescript animals at village level.

1.1.2. There are many semen production stations in the country (run either by the individuals or the institutions or state agricultural universities) which have neither been registered with the government nor evaluated and certified for their quality. Many of them are even involved in semen sale also. No authentic information about the bulls from these places is available. One can imagine the extent of damage they could be causing to livestock resources by making inferior quality bull semen (that too of unknown quality) available to community. Mechanism for their monitoring and control will be necessary.

1.2. Artificial Insemination Delivery :-

1.2.1. The quantified micro level information on extent of contribution provided by each type of player among many in the society, to the national cattle breeding services is desired but is not available to the accuracy desired. This would help assess deciding execution strategies, further, although the number of inseminations carried out by them could be large but the variation in their services provision approach could affect the efficiency and the outcome.

1.2.2. Field fertility response and the effect of associated factors could be different in different geographical and social situations. In tribal dominated situations for example in developing state of Jharkhand (S.B. Gokhale 2012), the data compiled and analyzed for 64677 inseminations in cattle and 3044 in buffaloes revealed mean conception rate of 52.62 +0.2% and 54.14 + 0.9% respectively. Bhagat and Gokhale (2013) based on data on 71,765 Artificial Inseminations on 42,962 crossbreed animals owned by 23,500 farmers from Western Maharashtra, reported conception rate of 46.40±0.19 per cent.

1.2.3. Effect of different factors affecting conception rate has been studied at field level. Gokhale S.B. (2012) reported that region wise conception rate figures in Jharkhand ranged from 36.36 + 19.44 % in Singhbhumi region to 53. 14 + 2.75% in Hazaribagh region. Generally more pregnancy rate was observed in animals from Above Poverty Line (APL) families. The results indicated that more efforts in creating awareness about benefits of dairy cattle rearing can reduce the observed disparity in approach to production of improved animals amongst zones. Animals inseminated between September to February yielded better conception rate because of the rains and more fodder availability for grazing in the state compared to those between March to August months of the year. This could mainly be because of the dry season of summer and non availability of grasses (dry or green) to animals. It was noted that within season between zones variation was not very important meaning that this was a generalized trend, the difference in animal management during the respective seasons will have to be appropriately attended to. Local cows showed better conception rate than crossbreds, Jersey crosses yielded better conception rates than HF crosses, large variation in conception rates among zones indicated necessity of in depth investigation. The effect of stage of heat studied under field conditions indicated that inseminations during mid heat period yielded higher conception rate while those during early & late heat yielded lower fertility, zonal variability indicated further investigations for the reasons, identification of heat stage seem to need further fine tuning. In Maharashtra, among the crossbred herds managed for commercial milk production, factors affecting conception rate were found different than in other situations. Effect of factors like mode of A.I. charges and type of land (irrigated or non irrigated) were found significantly affecting conception rate, however effect of animal breed, parity, season of A.I., period of A.I. and bull used for A.I. did not affect conception rate in Western Maharashtra rural crossbred cows.

1.2.4. There are large numbers of private individual inseminators in the country engaged in earning their livelihood through providing Artificial Insemination services in rural area. This number needs to be taken in consideration while assessing the extent of population being covered.

1.3. Information Systems:-

1.3.1. The utility of information system in dairy cattle performance is known since long and is profitably used in European countries and USA for augmenting dairy profits. The system did not exist in India for very many reasons. Some decades back an attempt was made in BAIF to introduce farmer information feedback system, even at that time, although the importance of keeping animal information was realized at farmer level, small herd size and the financial turn over at individual animal level was not attractive to invest time and money needed for information update. Although the times have changed and some farmer fractions are coming forward expressing need, unless the organized efforts are made to involve the farmers to pay for it and actively participate to derive benefits from the efforts, the activity will not be sustainable.

1.3.2. The use of an electronic device in the form of mobile telephone has been demonstrated at village level by Gokhale et al (2011). The device was tried at pilot scale in selected 492 Cattle Development Centre (CDC) locations operated by BAIF Development Research Foundation, across 55 districts distributed in the states of Jharkhand, Bihar, Uttar Pradesh and Maharashtra. Information collected on the device during 2006 to 2011 compiled and analyzed for 5,26,901 (4,10,801 cattle & 1,16,100 buffalo) Artificial Inseminations (A.I.) indicated that after first insemination, 2,30,671 A.I.s could be followed (cattle-1,82,438 & buffalo 46,233) indicating overall follow up 43.77%. The follow up percentage in cattle and buffalo was 44.41% and 41.54, respectively.

Further analysis of cattle data indicated that out of followed animals 44.98% were pregnant, 26.78% animals repeated and 22.52% were found empty after per rectum examination. The respective figures for buffaloes were 47.77%, 19.39% and 27.86 respectively. Incidence of re A.I. on the same heat was found to be 3.17% in cattle and 2.35% in buffaloes. Data on factors like sold, died, transferred, abortions, problem breeders, farmers discontinuing participation, farmers refusing to allow technician to examine their animals for pregnancy, animals not traceable and animals not examined for pregnancy were also recorded. It was observed that contribution of each of these factors is less than 1%. The constraints noticed in use of these devices at rural level included non-availability of network, difficult access to accessories (battery, charger, micro S.D. card etc.), non-availability of facilities for minor repairs and free device memory due to loading songs, video clips, photographs etc. by the technicians. It was concluded that it is feasible and useful to adopt electronic mobile telephone for capturing dairy animal field data at rural level to increase the possibility of generating reference population under field conditions. It is suggested that while capitalizing on the benefits, constraints needs to be addressed appropriately.

In orders to reach to solutions to many of the constraints mentioned above, a legislation covering solutions to the situation for livestock breeding is recommended.

1.4. Progeny Testing Programme_ BAIF Experiences

During the pre-independence period, sires were selected on breed characteristics and pedigree information. The evaluation of sires was mostly based on body size, confirmation and high production potential of dam. Thereafter investigations have revealed that young bulls must be tested based on their daughter's performance before extensive use in artificial insemination program. THE crossbred animals under Indian conditions undoubtedly produced more milk as compared to their counterpart Indigenous cattle breeds and non-descript animals; performance being highest in 1st

generation declined thereafter, it could not be stabilized due to segregation loss, small population size and lack of optimum selection strategies especially in later generations. Use of crossbred bulls with known genetic merit and exotic blood level has helped in sustaining the genetic progress in the crossbred herds, maintain exotic inheritance and improve non-descript population.

In India, the progeny testing has been first attempted in Indigenous breeds like Hariana, Sahiwal. Ongole and Gir either on organized farms or in associated herds. The programme involving single herd testing has always problem of base population and large herd size required which, was often constraint leading to mixed experiences in identifying improver bulls intended to be used on farm to produce future bulls. Based on the experiences gained in Kerala state, field progeny testing has been introduced in various states recently by Department of Animal Husbandry and Government of India.

BAIF started implementation of its rural cattle improvement program through crossbreeding in 1970, the need of field recording was realized to assess the baseline production level of crossbred population. BAIF sought funding support from an Industry in the year 1975 to explore the feasibility of field recording for collecting performance data. The project period of five years gave opportunity to understand the problems of field recording and try possible ways to record animals at farmer door. This experience was coordinated through the ad-hoc research project sanctioned by ICAR for standardizing procedures of field recording to be used for testing of bulls.

1.4.1. Approach for field recording:

The field performance recording was carried out using different approaches like farmer recording, full time permanent recorders, contract recorders, use of gram sevaks and village functionaries, school boys and teachers, dairy secretaries etc. Each one has its own merits and demerits. Considering the financial, operational and institutional implications, milk recording through contract milk recorders and supervision by permanent employee was found to be the best working solution for milk recording under Field Progeny Testing program.

The first recording was made within one week from the date of calving. Correction factors for extending incomplete lactation or for those in progress were arrived at and used for the progeny groups. The short lactation of less than 150 days duration were eliminated and those in progress of less than 90 days were also excluded for inclusion in the progeny group analysis. Alternate AM/PM method was used for milk recording and time interval method was used for estimation of lactation yield from day's yield.

1.4.2. Operational experiences:

In order to avoid biased use of bulls, in the initial years of the program, randomness in use of bulls was achieved by mixing semen straws of the bulls under test and supplying them in a goblet to the insemination center. This necessitated estimation of per month insemination performance of center, calculating number of straws required to be supplied to the center. Actual performance could be in variance with the estimated one thus resulting either in the shortage of surplus semen stock of bulls under test. Although this worked for quite some time, as the center insemination performance started increasing and number of breeds to be supplied to centre also started increasing, an improvement in process of randomness was required to be modified and supply of semen of one bull under test per month was adopted.

In initial period, simulating from A.I. and animal performance results at village level centers, it was estimated that lesser than 30 number of progenies per bull would provide lesser reliability of test results. In view of the operational constraints in getting at least 30 recorded progenies per bull for comparison at field level, 300 inseminations per bull were required to be performed. As the crossbreeding program progressed with the period of time, the sale of progeny increased and more number of inseminations were found to be required for getting effective daughter completing first lactation.

The continued identification of progeny was ensured by tagging at an early age and during initial period, body growth measurements (Height at withers, Girth and body length) at every three months interval were taken till the breed able age. When attempt to correlate sire merit from growth measurements to milk production did not yield favorable results, the body measurement period from three month interval was extended to six monthly interval just to insure the presence of animal till it reaches to breeding and lactation stage. Area wise large variations due to sale and disposal of progeny during pregnancy, post calving and milking results in varying number of progenies per bull thus were available for comparison and were given due weightage while ranking the bull. Recording of feed offered to and consumed by the progeny is kept for interpreting the progeny group data for bull comparison.

Frequently, herd size of less than four animals lead to birth, production and performance of one progeny per bull and resulted in to progeny data showing confounding of Bull X Herd effect leading to larger errors affecting the accuracy of the bull comparison. It was therefore recommended to have at least two bull's progeny in a herd and thus the herds of at least four breed able animals be selected under progeny testing. Selecting the herds of at-least four breed able animals per farmer further helps in reduction of milk recording expenses as one milk recorder records maximum animals.

Mangurkar and Gokhale (1995) reported results of milk performance recording in 2432 herds with 13535 crossbred cows. The data was analyzed to standardize the procedure in respect of the use of incomplete records, morning and/or evening records, test day yields from different recording interval plans, methods of estimating yields and assessing the need of correct test day yields for days in milk. The factors were developed for extending the incomplete records to 305 days. Milk yield 305 days estimated from alternate morning and evening recording was nearer to mean of standard lactation. Whereas use of either morning or evening records tended to overestimate or under estimate the yields. Comparison of test interval method, average yield method and centering date method for estimating lactation yields from test day records showed superiority of test interval method. The test day record collected in inclining and declining phase of lactation required correction for days in milk. The milk recording method of 2 month interval was adequate to estimate yields with less than 5% actual error though shorter intervals would be preferable in field conditions.

Considering the importance of quality of milk under field conditions Gokhale and Mangurkar (1993, 1994) examined 16101 milk samples from rural Jersey crossbreds and 27221 from Holstein crosses. Average milk fat content in Jersey crosses was observed to be 4.195 + 0.152 % and that it in Holstein crosses 3.89 + 0.13%. Least square analysis revealed effect of breed, period, region, season of calving, parity and age at calving had significant effect on milk fat content of jersey crossbreds. In Holstein crosses however, different interaction effects for example - Breed X season of calving, season X age at calving, lactation stage X age at calving, region X age at calving, age X parity, Parity X stage of lactation, region X season of calving, period X season of calving were significant and important. Higher significant differences between sires for milk fat content indicated sufficiently wide genetic variation in milk fat which could be exploited for genetic improvement through progeny testing. Use of highly selected bulls could improve the trait. Large variation of milk fat content in field Holstein crossbreds and various genetic and environmental factors affecting the trait warrant consideration of development of correction factors for important environmental effects.

Gokhale and Mangurkar (1995) while scrutinizing the field crossbred data under progeny testing noted that location, year and month of calving and exotic blood level of crossbred significantly affected the lactation yield. Under sire evaluation program data on 40 sires (23pure bred and 17 crossbred) having minimum 4 progenies were used. The estimated sire merit was calculated using different sire evaluation methods such as Simple daughter average (SDA), Herd mate comparison (HMC), Contemporary Comparison (CC) Least Square (LS) and Best Linear Unbiased Prediction (BLUP). The product moment correlation and rank correlation between sire evaluations based on different methods Ranged from 0.07101 to 0.9297. Standard error of sire estimate (used as measure to compare different methods) for BLUP was least. Amongst bulls tested, 10 purebred and 11 crossbred bulls had reliability of proof of more than 60%. The predicted difference in milk yield of 12 bulls exceeded population average by more than 5%.

The implications of conclusions drawn by Gaur et al (2008) indicating that bulls with higher ranks for milk production under military farm conditions did not retain their superiority under field conditions, are likely to have far reaching consequences since current approach for testing is on large herds or of associated herds. Investigations for reasons of poor correlations between testing under small and large herds and searching solutions to improve them will nationally help for genetic improvement of large dairy livestock.

In case of Buffalo Progeny Testing program, while implementing program by BAIF, the recent achievements have led to a possibility of searching and identifying QTLs for milk and milk component traits. The work is in progress and the utilizable results will be available within a year.

2. Views on Possible strategies for genetic improvement.

2.1. Considering the size of the country, agro-socio-economic variability in different regions, extent of utilization of large animals resources, different extent of religious importance given to cattle, ban on cow slaughter, requirement of differential selection criteria for improvement of cattle and buffalo population in the country etc., it is necessary to provide inputs for a broad approach of strategy for genetic improvement. Following could be cited as some examples.

2.2. One of the important strategies could be to augment the coverage of breeding of animals. For effective achievement of this objective, ways to differentiate between service provision and genetic improvement need to be searched and action strategy decided accordingly.

2.3. System to account for the A.I. contribution from each of the stake holder needs to be searched. It is experienced that private individuals opting for A.I. as a wage earning instrument, adopt different ways of using it, thus the number of inseminations in such a case could be misleading. An exercise leading to identification of these ways, giving appropriate weight to the reliability and then accounting could be useful in assessing it as a tool for considering in genetic improvement strategy.

2.4. Establishing Breeder societies, strengthening and expanding the existing ones would be necessary to optimally increase the qualitative insemination output from the inseminators. This would effect in defined direction to the A.I. necessary for defining and drawing genetic improvement strategy.

2.5. Identification and selection of potential breeding bull is an important step in the program for genetic improvement. Presently this program is almost nonexistent except for very few breeds where pedigree and phenotypic selection is resorted to. Conservation and improvement of large number of indigenous breeds necessitate careful planning and execution of strategies for selection and procurement of sufficient number of breeding bulls for catering to breeding needs of each breed in their home tract. Large number of inseminators presently available in the country could effectively reduce the requirement of present extent of number of bulls used for natural service.

2.6. If the situation is favorable, adoption and utilization of modern biotechnological tools for breeding bull production can enhance the speed and accuracy of genetic improvement programs. If it is not, required steps need to be taken. For example, the farmers have hazy ideas about the embryo technology and have varied opinions about it. Some of them feel that it is used for correcting reproductive problems in cattle and may give excellent results in correcting problem breeder animals, it can replace A.I., each transfer will sure lead to birth of calf, embryo transfer can be used for augmenting milk production etc.etc., necessary awareness program therefore would help increasing their knowledge necessary for their participation in bull production and progeny testing programs.

2.7. With regards to status of fitness of animals for embryo collection and transfer work, Gokhale S.B. (2005) undertook a field survey in 28 villages of Western region in Maharashtra covering 546 Dangi breed cows belonging to 241 farmers and assessed their status for fitness for inclusion in embryo collection and transfer program. Examination by veterinarians revealed that 16.48 % animals were normal and cyclical, 35.53 % animals either recently calved or pregnant while 47.99 % of animals were suffering from reproductive disorders. The analysis further indicated that in Dangi breed animals at village level; hardly 3% animals could qualify as donors for embryo collection. The situation in crossbred females however was much better. The strategy therefore would be to undertake breed improvement programs to reduce the phenotypic variability and attempt to standardize the breed population for getting results of desirable accuracy level.

2.8. The awareness and adoption of modern biotechnology like sexed semen amongst farmer community was found to be at much low level than desired. When surveyed amongst 249 forward looking farming in Western Maharashtra. It was noticed that nearly three fourth farmer fractions favored the use of technology, 17% did not want it while 10% did not want to enter into the debate. Those who favored had concern regarding the process resulting in reduction of males, technology being economically not affordable, the application of technique leading to reduction in price of animal and the consequences leading to fodder shortage. The farmers opined that the technology should thoroughly be tested before use, sex semen A.I. cost should be at par with existing cost rate of normal semen A.I. and animal should conceive in first A.I., the technique should be applicable in Indigenous breeds. Those who did not want argued that we should not disturb nature. Trainings of farming and technical manpower thus need to be an integral part of the genetic improvement strategy.

2.9. Establishing Data collection and information network related to animal breeding activities is essential beyond doubt. There are many agencies (like ICAR, National Bureau of Animal Genetic Resources, Department of Animal Husbandry and Dairying, National Information network etc.) claiming this necessity and are trying to have their own national network initiated and established. The process of individual identity, collaboration between different agencies etc need to be worked out in such a way that the working harmony amongst the agencies is maintained.

It is concluded that while deciding and implementing genetic improvement program under NDP-I, village level experiences need to be considered and learning incorporated as an input, consider different aspects and recommendations while drawing the strategy, work for securing required legislations for assuring proper implementation for genetic improvement, undertake trainings on various aspects of the program and establish the data collection and information network to effectively use for cattle and buffalo improvement through the project.

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