



Impact of crossbreeding and upgrading of nondescript cattle and buffaloes on livestock quality and income

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ABSTRACT

Upgradation of the progeny of low productive nondescript cattle through crossbreeding during 60's, marked the involvement of marginal and small farmers who represented 85% of the land holders in India, in dairy industry. Various development organisations took initiatives to conserve local breeds of cows and buffaloes. To study the response of farmers to genetic improvement of cattle through crossbreeding and upgradation with native breeds, a field survey was conducted in 8 states where BAIF has been providing livestock breeding services. The study revealed that with reliable services, the population of crossbred cattle increased with significant reduction in nondescript cattle. Recently, due to aggressive propaganda on native cows, farmers have been gradually shifting to native breeds of cattle. Most of the farmers had no idea about the economics of native cows while the average milk yield of crossbreds was 100% to 150% higher. With regard to buffaloes, Murrah breed was popular. The programme enabled farmers to generate higher income by selling surplus milk and animals. Farmers covered under milk collection realized higher price. There was 200% to 400% increase in income of dairy farmers, based on the duration of their participation, number of cows owned, availability of feed and veterinary services, realization of price for milk, etc. The programme helped significant number of poor families to come out of poverty. However, as there is a move to shift from crossbreeding to upgrade with native breeds, it is recommended to study the economics of milch animals with other advantages and disadvantages to enlighten the farmers.

Key words: Buffaloes, Crossbreeding, Genetic improvement, Income, Livestock, Non descript cattle

Genetic erosion of Indian cattle population over decades, had led to initiation of pilot projects on crossbreeding between 1910 and 1932, by National Research Institutions and Military Dairy Farms. Based on the successful performance of crossbred cows, several bilateral aided projects were initiated and the scientific panel of the Agriculture Ministry in 1965, recommended the upgradation of nondescript cattle with selected indigenous breeds as well as to crossbreed with exotic breeds. Crossbreeding of nondescript cattle for increasing milk production was adopted as an official policy of the Government of India in 1969 (Wakchaure *et al.* 2015). Realising the potential of crossbred cows to provide sustainable livelihood for small farmers, BAIF Development Research Foundation promoted crossbreeding programme across the country while expanding the cattle development programme, along with breeding of buffaloes and conservation of native breeds. The crossbreeding programme of BAIF was well accepted across Maharashtra, with 52.8% participants belonging to the category of landless, marginal and small farmers. The average milk yield of crossbred cows born to nondescripts was 2,413 litres/lactation. While the Jersey crosses yielded 1,765 in 189 days, H.F. crosses produced

2,867 litres in 252 days and local cows and buffaloes yielded 208 and 610 litres of milk in 135 and 150 days respectively. The cost of milk production of nondescript cows was 100% higher than crossbred cows due to low yield (Mangurkar 1991). In 2015–16, the milk production in India increased to 155.5 million tonnes, with buffaloes, crossbred cows and indigenous cows contributing 49%, 26% and 21% milk respectively. The national average milk of crossbred cows was 7.33 kg per day, while the yields of indigenous breed cows, non-descript cows, buffaloes of recognised breeds and nondescript buffaloes were 3.41 kg, 2.16 kg, 5.76 kg and 3.80 kg per day respectively (GoI 2017).

While the crossbreeding programme was well accepted by farmers over the last 4–5 decades, some drawbacks of crossbreeding such as susceptibility to diseases, high rate of infertility, poor tolerance to heat, high feeding cost, etc. were observed. Hence, BAIF had introduced the breeding service with elite native breeds in interior villages with poor access to veterinary services. In 2014, the Government of India launched the Rashtriya Gokul Mission scheme, to improve the genetics of local cattle using indigenous breeds, while preventing crossbreeding (GoI 2014), to discourage the production of A1 type milk, alleging that this milk was the cause of metabolic disorders like diabetes and heart diseases, although this claim has not been proved

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scientifically (Truswell 2005). With such reports, many political and religious lobbies have taken up intensive propaganda for prevention of crossbreeding in cattle without realizing its implication on milk production and income of dairy farmers.

Therefore to assess the impact of cattle breeding programme on the income of rural families, a study was undertaken with the objectives to assess the participation of different socio-economic sections of the rural community in cattle development; to assess different types of cattle and buffaloes owned by the farmers before and after availing the breeding services; to estimate the status of milk production of new progeny of crossbred and upgraded animals; to estimate the income of farmers maintaining different types of milking animals.

MATERIALS AND METHODS

The study covered over 500 villages in eight states namely Punjab, Uttarakhand, Jharkhand, Madhya Pradesh, Gujarat, Maharashtra, Rajasthan and Karnataka, where BAIF has been providing breeding services for many years. The age of the breeding programme ranged between 4 years to 20 years, which included breeding of cattle and buffaloes at the doorsteps of the livestock owners. For breeding nondescript cattle with frozen semen of exotic breeds such as Holstein Friesen and Jersey or crossbred bulls produced from these breeds, elite Indian breeds was used. The cows of Indian breeds were bred with the semen of the same breed, as per the breeding policy of the state. For breeding buffaloes, semen of Murrah, Jafrabadi, Surti, Banni, Bhadavari and Pandharapuri were available. AI technicians explained about the advantages of breeds and asked the farmers to select the semen of their preference before carrying out the insemination. The farmers in a new area were generally guided by the advice of the AI technician and subsequently with the experience gained over the years, farmers demanded the semen of specific breeds and bulls

of their choice. Over 1600 such dairy farmers who were availing BAIF's breeding services using semen of different breeds for different lengths of time ranging between 3 and 20 years, were selected at random from all 8 states and contacted for an interview with a schedule during the year 2016. 1180 of them responded. The data was compiled, analysed and a suitable strategy was suggested based on the observations on the study.

RESULTS AND DISCUSSION

Socio-economic status of dairy farmers: Among the dairy farmers interviewed, 39.24% were availing the services of BAIF for 3–6 years, 37.25% families were availing services for 6–10 years, 21.95% for more than 10 years and only 1.2% families were in the programme for less than 3 years. Among them, 42.93% families belonged to other backward communities (OBCs) and 40.10% were in the general category (Table 1). Over 85% of the farmers in Punjab belonged to general category followed by 61% in Uttarakhand and Maharashtra and 33% in Madhya Pradesh and Karnataka. The participants belonging to OBC were highest in Jharkhand (66%) followed by Madhya Pradesh (65%), Rajasthan (63%) and Karnataka (57%). In Rajasthan, 14% of the dairy farmers were Scheduled Tribes, while 10% beneficiaries were Scheduled Tribes in Gujarat and Maharashtra (Table 1). In another study undertaken in Bihar, Uttar Pradesh and Maharashtra (CMSRC 2016), 57.3% families were from OBC category, followed by general category (32.5%), SC (7.3%) and ST (2.9%). The participation of the Scheduled Tribes and Scheduled Castes was significantly low, which can be attributed to migratory lifestyle of the tribals and concern about feed shortage due to small land holding among them. The participation of tribals in dairy farming increased when they established their fruit orchards, which reduced their migration and ensured steady supply of fodder (Hegde 2014).

41.93% of the dairy farmers were marginal holders,

Table 1. Socio-economic status of cattle and buffalo owners under the study in different states

| Parameter | Punjab | Uttarakhand | Jharkhand | MP | Gujarat | Maharashtra | Rajasthan | Karnataka | Average |
|---------------------------------|--------|-------------|-----------|-----|---------|-------------|-----------|-----------|--------------|
| No. of farmers in study | 178 | 88 | 214 | 151 | 163 | 131 | 176 | 79 | 1180 (Total) |
| <i>Age of BAIF centres (%)</i> | | | | | | | | | |
| < 3 years | 0 | 0 | 4 | 0 | 0 | 4 | 0 | 0 | 1.20 |
| Between 3 and 6 years | 100 | 33 | 24 | 0 | 9 | 86 | 12 | 65 | 39.24 |
| Between 6 and 10 years | 0 | 53 | 60 | 0 | 44 | 5 | 71 | 32 | 37.65 |
| Above 10 years | 0 | 14 | 12 | 100 | 47 | 5 | 12 | 3 | 21.95 |
| <i>Social status (%)</i> | | | | | | | | | |
| General | 85 | 61 | 22 | 33 | 19 | 61 | 18 | 33 | 40.10 |
| OBCs | 7 | 23 | 66 | 65 | 31 | 29 | 63 | 57 | 42.93 |
| Scheduled Castes | 8 | 11 | 4 | 1 | 0 | 0 | 5 | 4 | 4.29 |
| Scheduled Tribes | 0 | 5 | 7 | 1 | 10 | 10 | 14 | 6 | 12.67 |
| <i>Land holding pattern (%)</i> | | | | | | | | | |
| Landless | 6 | 32 | 12 | 1 | 5 | 0 | 0 | 0 | 7.14 |
| Marginal | 24 | 39 | 50 | 69 | 45 | 25 | 43 | 29 | 41.39 |
| Small | 37 | 10 | 21 | 28 | 31 | 14 | 40 | 42 | 28.04 |
| Others (> 2 ha) | 33 | 19 | 17 | 2 | 19 | 61 | 17 | 29 | 23.43 |

28.08% were small holders, 23.43% owned more than 2 ha, while 7.14% were landless. There were large number of landless dairy farmers in Uttarakhand and Jharkhand as compared to other states (Table 1). Madhya Pradesh had the highest percentage of marginal farmers (69%) owning dairy animals, followed by Jharkhand (50%), Gujarat (45%) and Rajasthan (43%). Sixty one percent dairy farmers in Maharashtra were owning more than 2 ha while medium and large holders represented 33% participants in Punjab and 29% in Karnataka.

Status of nondescript and improved cattle population: Breeding of local cattle with exotic and native breeds, made a significant difference on the herd quality and milk production as presented below.

Population of nondescript cattle: With reliable access to breeding services in the field for over 10–15 years, the population of nondescript cattle had reduced by 56.44%, as presented in Table 2. Reduction was highest at 96.87% in Madhya Pradesh followed by 81.57% in Rajasthan and 67.5% in Punjab. Reduction was least in Uttarakhand (18.71%) and Jharkhand (26.92%), which could be due to good quality of the nondescript cows maintained by farmers. In the states where the productivity of nondescript cows was low, replacement of these cattle by improved progeny was faster as observed in Madhya Pradesh and Rajasthan.

Crossbred cattle: The crossbreeding programme using Holstein Friesian and Jersey breeds increased in the population of crossbreds by 423% over the population existed before BAIF launching the service. Highest increase in crossbred population was in Madhya Pradesh (4080%) followed by Rajasthan (2300%), Karnataka (1928%), Jharkhand (591%) and Gujarat (567%). The population of crossbred heifers had also increased by 522% over 10 years, with highest increase of 1960% in Madhya Pradesh,

followed by Maharashtra (1233%), Gujarat (889%) and Rajasthan (600%). The population of the crossbred calves had also increased by 337%, with highest increase of 1880% in Gujarat, followed by Maharashtra and Madhya Pradesh (Table 2). After owning superior progeny, farmers reduced their unproductive cattle. Dairy husbandry which was promoted for income generation, with regular interaction at their doorsteps, empowered small farmers to take up dairy farming as an economic enterprise. Milk collection and marketing activities undertaken by the local Dairy Federation motivated the farmers to adopt stall feeding, efficient use of fodder resources, control on herd size, timely health care, etc. to increase milk production. The programme enabled millions of small farmers to adopt dairy husbandry as a sustainable means of livelihood across the country (CMSRC 2016).

Population of indigenous breeds: After the introduction of breeding service using semen of recognized native breeds of cattle, the population of upgraded progeny of indigenous breeds had increased by 66%. The rate of upgraded cattle production was significantly low compared to the production of crossbred cattle, except in a few states. The increase in the population of native breeds was highest in Karnataka (1460%) followed by Jharkhand (256%), Rajasthan (217%) and Uttarakhand (207%), as shown in Table 2. In many districts of Karnataka, farmers had a liking for native breeds such as Hallikar, Amritmahal and Krishna Valley as the bullocks of these breeds were in good demand. In certain remote regions of Jharkhand, Rajasthan and Uttarakhand, where veterinary services and market outlet for milk were poor, farmers preferred native breeds. However, many of the farmers who opted for breeding with Indian breeds of cattle were ignorant about the milk yield and profitability of these cows (Personal communication

Table 2. Status of different categories of cattle before and after launching of BAIF's breeding services

| Parameter | Punjab | Uttarakhand | Jharkhand | MP | Gujarat | Maharashtra | Rajasthan | Karnataka | Average |
|------------------------------|--------|-------------|-----------|-------|---------|-------------|-----------|-----------|---------|
| <i>Nondescript cows</i> | | | | | | | | | |
| Before BAIF programme | 40 | 71 | 260 | 256 | 57 | 48 | 179 | 161 | 1072 |
| After BAIF's AI service | 13 | 58 | 190 | 8 | 34 | 22 | 33 | 109 | 467 |
| Change in population (%) | 67.5 | 18.31 | 26.92 | 96.88 | 40.35 | 54.17 | 79.89 | 32.30 | 56.44 |
| <i>Crossbred cows</i> | | | | | | | | | |
| Before BAIF programme | 84 | 46 | 110 | 10 | 38 | 48 | 8 | 7 | 351 |
| After BAIF AI service | 123 | 82 | 650 | 408 | 223 | 103 | 184 | 135 | 1908 |
| Change in population (%) | 146 | 178 | 591 | 4080 | 567 | 215 | 2300 | 1929 | 543.59 |
| <i>Crossbred heifers</i> | | | | | | | | | |
| Before BAIF programme | 16 | 13 | 56 | 5 | 9 | 3 | 7 | 18 | 127 |
| After BAIF AI service | 30 | 31 | 300 | 98 | 80 | 37 | 42 | 46 | 664 |
| Change in population (%) | 188 | 238 | 536 | 1960 | 889 | 1233 | 600 | 256 | 522.83 |
| <i>Crossbred calves</i> | | | | | | | | | |
| Before BAIF programme | 45 | 12 | 36 | 28 | 5 | 3 | 21 | 38 | 188 |
| After BAIF AI service | 58 | 17 | 173 | 158 | 94 | 18 | 56 | 59 | 633 |
| Change in population (%) | 129 | 142 | 481 | 564 | 1880 | 600 | 267 | 155 | 336.70 |
| <i>Cows of native breeds</i> | | | | | | | | | |
| Before BAIF programme | 184 | 28 | 98 | 40 | 32 | 0 | 12 | 5 | 399 |
| After BAIF AI service | 178 | 58 | 251 | 20 | 57 | 1 | 26 | 73 | 664 |
| Change in population (%) | 97 | 207 | 256 | 50 | 178 | 100 | 217 | 1460 | 166.42 |

with dairy farmers and AI technicians).

Population of buffaloes: After the introduction of buffalo breeding, using frozen semen of Murrah, Surti or Jafrabadi breeds for over 10 years, the population of low yielding, nondescript buffaloes had reduced to 54%, while population of upgraded progeny had increased by 284.62% (Table 3). The increase in upgraded buffalo population was highest in Rajasthan (2425%) followed by Maharashtra (1200%), Jharkhand (1000%) and Gujarat (850%). The population of recognized breeds of buffaloes in most of the states except Punjab was very small, but with the introduction of the breeding services, population of buffaloes of recognized breeds had increased by 134%. Growing stock of upgraded female buffalo progeny had also increased to 363% with highest increase in Maharashtra (1400%) followed by Gujarat (925%), Punjab (382%) and Jharkhand (300%).

Socio-economic benefits of livestock husbandry: Most of the dairy farmers sold their surplus milk locally either to the dairy cooperatives or to private buyers. 37% farmers sold more than 4,000 kg milk/year while only 10% farmers sold less than 1,000 kg milk per annum (Table 4). Farmers in Maharashtra were on top among those who sold over 4,000 kg milk per year (63%), followed by Madhya Pradesh (51%), Punjab (39%) and Jharkhand (36%). Only 33.4% farmers sold the milk for more than ₹ 25/kg while 66.6% farmers fetched less than ₹ 25/kg. Among milk producers, 77% in Maharashtra and 66% in Madhya Pradesh realized ₹ 25 or more/kg, while over 70% farmers in Jharkhand, Uttarakhand, Karnataka, Gujarat and Punjab realized less than ₹ 25/kg milk (Table 4). This reflected on the connectivity of farmers with dairy cooperatives and their efficiency. Although the consumers in urban areas were prepared to pay higher price for the milk of indigenous cows, most of these farmers did not realize higher price for cow's milk of native breeds.

While about 43.68% families consumed less than 2 kg milk, only 29.44% families consumed over 4 kg milk/day.

Seventy three percent families in Punjab and 59.5% in Uttarakhand consumed more than 4 kg milk/day. Seventy seven percent families in Karnataka and 69% in Gujarat consumed less than 2 kg milk per day (Table 4). In another study, the dairy farmers of BAIF in Bihar, Uttar Pradesh and Maharashtra reported an average consumption of 2.94 kg milk per day (CMSRC 2016).

The average milk produced by crossbred cows was 10.18 litres per day, followed by upgraded buffaloes (8.42 litres) and cows of native breeds (4.47 litres). The average milk yield per animal had doubled over the last 6–8 years due to improved quality animals, better feeding practices and timely veterinary care. The average milk production per family was 12.64 litres per day. Under this programme, 83% cows maintained were crossbreds while 14% were upgraded by indigenous breeds and only 3% were nondescript cows. About 63% buffaloes in these villages were upgraded stock and 37% were nondescript. On an average, each family had 1.44 milking animals, but the families in Maharashtra had more than 2 milking animals (CMSRC 2016).

The cost of milk production of indigenous cows was 98% higher than that of crossbred cows, but there was no premium price paid for milk of indigenous cows. Hence, the farmers maintaining indigenous cows were earning substantially lower income (CMSRC 2016). These farmers were unaware of the cost benefit analysis of dairy farming with indigenous cows, although dairy husbandry made significant contribution to their annual income.

The average annual income generated from dairy husbandry as reported by the dairy farmers varied from ₹ 67,911 to ₹ 1,83,350 per family (Table 4). This included the labour utilised by the family members. The income was highest in Maharashtra, where the programme has been in operation for over four decades. Lowest average annual income of ₹ 67,911 per family in Uttarakhand could be attributed to comparatively lesser duration of the programme, larger percentage of indigenous cows and

Table 3. Status of different categories of buffaloes before and after launching of BAIF's breeding services

| Parameter | Punjab | Uttarakhand | Jharkhand | MP | Gujarat | Maharashtra | Rajasthan | Karnataka | Average |
|---------------------------------------|--------|-------------|-----------|------|---------|-------------|-----------|-----------|---------|
| <i>Nondescript buffaloes</i> | | | | | | | | | |
| Before BAIF programme | 22 | 37 | 40 | 47 | 61 | 25 | 147 | 73 | 452 |
| After BAIF AI service | 7 | 29 | 38 | 3 | 43 | 12 | 72 | 41 | 245 |
| Change in population (%) | 31.19 | 78.38 | 95.00 | 6.38 | 70.49 | 48.00 | 48.98 | 56.16 | 54.20 |
| <i>Buffaloes of native breeds</i> | | | | | | | | | |
| Before BAIF programme | 349 | 4 | 5 | 5 | 22 | 0 | 11 | 1 | 397 |
| After BAIF AI service | 328 | 25 | 12 | 29 | 83 | 0 | 38 | 15 | 530 |
| Change in population (%) | 94 | 625 | 240 | 580 | 377 | | 345 | 1500 | 134 |
| <i>Upgraded buffaloes</i> | | | | | | | | | |
| Before BAIF programme | 113 | 5 | 3 | 7 | 6 | 1 | 4 | 4 | 143 |
| After BAIF AI service | 183 | 15 | 30 | 17 | 51 | 12 | 97 | 2 | 407 |
| Change in population (%) | 162 | 300 | 1000 | 243 | 850 | 1200 | 2425 | 50 | 285 |
| <i>Improved buffalo growing stock</i> | | | | | | | | | |
| Before BAIF programme | 17 | 3 | 2 | 2 | 4 | 0 | 11 | 10 | 49 |
| After BAIF AI service | 65 | 8 | 6 | 4 | 37 | 14 | 35 | 9 | 178 |
| Change in population (%) | 382 | 267 | 300 | 200 | 925 | 1400 | 289 | 90 | 363 |

Table 4. Quantity of milk sold by dairy farmers, served by BAIF, price realized and programme impact

| Parameter | Punjab | Uttarakhand | Jharkhand | MP | Gujarat | Maharashtra | Rajasthan | Karnataka | Average |
|----------------------------------|--------|-------------|-----------|-------|---------|-------------|-----------|-----------|---------|
| <i>Annual sale of milk (%)</i> | | | | | | | | | |
| <1000 kg | 14.19 | 17.74 | 6.76 | 0 | 7.76 | 6.67 | 8.11 | 32.76 | 10.09 |
| Between 1000 and 2000 kg | 16.77 | 37.01 | 22.3 | 21.43 | 15.52 | 20 | 27.03 | 20.69 | 21.46 |
| Between 2000 and 3000 kg | 14.84 | 19.35 | 21.62 | 11.43 | 22.41 | 0 | 25.68 | 17.24 | 17.62 |
| Between 3000 and 4000 kg | 14.84 | 17.74 | 12.84 | 16.43 | 14.66 | 10 | 10.81 | 6.9 | 13.79 |
| Above 4000 kg | 39.35 | 8.06 | 36.49 | 50.71 | 39.66 | 63.33 | 28.38 | 22.41 | 37.04 |
| <i>Price realised for milk</i> | | | | | | | | | |
| Below ₹ 25/kg | 69.23 | 81.97 | 86.14 | 33.57 | 70.59 | 22.58 | 63.89 | 70.69 | 66.63 |
| Above ₹ 25/kg | 30.77 | 18.03 | 13.86 | 66.43 | 29.41 | 77.42 | 36.11 | 29.31 | 33.37 |
| <i>Programme impact</i> | | | | | | | | | |
| Milk consumed at home | | | | | | | | | |
| Less than 2 kg/day | 5.99 | 27.03 | 56.25 | 51.58 | 69.01 | 50 | 54.45 | 77.14 | 43.68 |
| Between 2 and 3 kg/day | 5.39 | 5.41 | 21.25 | 25.26 | 9.86 | 3.57 | 25.97 | 14.29 | 14.4 |
| Between 3 and 4 kg/day | 15.57 | 8.11 | 8.75 | 15.79 | 12.68 | 32.14 | 10.39 | 1.43 | 12.48 |
| Above 4 kg/day | 73.05 | 59.46 | 13.75 | 7.37 | 8.45 | 14.29 | 9.91 | 7.14 | 29.44 |
| <i>Average annual income (₹)</i> | | | | | | | | | |
| Before joining BAIF programme | 16947 | 30256 | 21815 | 9133 | 10171 | 32150 | 27915 | 22302 | 20543 |
| After joining BAIF programme | 144118 | 67911 | 111513 | 69186 | 180637 | 183350 | 80994 | 75270 | 111743 |
| <i>Increase in APL families</i> | | | | | | | | | |
| No. of families before | 11 | 10 | 112 | 13 | 36 | 25 | 22 | 31 | 260 |
| After BAIF programme | 56 | 26 | 178 | 114 | 150 | 30 | 66 | 60 | 680 |
| Change (%) | 509.1 | 260 | 158.9 | 876.9 | 416.67 | 120 | 300 | 193.5 | 261.54 |

difficulty in mobilizing fodder during certain seasons. Dairy farmers who availed the breeding services of BAIF for over 10 years had enhanced their income by 544% (Table 4). CMSRC (2016) reported that the dairy farmers availing breeding services from BAIF in Bihar, Uttar Pradesh and Maharashtra had an average net income of ₹ 28,829 per annum from dairy animals. Kumar (2016) reported that for farmers in Prakasam and Khammam districts of Andhra Pradesh, the annual income per buffalo had increased from ₹ 12,309 to ₹ 35,194, when they replaced their nondescript buffaloes with upgraded Murrah breed. Sale of animals was an additional source of income for the dairy farmers. Major reasons for selling animals were to reduce the herd size, cull inferior and defective animals, mobilise money for meeting family needs, shortage of fodder and water resources, threat of disease outbreaks etc. The average price realized per pregnant crossbred cow and pregnant buffalo were ₹ 25,198 and ₹ 32,938 respectively (CMSRC 2016). Over 89% respondents expressed their interest to continue with the dairy business.

As a result of high yielding crossbred cows and improved buffaloes produced under BAIF's programme, the number of Above Poverty Line (APL) families had increased by 262% over the last 10 years (Table 4). Dairy farmers were more stable with low risk of failure as compared to those dependent on agriculture.

The crossbreeding programme was very well accepted by the farmers of all socio-economic groups across the country. The profitability of crossbred cows was influenced by well-planned breeding services, restriction of exotic blood level to 75% or less, timely availability of veterinary

services, easy access to good quality fodder, feed and water resources and linkage with milk marketing and processing organisations. Farmers having close tie up with dairy cooperatives or milk processing units and in areas where the milk marketing was efficient, price realization for milk was better, which motivated them to expand their dairy business.

With regard to improvement of native breeds, although the response was encouraging, there was lack of clarity about the income from these animals. Recent campaigning against crossbred cows and exaggerated benefits of native cattle are bound to confuse innocent farmers leading to lower milk production in the future.

Economic gain was the basic drive for the success of dairy farmers, which was the spirit behind the success of the crossbreeding programme. Cattle development without assured profitability, may not sustain the interest of dairy farmers. Therefore, the economics of different types of cattle namely crossbreds, cows of native breeds, upgraded cows and buffaloes should be worked out to enlighten the farmers.

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