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Genetic improvement of Kankrej cattle through associated herd progeny testing under field and farm conditions

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ABSTRACT

The genetic improvement programme of Kankrej cattle under AICRP on Cattle is implemented in their home tract for their conservation and propagation. The involvement of farmer's animal under the programme has helped to create awareness among the cattle breeders on the importance of this valuable breed. The production of frozen semen doses of genetically superior young bulls and providing the AI facility at the doorstep of the farmer has motivated and increased the conception rate to a large extent. The average age at first calving (AFC), first lactation 305 days milk yield, first lactation length and first peak yield were 1273.44±39.87 days (41.85 months), 2295.27±133.83 kg, 312.13±11.94 days and 10.53±0.51 kg, respectively. The average first service period and dry period were 149.81±16.27 and 126.30±13.31 days and overall lactation average dry period, service period and calving interval were 144.74±9.65, 169.39±15.03 and 434.24±12.94 days, respectively. The average all lactation 305 days milk yield, lactation length and days to attain peak yield were 2627.35±119.42 kg, 307.57±08.54 days and 55.75±6.12 days, respectively. The wet average and dry average were 8.58 and 5.38 kg, respectively. The performance of Kankrej cattle has improved over the years due to the implementation of the project and continuous efforts will be made to propagate this valuable germplasm to the needy people of the country.

Key words: AI, Daughters performance, Dry period, EBV, Germplasm, Kankrej breed, Milk yield, Service period

India has the largest cattle population in the world and indigenous cattle are regarded for heat tolerance and inherent resistance to diseases, and ability to sustain under extreme climatic conditions. According to 2012 census, the total cattle population of the country was estimated at 199.09 million. India ranks first in annual milk production with an average estimate of 155.5 million tonnes during the year 2015–16 (NDDB) with the per capita availability of 337 g of milk per day. So far, 40 indigenous cattle breeds have been recognized and classified according to their utility as milch (04), dual (08) and draft (28). Traditionally, the cattle breeding was practiced over centuries based on regional necessity and farmer preferences and constant inter-breeding among the animals of a region resulted in the formation of animal populations with some specific similar characters leading to the development of new cattle breeds. Further, the movement of animal owners from one region to another for their livelihood also made the movement of their cattle and their subsequent crossing with the native cattle breed of new location resulted in the formation of new populations/breeds having slight morphological differences from the parental breeds.

The majority of rural farmers of the country use cattle predominantly for agricultural operations and hence significant size of the cattle population is in the hands of marginal, small and landless farmers. Cattle in India have been raised over centuries primarily for agricultural operations and not for milk production, thus are often classified as draft animals. The country possesses only four defined milch breeds viz., Gir, Sahiwal, Red Sindhi and Rathi while the other important breeds such as Kankrej, Tharparkar, Hariana, Deoni, Ongole etc. are classified as dual purpose breeds and the rest of the breeds are described as draft cattle. The per animal milk production of important milch breeds of the country is much lower than the productivity of the exotic milch breeds such as Holstein-Friesian, Jersey etc. In order to increase the milk production, the crossbreeding of indigenous cattle with high yielding temperate cattle breeds was taken up extensively during 70s and 80s. This is now often criticized as it eroded the genetic base of our valuable and well adopted native cattle breeds and increased the incidence of diseases, heat stress and reproductive related problems in the crossbred progenies. There were no comparable large scale breeding programmes and resource investment for the improvement of milch/dual purpose/draft breeds of the country for enhancing their productivity. Further, the recent belief on

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the effect of A1-A2 beta casein milk on human health also favours the production of milk from indigenous cattle breeds which are essentially A2 type (Mishra *et al.* 2009). Thus, it becomes indispensable to take up a breed improvement programme for increasing the milk production of our native cattle breeds.

Looking into the importance of indigenous cattle breeds, the Indian Council of Agricultural Research under the All India Co-Ordinated Research Programme on Cattle (AICRP on Cattle) started the Indigenous Breeds Project (IBP) for the genetic improvement of important indigenous breeds of cattle from 11th Five-Year Plan period. The project is being operated by Central Institute for Research on Cattle, Meerut in the native breeding tracts of three indigenous cattle breeds, viz. Gir, Kankrej and Sahiwal in collaboration with various State Veterinary/Agricultural Universities and ICAR institutes, State Government Farms, NGOs and Gaushalas. The project is primarily aimed to conserve, improve and propagate the genetic potential of these three important indigenous cattle milch breeds involving the local farmers.

The objectives of the project were to study the genetic and phenotypic variances in milk and covariance among milk, and associated economic characteristics such as growth, reproduction and survival with a view to develop suitable selection criteria for improving milk production; and undertake progeny testing and selection of bulls for bringing genetic improvement in population involved and providing superior germplasm for utilization in development programme for improving milk production.

MATERIALS AND METHODS

Technical programme: The technical programme envisages the establishment of germplasm (GP) and data recording units (DR) for each breed by registering the animals maintained under farm and field conditions. The young bulls born out of nominated mating of elite cows with high genetic merit bulls maintained at the germplasm units were progeny tested using animal and farm facilities existing at the Data Recording Units/associated herds.

Germplasm unit: About 75 elite females were mated with 4 to 5 genetically superior/proven bulls of the breed for production of young bulls. These males were reared at the germplasm centre, out of which, about 8 to 10 bulls on attaining maturity were selected as future bulls based on their expected breeding values. These bulls were trained and used for semen collection and freezing of about 3,000 doses of semen from each bull. About 1,000 doses of frozen semen were utilized for sire evaluation at the data recording units and 1,000 doses each are maintained at the germplasm centre and gene pool laboratory of ICAR-Central Institute for Research on Cattle for future use.

Data recording units: The progeny testing of young bulls born out of the nominated mating of elite cows at the germplasm centre was carried out using the animal and farm facilities existing at the Data Recording Units/associated herds. To carry out this program, about 750 breedable females were identified at about 5 data recording units (herds) for that breed as far as possible near the germplasm centre. Each bull was mated with a minimum of 60 to 70 females in order to provide first lactation milk production records on at least 20 progenies per bull. Information on growth, reproduction, milk production and survivability were collected for genetic analysis.

Kankrej is a well-known dual purpose indigenous breed, originated from a territory of that name in Kankrej Tehsil, Radhanpur, Banaskantha, North Gujarat, India. It is one of the heaviest cattle breeds of India which thrives well in the extreme climatic conditions coupled with limited feed and fodder (Jain and Bais 2015). Considering the potential of this breed, it was included under the AICRP project for genetic improvement.

Livestock Research Station had established elite herd of 81 Kankrej cows for the production of young male calves. The home tract of the Kankrej cattle is Banaskantha (North Gujarat) and under the project, 13 villagers were covered nearby the Dantiwada, Palanpur. This unit is organizing awareness program regularly and providing AI training to the AI workers. Farmers program were also organized regularly in the selected villages to attract the farmers.

Topography and climate of the breeding tract: The Germplasm unit, Livestock Research Station, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Gujarat (India), about 27 km from Palanpur city and native tract of the Kankrej cattle lies between 23.81° 24.70' N north latitude and 71.10° 73.00' E) east latitude. The region experiences tropical climate with the temperature range of 10°C (January) to 48°C (May) with the relative humidity range of 60–80% during rainy seasons. The climatic condition of North Gujarat is comparatively extreme as compared to other parts of the Gujarat and India and as harsh as of Rajasthan. The green grass production as well as fodder production is also limited.

Project area: The Germplasm unit of Kankrej cattle is located at Livestock Research Station, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, (Gujarat). The DR units of the breed are located in villages in the region involving 13 farmer herds/centre and two associated herds. The detailed locations of farmer herds and associated herds are depicted in Fig. 1.

RESULTS AND DISCUSSION

Set wise performance: A total of 26 bulls in three sets (8+9+9 bulls) have so far been inducted in the program (Table 1). Total no. of semen doses frozen for the bulls of 3 sets was 121158 (8000+89438+23720). The number of cows covered for inseminations in different sets was 10000 (3000+3500+3500). A total of 1537 (407+1130) daughters have so far been produced from first two sets. One hundred seventy three from first two sets have reached at the age of calving, out of which 122 have completed their first lactation. A total of 111690 doses of frozen semen were available as on 31st December 2016. The average first lactation milk yield of the Kankrej daughters of first set of bulls was

Table 1. Set wise information on breeding bulls (since inception)

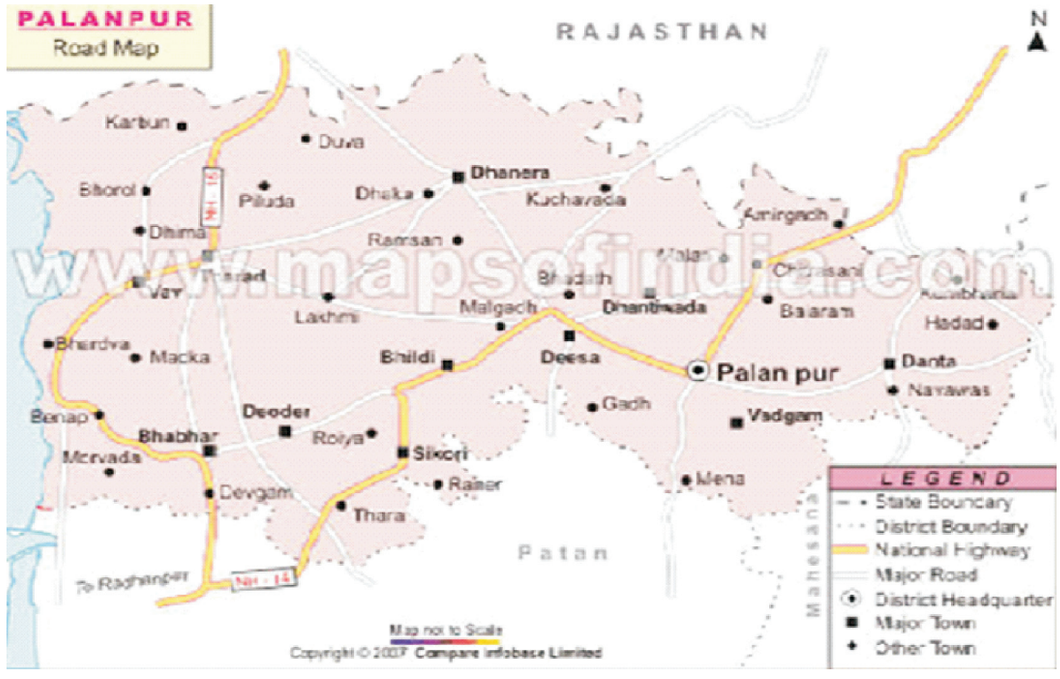
Particular	Set–1	Set–2	Set–3	Total
Year of induction of set	2011	2013	2016	-
No. of bulls inducted/ used	8	9	9	26
No. of semen doses frozen	8000	89438	23720	121158
No. of semen doses utilized	2178	5830	1460	9468
No. of semen doses discarded	0	1245	950	2195
No. of cows covered	3000	3500	3500	10000
No. of female calves born so far	407	1130	00	1537
No. of female reached AFC so far	116	57	00	173
No. of daughters completed 1st lactation so far	103	19	00	122
Frozen semen doses available	5822	83608	22260	111690

1973.09±76.02 kg (excluding the milk suckled by the calf). The semen doses of Kankrej cattle were also made available at the Co-ordinating unit of ICAR-CIRC, Meerut to supply to the needy farmers of the state.

Expected breeding values (EBVs) of Kankrej bulls inducted in the project: The EBVs of Kankrej bulls inducted in the first set were estimated by BLUP method and the breeding values of all the set bulls are given in Table 2. Bull K020 had the highest EBV of 156 kg while the fourth ranked bull had the EBV of 33.75 kg with the % superiorities of 7.61 and 1.65, respectively. The overall average of 2050.29 kg obtained in

Table 2. Expected breeding value of Kankrej bulls- First set

Sire	Factor	No.	LS Mean±SE (kg)	EBV (kg)	Ranking
	Overall	104	2050.29±119.20		
1.	K020	10	2206.29±155.90	+156.00	1
2.	K012	08	2126.51±159.88	+76.22	2
3.	K017	10	2095.44±153.88	+45.15	3
4.	K016	18	2084.04±143.87	+33.75	4
5.	K007	20	2034.77±135.08	–15.52	5
6.	K010	08	1981.40±152.26	–68.88	6
7.	K006	10	1968.55±154.88	–81.74	7
8.	K014	20	1905.31±121.51	–144.98	8



Germplasm unit	Data recording (DR) units (Farmer herds – in 11 villages in the tract)	Data recording (DR) units (Associated herds – 3 Nos.)
Livestock Research Satation, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Gujarat	Laxipura, Kotada, Sherpura, Limbau, Kansari, Therwada, Jadiya, Dama, Dungarasan, Rankpur, Khasa, Mithipaldi and Vatam	LRS, SDAU, Sardarkrushinagar, Gujarat, Gela Gaushala, Gela and Bhootnath Gaushala

Table 3. Comparative performance of productive and reproductive performance of Kankrej cows at Germplasm unit

Trait	2012 (At the start of the project)		2016	
	Number of observation	Mean±SE	Number of observation	Mean±SE
Age at first calving (days)	10	1348.62±33.48 (44.9 months)	18	1273.44±39.87 (42 months)
First lactation total milk yield (kg)	67	2431.99±59.96	18	2373.66±158.46
First lactation 305 days milk yield (kg)	–	–	18	2295.27±133.83
First lactation length (days)	67	299.98±5.06	18	312.13±11.94
Overall lactation milk yield (kg)	67	2517.97±71.47	48	2759.44±142.10
Total lactation milk yield (kg) in 305 days	–	–	48	2627.35±119.42
Overall lactation length (days)	–	–	48	307.57±08.54
First peak yield (kg)	–	–	18	10.53±0.51
Days to attain peak yield (days)	–	–	18	55.75±6.12
First dry period (days)	31	119.75±9.81	10	126.30±13.31
Overall dry period (days)	–	–	35	144.74±9.65
First service period (days)	57	133.17±7.56	16	149.81±16.27
Overall service period (days)	–	–	41	169.39±15.03
No. of AI per conception	–	–	23	1.65±0.22
Calving interval (days)	31	411.76±9.88	34	434.24±12.94
Wet average (kg)	60	8.82	41	8.58
Herd average (kg)	62	5.49	65	5.38

the present study was higher than the estimate 1711.63 kg reported by Singh and Singh (2016) in Sahiwal cattle.

Productive and reproductive performance: The details of productive and reproductive performance of Kankrej cattle maintained under GP of LRS, Sardarkrushinagar are presented in Table 3. The average age at first calving (AFC), first lactation 305 days, first lactation length and first peak yield were 1273.44±39.87 days (41.85 months), 2295.27±133.83 kg, 312.13±11.94 days and 10.53±0.51 kg, respectively. Contrary to the present findings, Parek *et al.* (2016) reported higher average AFC of 1376.09 days in Kankrej cattle. The average estimates of first lactation 305-days yield and lactation length obtained in the present study were higher than the estimates of 1860.30 kg and 279.9 days reported by Gajbhiye (2004) in the same breed. Jain and Bais (2016) also reported higher average milk yield of 1746 kg ranging from 1097 to 3194 kg in Kankrej cattle. However, Narwaria *et al.* (2015) reported that the incidence of short lactations (215.83±3.08 days) was alarming in the Sahiwal herd maintained at NDRI, Karnal.

The average first service period and dry period were 149.81±16.27 and 126.30±13.31 days, and overall lactation average dry period, service period and calving interval were 144.74±9.65, 169.39±15.03 and 434.24±12.94 days, respectively. The average all lactation 305 days milk yield, lactation length and days to attain peak yield were 2627.35±119.42 kg, 307.57±08.54 days and 55.75±6.12 days, respectively. The wet average and dry average were 8.58 and 5.38 kg, respectively. In general, productive and reproductive performance of Germpalsm unit has improved since inception of the project.

Impact of project: The major impacts of the indigenous breeds project - AICRP on Cattle are as follows:

1. More than 3,500 breedable females of Kankrej cattle reared in the breeding tract were registered under the project, bringing the farmers under one umbrella functioning like a breed society.
2. Under this project, a large number of semen doses were collected, frozen and made available for use to enable germplasm conservation and propagation.
3. Through associated herd progeny testing programme, farmers are provided free AI services at doorstep with semen of genetically superior young bulls born to elite females for AI free of cost.
4. The project also helped to supply the progeny tested high ranking bull semen for AI of the Kankrej animals by other developmental agencies, thus bring genetic improvement of the existing cattle population at a faster rate.
5. The farmers are also provided incentives like the mineral mixture, medicines for deworming and vaccination of animals at regular intervals besides bringing awareness regarding scientific cattle husbandry through regular visits and camps.
6. The programme also helped to upgrade the non-descript or diluted Kankrej cattle into defined breed so as to increase the population size for conservation of this elite cattle germplasm.
7. The farmers are regularly enriched with the knowledge on scientific dairy cattle production through seminars, animal welfare camps, training programme, scientists-farmer interactions etc. for improving the production.
8. Project created awareness among the farmers/ stakeholders on the importance of Kankrej cattle for milk production and to propagate the valuable germplasm to the needy farmers of the country.

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