



Estimation of breeding values of Kankrej bulls under associated herd progeny testing program

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Kankrej is one of the important indigenous cattle breeds of India known for its inherent ability of heat tolerance, resistance to many tropical diseases and to sustain under extreme climatic conditions prevailing in its native tract. Looking into the importance of this Indigenous cattle breed, efforts are being made by ICAR for genetic improvement through All India Coordinated Research project (AICRP) on Cattle in collaboration with Sardarkrushinagar Dantiwada Agriculture University, Sardarkrushinagar, Gujarat. Under this programme, Livestock Research Station, Sardarkrushinagar has been identified as bull mother or germplasm unit from which the young bulls born to elite females are identified as bulls for progeny testing. The farmer's herds, *gaushalas* and herds maintained by NGOs are utilized as data recording units where the semen of young bulls is used for insemination of Kankrej cows.

Kankrej breed of cattle originates from southeast of the Desert of Kutch in western India, particularly along the banks of the rivers Banas and Saraswati which flow from east to west and drain into the desert of Kutch. The breeding tract of the breed covers Kankrej, Radhanpur and Banaskantha Tehsils of North Gujarat, India. The "Kankrej" and "Wadlar" are the tracts of Banaskantha district of North Gujarat from which the breed has acquired its name; in some areas it is also called as "Wadiar" as reported by Raj (1987).

Evaluation of breeding bulls is needed for selection and dissemination of genetically superior germplasm for improving the milk production. The small herd size, lack of large commercial cattle herds and proper recording system are the major constraints preventing the evaluation of breeding bulls extensively in our country. These difficulties are overcome by the concept of associated herd progeny testing programme through which the bulls are evaluated utilizing large number of farmers' herds as field units so as to get enough number of daughter records for testing. Since no scientific study has been reported so far on the estimation of breeding values of Kankrej bulls through associated herd progeny testing programme, the present study was conducted to predict the expected breeding value (EBV) of 8 bulls of first set by best linear unbiased prediction method utilizing the first lactation 305-

days milk records of daughters.

For the present study, information on 127 Kankrej cows calved during 2013–17 and maintained under different data recording units of the project were utilized. The basic information on pedigree of Kankrej cattle was collected. Milk records collected at 15 days interval were utilized to predict the first lactation 305-days milk yield. Abnormal records, viz. abortion, still-birth, mastitis etc., were excluded from the study. Information on animals having incomplete lactation records due to early disposal was also excluded.

The Germplasm unit of the breed is located at Livestock Research Station, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Gujarat (India), about 27 km from Palanpur city. The native tract of 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 compare to other parts of the state and country and as harsh as that of Rajasthan. The green grass as well as fodder production is also limited. Based on agro-climatic conditions of the region, the whole year was divided into three seasons, viz. summer (March–June), monsoon (July–October) and winter (November–February). The information on centre, year and season of calving were utilized to generate the herd-year-season (HYS) effect which was considered as fixed effect while the effect of sire was considered as random. For sire evaluation, bulls having five and more daughters were only included. The expected breeding values (EBV) of bulls were estimated by best linear unbiased prediction (BLUP) method as given by Henderson (1973, 1975) using the LSMLMW Model VIII (Harvey, 1990).

The general model of BLUP estimation was considered:

$$Y_{ijk} = Xh_i + Zs_j + e_{ijk}$$

where Y_{ijk} , Observation vector of trait with dimension ($n \times 1$); X , Design matrix or incidence matrix for fixed effects with dimension ($n \times p$); h_i , A vector for fixed effect of dimension ($p \times 1$); Z , Design matrix or incidence matrix for random effects with dimension ($n \times q$); s_j , Vector of random effect with mean zero and variance $G\sigma_s^2$ with

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dimension ($q \times 1$); e_{ijk} , Random error vector with dimension ($n \times 1$) with mean zero and variance $I \sigma_e^2$.

The descriptive statistics for first lactation 305-days milk yield of Kankrej cattle was calculated. The first lactation 305-days milk yield of Kankrej cattle ranged between 633.2 to 3,243.6 kg with an overall average of 2,051.03 kg. The coefficient of variation was 27.86%.

The EBVs of Kankrej bulls were estimated by BLUP method using the LSMLMW package of Harvey and the results are presented in Table 1. The average number of daughters per bull ranged between 8 and 30. The variation in the number of daughters per sire was due to the loss of daughters data. Since the bulls were evaluated on the basis of daughters born in associated herds covering the farmer herds, loss of data due to disposal of animals before completion of first lactation could not be avoided.

Table 1. Estimated breeding values (EBVs) of first set Kankrej bulls

Sire No.	No. of observation	FL305 DMY	% of Genetic superiority over population	Ranking
Overall	127	2004.314		
K006	10	1892.478	-5.57	7
K007	30	1902.329	-5.08	6
K010	8	1923.515	-4.03	5
K012	10	2075.156	+3.53	4
K014	20	1852.993	-7.54	8
K016	24	2093.572	+4.45	3
K017	14	2100.422	+4.79	2
K020	11	2194.047	+9.46	1

The overall average breeding value of the Kankrej bulls for first lactation 305-days milk yield was 2004.31 kg which was comparatively lower than the breeding values reported for Sahiwal cattle by Banik and Gandhi (2006), Raja (2010) and Dongre and Gandhi (2014). However, the estimate was higher than the estimate of 1711.63 kg reported by Singh and Singh (2016) in Sahiwal cattle. The estimate was also lower than the EBV of 2137.17 kg reported by Pandey *et al.* (2013) in Vrindavani cattle and 2050.29 kg reported by Singh *et al.* (2018a) in Kankrej cattle and 2699.05 kg by Singh *et al.* (2018b) in Gir cattle. The estimated breeding values of Kankrej bulls were comparatively higher as compared to the breeding values of Hariana and Ongole bulls as reported by Singh *et al.* (2006, 2008 and 2012).

The EBVs of Kankrej bulls with the per cent genetic superiority over population mean ranged between -7.54 and +9.46. The higher variation in EBVs indicate that the BLUP method differentiates the bulls to a larger extent so that it can be used for selection of high genetic merit bulls for improving the milk yield in Kankrej cattle. Among the eight bulls, four bulls (50%) had breeding values above the overall average while rest four bulls (50%) had breeding values lower than the overall average. Similar to the present findings, Pandey *et al.* (2013) also observed that 50% of sires evaluated had breeding values equal and above the

overall average breeding value in Vrindavani cattle.

Based on the EBV estimates and sire rankings, it was recommended to use the frozen semen doses of two Kankrej bulls, viz. K020 and K017 to breed the Kankrej elite cows for increasing the milk production in subsequent generations.

SUMMARY

A study was conducted to predict the expected breeding values of 8 Kankrej bulls inducted under the All India Coordinated Research Project on Cattle. A total of 127 first lactation 305-days records of Kankrej daughters born during the period between 2013 and 2017 were analyzed by Best Linear Unbiased Prediction (BLUP) method using Model VIII of LSMLMW software. The BLUP model included the Herd-year-season effect as fixed factor and sires as random factor. The overall average expected breeding value (EBV) was 2004.314 kg. The breeding values of Kankrej bulls ranged between -151.321 and +189.733 kg. The results of the study revealed that the BLUP method discriminated the sires for their breeding values to a larger extent so that the genetically superior bulls can be discriminated from the poor bulls. Based on the results it was recommended only to use the frozen semen doses of two Gir bulls, viz. K020 and K017 to breed the Kankrej cows for increasing the milk production in subsequent generations.

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REFERENCES

- Banik S, Gandhi R S. 2006. Animal model versus conventional methods of sire evaluation in Sahiwal cattle. *Asian-Australian Journal of Animal Sciences* **19**(9): 1225-28.
- Dongre V B and Gandhi R S. 2014. Study on sire evaluation methods in Sahiwal cattle. *Indian Journal of Veterinary and Animal Science Research* **43**(3): 174-79.
- Harvey W R. 1990. Mixed model least squares and maximum likelihood computer program, PC-2 version, Ohio, USA.
- Henderson C R. 1973. Sire evaluation and genetic trends. *Journal of Animal Science*, Vol. 1973, Issue: Symposium, 1 January 1973, pp. 10-41. <https://doi.org/10.1093/ansci/1973.Symposium.10>.
- Henderson C R. 1975. Best linear unbiased prediction under a selection model. *Biometrics* **31**: 423-47.
- Pandey H O, Tomar A K S and Dutt T. 2013. Comparison of sire evaluation methods in Vrindavani cattle. *Indian Journal of Animal Sciences* **83**(4): 419-22.
- Raj Des. 1987. 'Development of optimum breeding programme for Kankrej cattle'. Ph.D. Thesis submitted to NDRI, Karnal Kurukshetra University, Kurukshetra.

- Raja T V. 2010. 'Part lactation records for Sahiwal Sire evaluation'. Ph.D. Thesis. Karnal, India: NDRI, Deemed University.
- Singh J and Singh C V. 2016. Evaluation of sires using different sire evaluation methods on the basis of first lactation traits in Sahiwal cattle. *Journal of Veterinary Science and Technology* 7: 296.
- Singh Umesh, Gaur G K, Garg R C and Vinoo R. 2006. Genetic evaluation of Ongole bulls at organized herds. *Indian Journal of Animal Sciences* 76(11): 931–33.
- Singh Umesh, Kumar Arun and Vinoo R. 2012. Breeding Values of Ongole bulls at Organized Herds. *Indian Veterinary Journal* 89(1): 92–93.
- Singh Umesh, Kumar Arun, Beniwal B. K. and Khanna A S. 2008. Evaluation of breeding values of Haryana bulls on organized farms. *Indian Journal of Animal Sciences* 78(4): 388–90.
- Singh Umesh, Raja T V, Alyethodi R R, Rathod B S, Birham Prakash and Vineet Bhasin. 2018a. Genetic improvement of Kankrej cattle through associated herd progeny testing under field and farm conditions. *Indian Journal of Animal Sciences* 88(3): 314–18.
- Singh Umesh, Raja T V, Alyethodi R R, Gajbhiye P U, Prakash B and Bhasin V. 2018b. Genetic improvement programme in Gir cattle for enhancing milk productivity. *Indian Journal of Animal Sciences* 88(1): 21–25.