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Factors affecting first semen collection traits of Kankrej cattle bull

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Abstract

Semen production data comprising from 26 bulls of Kankrej cattle breed was analysed. The first semen collection traits under study were body weight of bull at first semen collection, scrotal circumference of bull at first semen collection and age of bull at first semen collection. The objective of the present study was to assess the effect of various non-genetic factors especially environment and management related traits i.e. season of birth and period of birth affecting first time semen collection traits. Data collected of first time semen collection traits were analysed using general linear model, including fixed effect of various non-genetic factors. Least square means of body weight, scrotal circumference and age of bull at first semen collection were 578.68 ± 25.18 kg, 30.86 ± 1.60 cm and 1122.36 ± 86.9 days respectively. Effect of season as well as period of birth of bull was non-significant on first time collection of semen doses from Kankrej bull. Non-significant effect of season and period of birth reflects that the semen station scientific management system was working well and providing animal good comfort for production of semen. From this study, it is also noticed that Kankrej breed of cattle is well adjusted with local environment and capable of sustain in such harsh environment.

Keywords: First time semen traits, environmental factors, Kankrej cattle

Introduction

Dairy animals' genetic improvement can be achieved by the best tools like artificial insemination. Improvement programme in the form genetics of dairy animal requires genetically superior male for semen collection and to inseminate that semen in large number of females through artificial insemination can only get proper response and improvement. Many limitations and reduces genetic gain per generation was reported by the use of natural mating over the artificial insemination.

Intensive systemic and multistage selection is prime requirement of any semen station, institutional and commercial herd to get genetically superior bull. Breeding soundness of breeding bull should be evaluated by certain vigorous parameters like optimum serving capacity and profile of semen production traits. To get proper and lifelong semen production performance from extremely cherished breeding bull, it is obligatory to keep on suitable managerial circumstances. Species and breed of dairy animals should have substantial effect on male reproductive parameters specifically related to semen production which was also reported scientifically. Very fewer scientific reports are associated to first time semen collection traits and performance of Kankrej cattle bull from initiation to retention in semen production system. Effect of genetic composition was well recognised and described for production traits in dairy animals; however, effect of genetic and non-genetic factors on reproduction traits are not attainment much position in Indian circumstance due to need frozen semen doses are more and supply is scanty which hindered assessment system at some degree till date. Semen production traits like semen volume, sperm concentration and motility like parameters were studied by scientists but studies are very scanty when it comes to first time semen collection traits and factors disturbing them. When financial side of breeding bull is under deliberation, first time semen collection traits are very imperative. It is also essential while breeding bull found as recognised and progeny of the best dam and recognized bull will

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be desired in forthcoming semen collection of semen station. To form scientifically copied semen station, it is key requisite to identify about and designate the induction age bull of specific breed for good semen production.

Body weight and scrotal circumference are the essential and conjoint parameters must to be used to evaluate breeding soundness of bull. Pedigree records along with individuals' body weight and scrotal circumference as well as age at first semen collection show vigorous role in early age selection of breeding bull for optimal semen production. Moreover, now a day age, body weight and scrotal circumference of bull has been assimilated by semen stations in the reviewed physical examination at the time assortment of young breeding bull due to its durable correlation with sperm production.

Looking to this background information the present hypothesis was made to evaluate effect of season and period of birth of bull on age, body weight and scrotal circumference of bull at first semen collection in Kankrej cattle bulls.

Materials and Methods

Evaluation of first time semen collection traits were carried out on Kankrej cattle bulls of Dama Semen Production Unit (DSPU), Dama. Information on breed characteristics is available on the national portal of the NBAGR website (National Bureau of Animal Genetic Resources 2021).

Data pertaining to date of birth, date of the first semen collection of the bull, date of last semen collection and number of semen doses produce from each ejaculate are

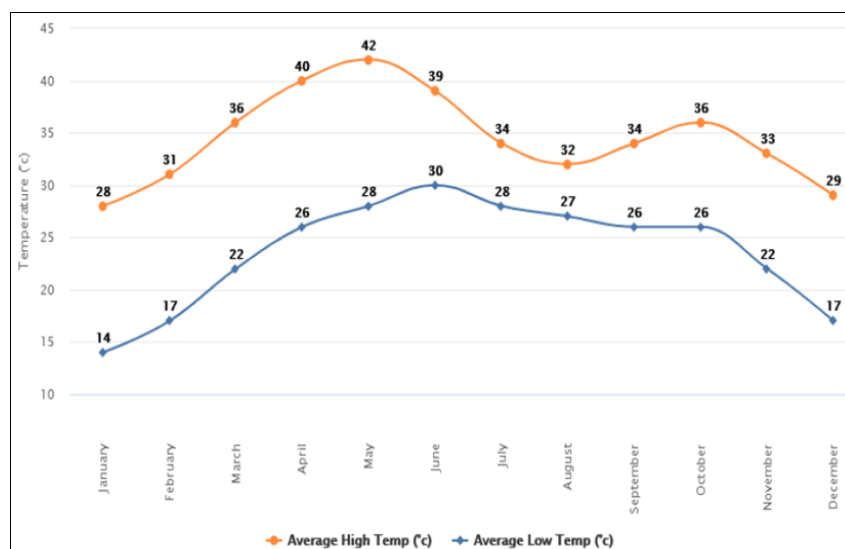
available with semen stations as databases which were utilized for the present study with permission of the semen stations. Details of period of data and number of bulls utilized for the present study is given following table.

Breed	Farm	Period of Data Collection	Number of Bulls
Kankrej Cattle	DSPU	2011-2020	26

The DSPU, Dama is located in Gujarat state, India, in the outskirts of Deesa city (24.2585° N, 72.1907° E) and at an altitude of 144.58 m above sea level. The region experiences three different seasons (Figure given below), viz. winter (November to February), monsoon (March to June), and winter (July to October) (<https://www.accuweather.com>).

The bulls were maintained under proper housing, feeding, management and health care. The young bulls were trained for semen collection using artificial vagina. The semen was collected twice a week from individual bull and ejaculates were obtained with an interval of 15 - 30 minutes. The nutrition requirement is standardized, so bulls are fed ad-libitum chaffed green and dry fodder mixture as per seasonal availability, concentrate mixture as per requirement based on body weight with area specific mineral mixture.

Body weight of bull at first semen collection, scrotal circumference of bull at first semen collection and age of bull at first semen collection were considered to study the effects of season of birth and period of birth.



Average monthly high and low temperature at DSPU, Dama during the period of study

Body weight of bull was measured using digital weighing balance by the semen station for each bull at regular time interval of a month. Body weight (kg) of the bull in the month of first semen collection was used for the present study.

Scrotal circumference was measured at the semen stations by pushing testicles firmly into the bottom of the scrotum by placing the thumb and fingers laterally on the side of the neck of the scrotum and pushed ventrally then a flexible metal measure tape was formed into a loop and slipped over the scrotum around its greatest diameter to measure scrotal circumference in centimetres. This scrotal circumference (cm) for each bull was measured by the semen stations every month were collected for the present study.

Data recorded by the semen stations regarding date of birth and date of first semen collection of the bulls were used to estimate age of bull at first semen collection (days) for the

present study.

Kankrej bulls were grouped as per seasons considering birth of bull as winter (November to February), summer (March to June) and monsoon (July to October).

Coding of season of birth

Month of Birth	Code
November to February	SB1
March to June	SB2
July to October	SB3

Data collected for Kankrej bulls from semen stations were grouped as per year in which particular bull was born. Considering the fact that the every two year environmental condition show change and accordingly the managerial practises were changing over the particular period, which affect the semen production traits under study.

Coding of period of birth

Period of Birth	Code for Kankrej Cattle Bulls
2006	PB1
2007	
2008	
2009	PB2
2010	
2011	PB3
2012	PB4
2013	
2014	PB5
2015	
2016	PB6
2017	

Statistical Analysis

The effects of season of birth and period of birth on body weight, scrotal circumference and age of bull at first semen collection were studied by multivariate analysis under general linear model and restricted maximum likelihood (REML) method considering all factors listed above have fixed effect. The data were analysed using SAS software version 9.3 and PROC GLM as base command SAS (2011).

The differences between the least squares means for sub classes under a particular effect were tested by Scheffe test Scheffe (1959) to check the significance. The high heterogeneous variances between the subclasses, unequal group size, pairwise and unpairwise comparison lead to use of Scheffe test as other tests find differences between the least squares subclass means. Scheffe test is one of the best adjustments that can used to decrease experiment wise error rates when testing multiple comparisons. Scheffe test is a very conservative adjustment that why it is the safest method for data with sub classes. The F-ratio used in the calculation is unique in that the mean square (MS) for only two groups being compared is used in the numerator and the MS for all respective comparison is used in the denominator. This means that each pairwise comparison has to have the same significance as the variance for all comparisons when using Scheffe test.

$$TS:Fs = \frac{(\bar{x}_i - \bar{x}_j)^2}{S_w^2 \left(\frac{1}{n_i} + \frac{1}{n_j} \right)}$$

Where,

TS = Test of significance

Fs = F for scheffe

X_i = Mean of ith group

X_j = Mean of jth group

S_w = Within group variance

n_i = Total number of observation of ith group

n_j = Total number of observation of jth group

Present model was design to estimate least squares means (LSMs) of first time semen collection traits under present study for fixed effects of factors i.e. season and period of birth.

$$Y_{ijx} = \mu + S_i + T_j + e_{ijx}$$

Where,

Y_{ijx} = Semen production trait of xth individual observation belonging to ith season of birth, jth period of birth

μ = Overall mean

S_i = Effect of ith season of birth (i = 1 to 3)

T_j = Effect of jth period of birth (j = 1, 2, 4, 5 and 6*)

e_{ijx} = Residual random error, NID (0 and σ²_e)

*Period-6 for effect on age of bull at first semen collection only

Results and Discussion

The LSMs of body weight, scrotal circumference and age of bull at first semen collection with the fixed effect of non-genetic factors such as season of birth and period of birth are given in Table-1. General linear model was used for analysis of body weight, scrotal circumference and age of bull at first semen collection. The least squares analysis of variance for the factors affecting these traits are given in Table-2. Numbers of observations for this analysis were comparatively low hence, standard errors are higher.

Body weight of bull at first semen collection

The verall LSM for body weight of bull at first semen collection was 537.69 ± 10.51 kg. Non-genetic factors like season of birth and period of birth contributed non-significantly (P>0.05) for variation in body weight of bull at first semen collection.

The overall LSM for body weight of bull at first semen collection was higher as compare to 360 and 284.7 kg reported by Sethi *et al.* (1989) [7] in Karan Fries cattle and Siddiqui *et al.* (2007) [8] in crossbred cattle respectively.

Body weight of bulls at first semen collection were found to be 572.04 ± 34.35, 580.00 ± 23.78 and 584.00 ± 45.54 kg in winter, summer and monsoon born bulls respectively. In accordance to the present study, Naha *et al.* (2019) [5] reported non-significant effect of season of birth on body weight of bull at first semen collection.

Bulls born during 2006 to 2016 were taken in to consideration for the present study. Based on the different periods of birth, body weight of bull at first semen collection ranged from 481.68 ± 59.89 to 692.68 ± 59.89 kg.

Table 1: Least-squares means of body weight and scrotal circumference at first semen collection for non-genetic factors in Kankrej bulls

Non-genetic factors	n	Body weight at first semen collection (kg)	Scrotal circumference at first semen collection (cm)	n	Age of bull at first semen collection (Days)
Overall	13	578.68 ± 25.18	30.86 ± 1.60	26	1122.36 ± 86.9
Season of birth		ns	ns		ns
SB1 (Winter)	5	572.04 ± 34.35	28.59 ± 2.18	8	1233.17 ± 120.3
SB2 (Summer)	6	580.00 ± 23.78	34.00 ± 1.51	12	1036.69 ± 94.16
SB3 (Monsoon)	2	584.00 ± 45.54	30.00 ± 2.89	6	1097.22 ± 129.95
Period of birth		ns	ns		ns
PB1 (2006-07)	1	692.68 ± 59.89	36.86 ± 3.80	1	1151.67 ± 261.95
PB2 (2008-09)	6	569.49 ± 23.70	32.90 ± 1.51	13	1101.25 ± 73.33
PB4 (2012-13)	1	481.68 ± 59.89	23.86 ± 3.80	1	1150.67 ± 261.95
PB5 (2014-15)	5	570.86 ± 25.22	29.83 ± 1.60	9	1298.05 ± 85.02
PB6 (2016-17)	-	-	-	2	910.16 ± 181.66

NS – Non-significant, n = Number of observations

Table 2: Least-squares analysis of variance for non-genetic factors affecting body weight and scrotal circumference at semen collection in Kankrej bulls

Source of variation	DF	Body weight at first semen collection		Scrotal circumference at first semen collection		DF	Age of bull at first semen collection	
		F Value	P Value	F Value	F Value		F Value	P Value
Season of birth	2	0.04	0.9589	2.72	1.32	2	0.1338	0.2903
Period of birth	3	2.5	0.1432	3.05	1.3	4	0.1015	0.3059
Error	7	MSS		MSS		19	MSS	
		3016.2328		12.1693122			63387.49	

MSS = Mean sum of squares, DF = Degree of Freedom

Scrotal circumference of bull at first semen collection

The overall LSM for scrotal circumference of bull at first semen collection was 30.86 ± 1.60 cm. Effect of non-genetic factors like season of birth and period of birth were non-significant ($P>0.05$) on scrotal circumference of bull at first semen collection.

The overall LSM for scrotal circumference of bull at first semen collection was higher as compared to 28.20 cm reported by Siddiqui *et al.* (2007) [8] in Crossbred cattle.

Bulls born during winter, summer and monsoon seasons has 28.59 ± 2.18 , 34.00 ± 1.51 and 30.00 ± 2.89 cm mean scrotal circumference at first semen collection.

Scrotal circumference of bull at first semen collection ranged from 23.86 ± 3.80 to 36.86 ± 3.80 cm during the different periods of birth.

Age of Bull at First Semen Collection

The overall LSM for age of bull at first semen collection was 1122.36 ± 86.9 days. Non-genetic factors like season of birth and period of birth contributed non-significantly ($P>0.05$) to the variation in age of bull at first semen collection.

Naha *et al.* (2015) [4] and Naha *et al.* (2019) [5] reported higher age of bull at first semen collection of 3.17 and 3.14 years as compared to present study in Sahiwal cattle. Contrary to present finding, lower age of bull at first semen collection were found in the reported values of 20.5 months in HF X Zebu (Siddiqui *et al.*, 2008) [9], 923 days in F1 Friesian X Tharparkar, 916 days in 50% HF X Tharparkar and 937 days in 75% HF X Tharparkar (Chauhan *et al.*, 2010) [1], 872.06 days in Karan Fries (Mukhopadhyay *et al.*, 2010) [3], 908.1 days in HF crossbred (Khatun *et al.*, 2013) [2], 738.39 days in HF Crossbred (Vijetha *et al.*, 2014) [10], 1111.37 days in Tharparkar, 810.84 days in 50% Friesian X Tharparkar, 798.41 days in 75% Friesian X Tharparkar and 796.21 days in F1 Friesian X Tharparkar (Panmei *et al.*, 2016) [6].

Age of bull at first semen collection were 1233.17 ± 120.30 , 1036.69 ± 94.16 and 1097.22 ± 129.95 days for winter, summer and monsoon born bulls however the differences between them was non-significant. Similarly Chauhan *et al.* (2010) [1], Mukhopadhyay *et al.* (2010) [3], Khatun *et al.* (2013) [2] and Panmei *et al.* (2016) [6] reported non-significant effect of season of birth on age of bull at first semen collection.

Based on the different periods of birth, age of bull at first semen collection ranged from 910.16 ± 181.66 to 1298.05 ± 85.02 days. Effect of period of birth of bull was also found non-significant ($P>0.05$) on age of bull at first semen collection in the present study. Contrarily, Significant effect of period of birth on age of bull at first semen collection was reported by Chauhan *et al.* (2010) [1], Mukhopadhyay *et al.* (2010) [3], Khatun *et al.* (2013) [2] and Panmei *et al.* (2016) [6].

Conclusion

Effect of season as well as period of birth of bull was non-

significant on first time collection of semen doses from Kankrej bull. Non-significant effect of season and period of birth reflects that the semen station scientific management system was working well and providing animal good comfort for production of semen. From this study, it is also noticed that Kankrej breed of cattle is well adjusted with local environment and capable of sustain in such harsh environment.

Conflict of Interest

Not available

Financial Support

Not available

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