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Relation between Age at First Semen Freezing of Holstein Friesian Crossbred Bulls and its Field Fertility

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Abstract: *Effect of age of bull on semen quality parameters is studied and widely reported however few reports are available on field fertility status in relation to age at first semen freezing of the crossbred bulls. A study, under ICAR sponsored field progeny testing programme, on 43 Holstein Friesian crossbred bulls of ¾ exotic inheritance, whose semen was produced and used during the period of 8 years (January 2008 to November 2015) to carry out 16,112 Artificial Inseminations(A.I.ˢ) on9,434crossbreed animals across 18 cattle development centres in Pune, Ahmednagar and Satara districts of Western Maharashtra, was carried out to determine the effect of age of bulls at first semen freezing on the conception rate at rural level. The overall mean conception rate was recorded as 40.43±0.39 per cent. The results of study indicated that age of bulls at first semen freezing was negatively correlated with field conception rate and to garner maximum fertility in field animals, it would be beneficial to have first semen freezing age between >22 to 28 months under our management regime. Although semen from heavier weight (>441kg) crossbred bulls exhibited low conceptions (38.85±1.37%) compared to lower weight bulls, body weight of bulls at the time of first semen freezing not affected overall conception rate of the field animals.*

Keywords: *¾ exotic inheritance Holstein Friesian crossbred bulls, field animals, conception rate, first semen freezing age of bulls.*

I. Introduction:

Crossbreed animals, after buffalo, contribute to major part of milk production under Indian condition. Semen of crossbred bulls in field animals is being extensively used for inter-se mating to maintain desirable exotic blood level. Fertility of animals is the result of combination of genetic potential and environmental factors including nutrition, health and bull management (Hamilton, 2009). Mir et.al., (2015) in their study observed that age of bull has an effect on semen parameter, which in turn reflects in terms of fertility in the herd. Kuhn and Hutchison (2008) noted that optimizing age of breeding bulls for fertility, as a criteria improves the selection and use of selected breeding bulls at right age enhances herd performance. Many reports are available on semen quality and breeding soundness of bulls based on laboratory parameters (Lemma and Shemsu, 2015, Thippeswamy et. al., 2014, Naha et. al., 2015, Kuhn and Hutchison, 2008, Mandal et. al., 2012) however, authors did not come across reports on studies relating age at first semen freezing of crossbred bulls and their field fertility status at village level. The present investigation was undertaken to examine the effect of optimum age for semen freezing of bulls.

II. Materials And Methods:

The study was conducted on records of ¾ exotic inheritance Holstein Friesian crossbred bulls used under ICAR sponsored field progeny testing programme. All the bulls were maintained at Urulikanchan which is situated at an altitude of 555 meters above mean sea level and 18.48 latitude and 74.13longitude east of Pune city in Maharashtra state. The weather is dry and maximum temperature ranged from 8°C during December month to 40°C during April, May. Average rainfall recorded as 450 mm. On the basis of prevailing climatic conditions, study was divided into three seasons, i.e. rainy (June-September), winter (October-January), summer (February-May).The traits considered were age of bull at first semen freezing (< 22 ,>22 to 28, >28 to 36 , >36 months), cattle development centre groups (Haveli, Karjat, Kopargaon, Sangamner), lactation order (Heifers, 1, 2, 3, 4, 5&above), Artificial Insemination (AI) years (2008 to 2015), AI season (Rainy, Summer, Winter) and body weight at the time when bull was introduced first for semen donation (<310, 311 to 380, 381 to 441, >441 kg).Fertility of bull was estimated using number of inseminations carried out and number of confirmed pregnancies confirmed through rectal palpation of cows after 60-70 days post insemination by individual centre in-charges. The fertility data of 43 bulls used on 16,112 AI records performed on 9,434crossbreed animals maintained by individual farmers at village level from villages covered under 18 cattle development centres in Pune, Ahmednagar and Satara

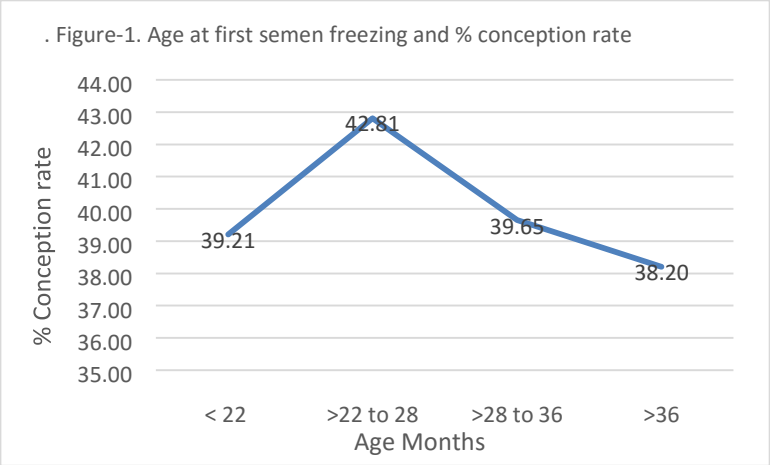
districts of Western Maharashtra and spread over a period of 8 years (January 2008 to November 2015) were compiled and analyzed. The data was classified into various sub-classes to assess the effect of non-genetic factors such as season and year of bull birth, year and season of first semen freezing and analyzed for significant effects by using fixed linear models and adjusted data further used for assessing the effect of various factors on traits under study. Data was analyzed using 'R' software and the differences of means between sub-classes were tested by using Duncan's Multiple Range Test (Kramer, 1957).

III. Results And Discussion:

The overall mean conception rate was recorded as 40.43±0.39 per cent. The conception rate noticed in present investigation was comparatively less to those reported by Bhagat et. al. (2008 & 2009) in field crossbred cattle (45.16±0.46 & 43.58±0.40%, resp.), Shindeyet. al. (2014) in field animals from Wardha district in Maharashtra state (47.29±0.33%), Anzar et. al. (2003) in Pakistan (29.00%), Nordin et. al. (2004) in Malaysia (35.50%) and Woldu et. al. (2011) in Ethiopian cattle (48.30%). The difference in mean conception rate observed by different workers might be attributed to number of observations and overall management of field animals during the study period. Bulls' first semen freezing age-wise means with standard errors of conception rate (%) for different attributes in field crossbreed animals are presented in Table-1.

Age at first semen freezing:

The age at first semen freezing of bull and conception rate in field animals was found significantly related and it was noticed that with advancement of first semen freezing age of the bull, conception rate in field crossbred animals decreased significantly (Figure1).These results corroborates with those observed by Thomas (2009), he observed that highest fertility of bull was found around 2-4 years of age and started declining thereafter. It was noticed that highest number of bulls (14) came under semen collection between the age of >22 to 28 months. Thippeswamy et. al. (2014) in Holstein Friesian x Tharparkar crossbred bulls observed that age at first semen freezing was 28.47±1.20 months, which was noticed to be quiet similar to present findings. They further noticed that the crossbred bulls produced semen at an early age, the quality of semen was not good at that moment and bulls required some more days to produce ejaculates that meet quality standards of cryopreservation, in present study, it was observed that bulls having first freezing age below 22 months had significantly low conception rate as 39.21±0.68 per cent and highest conception rate of 42.81±0.69 per cent for the bulls whose semen was first freezed between >22 to 28 months of age. Mir et. al. (2015) also noticed highest conceptions rate (41.81%) at younger age of bull at 2.5-3 years and lowest (37.89%) at above 3.5 years of age at first semen freezing of Murrah bulls, although the species is different, these results collaborated with results of present investigation that bulls having first semen freezing age above 36 months recorded significantly low conception rate (38.20±1.45%). Taylor et. al. (1985) studied the effect of bull's age at the time of semen collection and found general pattern of increasing conception rate with increasing age,



Cattle Development Centers (CDC):

The field animals under study were from 18 CDC's jurisdiction and spread over four blocks. Based on irrigation facility for green fodder growing these CDC's are divided into four groups and it was noticed that bulls whose semen was first freezed during >22 to 28 months recorded significantly higher conception rate compared to bulls of other age groups.

Lactation order:

The lactation order significantly ($P<0.05$) affected conception rate in the age group of bulls whose semen was first freezed during >22 to 28 months and >28 to 36 months. The highest (42.10±0.88%) conception rate was recorded in second lactation animals followed by first (41.93±1.08%), third (40.82±0.82%), fourth (38.42±1.03%) and lowest conception rate was recorded in fifth and above lactation (25.20±1.17%) animals. Qureshi et. al. (2008) recorded highest conception rate in first lactation in Mirpur Azad in Jammu and Kashmir State. The conception

rate in heifers was lower (41.42±0.85%) compared to lactating animals and these results are in agreement with the findings of Gunasekaran et. al. (2008) and Bhagat and Gokhale (1999) who noticed lowest conception rate in NDRI crossbred heifers and field crossbreed animals, respectively however, Bhagat et. al. (2009) recorded higher conception rate in heifers compared to lactating animals.

A.I. Year:

The year of insemination highly affected the conception rate in the age group of bulls whose semen was first freezed during >22 to 28 months and did not have any effect in other age groups of bulls. The overall conception rate was noticed to be increased from 2008 to 2013 and then declined.

A.I. season:

Out of total 16,112 inseminations 38.50% inseminations were performed during rainy season (June to September), 35.38% in summer (February to May) and 26.12%winter (October to January). The overall highest conceptions were recorded in rainy season (41.03±0.62%) followed by summer season (40.95±0.65%) and winter season (38.85±0.75%). The study results of Bhagat and Gokhale (1999) indicated reverse trend in which they noticed animals inseminated during winter season showed higher conception rate. The effect of AI season on conception rate was found significant ($P<0.05$) in the age group of bulls whose semen was frozen during >28 to 36 months.

Body weight at first semen freezing:

Body weight of bull at the time of first semen freezing did not significantly affect the overall conception rate in field animals, however bulls whose semen was frozen during the age of >22 to 28 months significantly affected conception rate ($P<0.05$). The bulls of body weight between 311 to 380 kg had highest inseminations (6990) and registered conceptions rate (41.04±0.59%) at par with bulls having body weight 381 to 440 kg. It was further noticed that heavier weight (>441 kg.) crossbred bulls recorded low conceptions (38.85±1.37%) compared to other lower weight group bulls.

IV. Summary:

The first semen freezing age of 3/4th exotic inheritance Holstein Friesian bulls' was found negatively associated with conception rate in field animals and to garner maximum fertility, it would be beneficial to have first semen freezing age between >22 to 28 months under existing management regime, however study based on large number of animals across all the states would help to accuracy of results to facilitate optimization of the age at first semen freezing for better utilization of superior germ-plasm.

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Table-1: Bulls' first semen freezing age-wise means with standard errors of conception rate (%) for different attributes in field crossbreed animals

#	Source of variation	Aspect	Age at first semen freezing (Months)												Overall		
			< 22 Months			> 22 to 28 Months			> 28 to 36 Months			> 36 Months					
			Bulls	A.I.	% CR&Se	Bulls	A.I.	% CR&Se	Bulls	A.I.	% CR&Se	Bulls	A.I.	% CR&Se	Bulls	A.I.	% CR&Se
1	Cattle Development Centre block	Significance level			P<0.01			P<0.01									P<0.01
		Haveli	11	542	45.76±2.14^{a}	12	338	50.00±2.72^{a}	8	237	40.51±3.20	4	52	32.69±6.57	35	1169	45.34±1.46^{a}
		Karjat	9	166	36.14±3.74^{b}	11	409	48.90±2.47^{a}	9	184	42.93±3.66	1	41	53.66±7.88	30	800	45.13±1.76^{a}
		Kopargaon	13	2726	41.56±0.94^{c}	14	3307	43.76±0.86^{b}	12	2343	41.05±1.02	4	684	36.55±1.84	43	9060	41.82±0.52^{a}
		Sangamner	13	1723	33.72±1.14^{b}	14	1160	35.86±1.41^{c}	12	1854	37.43±1.12	4	346	40.46±2.64	43	5083	36.02±0.67^{b}
2	Lactation Order	Significance level						P<0.05			P<0.05						P<0.01
		Heifer	13	1145	39.13±1.44	14	1077	43.73±1.51^{a}		908	43.17±1.64^{b}	4	250	35.60±3.03	43	3380	41.42±0.85^{ac}
		First	13	634	42.43±1.96	14	638	44.04±1.97^{a}	12	700	39.71±1.85^{a}	4	129	41.09±4.35	43	2101	41.93±1.08^{a}
		Second	13	1012	41.60±1.55	14	1020	43.73±1.55^{a}	12	888	41.33±1.65^{a}	4	201	38.80±3.46	43	3121	42.10±0.88^{a}
		Third	13	1205	38.26±1.40	14	1203	44.80±1.43^{a}	12	932	38.84±1.60^{a}	4	288	41.32±2.91	43	3628	40.82±0.82^{a}
		Forth	13	658	36.93±1.88	14	765	40.52±1.78^{a}	12	646	38.70±1.92^{a}	4	151	33.11±3.84	43	2220	38.42±1.03^{a}
		Fifth & above	13	503	25.79±2.14	14	511	36.20±2.13^{b}	12	544	33.46±2.02^{a}	4	104	36.54±4.74	43	1662	25.20±1.17^{b}
3	A.I. Year	Significance level			P<0.05			P<0.01									P<0.01
		2008	NA	NA	NA	NA	NA	NA	2	416	37.50±2.38	3	485	35.05±2.17	5	901	36.18±1.60^{a}
		2009	NA	NA	NA	3	231	48.48±3.30^{a}	3	284	41.55±2.93	4	368	36.68±2.52	10	883	41.34±1.66^{a}
		2010	NA	NA	NA	3	602	39.70±2.00^{b}	1	157	42.68±3.96	2	270	46.27±3.05	5	1027	41.87±1.54^{a}
		2011	5	834	41.37±1.71^{a}	5	462	41.56±2.30^{a}	1	18	61.11±11.82	NA	NA	NA	11	1314	41.70±1.36^{a}
		2012	13	897	41.47±1.65^{a}	5	466	43.13±2.30^{a}	4	199	42.71±3.52	NA	NA	NA	22	1562	42.33±1.25^{a}
		2013	8	1282	40.95±1.37^{ab}	2	356	49.44±2.65^{a}	4	564	44.33±2.09	NA	NA	NA	14	2202	43.19±1.06^{b}
		2014	10	1255	38.49±1.37^{a}	9	1858	41.33±1.14^{c}	10	1572	36.39±1.21	NA	NA	NA	30	4686	38.19±0.71^{c}
		2015	11	889	33.41±1.58^{a}	8	1239	43.91±1.41^{a}	8	1408	40.63±1.31	NA	NA	NA	28	3537	39.95±0.82^{ac}
4	A.I. Season	Significance level									P<0.05						P<0.05
		Rainy	13	2002	39.16±1.09	14	2016	42.81±1.10	12	1942	41.76±1.12^{a}	4	243	35.80±3.08	43	6203	41.03±0.62^{a}
		Summer	13	1772	40.01±1.16	14	1820	43.52±1.16	12	1497	38.94±1.26^{a}	4	611	40.92±1.99	43	5700	40.95±0.65^{a}
		Winter	13	1383	38.25±1.31	14	1378	41.87±1.33	12	1179	37.07±1.41^{b}	4	269	34.20±2.90	43	4209	38.85±0.75^{b}
5	Body weight at first semen freezing	Significance level						P<0.05									
		<310	6	3098	39.25±0.88	1	263	38.78±3.01^{a}	2	552	39.31±2.08	NA	NA	NA	9	3913	39.23±0.78
		311 to 380	6	1803	38.21±1.14	7	2817	43.81±0.93^{a}	5	2088	40.76±1.08	1	282	33.69±2.82	19	6990	41.04±0.59
		381 to 440	1	256	45.70±3.12	4	1592	43.59±1.24^{a}	4	1529	37.41±1.24	2	558	41.68±2.09	11	3935	41.04±0.78
		>441	NA	NA	NA	2	542	37.27±2.08^{b}	1	449	42.54±2.34	1	283	36.04±2.86	4	1274	38.85±1.37
Overall			13	5157	39.21±0.68	14	5214	42.81±0.69	12	4618	39.65±0.72	4	1123	38.20±1.45	43	16112	40.43±0.39

Means having same superscripts within columns did not differ significantly.