



ISSN (E): 2277-7695

ISSN (P): 2349-8242

TPI 2025; 14(2): 86-88

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www.thepharmajournal.com

Received: 16-11-2024

Accepted: 24-12-2024

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Performance of sex sorted semen in indigenous cattle and buffalo in Maharashtra State

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Abstract

The present study was carried out to determine the conception rate (CR) and sex ratio of artificial insemination using sex-sorted semen in Indigenous cattle and buffaloes. The study was conducted by various cattle development centers operated by BAIF institute for sustainable livelihoods and development (BISLD), Maharashtra from April 2019 to March-2022. The overall CR was 44.88% and the sex ratio of female over the male was 91.14 from a total of 8,963 insemination records. Highest CR was observed in buffaloes 45.18% while in cattle 44.62% and sex ratio of female over the male is 91.68% in cattle while 90.56% in buffalo. Amongst buffaloes, Murrah showed the highest CR (45.29%) than Jaffrabadi (44.50%). Amongst Indigenous native cattle breeds, the CR in Sahiwal, tharparkar, Khillar and Gir were 45.67, 44.46, 44.20 and 43.79%, respectively. Similarly CR in Khillar sex-sorted semen using Y-chromosome bearing sperms was found to be 45.50% with the sex ratio of male over female 90.82% from a total of 478 followed insemination records. The success observed with the use of sex-sorted semen boosted confidence to artificial insemination technicians and farmers for adaptation of sex sorted semen technology and also opportunity could be made available for faster multiplication of progenies with desired sex. Application of sex sorted semen in the breeding of indigenous cattle and buffalo would also help to protect endangered species.

Keywords: Indigenous bovine, artificial insemination, conception rate, sex-sorted semen.

Introduction

Artificial insemination (A.I.) technology is widely seen as a boon to the dairy sector. The AI approach not only aids farmers in enhancing the genetics of their dairy herds but also increases milk output and farmer income. The dramatic increase in milk output in India between 2017-18 and 2018-19 may attest to this.

The Indian dairy industry has had access to sexed semen, commonly known as Gender Enhanced Semen (GES), for almost six years. Although this technology is only occasionally employed, dairy farms appear to be quite interested in this new tool. Although sexed semen has been offered commercially for some time, the dairy industry has been slow to adopt it. The demand for sexed semen has increased due to worries about the slaughter of undesired male dairy calves and a potential lack of dairy replacements and beef cattle.

Sexed semen technique involves separating or sorting the X-sperms from the Y-sperms to determine the sex of the offspring in advance. By using solely sperms carrying the X chromosome to inseminate cows, the goal is to deliver freedom from male calves. Nothing could be worse for dairy producers in these days of gaurakshak activity than when their cows or buffaloes give birth to male calves. Fortunately, technology is now available to partially address the issue, in the form of "sexed semen" that can only produce female kids and contains 90% or more sperm that carry the X chromosome. Artificial insemination (AI) is an effective method of applying sexed bovine sperm to change the sex ratio and quickly increase the number of dairy herds carrying animals with high genetic value. Sex-sorted seed has been processed and sold for a very high price abroad for the past few years. Commercially sexed semen has been used for a number of years in countries including Australia, New Zealand, Denmark, and the United States. In order to capitalize on its advantages, sexed semen straws containing only female sperm have recently become available in India. The Department of Animal Husbandry has also capped this technology, and the Government of India provides sexed semen straws for insemination at the field level.

The current study investigated the impact of indigenous sexed-sorted semen in various districts of Maharashtra.

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Methodology

Area and sample size: In this study a total of 9441 AI data were collected from April 2019 to March 2022 from 227 Cattle Development Centre's (CDC) under 19 different projects covering 21 districts of Maharashtra, India. Out of 9441, 4668 AI done in cattle and 3899 AI done in buffalo. A total of 3,311 calving followed which included abortion, still birth, dystocia and normal calving. All the cows inseminated with sex sorted semen were tagged with 12-digit unique identity numbers and the data pertaining to inseminations were collected through an online digital platform, stored and analyzed using BAIF' data storage and data management pipeline.

Processing of sex sorted semen: The process of separating spermatozoa into two subpopulations that carry the X and Y chromosomes, with higher than average concentrations (up to 90%) of either sperm, is known as "sexing semen" and is used to produce offspring of the desired gender (Joshi and Singh 2005) [3]. The Sex ULTRATM sperm sex sorting system, a patented innovation of Sexing Technologies (ST), USA, is used at the BAIF frozen semen station to create semen that has been sorted. In the world of sex sorting technology, Sexing Technologies (ST) is the pioneer. The original invention of the bovine semen sex sorting methods was attributed to XY, LLC, a subsidiary of ST, under license to ST. The procedure outlined by Gonzalez-Marin *et al.* (2018) [1] was followed while sorting and processing the semen. Using established procedures, quality control was applied to each and every batch of semen that had been sorted for sex. According to the prescribed criteria, the study's sex-sorted frozen semen met the following quality standards: gender purity, as determined in the laboratory, was better than 90%; post-thaw incubation of progressive motility at 0 and 3 hours

was above 50% and 30%, respectively; The ultimate concentration of spermatozoa was at least 2.1 million sperm per frozen semen straw, while the number of bacteria was less than 100 CFU.

Study parameters and determining elements

The study's parameters were the sex ratio of semen that had been sorted by sex and the conception rate. The percentage of pregnancies verified per rectal tract 90 to 120 days after insemination, divided by the total number of inseminations tracked for pregnancy diagnosis across time, was used to determine the conception rate (CR).

Results and Discussion

The overall CR in cattle is 44% while in buffalo is 45% and female sex ratio in cattle and buffalo is 91: 90 percent (Table 1).

During the period April-2019 to March-2022, total record of 8963 artificial insemination with sex sorted semen of Gir (2119), Sahiwal (1837), Tharparkar (677), Khillar (138), Murrah (3619) and Jafra (573). Calving record of Gir, Sahiwal, Tharparkar, Khillar and Murrah and Jafra were 837, 704, 262, 61, 1431 and 238 respectively.

Overall conception rate in cattle is 44 percent while 45 in buffalo and sex ratio of female over the male is 91 percent in cattle while 90 percent in buffalo.

This study investigates the conception rate and sex ratio of indigenous male sex sorted semen of Khillar breeds, total 478 sex sorted semen artificial insemination done of Khillar male and the conception rate in Khillar male is 45 percent. Sex ratio of Khillar male is 90 percent.

Use of sexed semen will result in production of almost 90% females and eliminate the male calves right at the birth. It is playing a very important role in this pilot project.

Table 1: Conception rate & sex ratio in indigenous cows and buffalo inseminated with sex sorted semen

Breed of Bull	AI Follow up			Calving follow-up: Sex Ratio				
	No of Inseminations	Confirm Pregnant	Conception rate %	Total calving	Female	Male	% Female	% Male
Sahiwal	1837	839	45.67±0.91	704	651	53	92.47	7.53
Tharparkar	677	301	44.46±2.01	262	238	24	90.84	9.16
Khillar	138	61	44.20±4.56	61	55	6	90.16	9.84
Gir	2119	928	43.79±0.84	837	765	72	91.4	8.6
Murrah	3619	1639	45.29±0.79	1531	1383	148	90.33	9.67
Jaffrabadi	573	255	44.50±1.92	238	219	19	92.02	7.98
Total	8963	4023	44.88±0.42	3633	3311	322	91.14	8.86
Buffalo	4192	1894	45.18±0.60	1769	1602	167	90.56	9.44
Cattle	4771	2129	44.62±0.59	1864	1709	155	91.68	8.32
Khillar (Y-Chromosome)	478	217	45.40±2.89	207	19	188	9.18	90.82
Overall Total	9441	4240		3840	3330	510		

The conception rate is not significant at the species level, however it is significant at the 5% and 1% levels of significance for breeds.

Application of sexed sperm in the breeding of indigenous cattle and buffalo would help to protect endangered species, and it also helps to improve the productivity of indigenous milch animals which can survive long starvation and are well adapted to Indian climatic conditions along with disease resistance

Some of our precious indigenous breed's animals are declining in numbers and with special breed development programmers, opportunities could be made available to use sorted semen technology for faster multiplication of female

population in the respective breed tract to increase the population within stipulated time.

The success observed with the use of sex sorted semen provided confidence to artificial insemination technicians and farmers for adaptation a sex sorted semen technology.

Conclusion

- The overall CR was 44.88% and the sex ratio of female over the male was 91.14
- Similarly CR in Khillar sex-sorted semen using Y-chromosome bearing sperms was found to be 45.40% with the sex ratio of male over female 90.82%
- Success boosted confidence to artificial insemination

technicians and farmers for adaptation of new technology

- Opportunity for faster multiplication of progenies with desired sex
- Conservation of Indigenous breeds having lesser population

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