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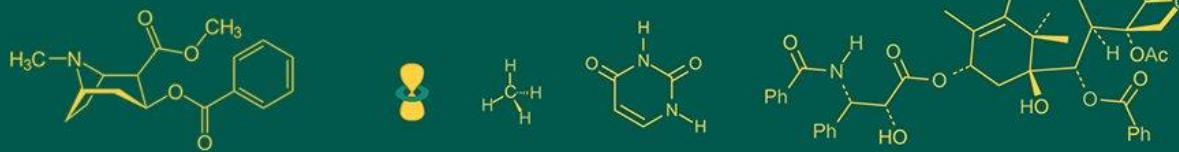
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# Factors affecting conception rate in dairy cattle using sorted semen in Uttarakhand

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**Abstract**
The primary aim of this study was to evaluate the performance of sorted semen in dairy cattle of various breeds in Uttarakhand. Total 6382 inseminations were performed in different districts. Different factors considered for study were region, dam breed, parity number, insemination season, bull breed used for insemination. Sorted semen provided by Uttarakhand Livestock Board. Total 6382 inseminations were considered for this study and the statistical analysis was performed using R version 4.3.1 software to study the effect of these different factors on conception rate. Except dam breed all other factors were having significant effect over conception rate. The overall conception rate was $37.2\pm1.12\%$. Highest conception rate $35.7\pm1.69\%$ was observed in first parity lowest was in heifer that was $30.1\pm1.38\%$. In season study summer season was having highest conception rate summer $39.1\pm0.98\%$ while rainy season was having $35.9\pm1.17\%$ conception rate lowest was in winter $23.9\pm1.48\%$. Animals inseminated in Hilly region were shown conception rate of $30.2\pm1.2\%$ while animals in Plane region were having conception rate of $35.8\pm0.94\%$. Gir bulls were having highest conception rate $34.7\pm1.42\%$ followed by Sahiwal $34.6\pm0.86\%$ Red Sindhi bulls were having lowest conception rate $29.6\pm1.43\%$.

**Keywords:** Bulls, season, sorted semen, conception rate

## Introduction

Uttarakhand, being a hilly state, is abundant in natural resources such as water, land, forests, and biodiversity. Apart from tourism, milk production serves as a crucial source of livelihood in the region. As per 20th livestock census 2019 in comparison to country Uttarakhand has 0.96% cattle, 0.79% buffaloes, 0.38% sheep, 0.92% goats, 0.20% pigs and 0.59% poultry. The government has implemented several measures to promote the growth of dairy business and livestock farming. Through the provision of infrastructural support and policy frameworks, millions of dairy farmers are benefiting from these initiatives. There has been a significant increase in the population of crossbred cattle. Livestock farming serves as the second most significant occupation after agriculture, playing a vital role in providing subsistence to marginalized farmers through the provision of milk, meat, manure, and wool. Uttarakhand, being an ecologically diverse region, supports a wide array of fodder plants and grass species, accommodating a substantial livestock population. The primary livestock species in the Uttarakhand Himalaya consist of cow, buffalo, oxen, hen, goat, sheep, and lamb. Among these, improved livestock accounts for the highest proportion (45.4%), followed by milching buffalo (17.8%) and indigenous milching cow (15.3%). In contrast, goat has the lowest share (1.8%), followed by indigenous milching cow (5.2%) and hen (6.1%). Sheep constitutes only 6.6% of the total. The Uttarakhand Himalaya offers favourable conditions for dairy farming across different altitudinal zones. Milching cow and buffalo are reared at all altitudes, highlighting their potential for fostering dairy farming development. To keep up with the growing demand and improve the overall productivity of dairy cattle, various advancements and technologies have been introduced. An innovative advancement in Indian dairy cattle breeding is the introduction of sorted semen. This cutting-edge reproductive biotechnology enables the separation of X-chromosome-bearing (Female) and Y-chromosome-bearing (male) spermatozoa in semen samples. Despite some challenges, the benefits of this technology in terms of genetic progress, milk production, and efficient herd management make it a promising tool for dairy farmers aiming to optimize their operations and contribute to the nation's dairy sector's sustainable growth.

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Proper training, awareness, and support from the government and dairy associations can aid in the successful adoption of sorted semen technology across the Indian dairy industry.

## Materials and Methods
### Area of study
The current research was conducted at various field Artificial Insemination (AI) centers operated by the BAIF Development Research Foundation in 13 districts of Uttarakhand. BAIF Development Research Foundation, a prominent NGO situated near Uruli Kanchan, close to Pune, offers door-to-door cattle and buffalo AI services. A total of 6382 inseminations were performed on cows with diverse genetic backgrounds. The inseminations were conducted between July 2020 and March 2022. All doses of sexed sorted semen were passed quality norms. Inseminations data was collected and analysed using R software version 4.3.1. For calculation of conception rate code given 0 for animals that are not pregnant and 1 for animals that were pregnant. Conception rate was estimated by per rectal palpation of genital tract after 90 to 120 days of post-insemination against total number of insemination. Seasonal variation was used by month of inseminations while for parity number was grouped as from heifer, first to four and more. Dam breed identified as Holstein-Friesian cross, Jersey cross, Indigenous cattle and Non-descript cattle breed. Bull breeds were from Gir, Sahiwal, and Red Sindhi. Region of district was divided as hilly region and plane region depend on locality.

## Result and Discussion
The overall conception rate of sex-sorted semen was 32.96±1.19%, Healy (2013) [6] found that the empirical conception rates were 31.6% for sexed semen. S.B. Patel and P.C. Jethva (2019) got 39.53% conception rate of sexed semen in their study. The factors that had a very high significant effect ($p<0.001$) on the conception rate were region, parity number, insemination season, bull breed while dam breed was not having any significant effect over conception rate. All factor-wise details are given in Table-1. Animals inseminated in Plane region shown higher conception rate 35.8±0.94% than animals in Hilly region 30.2±1.2%. In season study summer season was having highest conception rate Summer 39.1±0.98% while rainy season was having 35.9±1.17% conception rate lowest was in winter 23.9±1.48%. Mellando et al. (2014) [8] in his study reported that month of insemination was important factor for difference in conception rate in sexed and conventional semen. In another research Healy et al. (2013) [6] found significant effect of various factors as humidity and temperature, age at insemination, technician, breeding place, service per conception, sire in Holstein heifers. Gir bulls were having highest conception rate 34.7±1.42% followed by Sahiwal 34.6±0.86% Red Sindhi bulls were having lowest conception rate 29.6±1.43%. Many researchers reported that conception rate across services generally declined as parity increased for both conventional semen and sexed semen breedings. Schenk et al. (2009) [13] also reported lower pregnancy rates for sexed semen breedings as parity increased while in present study, the overall conception rate was 32.96±1.38%. Highest conception rate 35.7±1.69% was observed in first parity lowest was in heifer it was 30.1±1.38%. In a study conducted by Norman et al. (2008) [14], the mean conception rate for heifers using conventional semen was found to be 56%, while for sexed semen, it was 39%. Subsequently, Norman et al. (2010) [10] reported that conception rates with sorted sexed-semen was typically 10-20% lower than those achieved with conventional semen. Numerous factors influence the conception rate, including low sperm concentration and loss during the sorting process (Frijters et al., 2009) [5]. Furthermore, the site of semen deposition in the uterus also impacts the conception rate for sexed semen. In buffalo heifers, a higher conception rate (45%) is observed when sexed semen is deposited in the body of the uterus, compared to the horn of the uterus (32%) (Campanile et al., 2011) [3]. Multiple studies (Andersson et al., 2006; Barba et al., 2006; Cerchiaro et al., 2007; Norman et al., 2010; Norman et al., 2011; Healy et al., 2013; Karakaya et al., 2014) [1, 2, 4, 10, 11, 6, 7] have confirmed that sexed semen generally exhibits a lower conception rate than conventional semen. Sharma et al. (2018) [9] reported a 40% conception rate using sorted semen under Indian conditions.

**Table 1:** Different factors affecting conception rate in dairy cattle in Uttarakhand

| Factors | Particulars | Total Inseminations | Conception Rate (%) with Standard Error |
|---|---|---|---|
| Region *** | Hilly | 2046 | 30.2±1.20 |
| | Plane | 4336 | 35.8±0.94 |
| Dam Breed[NS] | Holstein Friesian Crossbreed Cattle | 2105 | 32.0±1.29 |
| | Indigenous Cattle | 1399 | 32.3±1.44 |
| | Jersey Crossbreed Cattle | 1782 | 33.2±1.24 |
| | Non-Descript Cattle | 1096 | 34.3±1.56 |
| Parity Number** | Heifer | 1426 | 30.1±1.38 |
| | 1 | 882 | 35.7±1.69 |
| | 2 | 1698 | 33.6±1.28 |
| | 3 | 1381 | 33.5±1.43 |
| | 4 | 995 | 32.0±1.60 |
| Season of insemination*** | Rainy | 2053 | 35.9±1.17 |
| | Summer | 3111 | 39.1±0.98 |
| | Winter | 1218 | 23.9±1.48 |
| Bull Breed ** | Gir | 1348 | 34.7±1.42 |
| | Red Sindhi | 1285 | 29.6±1.43 |
| | Sahiwal | 3749 | 34.6±0.86 |

(***Means 0.001, **Means 0.01, *Means 0.05 level of significance)

## Conclusion
Using sexed sorted semen dairy farmers can get desired sex for their breed and maintain herd size by replacing heifers. This technology makes it possible for dairy farmers to selectively choose the sex of the offspring they wish to produce, providing greater control over the breeding process.

There are many factors that contribute increase in conception rate as handling of semen doses, site of semen deposit in, farmers awareness and information about sexed sorted semen

## Acknowledgements

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