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Use of Sexed Semen in Indian Dairy Cattle: A Case Study

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Abstract

This study was undertaken at the calf rearing project (CRP) of AMUL at Sarsa Village, Anand, Gujarat to assess the conception rate and sorting efficiency of imported sexed semen of HF bulls. In all, 127 pubertal crossbred heifers (b.wt. 250-300 kg) were artificially inseminated during the year 2016-17 using 172 sexed semen doses (few with repeat insemination), resulting in 68 pregnancies. The conception rate of sexed semen was found to be 39.53%. Out of 68 pregnant heifers, 2 heifers aborted and one heifer died before calving. Out of rest 65 animals that calved, 54 heifers delivered female calves, 9 had male calves and two were female stillbirth. Thus, sexed semen produced 86.15% female calves and 13.85 % male calves. This small scale study highlights the success of sexed semen under field condition in producing calves of the desired sex in high percentage.

Introduction

Sexed semen is a new reproductive technology aimed to alter the sex ratio of the offspring toward a desired gender. The use of sexed semen provides dairymen the ability to produce more replacement heifers on their farms. Sexed semen is one that has been sorted for its X and Y chromosome bearing sperms and allows a producer to limit offspring to a single sex as opposed to the near 50/50 natural selection. Sexed semen can achieve 90% accuracy of a desired sex (Seidel *et al.,* 1999; Seidel and Garner, 2002; Seidel and Schenk, 2002; Garner and Seidel, 2003; Seidel, 2003; DeJarnette *et al.,* 2008[a]; DeJarnette *et al.,* 2009) suggesting profound implications for the dairy industry in terms of economic returns. Sexed semen was first used in the bovine population in UK at the start of the 21st century. The high cost and low conception rate are two factors which limit its usage especially in the developing countries (Seidel, 2003). Data from various studies show that the fertility of sexed semen is much lower than that of unsexed semen (Borchersen *et al*., 2009; De Jarnette *et al*., 2009; Dominquez *et al.,* 2011) adding to the difficulty in its field application.

The use of sexed semen increases the rate of genetic gain not only from the daughter-dam

path but also through production of superior male from elite cows for future breeding. For thousands of years, livestock owners have desired a methodology to predetermine the sex of offspring for their herds. Sexed semen has been proven to produce genetically superior daughters, rapidly increase desired traits within a herd, and subsequently creating more opportunities for the sale of dairy genetics (embryo sales and bull marketing). Additionally, sexed semen can be utilized to breed the top cows of the herd which will result in increased genetic base of the herd. Separation of X- and Y- chromosome bearing sperm by flow cytometric sorting is the most successful assisted reproductive technique. There is no alternative method currently available which can successfully replace the flow cytometric sperm sorting procedure (Seidel, 2012). Sexed semen contains a lower concentration of sperm per straw (approximately 2 million) than non-sexed semen (20 million) because of relatively slow sorting process. Fertility of sexed sperm is typically lower compared with conventional sperm (Garner and Seidel, 2003; DeJarnette *et al.,* 2008[b]) due to low sperm count and possible negative effect of the sorting process. Hence, this study was undertaken with the objective of creating awareness among the dairy farmers as to the use of sexed semen, and to access the conception rate and sex ratio of sexed semen under field conditions in Anand and Kheda districts.

Materials and Methods

The study was undertaken on a pilot basis between January, 2016 and May, 2017 at calf rearing project (CRP) of AMUL dairy at Sarsa, Anand, Gujarat. The village is located at 22°33'0" North, 73°4'0" East, 13 kms towards East from District head quarter, Anand. The straws of sexed semen of pure HF bulls sorted for female sex by flow cytometry were obtained from ABS Global, costing Rs.1470/-per straw.

For this study, total 127 pubertal crossbred (HF x Gir) heifers were selected from calf rearing project (CRP), weighing between 250 and 300 kg. All heifers were examined per rectally to exclude any heifer with genital tract anomaly. These heifers were artificially inseminated using 172 imported sexed semen doses of HF bulls on observed estrus and further confirmed by per rectal palpation. Heifers were inseminated nearly 12-24 hrs after the reporting of estrus signs. The semen was deposited into the internal os of cervix by a skilled veterinarian. The non-return heifers were examined per rectally between 12-15 weeks after insemination to detect pregnancy. The pregnant animals were followed till calving for recording sex of the calf born.

Data related to conception and final calving was recorded for all the 68 heifers conceived and/or calved following sexed semen inseminations. The sex of the calves born in the study was also noted. The conception rate and percentage of male and female calves born of semen employed for insemination were calculated.

Results and Discussion

In the present study, pubertal crossbred (*Bos indicus* x *Bos taurus*) heifers were targeted as they give best results with sexed semen. In all 127 heifers were selected for breeding through sexed semen initially, of which some conceived at first AI and others showed repeat estrus after 18-21 days and were re-inseminated with sexed semen again. Thus, out of total 172 sexed semen doses utilized on 127 heifers at calf rearing project, 68 heifers conceived. The conception rate of sexed semen thus calculated was found to be 39.53%. Out of these 68 pregnant heifers, 2 heifers aborted and one heifer died before calving. Out of 65 animals that calved, 54 heifers delivered live female calves, 9 heifers had male calves, and two had female stillbirth. Thus, with regards to sex of calf born with sexed semen including stillbirths, 86.15% were female calves and 13.85 % were male calves (Table 1).

As per West Bengal Livestock Development Board, the first male calf named Shreyas was born in India on 1st Jan 2011 using sexed semen. Later female calves were also successfully born to sexed semen. The conception rates observed were 20.7% in cows and 35.3% in heifers using sexed semen (Mumtaz *et al.,* 2017). Lower number of sperm cells may achieve greater success in heifers rather than in cows because the virgin reproductive tract lacks the intense nutritional demands such as no lactation or postpartum stress. Using good technique and proper insemination timing may result in better

conception rates. For 70 cows inseminated with sexed semen from three centers of Lohaghat block, the conception rate, female calves and male calves born were 40.00%, 82.14% and 17.85%, respectively (Sharma *et al.,* 2018). Norman *et al.* (2010) reported mean conception rate for heifers as 39% for sexed semen, while Djedovic *et al.* (2016) observed it as 44%.

Research has consistently demonstrated that the technology used to sort semen produces about 90% calves with the desired gender (DeJarnette *et al.,* 2008[a]). Sexed semen has always been recommended for use in heifers because of the known compromise in conception rates largely due to the reduced sperm number per unit. Initial reports published from a limited

Table 1: Results of sexed semen used under calf rearing project (CRP) at Sarsa, Anand

Details of sexed semen impregnated females		
Particulars		**Number**
Sexed Semen & CR	Sexed semen doses utilized	172
	Number of heifers inseminated	127
	Heifers conceived with sexed semen	68
	Conception rate (%)	**39.53%**
Pregnant Heifers	Pregnant heifers completed gestation	65
	Heifers aborted	2
	Pregnant heifers died before calving	1
Calving of Heifers	Female calves born	54
	Male calves born	9
	Stillbirth (female calves)	2
Sex Ratio %	Female calves (%)	**86.15%**
	Male calves (%)	13.85%

number of inseminations warned of approximately a 30% reduction in conception rates in virgin heifers (Olynk and Wolf, 2006).

The percentage of female calves born in a study varied from 89 to 93% among three breeds of cattle (Borchersen *et al.,* 2009). Abdalla *et al.* (2014) also reported the female calf percentage of 88% following three inseminations in cattle, while Sharma *et al.* (2018) reported birth of 85-90% female calves by sexed semen. In a well-managed dairy herd many authors reported the pregnancy rates with sexed spermatozoa usually have been 60-80% of unsexed control spermatozoa (Seidel *et al.,* 1999; Doyle *et al.,* 1999). A study on farm records in Australia (Healy *et al.,* 2013) revealed 52% pregnancy rates for sexed semen and 58% for conventional semen. Abdalla *et al.* (2014) studied fertility of commercially available sexed semen in Egypt and recorded calving rates of 29.3% and 51.1% for sexed and unsexed semen, respectively. This was relatively lower than that observed in our study.

Successful use of sexed sperm requires excellent management of cattle, careful handling of sperm and use of a skilled inseminator (Seidel, 2007). Reproductive efficiency plays an important role in the expected conception rate with sexed semen, with larger differences when reproductive management is poor. When reproductive management is excellent, conception rates in heifers are only slightly lower than normal when using low doses of sexed semen (Seidel, 2007). Some studies reported 90% fertility. With marginal management, fertility of sexed semen could decrease to 50 to 60% of conventional sperm.

Conclusion

The use of sexed semen for gender selection is a reality today. Sexed semen is considered to

be a useful tool to increase proportion of heifers, with unit costs expected to drop as the technology is further refined. The present study involving 172 sex sorted semen doses by flow cytometry on 127 pubertal heifers achieving 39.53% conception rate and 86.15% female calves birth, highlights the importance of using sexed semen to increase the milk yield and reduce the burden of male calves on the farm.

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Conflict of Interest:

Authors declare that they have no conflict of interest.

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