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Popular Article

# Non-Genetic Parameters of Semen Analysis in Bulls

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## *Abstract*

The current article summarizes the impact of several non-genetic factors on the quality of the semen produced by both buffalo and cattle. Selection of breeding bulls along with good semen producing ability is important component for genetic improvement of cattle and buffalo resources. The semen quality is affected by many factors, such as the genetic and non-genetic factors. Bull to bull variation was observed as considerable difference for numerous seminal parameters. The freezing of bull semen substantially hampers the motility of sperm which reduces the conception rate in dairy farm animals. Variations in semen quality parameters may be due to individual variations, ejaculate frequency, differences in age, genetic makeup of the bulls, season of study and agro climatic conditions. While non-genetic factors may be regulated to improve semen quality in bulls, genetic factors are heritable qualities that are difficult to alter in a short amount of time.

## Introduction

Profitability of farmers is affected through reproductive and productive overall performance of dairy animals. Selection of breeding bulls with excessive genetic advantage is an essential aspect for genetic development of cattle resources. The bulls genetically superior for milk production won't be superior in semen production. Therefore, it will become a tough challenge to get the bulls with excellent genetic merit for milk production together with good semen producing ability. The farm animals quarter plays a critical role withinside the socio-economic development of rural households.

Livestock sector contributes about 4.9 percent to the Gross Domestic Product (GDP/GVA) at constant rate in 2017-18 (National Accounts Statistics-2019, Central Statistical Organization,

GoI). As per the twentieth Livestock census, the total cattle population shows a boom of 4.6 percent over the Livestock census 2012 with 192.49 million cattle and109.85 million buffalo.

When only high fertility bulls are used, better fertilization rates and reproductive outcomes are achieved, increasing the reproductive efficiency and thus, reducing the costs of the programs. Given the complexity of the reproductive process, it is unlikely that the evaluation of a single sperm characteristic may reflect the actual sperm fertilization ability of a semen sample, even though an in vitro semen parameter for determining bull fertility could be of great benefit to AI programs.

The semen quality is affected by many factors, such as the genetic and non-genetic factors. 96% of the difference in conception rates may be attributed to management and environmental variables. The bulls used in Artificial Insemination programme fulfill quality norms for production and distribution of frozen semen are important components for fertility traits. Bull to bull variation was observed as considerable difference for numerous seminal parameters (Tiwari *et al*., 2011). The freezing of bull semen substantially hampers the motility of sperm which reduces the conception rate in dairy farm animals (Deb *et al.*, 2015). Harvest and processing of semen for Frozen Semen Doses (FSDs) are dependent on quality of semen.

1. **Age of Bull**

As the body grows normally, output of testosterone in testes awakens the male characteristics, and the bulls develop sex desire. It may generally be believed that zebu and buffalo bulls produce spermatozoa first at an age of 12 to 16 months. Bos taurus produce spermatozoa from 8 to 10 months. Zebu and buffalo bulls donate semen at an age of 24 to 36 months. Species and breed differences are generally responsible for the augmentation of early sexual maturity.

2. **Number of Collection**

In frozen semen banks, bulls are typically used for collection in 2-3 times per week with 1-2 ejaculation per collection a day. Frequent collections of semen from bulls indicate that sex libido, ejaculate volume, initial motility and density are greatly reduced with increase in interval between collections. Short interval between collections of semen showed less motile spermatozoa than those collected at long interval (Boujenane and Boussaq, 2013).

3. **Ejaculation Time**

The time taken from intromission to ejaculation and dismounting is momentary. Only about



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5 to 10 seconds may be required to perform all these acts. Immediately after intromission the bull ejaculates in only about 2 to 3 seconds. Prior to actual ejaculation of semen, some thin slimy fluid is ejected out of the penis. This fluid has some cleansing effect on the urethral canal. More is the volume of fluid trickled out before actual mounting, better is the quality of semen ejaculated by the bull. Ejaculation of semen is in the form of forceful intermittent spray.

4. **Season and environmental factors**

Seasons play a great role in conditioning the sexual behavior of bulls. Buffalo bulls were found sexually less active during summer months. They donated maximum ejaculations during winter season. Hariana and Sahiwal bulls, however, indicated no seasonal changes in the sex behavior. Seminiferous tubules as well as thyroid gland of buffaloes are most active during winter season. At the bull station, the Friesian breed should be encouraged. Most semen should be collected during the rainy season, particularly the short rains (October to November). The emphasis should be on young bulls under the age of three.

5. **Frequency of Semen Collection**

Repeated use of bulls for semen collection is a matter of their ability to ejaculate normally and regularly. For higher fertility rates it is generally desired that semen may be used fresh. Depending upon the strength of bulls maintained at a semen collection station. Semen is required to be collected every 48 hours to 96 hours. Collection of semen every fourth day from bulls showed that there were significant differences in several parameters of semen quality between first and second ejaculations (Khaki *et al*., 2019). But on many occasions the bulls may either refuse to ejaculate or take longer reaction time. There were substantial variations in a number of semen quality measures between the first and second ejaculations. Some outstanding bulls can bear the stress of frequent ejaculations, and their semen may be used suitably for artificial insemination.

6. **Volume of Ejaculation**

Volume of an ejaculate is measured immediately following semen collection with a graduated semen collection tube. Ejaculate volume is of prime importance in artificial insemination. Friesian bulls generated less ejaculate in dry summer, but Jersey bulls produced more in the rainy summer than in the dry summer. Although short collection intervals of 2 to 4 days yielded higher yield in terms of total semen dosages without compromising semen quality (Bhave et al., 2020), longer collection intervals are preferable to shorter ones for all metrics.



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The ejaculate volume of bull semen depends upon the body/scrotal size and weight, apart from general and genital health and quality of ejaculatory thrust by the bull. Ejaculate volume together with sperm concentration and motility are of great importance in frozen semen production for wider application in AI industry. The differences in ejaculate volume and sperm concentration in bovine and bubaline species could be due to variation between breeds, individual, age, libido, climate, testicular health, accessory sex gland's function, and frequency and method of semen collection (Pathak *et al*., 2018).

**7. Motility of Spermatozoa**

The live spermatozoa were motile, but all immotile sperms were not dead. Many motile semen samples gain motility when treated suitably with diluents. Spermatozoan motility is judged as gross motility, and as individual motility. It is commonly used for scoring the initial motility of semen samples immediately after collection. Motility is graded under low power objective according to mass movement of the spermatozoa. The methods employed for undiluted semen are similarly used for diluted semen.

**8. Sperm Concentration per dose**

Semen concentration and total sperm output were analyzed with the respect to season, age of bull, ejaculate volume and total sperm output in all breeds. As for sperm concentration/production, a seminal characteristic that varies until the end of testicular growth when males reach full sexual maturity, it is expected that the sperm concentration varies between 500 x 106 to 1,200 x $10^6$ spermatozoa per ml (Vale, 2011).

**9. Post Thaw motility (PTM)**

The percentages of motility and live sperm in both fresh and frozen-thawed semen were significantly higher in buffalo bulls breeds than the Gir bull and the bull variation was significant only in buffalo breeds. The individual sperm motility and viability are essential parameters for assessment of semen quality and freeze ability, and can yield a reliable picture of semen potency, because they give clue concerning acceptance or rejection of the ejaculate for advance processing and both are positively correlated with freeze ability of semen sample.

Sperm motility is essential during their transportation in the oviduct and oocyte penetration. However, it swings between breeds, species, individuals, age groups, seasons and the evaluation techniques employed. The variation in post-thaw motility and viability of sperms may be due to



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variation in initial quality of semen, extender, equilibration and freezing-thawing protocol used, and the stain and staining technique followed in different studies.

**Conclusion**

Variations in semen quality parameters may be due to individual variations, ejaculate frequency, differences in age, genetic makeup of the bulls, season of study and agro climatic conditions. Semen characters of Jaffrabadi bulls are comparable to Murrah and their characteristics can be made use of to meet the high demand for semen from selected bulls of high genetic merit.

One of the most effective methods used in bovine reproduction is artificial insemination that significantly increases breeding effectiveness. The semen quality is important in successful conception of the females. The farmers are also looking forward to receiving high-quality sperm to boost agricultural income. Several factors, including both genetic and non-genetic ones, have an impact on the quality of the semen. While non-genetic factors may be regulated to improve semen quality in bulls, genetic factors are heritable qualities that are difficult to alter in a short amount of time. The non-genetic factors are having a significant effect on the bull's performance and the semen quality. The main factors include THI, season, age and testicular size. The current article summarises the impact of several non-genetic factors on the quality of the semen produced by both buffalo and cattle.

The other method for maximising the number of inseminations possible per bull was to harvest the maximum semen dosages. According to the capacity of the semen station operating at the cattle breeding farm, planning the activities of the AI centre at the field level will be made easier with information on expected semen dosages per bull.

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