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An Introduction to Benefits of Sexed Semen in Dairy and Meat Industry

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The use of sexed semen in animal production provides a number of benefits at both dairy farm and meat industry levels. Semen sexing is the process of augmenting sperm cells according to their sex to enable regulated reproduction and guarantee the desired progeny. This method offers the opportunity to modify the sex ratio of offspring, resulting to greater genetic advancement and improved herd management, and it holds enormous potential in the field of animal breeding.There is an increasing demand for dairy and meat products across the globe, which will necessitate a greater focus on improving production efficiency. In dairy animal farming, there is surplus production of unwanted new born male animal. New born dairy male animal increase the risk of dystocia a compared with new born female animal, and as an unwanted by-product of breeding with conventional semen, they have a low economic value. Incorporating sexed semen into the breeding programme can minimise the number of unwanted new born male dairy animal and reduce dystocia. Sexed semen can be used to generate herd replacements and additional heifers for herd expansion at a faster rate from within the herd, thereby minimising biosecurity risks associated with bringing in animals from different herds. Furthermore, the use of sexed semen can increase herd genetic gain compared with use of non-sorted semen. In dairy herds, a sustainable breeding strategy could combine usage of sexed semen to generate replacements only, and usage of meat semen on all dams that are not suitable for generating replacements. This results in increased genetic gain in dairy herd, increased value of meat output from the dairy herd, and reduced greenhouse gas emissions from meat. It is important to note, however, that even a small decrease in fertility of sexed semen relative to conventional semen can negate much of the economic benefit. A high fertility sexed semen product has the potential to accelerate herd expansion, minimise waste production, improve animal welfare and increase profitability compared with non-sorted conventional semen.

Understanding to Sexed Semen production process

(1) Semen Collection: From selected sires with desired genetic features, semen samples are taken by highly skilled technicians. Based on their genetic potential, health, and fertility, these sires go through a thorough screening and selection process.

(2) Semen Processing: TheCattle, Buffalo, pigs, horses, Sheep and goats are some of the farm animal species that can benefitted using semen sexing technology. After semen collected, these samples are screened on the three primary factors, Concentration, Motility and Morphology to process only the healthy cells for the continuing the process. The use of sex-sorted semen in both dairy and meat production allows predetermination of new born animal sex with ~90% reliability. An X-chromosome bearing sperm contains 3.8% more DNA than a Y-chromosome bearing sperm (Johnson, 1995), providing a feature that can be utilised to quickly identify X- and Y-chromosome bearing sperm. The only reliable method

of pre determining offspring sex is by manipulating the relative abundance of viable X- and Y chromosome bearing sperm. This is typically carried out via a specialised type of flow-cytometry called fluorescence-activated cell sorting (Garner *et al.,* 2013), but other methods such as laser splitting of the unwanted X- or Y-chromosome bearing sperm have recently been reported (Faust *et al*., 2016).

(3) Semen Freezing: Once the identification and processing of the semen sample is completed. The semen sample are subjected to cooling using Liquid Nitrogen which has special property of being stable at -196^{o}C. The semen packed in straws are frozen and kept in LN_2 till it reaches the final destination i.e., dairy farmers. This would be then used by the Veterinarian for performing the AI on the selected animals.

Benefits to using sexed semen

(1) Sex Selection: Sexed semen allows dairy farmers to carefully select the sex of the progeny, allowing them to concentrate on breeding animals with desired features.

(2) Improved Additive genetic selection gain: This improves the herd's overall quality and genetic advancement. The advent of genomic selection has allowed earlier identification of the next generation of sires (Caluset *al.*, 2015). One of the major potential benefits associated with use of sexed semen, which is often overlooked, is the more efficient dam selection. With non-sorted semen use, ~90% of genetic gain in milk and meat yield has occurred from sire selection (Wilcox *et al.*, 1992). Sexed semen facilitates concurrent sire and dam selection, which has been estimated to increase the rate of genetic gain by 15% (Weigel, 2004).

(3) Improved breeding effectiveness: Farmers can make sure that every mating is more likely to produce the desired sex of the progeny by utilising sexed semen. This may result in increased conception rates and less time and money being used to care for and rear undesired animals.

(4) Reduce dystocia:-Sexed semen can help reduce dystocia in primiparous and pluriparous dams.

(5) Rearing dairy heifer calves for milk production: In order to obtain maximum lifetime milk production, all replacement heifers should be first bred at ~15 months of age (to calve at ~24 months of age). This is particularly important in seasonal pasture-based systems, where it is desirable to have heifer calves born at the start of the calving period. This could be achieved by using the allocated quota of sex-sorted semen in the first 3 weeks of the breeding season. The resulting heifer calves would be born at the start of the subsequent seasonal-calving period and thus be older at first insemination, which would favourably impact their productivity and longevity in the herd (Butler *et al.*, 2014).

(6) Meat production: Semen biased for female offspring from a sire with excellent maternal traits would be used to create a maternal crossbred and this maternal crossbred would then be inseminated with Y-chromosome bearing sperm from a sire with excellent terminal meat production traits. This system would not only increase heterosis, but would also utilise complimentary traits from different breeds for maximum advantage. Meat production systems will only profit from the uptake of sexed semen when the monetary return from producing offspring of a desired sex is greater than the cost of implementing it (Hohenboken, 1999).

(7) Greater financial gains: Sexed semen has the potential to be more profitable. Farmers might concentrate on breeding animals that have higher market value, which will increase their profits. Additionally, higher financial results may result from lower expenses related to caring and raising surplus farm animals.

(8) Environmental sustainability: Sexed semen aids in lowering the birth rate of male animals, which may have favourable effects on the environment. Using sexed semen might lessen the total environmental impact associated with animal husbandry because males often

use more resources and have lower economic value in particular milk and meat production systems.

(9) Better Animal welfare: Farmers can enhance the general health and welfare of their animals by selectively breeding for desired features. This covers characteristics relating to milk, calves veal, meat, milk productivity, illness resistance and general requirements for animal welfare.

Conclusion

In conclusion, semen sexing technology has revolutionized animal breeding by providing farmers with the ability to control the sex of their offspring. Animal Genus breeding a leading supplier of reproductive solutions, has played a significant role in developing and promoting semen sexing technology in dairy and meatfarm animals. This technology has proven to be highly advantageous in various species such as cattle, buffalo, sheep, pigs, horses, and goats. By utilizing cutting-edge techniques like flow cytometry, Animal genus breeding ensures the production of high-quality sexed semen. A high fertility sexed semen product allows much greater flexibility in the breeding management programme, improved genetic selection, enhanced breeding effectiveness, better control over herd dynamics, greater dairy and meat production, greater financial gains, environmental sustainability andgreater sex selection intensity on the dam line, diminished numbers of low value new born male dairy animals or calves, easier heifer rearing, improved biosecurity, provide animal meat protein products that are economicallyand improved animal welfare. The advantages conferred by sexed semen must be harnessed to improve production efficiencyOverall, semen sexing offers tremendous potential for genetic advancement, improved herd management, and meeting the demands of the dairyand meat industry.

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