NEW GENERATION TECHNOLOGIES IN ANIMAL REPRODUCTION:

Revolutionizing Breeding, Fertility & Genetic Advancement

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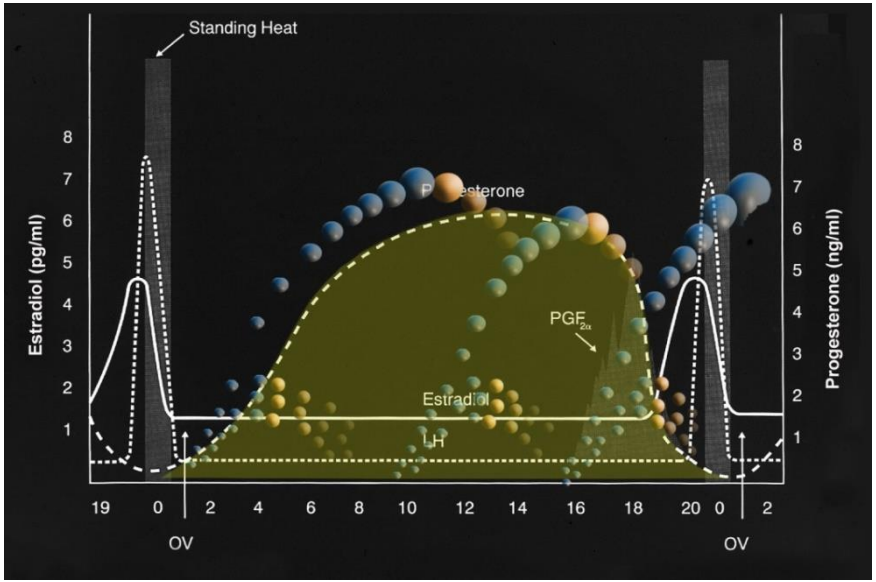
Advanced Reproductive Technologies

- Estrus Induction/Estrus Synchronization
- FTAI
- MOET
- OPU-IVF-ET
- Cloning & Transgenic
- Sex sorting of sperm



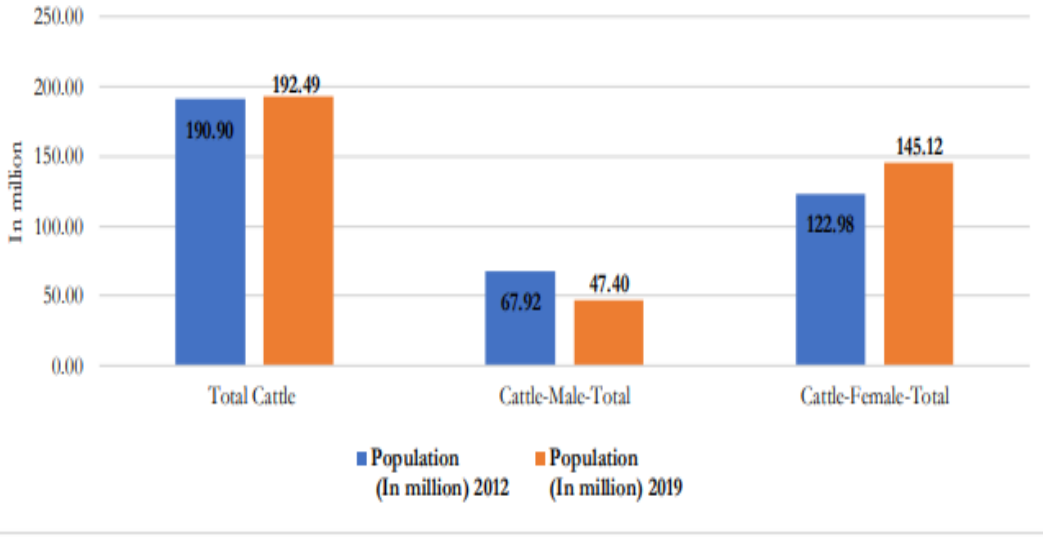
Sex-Sored Semen : Current Status and Future Prospects

Livestock sector:

- Contributes 5% to National GDP
- Contributes 26% to agricultural GDP

Animal breeders - made efforts to exploit genetic potential of milch animals

To enhance milk production - more females births are needed & sexed semen is best tool





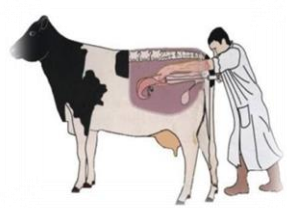
Increased agricultural mechanization



Introduction of AI

Reason for low share of bulls in dairy economy

More focus on milk production



Rearing raises financial burden

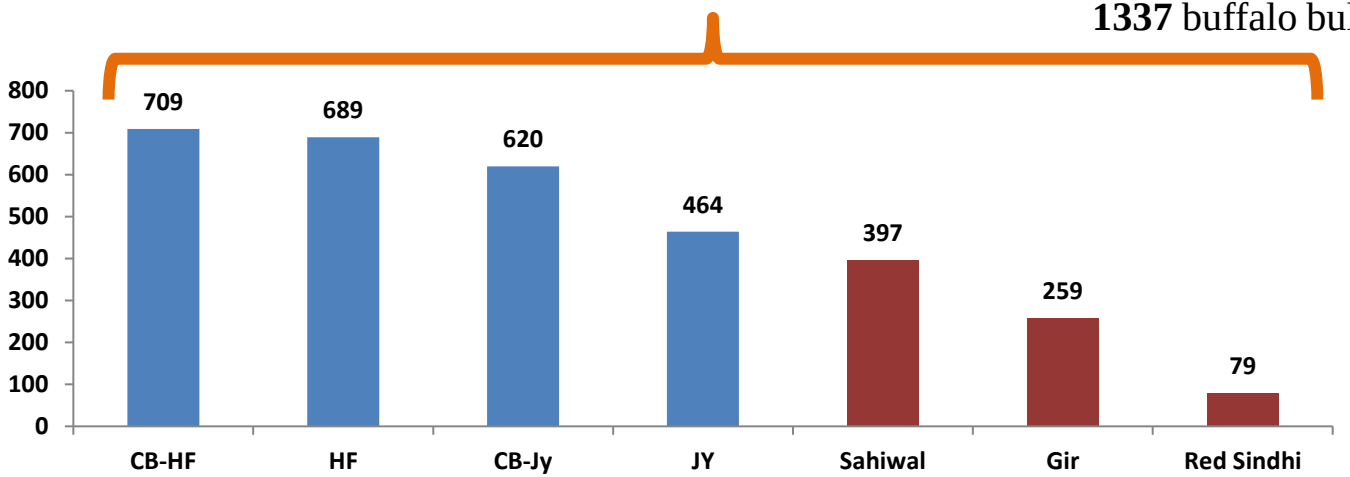
Difficult to manage after maturity





Semen Production (1:24906)

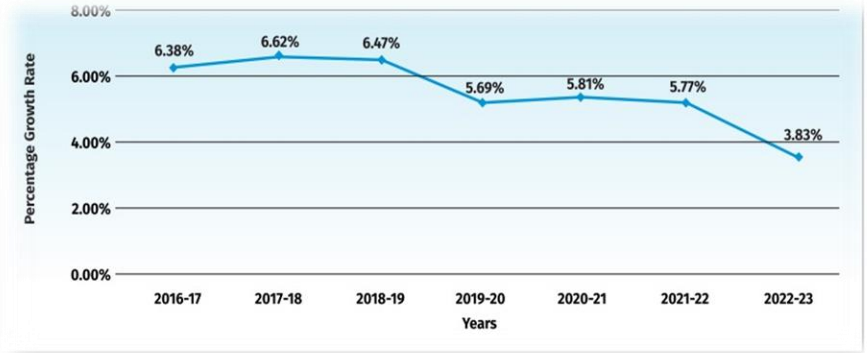
- 80.95 million adult cows
  3212 bulls available **(1:24906)**
- **55** million adult buffaloes
  1337 buffalo bulls available **(1:37187)**



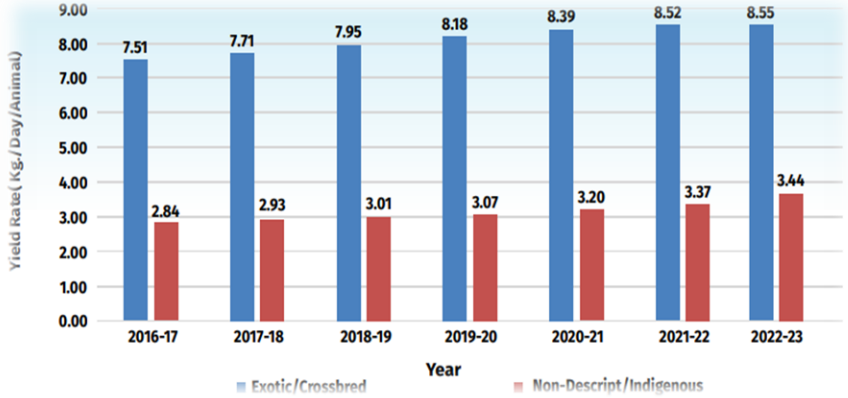
- Overall AI coverage in bovines is only 30 % with a conception rate of 35 % (DAHDF, 2019)
- **57** semen station → Produce-**122 million doses** (2020-21) (NAAS, 2020)
  → Demand-**200 million doses** (2023-24)

Chronic paucity of superior germplasm in indigenous breeds

Requirement of elite bulls



Annual growth rate of milk production



Average yield rate of cattle (BAHS, 2023)

WHY?

mint

Markets Premium Money Mutual Fund Industry Companies Technology

India imports bull semen from Brazil to raise milk production

3 min read • 21 Jan 2024, 11:42 PM IST

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The National Dairy Development Board imports 40,000 doses of bull semen from Brazil to increase milk production of Indian native breeds.

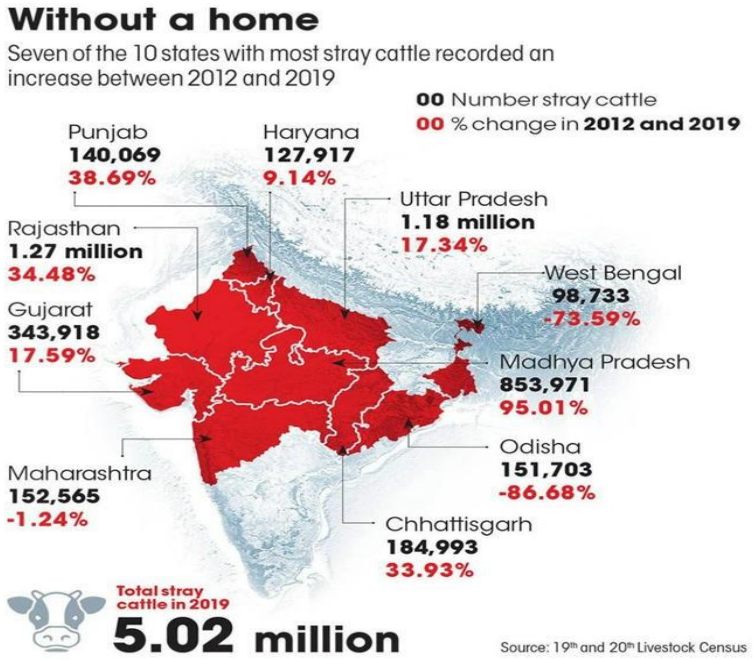


Brazil has preserved the original breed of Gir cows that was gifted by the Maharaja of Bhavnagar to Brazil in the 18th century.

- India's dairy sector has significant growth potential but faces challenges such as low productivity and unproductive animals.

(Deptt. A.H report ,2019)

- Over five million stray cattle, as per the 20th Livestock Census.
- Rising populations of stray cattle create issues related to economic value, animal welfare, and public health.
- Adoption of sexed semen can help to optimize livestock populations in the long run, leading to an increase in milk production.



Sex Sorted Semen

- **Production of offspring of the desired sex**

- **Govt. aim → 12 semen stations → Only 7 are currently operational**

Faster multiplication of Elite germplasm

Increased selection intensity thus increased genetic gain

Reduce unwanted male calves

Increase daughters per bull



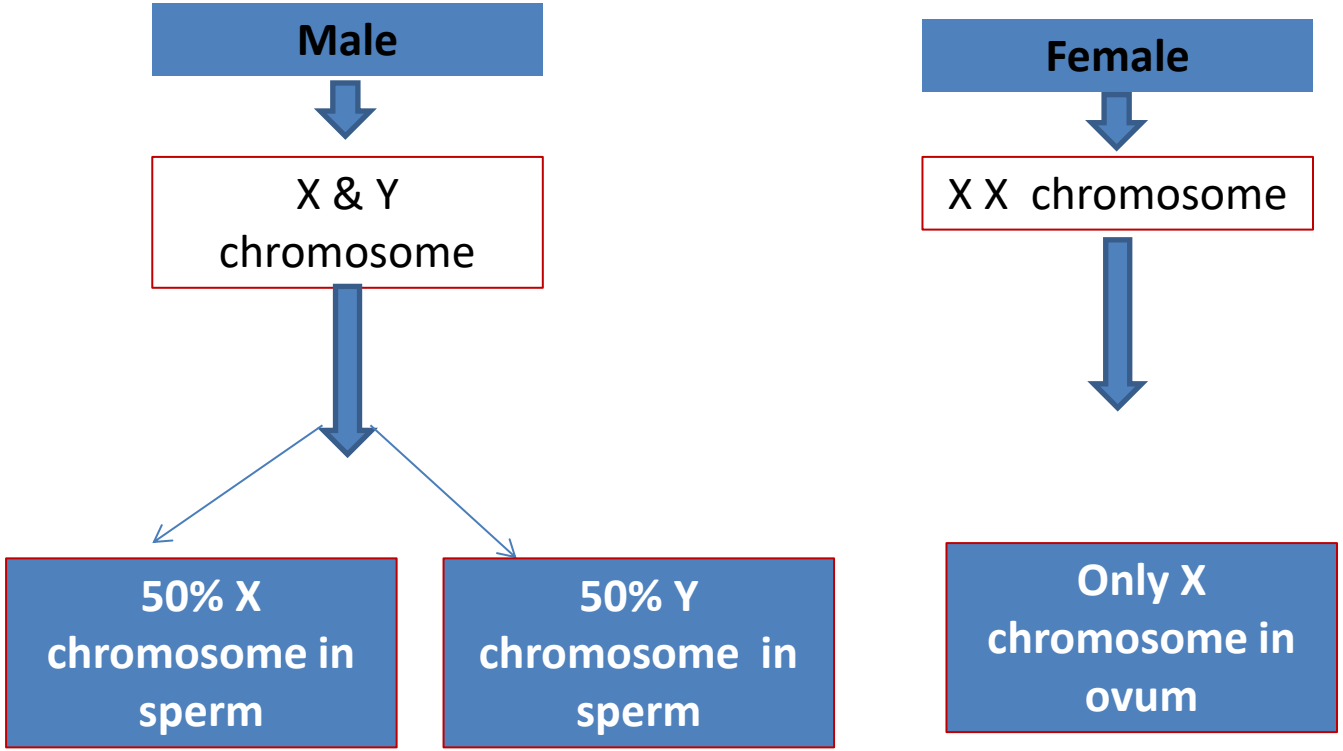
Increased milk production meeting rising milk demands

Herd expansion

Improved herd biosecurity

Reduced post-partum complications

Reduced greenhouse gas emissions


Male
X & Y chromosome
50% X chromosome in sperm
50% Y chromosome in sperm
Female
X X chromosome
Only X chromosome in ovum

Difference between X and Y chromosome

Parameters	Diffrences
DNA content	High in X sperm
Bovine sperm DNA content	3.7-4.22% (specific breed)
Other mammals DNA content	2.3-7.5% (Sharpe et al., 2009)
Size	X sperm is larger
Motility	Y sperm faster
Surface charge	X sperm positive
Cell surface antigen	H-Y antigen on Y sperm

***X chromosome bearing sperm can be sorted under Fluorescence Activated Cell Sorting System (Flow Cytometory)**

Rashtriya Gokul Mission (RGM)

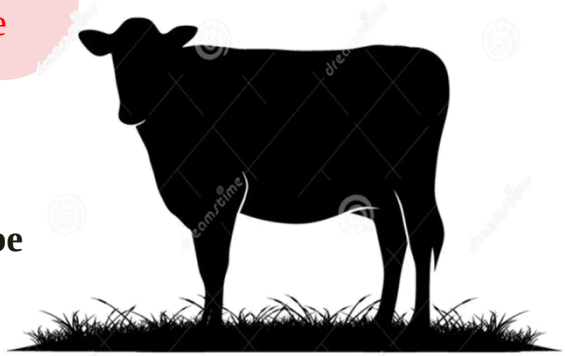
- RGM has been initiated in December 2014 exclusively for development and conservation of indigenous bovine breeds in a scientific holistic manner

राष्ट्रीय गोकुल मिशन

Components of RGM

- Availability of High genetic Merit Germplasm
- Extension of Artificial Insemination Network
- Development and Conservation of indigenous Breeds
- Skill Development
- Farmers Awareness
- Research Development and Innovation in Bovine Breeding

(DADHF, 2022-23)



- **During next 5 Year Expectedly 51 lakh sex sorted pregnancies will be established**

Challenges

- **Higher Production Cost**:
  More expensive than conventional semen, with prices ranging between ₹1,200 and ₹1,500 per dose.
- **Lower Conception Rates**:
  Reduced conception rate, averaging 30-40% compared to 50-60% with conventional semen.
- **Infrastructure**:
- Requires robust infrastructure
- Proper estrus detection
- Trained artificial insemination (AI) technicians
- Proper storage facilities

Future Directions

- **Improving Conception Rates**:
  Research is needed to optimize sperm sorting and AI techniques to improve the conception rates of sexed semen.
- **Scaling Infrastructure**:
  Expanding storage, AI technician training, and estrus detection infrastructure will make sexed semen more accessible to smallholder farmers.
- **Cost Reduction**:
  Efforts to reduce the costs of sexed semen production, including indigenous development of sorting technologies, could enhance adoption among Indian farmers.

Conclusion

- Sexed semen offers significant advantages for India's dairy sector, including higher genetic gains, improved milk production, and reduced maintenance costs for male calves.
- Despite challenges like high costs and lower conception rates, the increasing adoption in states like Gujarat and Haryana demonstrates its potential.
- Research and infrastructural development need to be ensured in expanding its benefits across India.