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Popular Article

Breeding Strategies for Improved Meat and Milk Productivity

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Abstract

Livestock production is critical to maintaining global food security, nutrition, and rural livelihoods. However, the need to fulfill rising worldwide demand for meat and milk has increased the need for long-term genetic improvement of cattle, buffalo, sheep, and goats. Effective breeding tactics, which include selective breeding and crossbreeding as well as modern genomic tools and assisted reproductive technologies, may greatly increase productivity while retaining flexibility and animal health. This article emphasizes the necessity of increasing meat and milk productivity in livestock, reviews main breeding methodologies, explores the impact of new technology, and underlines the need for balanced breeding programs that consider climate resilience, welfare, and biodiversity. Strengthening genetic advances in cattle will contribute to long-term economic growth, increased farmer income, and sustainable agriculture.

Keywords: Livestock breeding, animal genetics, genomic selection, dairy improvement, sustainable livestock development, reproductive technologies

Introduction

Livestock contribute significantly to agricultural GDP in many countries and are an important source of income for smallholder farmers. Milk and meat output in emerging countries is quickly expanding as buying power rises and diets diversify. However,

production per animal remains lower than worldwide norms due to poor animal genetics, insufficient food, and illness restrictions.

Improving cattle genetic potential is one of the most effective and long-term ways for increasing productivity. Animals with superior genetics use equivalent or less resources while producing higher returns. As a result, scientific breeding initiatives aimed at increasing meat and milk yield have become critical to sustainable livestock growth.

➢ **Traits Targeted in Breeding for Productivity**

Category	Primary Traits Improved	Importance
Milk Production	Milk yield, fat%, protein%, lactation length, udder health	Ensures dairy industry growth and farmer earnings
Meat Production	Growth rate, carcass quality, feed efficiency	Supports profitability and market value
Fertility & Reproduction	Age at maturity, calving interval	Determines lifetime productivity
Adaptability	Heat and disease tolerance	Essential for climate change resilience

A balanced approach ensures productivity is improved without compromising animal welfare or adaptability.

Major Breeding Strategies for Milk and Meat Improvement

1. **Selective breeding:** involves selecting superior males and females based on performance records and pedigree values. It is commonly utilized in dairy cattle (Gir, Sahiwal) and buffalo (Murrah).

   Advantages:

   - Simple, low-cost, and retains breed uniqueness.
   - Effective for improving dairy and meat quality.

Limitations: include slow genetic progression without modern tracking techniques.

2. **Crossbreeding.**

   Crossing two genetically distinct breeds to combine desired characteristics such as:

   1. Exotic breeds have high milk yields.
   2. Heat tolerance among indigenous breeds.

   Examples include Holstein Friesian x Sahiwal for dairy development and Duroc x Large White Yorkshire for pork quality.

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Benefits:

- Hybrid vigor (heterosis) leads to improved growth and reproduction
- Fast improvement in productivity

3. Artificial Insemination (AI)

AI is commonly used for the fast spread of top male genetics.

• Allows for global usage of high-performance bulls.

• Lowers breeding expenses and disease transmission.

Buffalo and cattle AI networks have expanded in several nations through government schemes.

4. Genomic Selection

Genomics improves breeding efficiency by finding genes associated with:

• Milk and fat proportion.

• Tender meat with good marbling and disease resistance.

Advantages:

• Accurately choose bulls and dams for faster genetic gain.

• Predict future performance early on.

5. Precision Breeding Including Gene Editing

CRISPR-Cas9 enables targeted introduction of traits such as:

- Heat tolerance
- Improved protein and fat content
- Disease resistance

6. Embryo Transfer and IVF

Advanced reproductive technologies accelerate genetic progress:

Technique	Achievement
MOET (Multiple Ovulation Embryo Transfer)	More calves from elite females
IVF (In-Vitro Fertilization)	Breeds animals year-round
Embryo Cryopreservation	Conservation of valuable genetics

Species-Specific Breeding Approaches:

1. Buffalo

- Breeding focused on milk fat content, growth rate
- Murrah, Nili-Ravi recognized for high-yielding dairy potential

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2. **Cattle (Dairy and Beef)**
   - Holstein, Jersey used for dairy upgrading
   - Indigenous breeds sustained for tropical adaptability
   - Angus, Hereford used for beef improvement
3. **Poultry**
   - Selective breeding improves egg production and feed efficiency.
   - Broiler breeding prioritizes rapid weight gain.
4. **Sheep and Goats**
   - Prioritized meat-focused selection based on growth rate and lambing frequency.
   - Improved goat productivity for both milk and meat production.
   - Prioritized adaptability and production for breeds like Sirohi and Malabari.

➢ **Economic and Environmental Significance**

1. Income and Employment

   Improved genetics enhances farm profitability and market competitiveness
2. Resource Efficiency

   Better feed utilization reduces cost per liter of milk or kg of meat
3. Climate Resilience

   Heat-tolerant and disease-resistant animals reduce mortality under changing climates
4. Food and Nutrition Security

   High-quality protein from meat/milk addresses malnutrition, especially in children

Breeding, therefore, directly contributes to SDGs: Zero Hunger, No Poverty, and Climate Action.

Challenges in Genetic Improvement

Challenge	Consequence
Lack of pedigree and performance recording	Slower genetic progress
Small herd size in rural farms	Limited use of modern technologies
Overreliance on exotic breeds	Loss of indigenous resilience
Feed and healthcare deficiencies	Productivity gains not realized
Limited breeder awareness	Adoption barriers

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➢ **Future Roadmap for Sustainable Breeding**

1. Improve breeding infrastructure using semen stations and AI networks.
2. Develop national databases for digital animal identification and performance tracking.
3. Encourage community-based breeding through cooperatives and farmer breeding organizations.
4. Integrate biotechnology into field-based projects.
5. Promote breed conservation to preserve genetic variety.
6. Promote indigenous breed value-chain development (A2 milk and organic meat).

Conclusion

Genetic enhancement of livestock is critical to meeting the growing worldwide demand for milk and meat. Well-designed breeding programs have the potential to significantly increase output while conserving indigenous breeds' distinctive qualities. The combination of selective breeding, crossbreeding, genomics, and reproductive technology provides a synergistic method for accelerating genetic development. However, breeding activities must be consistent with sustainability principles, ensuring that productivity gains do not jeopardize biodiversity, animal welfare, or adaptability. Strengthening research, policy, farmer awareness, and genetic resource conservation can pave the road for a sustainable and successful cattle sector that will feed human societies into the future.

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