

FIRST GENE EDITED SHEEP USING CRISPR-Cas9: SCIENCE & TECHNOLOGY

NEWS: India's first gene-edited sheep developed in Kashmir agricultural varsity

WHAT'S IN THE NEWS?

India has developed its first gene-edited sheep using CRISPR-Cas9 at SKUAST-Kashmir by targeting the *myostatin* gene to enhance muscle mass by 30%. Since no foreign DNA was introduced, the sheep is classified as non-transgenic and aligns with India's 2022 regulatory exemptions under the EPA.

India's First Gene-Edited Sheep Using CRISPR-Cas9

Context and Overview

- India's first gene-edited sheep was developed by Sher-e-Kashmir University of Agricultural Sciences and Technology (SKUAST), Kashmir.
- The breakthrough used CRISPR-Cas9 gene editing technology to alter the myostatin gene, leading to enhanced muscle growth.
- This development is considered a significant step forward in Indian livestock biotechnology, as the sheep is classified as non-transgenic.

Institution Involved

- The project was led by Riaz Ahmad Shah, Dean of the Faculty of Veterinary Sciences at SKUAST-Kashmir.
- SKUAST previously gained recognition in 2012 for cloning India's first Pashmina goat, named Noori.
- The sheep project was executed following international biosafety and gene-editing protocols.

Technology Used – CRISPR-Cas9

- CRISPR stands for Clustered Regularly Interspaced Short Palindromic Repeats.
- Cas9 is a CRISPR-associated endonuclease enzyme that acts as molecular scissors to cut DNA at a specific sequence.
- Guide RNA (gRNA) is used to direct Cas9 to the targeted gene region for precise editing.
- In this case, the myostatin gene (which restricts muscle growth) was “knocked out” to promote hypertrophy (muscle gain).
- The editing enhanced muscle mass by approximately 30%, without inserting foreign DNA.

Scientific and Biological Basis

- The myostatin gene is a known negative regulator of muscle development.

- Inactivation of this gene is seen in some high-muscle European sheep breeds like Texel.
- Indian breeds generally lack this mutation, which motivated the gene-editing initiative.
- The result is a breed with better muscle development and potentially higher meat yield.

Significance of the Breakthrough

- This is the first time in India that a livestock species has been gene-edited using CRISPR without introducing transgenic elements.
- Under India's 2022 guidelines under the Environment Protection Act (EPA), SDN-1 and SDN-2 category gene-edited organisms are exempt from being classified as GMOs (Genetically Modified Organisms).
- The sheep qualifies under SDN-1 (Site-Directed Nuclease), hence does not require strict GMO regulations.

Regulatory and Ethical Implications

- The sheep is expected to face less public resistance due to the absence of foreign DNA.
- Approval is likely to be streamlined as per the latest regulatory amendments.
- Aligns with India's goals under "Make in India" and "Aatmanirbhar Bharat" initiatives in biotech innovation.

Future Applications

- Use of CRISPR gene editing can help create:
 - Disease-resistant livestock.
 - Improved reproductive traits (e.g., twinning, fertility).
 - Livestock with improved feed efficiency and climate adaptability.
- Such research can also pave the way for cost-effective meat production and export.

Comparison to Global Trends

- Follows recent Indian success in developing gene-edited rice, showing India's growing footprint in precision agriculture and livestock science.
- Many developed countries are using CRISPR for disease control, improved yield, and ethical gene modification in animals.

CRISPR vs Traditional Genetic Engineering

- Traditional GMO techniques often introduce genes from other organisms, raising biosafety and ethical concerns.

- CRISPR works by modifying endogenous genes, creating mutations or deletions within the native genome—making it more acceptable to regulators and the public.
- The CRISPR-edited sheep is a non-transgenic organism, hence not legally classified as a GMO under India's biotech laws.

Broader Applications of CRISPR-Cas9

- Human health: Treatment of genetic diseases such as sickle cell anemia, cystic fibrosis, and some cancers.
- Agriculture: Creation of drought-tolerant, pest-resistant, and high-yield crop varieties.
- Livestock: Breeding for productivity, disease resistance, and quality improvement.

Source: https://www.business-standard.com/industry/agriculture/india-s-first-gene-edited-sheep-developed-by-kashmir-agriculture-university-125052701664_1.html