



Popular Article

Domain: **Agriculture Science**

Vol 5 Issue 2, Feb 2026, 157-161

The Global Milestone: India's Genome-Edited Rice

Nishant Prakash, Shubham Choudhary, Pallabi Das

School of Crop Improvement, CPGS-AS, Central Agricultural University, Imphal, Umiam, Meghalaya, India – 793301

[DOI:10.5281/trendsinaagriculture.18721133](https://doi.org/10.5281/trendsinaagriculture.18721133)

INTRODUCTION

In a groundbreaking achievement, India has become the first nation to unveil genome-edited rice varieties, revolutionizing the country's agricultural landscape. Developed by the Indian Council of Agricultural Research (ICAR), these innovative crops leverage CRISPR-Cas9 technology to address the pressing challenges of food security and environmental stress. With the potential to save millions of cubic meters of irrigation water, reduce methane emissions, and enhance crop productivity, these varieties are poised to transform farmers' livelihoods and contribute to a more sustainable future.

In May 2025, India achieved a historic global milestone by becoming the first country to approve genome-edited rice varieties for commercial cultivation. Developed using the advanced CRISPR-Cas9 molecular tool, these varieties—**DRR Dhan 100 (Kamala)** and **Pusa DST Rice 1**—represent a transformative shift toward climate-smart, high-yield agriculture for 2026 and beyond.

Key Genome-Edited Rice Varieties

DRR Dhan 100 (Kamala)

DRR Dhan 100 (Kamala), developed by ICAR–Indian Institute of Rice Research (IIRR), Hyderabad, is an improved version of the widely cultivated Samba Mahsuri (BPT-5204).

Genetic Edit:

This variety was developed by targeting the **CKX2 (Cytokinin Oxidase 2)** gene, which regulates cytokinin degradation. The modification enhances cytokinin availability, resulting in increased grain number per panicle.

Benefits:

- Early maturity of 15–20 days (approximately 130 days total duration)

- Yield increase of 19–25% compared to the parent variety
- Stronger culm, reducing lodging risk
- Reduced irrigation requirement

Pusa DST Rice 1

Pusa DST Rice 1 was developed by ICAR–Indian Agricultural Research Institute (IARI), New Delhi, based on the popular MTU-1010 variety.

Genetic Edit:

Scientists modified the **DST (Drought and Salt Tolerance)** gene, which regulates stomatal density and water-use efficiency.

Benefits:

- Yield increase of 9.6% to 30.4% under saline and alkaline conditions
- Improved drought and salinity tolerance
- Enhanced water-use efficiency
- Suitable for coastal and salt-affected regions

The Global and Domestic Impact

The introduction of genome-edited rice varieties is widely regarded as a cornerstone of India's emerging **Second Green Revolution**, driven by precision biotechnology.

Environmental Gains:

Cultivation across approximately 5 million hectares is projected to:

- Reduce methane emissions by about 20%
- Save nearly 7,500 million cubic meters of irrigation water

Regulatory Leadership:

Unlike genetically modified (GM) crops, these genome-edited varieties were developed using **SDN-1 and SDN-2 techniques**, which do not involve foreign DNA insertion. India's 2022 regulatory reforms exempted such crops from stringent GM regulations, enabling faster commercialization.

Food Security:

By improving popular rice varieties cultivated on nearly 9 million hectares, India aims to produce an additional **4.5 million tonnes of rice annually**, strengthening national food security.

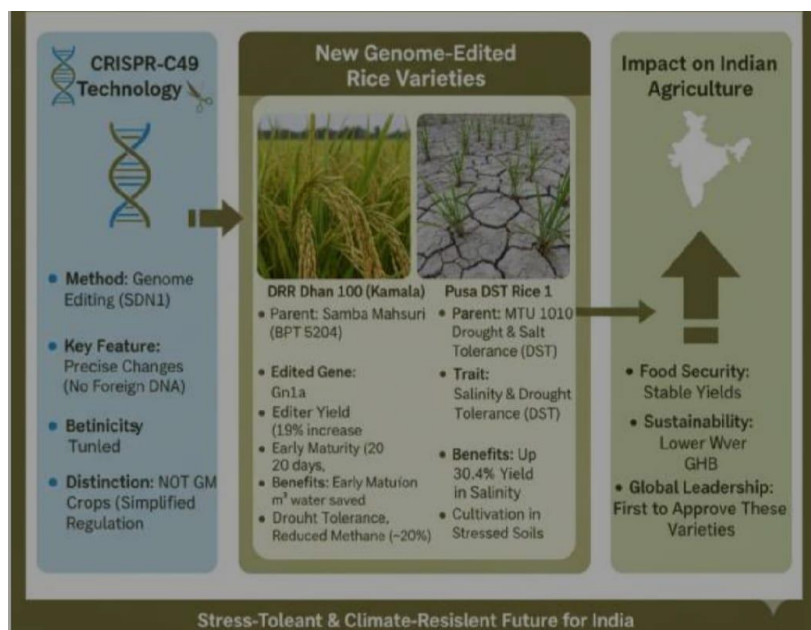
Commercialization Roadmap for 2026

As of January 2026, the Government of India and ICAR are focusing on rapid seed multiplication, including breeder, foundation, and certified seeds, to ensure timely availability to farmers.

These varieties have been recommended for cultivation in major rice-growing states, including:

- Andhra Pradesh
- Telangana
- West Bengal
- Uttar Pradesh

Their adoption is expected to enhance productivity, improve farmer income, and conserve natural resources.



Revolutionizing Indian Agriculture: The Impact of Genome-Edited Rice Varieties

India’s genome-edited rice represents a landmark advancement in agricultural biotechnology. These climate-resilient varieties are designed to address key challenges such as:

- Climate change
- Water scarcity
- Soil salinity
- Food insecurity

By improving productivity while reducing environmental impact, genome editing offers a sustainable solution for future agriculture.

Global Significance

India’s success in genome-edited rice provides a model for other countries facing similar agricultural challenges. The large-scale adoption of these varieties is expected to:

- Improve global food security
- Promote sustainable farming practices
- Reduce agriculture-related greenhouse gas emissions

Economic Strategy

The Government of India has introduced the “**Minus 5 and Plus 10**” strategy, which aims to:

- Reduce rice cultivation area by 5 million hectares
- Increase production by 10 million tonnes

This approach will enable crop diversification, allowing increased cultivation of pulses and oilseeds.

Impact on Farmers

Genome-edited rice varieties offer multiple benefits to farmers:

- Increased yield and income
- Reduced irrigation cost
- Improved tolerance to drought and salinity
- Reduced crop losses
- Improved farming sustainability

Environmental Impact

Genome-edited rice will contribute significantly to environmental sustainability by:

- Conserving water
- Reducing methane emissions
- Improving resource-use efficiency
- Lowering agriculture's carbon footprint

Challenges and Opportunities

Challenges

- Public awareness and acceptance
- Regulatory clarity in global markets
- Intellectual property concerns

Opportunities

- Development of genome-edited wheat, pulses, and oilseeds
- Climate-resilient crop improvement
- Enhanced nutritional quality

Future Directions

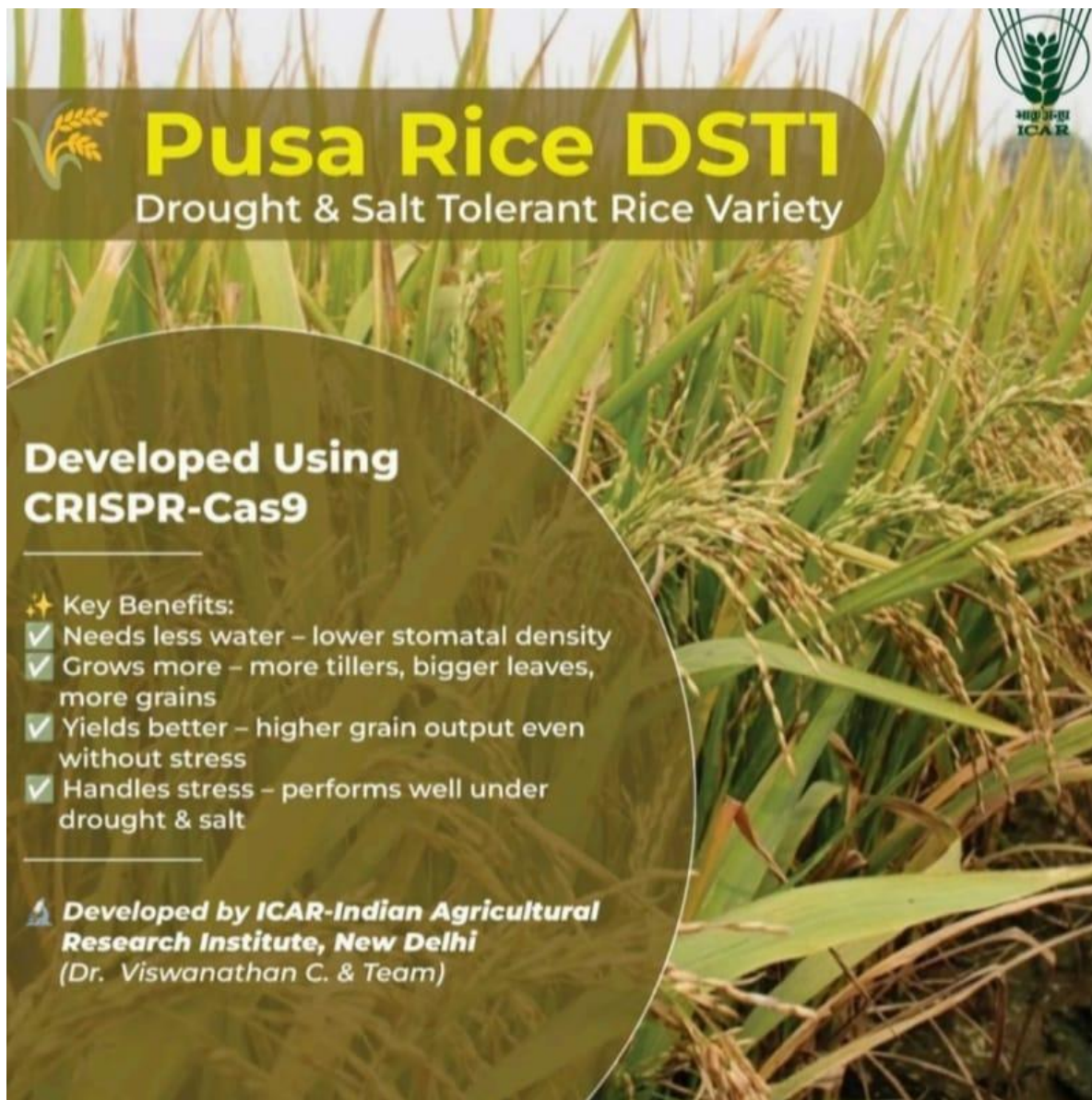
Genome editing has immense potential to revolutionize agriculture. Future research may focus on:


- Developing climate-resilient crops
- Improving yield and productivity
- Enhancing nutritional quality
- Improving tolerance to abiotic stresses

Conclusion

The development of genome-edited rice varieties marks a historic milestone in Indian agriculture. These varieties offer a powerful solution to the dual challenges of food security and climate change. With higher productivity, improved stress tolerance, and reduced environmental impact, genome-edited rice supports sustainable farming and farmer prosperity.

India's pioneering work in genome-edited rice is not only a scientific achievement but also a strategic advancement toward ensuring food security, climate resilience, and sustainable agriculture. As global food demand continues to rise amid climate uncertainty, India's innovation sets an important precedent for the future of agriculture worldwide.




 **Pusa Rice DST1**
Drought & Salt Tolerant Rice Variety

**Developed Using
CRISPR-Cas9**

✦ Key Benefits:

- ✓ Needs less water – lower stomatal density
- ✓ Grows more – more tillers, bigger leaves, more grains
- ✓ Yields better – higher grain output even without stress
- ✓ Handles stress – performs well under drought & salt

 **Developed by ICAR-Indian Agricultural Research Institute, New Delhi**
(Dr. Viswanathan C. & Team)