



Designing of Climate-Smart Rice with Ideal Grain Quality for North-East India

(*Attay Waris¹, Amarjeet Kumar², Pramod Kumar Pandey², Alka Bharati³ and Shital Kumari⁴)

¹College of Post Graduate Studies and Agricultural Sciences, Umiam, CAU (Imphal)

²College of Agriculture, CAU (Imphal), Kyrdemkulai, Meghalaya

³ICAR-Central Agroforestry Research Institute, Jhansi

⁴Bihar Agricultural University, Sabour

*Corresponding Author's email: attaywaris707@gmail.com

Rice is one of the most important cereal food crops, it is consumed as a staple food by more than half of the world's population and fulfills over 21% of total caloric requirements. The centre of origin of rice is South East Asia and more than 90% of the world's rice is cultivated and consumed in Asia. It has been documented that the world population is predicted to reach 7.6 billion to 9.8 billion by 2050. The existing challenge toward the rice breeding programs is to develop high yielding varieties suitable for NEHR (North Eastern Hill Region) to feed the increasing population with diminishing natural resources and unpredictable environmental fluctuations on one hand and varieties that have grain quality to provide the nutritional security, on the other. With the intensification of diverse food demands, RGQ has become a major concern for rice breeders as consumer preference, acceptance and economic value of a rice variety depends on its grain quality. The NEHR of India is known for its diverse landscapes, rich in biodiversity, and unique cultural heritage. However, the region also faces various challenges due to climate change. Rising temperatures, erratic rainfall patterns, and extreme weather events have significant implications for agriculture, particularly rice cultivation, the staple food of the NEHR region. To secure food and livelihoods, it becomes imperative to design climate-smart rice varieties with ideal grain quality suited for North-East India.

The North-Eastern region of India is blessed with breathtaking landscapes and a rich agricultural heritage, where rice has been a staple crop for generations. However, in recent years, the region has been facing the harsh realities of climate change, posing significant challenges to traditional rice cultivation. Rising temperatures, altered rainfall patterns, and increased water scarcity threaten the livelihoods of farmers and the region's food security. In response to these challenges, scientists and agricultural experts are working tirelessly to develop climate-proof rice varieties that can withstand the changing climate while maintaining ideal grain quality. By embracing cutting-edge research and community collaboration, they aim to equip farmers with the tools they need to adapt and thrive in a rapidly changing world.

Harnessing the Power of Genetics

The first step in designing climate-smart rice is unlocking the potential of genetics. Plant breeders carefully select the desirable parents to introgress the climate-proofing traits to develop hybrids with desirable traits. These traits may include drought tolerance, acidic soil tolerance including metal toxicity, waterlogging tolerance, and early maturity. Nutrient leaching is a major problem in the NEHR due to the high amount of rainfall particularly in

Meghalaya, therefore, there is an urgent need for nutrient use efficient genotype in the area. By focusing on these qualities, climate-resilient rice can survive and thrive under new climatic conditions.

Data-Driven Innovation

Designing climate-smart rice demands a data-driven approach. Scientists closely monitor climate trends, collect extensive data, and conduct rigorous field trials to identify the most promising varieties. This data-driven innovation ensures that climate-smart rice is well-adapted to the region's specific challenges and delivers on its promise of sustaining grain quality.

Climate change poses significant challenges to rice cultivation in North-East India. Altered climatic conditions, water scarcity, heat stress, pests, diseases, and nutrient availability all impact crop growth and grain quality. To address these challenges, researchers are developing climate-resilient rice varieties with enhanced resilience. These climate-smart rice varieties exhibit drought tolerance, water use efficiency, and heat tolerance to thrive in changing environments. They also incorporate genes for pest and disease resistance, ensuring minimal yield losses. Moreover, efforts to enhance nutrient use efficiency ensure improved grain quality and nutritional content.

Building Climate Resilience

With the intensification of extreme weather events, such as prolonged droughts and severe floods, rice varieties need to be resilient to these challenges. Climate-resilient rice should be capable of enduring periods of water scarcity without compromising grain quality. Likewise, it should also have the ability to withstand heavy rainfall and flooding, preventing substantial crop losses.

Promoting Sustainable Farming Practices

Climate-smart rice will support the sustainable farming practices. By adopting practices such as conservation agriculture, organic farming, and integrated pest management, farmers can create resilient agroecosystems that work in harmony with nature. These methods reduce the reliance on chemical inputs, protect the environment, and ensure the long-term sustainability of rice cultivation.

Participatory Breeding in Rice

Farmers are at the heart of agriculture, and their knowledge and experience are invaluable in the design of climate-smart rice. Participatory breeding programs allow farmers to share their insights and priorities, ensuring that the resulting varieties align with their needs and preferences. By involving farmers in the process, scientists can create rice that truly serves the communities it was designed for. Community engagement and farmer participation have been instrumental in tailoring rice varieties to local needs. By involving farmers in the process, these varieties resonate with the farming community and promote sustainable agriculture. Through these innovative strategies, climate-smart rice offers hope for food security and sustainable agriculture, safeguarding the region's future amidst a changing climate.

Enhancing Nutritional quality

Climate-smart rice is not only about resilience; it also addresses the nutritional needs of the population. By incorporating genes that enhance essential vitamins and minerals, such as iron and zinc, climate-resilient rice becomes a potent tool in combating malnutrition and promoting better public health. Now, 75 years of independence, the nutritional security is one of the major challenge for NEHR.

		
Fig: Showing drought condition	Fig: Showing water logged condition	Fig: Showing normal condition

Conclusion

The impact of climate change on designing climate-smart rice with ideal grain quality for NEHR is substantial. Altered climatic conditions, water scarcity, heat stress, pest and disease pressures, and nutrient availability all present challenges that must be addressed to ensure food security and sustainable agriculture in the region. Through scientific research, community engagement, and farmer participation, climate-resilient rice varieties are being developed to thrive in the face of changing climates, ensuring the region's food security and preserving ideal grain quality for generations to come.

References

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