Solution:

Breeding with speed of climate change via speed breeding for accelerating rice improvement

Submitter: (International Rice Research Institute - IRRI)

Solution Overview

What is it, and what problem does it solve? Brief 2–3 sentence description.

This technology tackles the major challenge of long breeding cycles in conventional rice improvement by enabling the accelerated development and delivery of improved, climate-resilient, and high-yielding rice varieties to farmers there by able to breed with the keep pace with the rapidly changing climate.

Key Features & Benefits

Main components and why it is useful? Bullet points summarizing methods, tools, and value added.

Methods and tools:

Breeding with the speed of climate change via a state-of-the-art speed breeding facility capable of cultivating 4–5 generations annually for both indica and japonica rice varieties. A comprehensive speed breeding protocol for indica and japonica rice, published in Plant Biotechnology Journal, enabled flowering within 60 days in tested varieties. A new protocol was developed to shorten the maturation phase to just 15–17 days. These advancements were achieved using: 1. Full-spectrum LED lighting to control light spectrum, intensity, and photoperiod. 2. Controlled growth chambers to manage additional parameters such as temperature and humidity. IRRI also published a related study on "Speed Breeding 3.0" in Trends in Biotechnology, introducing innovative strategies to develop robust speed breeding protocols across short-day, long-day, and day-neutral crops.

Value added:

This approach adds significant value by enabling 4–6 generations per year compared to just 1–2 in the field, accelerating the development of improved rice varieties. It allows rapid transfer of genes for high yield, stress tolerance, and enhanced nutrition, supporting accelerated responses to emerging climate, disease, and pest challenges. Integration with tools like SpeedScan (rapid and precise phenotyping under speed breeding) enhances phenotyping efficiency and alignment with field data. The approach is scalable, supports evaluation of more lines in less time, and complements the OneRice IRRI breeding framework to boost genetic gains. Despite initial setup costs, it leads to long-term savings and supports global capacity building through training and knowledge sharing.

Where It Works and Where It Can Work

Existing and potential target regions, agroecologies, or farming systems. Include examples if available.

Currently working: Speed breeding is currently operational at ISARC in India and IRRI headquarters in the Philippines, with IRRI also supporting NARES partners across Asia in establishing similar facilities. The robust protocols developed are scalable and hold strong potential for application to crops in Africa.

Where It Can Work (Potential Target Regions and Farming Systems): Speed breeding can be effectively implemented across diverse agroclimatic zones and ecologies—including irrigated and rainfed lowlands, uplands, deepwater and flood-prone areas, coastal saline regions, and drought-prone zones—spanning tropical, subtropical, and temperate climates.

Evidence & Impact

What results has it shown? Stats, pilot outcomes, or testimonials.

OneRice breeding strategy coupled with Speed Breeding have shown significant impact by enabling up to 4–5 rice generations per year, cutting breeding timelines from 6–7 years to just 1.5–2 years. This has led to faster genetic gains in yield, resilience, and nutrition, while optimizing resource use. An estimated economic benefit of USD 18 million was projected from the shortened breeding cycle. While

large-scale field impact is still unfolding, early results highlight speed breeding's transformative potential for rice improvement and climate-resilient food security.

Scalability & Adoption Support

Why it can be scaled and what's needed to adopt it?

Speed breeding is highly scalable due to its adaptable setup, which works in both high-tech growth chambers and low-cost greenhouses. Its modular design allows customization based on program size, while ongoing efforts are making protocols more cost-effective using affordable LEDs and simplified controls. IRRI supports adoption through training, standardized protocols, and partnerships with NARS, universities, and private entities. It integrates seamlessly into existing breeding pipelines and can be decentralized for regional use. To adopt it, basic infrastructure, training, and alignment with breeding goals are essential, along with continued R&D and collaborative knowledge sharing.

Partners & Contact Info

Who's involved and how to connect? List of key contact and partners + email / phone.

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