

## GREEN REVOLUTION - ECONOMY

NEWS: India is facing both a responsibility and a historic opportunity — to repay the debt owed to regions that fueled India's food security, and to reimagine agriculture for a sustainable future.

### WHAT'S IN THE NEWS?

#### Origin of the Term and Global Linkages

- **Coinage of the Term:**  
The term “**Green Revolution**” was coined in 1968 by **William S. Gaud**, then Administrator of the **United States Agency for International Development (USAID)**, to describe the dramatic rise in food grain production in developing countries, particularly in Asia and Latin America.
- **Role of Global Institutions:**  
India's Green Revolution was **catalyzed by international scientific collaboration**, notably with the **International Maize and Wheat Improvement Center (CIMMYT)** and the **International Rice Research Institute (IRRI)**.
- **USAID Support:**  
CIMMYT's research was **funded heavily by USAID**, which provided **\$83 million of its \$211 million** funding in 2024, until funding cuts during the Trump administration.

#### Green Revolution in India: Scientific and Institutional Foundations

- **Introduction of Semi-Dwarf Wheat:**  
In 1964–65, semi-dwarf wheat varieties like **Lerma Rojo 64A, Sonora 63, and Mayo 64** (developed by CIMMYT and Norman Borlaug) were introduced in India, helping raise yields from **1–1.5 tonnes/hectare** to **4–4.5 tonnes/hectare**.
- **Breakthrough Indian Varieties:**
  - **Wheat:** Varieties like **Kalyan Sona and Sonalika** (1967–68) were adapted from CIMMYT lines.
  - **Rice:** Indian institutions released iconic varieties such as **Swarna (1982), Samba Mahsuri (1986), and Pusa Basmati 1121 (2003)**.
- **Rice Revolution via IRRI:**  
IRRI-developed rice varieties helped raise yields from **1–3 tonnes to 4.5–10 tonnes/hectare**, while also **shortening crop duration** to 110–130 days.

#### Regional Impact and Economic Gains

- **Regional Concentration:**  
The Green Revolution was concentrated in **Punjab, Haryana, and Western Uttar Pradesh**, due to suitable irrigation infrastructure and policy focus.
- **Basmati Rice Export Success:**  
In 2024–25, India exported **6.1 million tonnes of basmati rice** worth **\$5.94 billion**, with **over 90% derived from IARI-developed varieties**, particularly **Pusa Basmati 1121**.
- **National Self-Sufficiency:**  
The revolution transformed India from a **famine-prone, food-importing country** into a **self-sufficient, grain-surplus nation**.

### Continued Dependency on Global Germplasm

- **Wheat Varieties (2024–25):**  
**6 of the top 10 wheat varieties** sown across **20 million hectares** in India are **still based on CIMMYT breeding material**.
- **Limited Indigenous Breakthroughs:**  
Apart from **HD 2967**, few recent wheat varieties have been developed purely from Indian research efforts.
- **Minimal Financial Contribution by India:**  
In 2024, India contributed just **\$0.8 million to CIMMYT** and **\$18.3 million to IRRI**, despite being among the largest beneficiaries.

### Ecological and Structural Costs of the Green Revolution

- **Soil and Water Depletion:**  
Continuous wheat-rice monoculture and excessive use of fertilizers have led to **soil nutrient exhaustion** and **groundwater depletion**, especially in Punjab and Haryana.
- **Neglect of Other Regions:**  
Eastern and Central India — including states like Bihar, Odisha, and Chhattisgarh — were **largely excluded** from Green Revolution benefits.
- **Monoculture Dependency:**  
Farmers have become heavily dependent on **input-intensive, procurement-supported cultivation** of wheat and rice, at the cost of **crop diversity and agroecological balance**.

### Key Policy Gaps and Need for Reform

- **Procurement Bias:**  
Public procurement and Minimum Support Price (MSP) mechanisms continue to prioritize **wheat and rice**, discouraging diversification into **pulses, oilseeds, and millets**.

- **Input-Heavy Subsidy Regime:**  
Over-reliance on **fertilizer, water, and power subsidies** encourages **unsustainable farming practices** and **discourages innovation**.

### **Policy Recommendations for Sustainable Agriculture**

- **Decentralized Procurement:**  
Expand procurement and MSP support to include **nutri-cereals (millets), pulses, and oilseeds** from underserved regions like **Central India and the Northeast**.
- **Agroecological Transition:**  
Encourage **regenerative agricultural methods**, such as **organic farming, crop rotation, bio-fertilizers, and natural pest control**.
- **Water-Smart Agriculture:**  
Promote **climate-resilient cropping patterns** based on **local water availability and ecological suitability**, instead of one-size-fits-all farming.
- **Farmer Income Diversification:**  
Support **value addition, agro-processing, rural credit access, and producer cooperatives** to offer **alternative income streams** to farmers.
- **Regional Equity in Investment:**  
Focus public investment and agricultural R&D in **underrepresented states**, creating **regional equity** in agricultural growth and innovation.

### **India's Strategic Opportunity and Global Responsibility**

- **Need for Strategic Funding:**  
India must **increase contributions to international research bodies** like CIMMYT and IRRI, especially in areas like:
  - Heat and drought tolerance
  - Nitrogen-use efficiency
  - Gene editing
  - Artificial Intelligence in crop breeding
- **Support for Collaborative Science:**  
India can leverage its expertise and stake in **climate-resilient agriculture**, thereby shaping global food security dialogues.

### **Recent Initiatives as Positive Signals**

- **International Year of Millets (2023):**  
India's leadership in promoting millets globally aligns with climate-resilient and nutrition-sensitive farming.
- **Bringing Green Revolution to Eastern India (BGREI):**  
Focuses on improving irrigation, seed supply, and extension services in **Bihar, Chhattisgarh, Odisha, and Eastern UP.**
- **Regenerative Agriculture Push:**  
Government and non-government actors are exploring **carbon farming, organic certification, and ecosystem services** to reduce input costs and increase sustainability.

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