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**News:** Architect of India's Green Revolution departs

- Mankombu Sambasivan Swaminathan, popularly known as M.S. Swaminathan, the legendary agricultural scientist and a key architect of the country's Green Revolution, passed away at his residence in Chennai on Thursday, following age related issues. He was 98.

## **Green Revolution**

- The Green Revolution was an **endeavour initiated by Norman Borlaug in the 1960s. He is known as the 'Father of Green Revolution' in world.**
- It led to him **winning the Nobel Peace Prize in 1970 for his work in developing High Yielding Varieties (HYVs) of wheat.**
- In India, the **Green Revolution was mainly led by M.S. Swaminathan.**
- The Green Revolution resulted **in a great increase in production of food grains (especially wheat and rice) due to the introduction into developing countries of new, high-yielding variety seeds, beginning in the mid-20<sup>th</sup> century.**
- Its **early dramatic successes were in Mexico and the Indian subcontinent.**

- The Green Revolution, spreading over the period from 1967-68 to 1977-78, changed India's status from a food-deficient country to one of the world's leading agricultural nations.

## Green Revolution

### Objectives of Green Revolution

- **Short Term:** The revolution was launched to address India's hunger crisis during the second Five Year Plan.
- **Long Term:** The long term objectives included overall agriculture modernization based on rural development, industrial development; infrastructure, raw material etc.
- **Employment:** To provide employment to both agricultural and industrial workers.
- **Scientific Studies:** Producing stronger plants which could withstand extreme climates and diseases.
- **Globalization of the Agricultural World:** By spreading technology to non-industrialized nations and setting up many corporations in major agricultural areas.

## Basic Elements of the Green Revolution

- **Expansion of Farming Areas:** Although the **area of land under cultivation** was being increased from 1947 itself, this was not enough to meet the rising demand.
- The Green Revolution **provided assistance in this quantitative expansion of farmlands.**
- **Double-cropping System:** Double cropping was a **primary feature of the Green Revolution.** The decision was made to **have two crop seasons per year instead of just one.**
- The **one-season-per-year practice** was based on the fact that there is only one rainy season annually.
- **Water for the second phase now came from huge irrigation projects. Dams were built** and other simple irrigation techniques were also adopted.
- **Using seeds with improved genetics:** **Using seeds with superior genetics was the scientific aspect** of the Green Revolution.
- The **Indian Council for Agricultural Research developed new strains of high yield variety seeds,** mainly wheat and rice, millet and corn.

## Important Crops in the Revolution

- Main crops were **Wheat, Rice, Jowar, Bajra and Maize.**
- **Non-food grains were excluded** from the ambit of the new strategy.
- **Wheat remained the mainstay** of the Green Revolution for years.

## Green Revolution in India

### Background of Green Revolution in India

- In 1943, India suffered from the world's worst recorded food crisis; the Bengal Famine, which led to the death of approximately 4 million people in eastern India due to hunger.
- Even after independence in 1947, until 1967 the government largely concentrated on expanding the farming areas.
- But the population was growing at a much faster rate than food production.
- This called for an immediate and drastic action to increase yield. The action came in the form of the Green Revolution.
- The green revolution in India refers to a period when Indian Agriculture was converted into an industrial system due to the adoption of modern methods and technology such as the use of HYV seeds, tractors, irrigation facilities, pesticides and fertilizers.
- It was funded by the US and the Indian Government and the Ford and Rockefeller Foundation.
- The Green Revolution in India is largely the Wheat Revolution as the wheat production increased by more than three times between 1967-68 and 2003-04, while the overall increase in the production of cereals was only two times.

## Positive Impacts of Green Revolution

- **Tremendous Increase in Crop Produce:** It resulted in a grain output of 131 million tonnes in the year 1978-79 and established India as one of the world's biggest agricultural producers.
- The crop area under high yielding varieties of wheat and rice grew considerably during the Green Revolution.
- **Reduced Import of Food-Grains:** India became self-sufficient in food-grains and had sufficient stock in the central pool, even, at times; India was in a position to export food-grains.
- The per capita net availability of food-grains has also increased.
- **Benefits to the Farmers:** The introduction of the Green Revolution helped the farmers in raising their level of income.
- Farmers ploughed back their surplus income for improving agricultural productivity.
- The big farmers with more than 10 hectares of land were particularly benefited by this revolution by investing large amounts of money in various inputs like HYV seeds, fertilizers, machines, etc. It also promoted capitalist farming.
- **Industrial Growth:** The Revolution brought about large scale farm mechanization which created demand for different types of machines like tractors, harvesters, threshers, combines, diesel engines, electric motors, pumping sets, etc.

- Besides, demand for chemical fertilizers, pesticides, insecticides, weedicides, etc. also increased considerably.
- Several agricultural products were also used as raw materials in various industries known as agro based industries.
- **Rural Employment:** There was an appreciable increase in the demand for labour force due to multiple cropping and use of fertilizers.
- The Green Revolution created plenty of jobs not only for agricultural workers but also industrial workers by creating related facilities such as factories and hydroelectric power stations.

### **Negative Impacts of Green Revolution**

- **Non-Food Grains Left Out:** Although all food-grains including wheat, rice, jowar, bajra and maize have gained from the revolution, other crops such as coarse cereals, pulses and oilseeds were left out of the ambit of the revolution.
- Major commercial crops like cotton, jute, tea and sugarcane were also left almost untouched by the Green Revolution.
- **Limited Coverage of HYVP:** High Yielding Variety Programme (HYVP) was restricted to only five crops: Wheat, Rice, Jowar, Bajra and Maize.
- Therefore, non-food grains were excluded from the ambit of the new strategy.

- The HYV seeds in the non-food crops were either not developed so far or they were not good enough for farmers to risk their adoption.
- **Regional Disparities:** Green Revolution technology has given birth to growing disparities in economic development at interregional and intra-regional levels.
- It has so far affected only 40 percent of the total cropped area and 60 percent is still untouched by it.
- The most affected areas are Punjab, Haryana and western Uttar Pradesh in the north and Andhra Pradesh and Tamil Nadu in the south.
- It has hardly touched the Eastern region, including Assam, Bihar, West Bengal and Orissa and arid and semi-arid areas of Western and Southern India.
- The Green Revolution affected only those areas which were already better placed from an agricultural point of view.
- Thus the problem of regional disparities has further aggravated as a result of the Green Revolution.
- **Excessive Usage of Chemicals:** The Green Revolution resulted in a large-scale use of pesticides and synthetic nitrogen fertilisers for improved irrigation projects and crop varieties.
- However, little or no efforts were made to educate farmers about the high risk associated with the intensive use of pesticides.

- Pesticides were sprayed on crops usually by untrained farm labourers without following instructions or precautions.
- This causes more harm than good to crops and also becomes a cause for environment and soil pollution.
- **Water Consumption:** The crops introduced during the green revolution were water-intensive crops.
- Most of these crops being cereals required almost 50% of dietary water footprint.
- Canal systems were introduced, and irrigation pumps also sucked out the groundwater to supply the water-intensive crops, such as sugarcane and rice, thus depleting the groundwater levels.
- Punjab is a major wheat- and rice-cultivating area, and hence it is one of the highest water depleted regions in India.
- **Impacts on Soil and Crop Production:** Repeated crop cycle in order to ensure increased crop production depleted the soil's nutrients.
- To meet the needs of new kinds of seeds, farmers increased fertilizer usage.
- The pH level of the soil increased due to the usage of these alkaline chemicals.
- Toxic chemicals in the soil destroyed beneficial pathogens, which further led to the decline in the yield.



- **Unemployment:** Except in Punjab, and to some extent in Haryana, farm mechanization under the Green Revolution created widespread unemployment among agricultural labourers in the rural areas.
- The worst affected were the poor and the landless labourers.
- **Health Hazards:** The large-scale use of chemical fertilizers and pesticides such as Phosphamidon, Methomyl, Phorate, Triazophos and Monocrotophos resulted in a number of critical health illnesses including cancer, renal failure, stillborn babies and birth defects.

## Various Revolutions in India (Agro – based)

### Blue revolution

- The Blue Revolution refers to the enormous expansion and development of worldwide aquaculture output from the mid-twentieth century to the present, especially in developing nations.
- It entailed the implementation of a comprehensive plan to boost the production of marine and fish goods.
- The blue revolution ushered in a massive increase in aquaculture, as well as highly productive agricultural activities.
- Fathers of the Blue Revolution include Hiralal Chaudhuri and Dr. Arun Krishnan.

## **White revolution**

- The **White Revolution in India**, also known as **Operation Flood**, is a **revolution connected with a dramatic increase in milk output in the country.**
- During the White Revolution, **India's goal was to become a milk-producing nation.**
- In India, **Verghese Kurien** is recognized as the **“Father of the White Revolution”.**

## **Yellow revolution**

- The **Yellow Revolution** began in **1986-87** with the goal of increasing edible oil production, particularly mustard and sesame seeds, in order to attain self-sufficiency.
- **Sam Pitroda** is widely regarded as the father of India's Yellow Revolution.
- Complementary methods for oil production were also part of the yellow revolution.

## **Golden revolution**

- **Honey production and horticulture** are linked to the **Golden Revolution.**
- It is a component of India's major agricultural revolutions.
- **Nirpakh Tutej** is regarded as the **Father of India's Golden Revolution.**
- In India, the era from **1991 to 2003** is known as the **Golden Revolution.**