All about Green Revolution

Why in news?

MS Swaminathan, Father of India's Green Revolution who played a crucial role in combating India's food insecurity, passed away recently.

How about the case of food security during 20th century?

- **Pre-independence** - In 1943, India was ravaged by a *famine in the Bengal* region.
- Over 3 million people lost their lives due to starvation.
- Back then, India suffered from an acute food shortage partly due to the colonial hangover and mainly depended on foreign aid for imports of wheat.
- **Post- independence**- India signed a long-term ***Public Law (PL) 480 agreement*** to get food aid under Government agricultural trade development assistance, with the US in 1954.
- The ships would land on our shores with grains and they would directly go to feed the people and they called it a *"**ship-to-mouth**' existence*.
    - During 1961-65, foodgrain production growth halved from nearly 3% in 1955-60 as India depended on rain-fed agriculture.
- **C Subramaniam's role** - C Subramaniam, who became the Food and Agriculture Minister in Shastri's Cabinet came up with two-point formula.
- To provide price incentives to farmers
- To go in for science and technology application
- *Fourth Five Year Plan* was redrafted with higher financial allocation for agriculture and agricultural research was given priority.

What is Green revolution?

- Green revolution refers to the large increase in production of food grains resulting from the use of ***high yielding variety (HYV) seeds*** especially for wheat and rice.
- The problem with the traditional wheat and rice varieties was that they were *tall and slender.*
- They fell flat on the ground when they grew and their earheads were heavy with well-filled grains produced in response to high fertiliser doses.
- The seeds of the Green revolution were sown in the 1940s, when an American scientist named ***Norman Borlaug*** was hard at work creating his dwarf varieties with ***Norin-10 dwarfing genes.***
- Dr. Swaminathan was the key architect of this movement who worked towards safeguarding India's food security.

Norman Borlaug - Father of Green Revolution

M.S. Swaminathan - Father of Indian Green Revolution

1st Phase- Mid 1960s to mid-1970s

- The use of HYV seeds was restricted to the more affluent states such as Punjab, Andhra Pradesh and Tamil Nadu.
- Further, the use of HYV seeds primarily benefited the wheat growing regions only.

2nd phase- Mid-1970s to mid-1980s

- The HYV technology spread to a larger number of states and benefited more variety of crops.

What are the key features of Green revolution?

- The main features of the green revolution movement in India include
  - The HYV seeds,
  - Use of chemical fertilizers and pesticides,
  - Application of modern farm machines,
  - Extensive irrigation facilities,
  - Multiple cropping,
  - Improved credit facilities,
  - Support price policy,
  - Improved R&D and extension infrastructure
- GR technology was more suited to the areas that had adequate irrigation facilities as well as proper water *irrigation system.*
- While on the one hand the HYV seeds required high doses of *chemical fertilizers* for their growth, the use of fertilizers in turn generated weeds, requiring the *application of weedicides.*
- One of the key features of HYV seeds is that they had *shorter period of maturity* which gave opportunity to farmers to grow more number of crops in a year thus increasing cropping intensity.
- In order to release the land for next crop, farmers needed to do various farm operations for the next crop, in time. For this, use of *modern farm machines* such as tractors, threshers, irrigation pumps, etc were required.
- Thus, the GR technology helped in attracting more investment in manufacturing of farm machines, irrigation pumps, etc. and also to set up *banking and marketing infrastructure* facilities in small towns and rural areas.

The success of 'green revolution' during 1960s was only possible when the semi-dwarf gene or sd1 gene (mutant allele of plant height) was discovered in the Chinese cultivar 'Dee-geo-woo-gen' (DGWG).

What are the impacts of Green revolution?

Positive impacts

- **Increase in Production and Productivity of Food Grains –** Green revolution shaped India from producing just 10–12 million tonnes of wheat in a year in the early 1960s, to over 110 million tonnes today.
- Per hectare yield of food grains increased from 6.3 quintal per hectare (Q/ha) in 1965-66 to 10.2 Q/ha in 1978-79.
- These productivity increases enabled India to become an exporter of food grains.
- **Employment Generation** - GR technology in terms of 'seeds-fertilizer-irrigation' package had substantial positive impact on employment generation in agriculture.
- Moreover, farm machines and equipment also helped generate additional employment in the non-farm activities by way of forward and backward linkages.
- **Flow of Public/Private Investment in Agriculture** - The share of mechanical and electrical power in India increased substantially from 39.4% in 1971-72 to 86.6% in 2005-06.
- This trend implies that private investment in agriculture after the green revolution significantly increased following the stimulus provided by increased public investment.
- **Land Saving** - GR technology is considered land-saving as it significantly increased the per hectare yield of various agricultural crops.
- Productivity growth in agriculture has also indirectly saved the forest land as in the absence of increased agricultural output due to GR.
- **Impact on Rural Non-farm Economy** – Expansion of demand for farm inputs, repairs & maintenance of farm tools and machines, transportation and marketing services, etc. generated additional income and employment to rural households engaged in non-agricultural activities.

Negative Impacts

- **Decline in Soil Fertility** - Absence of reliable advice and soil testing facilities contributes to the indiscriminate and harmful use of chemicals.
- Use of Farm Yard Manure and Green Manure has declined due to decline in draught animals, change in the cropping pattern etc.
- It is also argued that green revolution technology could not promote crop-diversification but rather encouraged the crop-concentration.
    - As per the Working Group Report on 'Natural Resource Management' (2007), the estimated loss to the economy on account of soil degradation during 1980s and 1990s ranged from 11 to 26% of GDP.
- **Loss of Biodiversity** - The use of HYV seeds displaced indigenous species and agricultural system that had been built up over generations thus aggravating the genetic vulnerability of many valuable gene pools.
- **Depletion of Groundwater Resources** - The exponential growth of tube-wells in the Indo-Gangetic regions has been the main reason in the rapid decline of groundwater resources.
- Providing agricultural subsidy on critical inputs, lack of effective regulation on sustainable groundwater usage, etc. have contributed to rapid depletion of ground water resources.
- **Impact on Small and Marginal Farmers** - Shifting from traditional farming to

monoculture had negative effects on small farmers.
- Small and marginal farmers had to purchase costly HYV seeds, fertilizers, and pesticides for which they took loans at relatively higher interest rates and consequently came under '*debt trap*'.
- **Over-capitalization in Agriculture** - The new agricultural technology required huge investment in modern farm machines, tractors, pump sets, etc. which in most of the cases remained underutilized due to division of operational holdings.
- **Widening Disparities** - The benefits of the new technology was mainly limited to the few crops, such as wheat, rice, sugarcane and few agriculturally developed regions, having adequate irrigation facilities.
- **Impact on Environment** - The intensive use of fertilizers, pesticides, and weedicides resulted in degradation of natural resources.
- **Energy Problems** - It is argued that increase in the cost of energy-based agricultural inputs has resulted in an increase in the prices of agricultural products making the GR system economically and ecologically questionable.
- High demand for diesel import has also put more pressure on India's foreign currency reserves.

Contributions of MS Swaminathan

• In the annals of India's agricultural history, Dr. M.S. Swaminathan stands as a beacon of hope and innovation.
• **Food security**- Dr. Swaminathan's pioneering work has not only reshaped the nation's agricultural landscape but also contributed to making India self-sufficient in foodgrains production.
• **Economic impact**- His work not only averted potential famines but also elevated the economic conditions of countless farming communities.
• **Ecological impact** - Sensing that the long-term detriments of the GR outweighed its short-term gains, Swaminathan had called for an "*Evergreen Revolution*", which would enhance productivity without perpetrating ecological harm.
• **Social impact-** His initiatives in agriculture empowered marginalized communities especially women to actively participate in farming and agriculture decision making.
• **Positions held**- He served as the Director General of *Indian Council of Agricultural Research (ICAR)* and later *International Rice Research Institute (IRRI).*
• He also served as the Principal Secretary of the Ministry of Agriculture in 1979.
• In 1988, Swaminathan became the president of the *International Union of the Conservation of Nature and Natural resources (IUCN).*
• In 2004, he was appointed as chair of the *National Commission on Farmers*, where he recommended that the Minimum Support Price should be *at least 50% more* than the weighted average cost of production.
• **Honours-** His contributions earned him numerous accolades and honours, including the *Padma Bhushan and Padma Vibhushan*, two of India's highest civilian awards.
• He was awarded the *1st World Food Prize in 1987* following which he set up the MS Swaminathan Research Foundation in Chennai.
• He is also the recipient of the H K Firodia award, the Lal Bahadur Shastri National Award and the Indira Gandhi Prize, apart from the *Ramon Magsaysay Award* (1971) and the Albert Einstein World Science Award (1986).

What lies ahead?

- While we've had one green revolution already, in the words of Dr Swaminathan, today

we need an *"evergreen revolution"*—one that combines science with ecology.
- *Green Revolution 2.0* has to be about varieties that can withstand extreme temperature and rainfall variations, while yielding more, using less water and nutrients accompanied by better crop planning and market intelligence

References

1. Indian Express- Explained Green Revolution
2. IGNOU | Green Revolution

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