

CLIMATE RESILIENT AGRICULTURE IN INDIA



Questions Covered:

1. What is meant by Climate resilient agriculture? Analyze its significance in ensuring the sustainable food security in India
2. In the wake of natural calamities resulting in huge losses for farmers, it is necessary to popularize climate-resilient agricultural practices
3. Do you think government is taking adequate adaptation technologies to make the agriculture in India as climate resilient? Examine
4. Enumerate several methods of climate smart agriculture for doubling the farmers income in India

Climate resilient Agriculture in India

One of the critical challenges for a country's food security is climate change and its impact in form of extreme weather events. The predicted 1-2.5 degrees Celsius temperature rise by 2030 is likely to show serious effects on crop yields and can reduce agricultural income; it is high time that rationale of climate-resilient agriculture (CRA) is valued and implemented more rigorously

Significance of Indian Agriculture

- India's population touched **1.38 billion** in 2020 i.e. 17.7 per cent of the world's population according to global population data.
- The country's population has increased 3.35 times since Independence; by 2027, it will surpass China to become the most populated country in the world.
- And yet, India accounts for only **2.4 per cent** of the global land. The average size of landholding per state is **1.08 hectares**, according to the latest agricultural census.
- Farmers in half the Indian states are **marginal** (with land less than 1 ha); the remaining are **small** farmers (land holdings of 1-2 ha).
- Most of them have been facing **several major constraints** such as input supply, credit availability, proper transport, and market facility, etc.
- Their share nearly **60 per cent** in total food grain production: 49 per cent rice, 40 per cent wheat, 29 per cent coarse cereals and 27 per cent pulses as well as over half of the country's fruits and vegetable production, according to **Agricultural Census 2015-16**.
- Agriculture is **the primary source of livelihood** for about 58 per cent of India's population.
- Other **natural resource-based enterprises** are also the foundation for the country's economic growth.
- Its related sectors, including field crops, horticulture, livestock, fishery and poultry are strongly associated with several **United Nations Sustainable Development Goals (SDG)** such as zero hunger, nutrition, and climate action, among others.
- According to Union government estimates, India's **food production** was 291.95 MT in 2019-20; for 2020-21, the government had set the target up to 298.3 MT, which was two per cent from the previous year's output.

- Food production must double by 2050 to match the country's population and income growth. The small and marginal farmers, therefore, have a major role in the country's food security and meeting the SDG goals.
- Nearly 14 per cent of the population (189.2 million) is still undernourished in India, according to State of Food Security and Nutrition in the World, 2020 report.
- The Global Hunger Index 2020 placed India at the 94th position among 107 countries. Achieving 'zero hunger' by 2030 is a humungous challenge, and needs an integrated and multi-dimensional approach for overall **sustainable agriculture and food systems** in the country.

Impact of Climate Change on Indian Agriculture

- The impact of climate change is **directly or indirectly** related to crop, water and soil as it influences the water availability, changes the intensity and frequencies of drought, effects microbial population, soil organic matter reduction, yield reduction, depletion of soil fertility as driven by soil erosion, etc.
- 1. Reduction of Agri income:**
 - ✓ An **economic survey in 2017-18** cautioned that "climate change might be reducing annual agriculture income in the range of **15 per cent to 18 per cent** and up to 20 per cent to 25 per cent for unirrigated areas".
 - ✓ This creates food shortages, nutrient deficiencies in humans due to inadequate intake of healthy food makes humans vulnerable to health issues.
 - 2. Impact on crop yield**
 - ✓ Cultivation practices are completely based on climatic situations. An average of **30 per cent reduction in crop yields** is anticipated by the mid-21st century in South Asian countries.
 - ✓ For example, in India, an increase in temperature by 1.5°C and a reduction in the precipitation of 2 mm can reduce the rice yield by 3 to 15 per cent
 - 3. Impact on horticulture crops**
 - ✓ High temperature causes moisture stress situation, directing to sunburn and cracking symptoms in fruit trees like apricot, apples and cherries.
 - ✓ The temperature increase at the **ripening stage causes** fruit burning and cracking in litchi plantation

4. Impact on livestock and poultry

- ✓ Higher temperatures alter the animals' body physiology like an increase in heart rates (more than 70-80 / minute), blood flow and body temperature (more than 39.17°C). Dairy breeds are more prone to heat stress than meat breeds.
- ✓ An increase in metabolic heat production breeds leads to higher susceptibility to heat stress; while the low milk giving animals are resistant
- ✓ Poultry are severely sensitive to temperature-associated problems, particularly heat stress.
- ✓ Because of heat stress, feed eating by poultry will come down which leads to lesser body weight and egg production, and affects quality of meat. It decreases the density of eggshell and enhances the egg breakage

5. Impact on fisheries

- ✓ Increasing environmental temperature may cause seasonal betterment in the growth and development of fishes, but enhances the dangers to the populations living away from the thermal tolerance zone

About Climate resilient agriculture

- ✱ Climate-resilient agriculture (CRA) is an approach that includes sustainably using existing natural resources through crop and livestock production systems to achieve long-term higher productivity and farm incomes under climate variability.
- This practice reduces hunger and poverty in the face of climate change for forthcoming generations.
- CRA practices can alter the current situation and sustain agricultural production from the local to the global level, especially in a sustainable manner.
- Improved access and utilisation of technology, transparent trade regimes, increased use of resources conservation technologies, an increased adaptation of crops and livestock to climatic stress are the outcomes from climate-resilient practices.
- Most countries have been facing crises due to disasters and conflicts; food security, however, is adversely affected by inadequate food stocks, basic food price fluctuations, high demand for agro-fuels, and abrupt weather changes.

Strategies and technologies for climate change adaptation

1. Tolerant crops:

- ✓ Patterns of drought may need various sets of adaptive forms.
- ✓ To reach deficient downpour conditions, early maturing and **drought-tolerant cultivars** of green gram (BM 2002-1), chickpea and pigeon pea (BDN-708) were brought on selected farmer's fields in Aurangabad district of Maharashtra (rainfall of 645 millimetres).
- ✓ This provided 20-25 per cent higher yield than the indigenous cultivars. In the same way, drought-tolerant, early maturing cultivars of pigeon pea (AKT-8811) and sorghum (CSH-14) were introduced in the villages of Amravati district, Maharashtra (rainfall of 877 mm).

2. Tolerant breeds in livestock and poultry

- ✓ **Local or indigenous breeds** have the notion to forage for themselves. In nomadic systems, the animals show their owners when to move in search of new grasslands.
- ✓ Indigenous breeds have unique characters that are adapted to very specific eco-systems across the world.
- ✓ These unique characters are resistant to droughts, thermoregulation, ability to walk long distances, fertility and mothering instincts, ability to ingest and digest low-quality feed, and resistance to diseases.
- ✓ These livestock breeds may not be highly productive in terms of meat or milk production, but are highly adaptive to the unpredictable nature and have low resource footprints.

3. Feed management:

- ✓ **Betterment of feeding systems** as an adaptation measure can indirectly improve the efficiency of livestock production.
- ✓ Some feeding methods include altering feeding time or frequency and modification of diet composition, including agroforestry species in the animal diet and training producers in production and conservation of feed for various **agro-ecological zones**.
- ✓ These measures can decrease the risk from variations of climate by encouraging higher intake or compensating low-feed consumption, decreasing excessive heat load, reducing animal malnutrition and mortality and reducing the feed insecurity during dry seasons respectively.

4. Water management:

- ✓ **Water-smart technologies** like a furrow-irrigated raised bed, **micro-irrigation**, **rainwater harvesting structure**, cover-crop method, greenhouse, laser land levelling, reuse **wastewater**, deficit irrigation and drainage management can support farmers to decrease the effect of variations of climate.
- ✓ Various technologies based on a **precision estimation** of crop water needs; groundwater recharge techniques; adoption of scientific water conservation methods; altering the fertilizer and irrigation schedules; cultivating less water requiring varieties; adjusting the planting dates; irrigation scheduling; and adopting **zero-tillage** which may help farmers to reach satisfactory crop yields, even in deficit rainfall and warmer years.
- ✓ Hence, many international organizations, national governments' research institutions, farmers' organizations, non-profits and private agencies across the world have been focusing their efforts on the design, development of cost-effective and environmentally friendly water-conserving devices to enhance **water use efficiency**.

5. Agro-advisory:

- ✓ **Response farming** is an integrative approach; it could be called farming with advisories taken from the technocrats depending on local weather information. The success of response farming, viz., decreased danger and enhanced productivity has already been taken in Tamil Nadu and many other states.
- ✓ Response farming can be a viable choice for climate change adoption strategies, for the variations of climate is not a sudden one. The main cause for the success of response farming is because of both location and time-specific technologies. It is time to take forward the success of response farming to the entire farming community.

6. Soil organic carbon:

- ✓ Different farm management practices can increase soil carbon stocks and stimulate soil functional stability.
- ✓ **Conservation agriculture technologies** (reduced tillage, crop rotations, and cover crops), soil conservation practices (contour farming) and nutrient recharge strategies can refill soil organic matter by giving a protective soil cover
- ✓ **Integrated nutrient management** deals with the application of organic and inorganic fertilizers, in addition to farmyard manure, vermicomposting, legumes in rotation, and crop residue for sustaining soil health for the long term.

- ✓ **Feeding the soil** instead of adding fertilizers to the crop without organic inputs is the key point for the long-term sustainability of Indian agriculture.

Government's adaptation initiatives

- ✓ The convergence of various policy programmes and sectoral plans has been undertaken by the Government of India to ensure synergy and effective utilisation of existing resources.
 1. **The National Mission on Sustainable Agriculture** was implemented in 2010 under the National Action Plan on Climate Change (NAPCC) to promote the judicious management of available resources and this was one of the eight missions under NAPCC.
 2. **The Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)** was launched in 2015 to address the issues of water resources and provide a permanent solution that envisages Per Drop More Crop, by promoting micro / drip irrigation for the conservation of maximum water.
 3. **The Paramparagat Krishi Vikas Yojana mission** was executed to extensively leverage adaptation of climate-smart practices and technologies in conjunction with the Indian Council of Agricultural Research and state governments of India.
 4. To mitigate climate extreme actions, **Green India Mission** was launched by the GOI in 2014 under the umbrella of NAPCC with the primary objective of protecting, restoring and enhancing India's diminishing forest covers, thereby reducing the deleterious effects of climate change.
 5. To protect the soil health, GOI has launched the **Soil Health Card scheme** with the main objective of analysing cluster soil samples and advocating farmers regarding their land fertility status. Additionally, **Neem-Coated Urea** was also introduced to minimise the excess addition of urea fertilizers, thereby protecting soil health and supplying plant nitrogen.
 6. To encourage farmers with more income benefit and ecosystem protection, programmes such as the **National Project on Organic Farming and National Agroforestry Policy** was introduced in 2004 and 2014 respectively. These policies are aimed at supplying plant nutrients in the form of organic amendments, soil carbon stock improvement, and soil protection from erosion loss.

7. Andhra Pradesh, Himachal Pradesh, Sikkim, etc., have already initiated several programmes to adopt and promote **organic farming practices** on a wider scale. Recently, GOI announced Sikkim as organic state.
8. The ICAR, through its network research Institutes, state agriculture universities and all line departments is implementing agriculture contingency plans in about 650 districts of India towards climate change preparedness for the last seven years.
9. These models are taken forward to SAARC countries towards adaptation to climate change impacts like floods, cyclones, droughts, and heat waves and seawater intrusion. ICAR has established **climate-resilient villages** across India in 151 districts, which are replicated by the state governments towards the overall objective of building carbon positive villages.
10. **The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA)** was initiated in 2005 with the key objective of “enhancing employment opportunities, additionally, providing economic security and protecting the environment”.

Way forward

- ✓ Reduction of greenhouse gas emissions from all agriculture and non-agricultural sources has to be prioritised. The introduction of neem-coated urea is one such policy intervention
- ✓ Structured training is essential to build confidence in stakeholders and sensitise them to understand the climate change events
- ✓ Fine tuning the gap between current management practices and essential agro-advisories
- ✓ Implementing CRA across the country is the need of the hour
- ✓ Flagship farmer-oriented programmes are needed to improvise skills in agriculture and allied sectors
- ✓ Collaboration between farmers, research institutions, funding agencies, governments, and non-government organisations and private sectors combine strengths to promote CRA



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