



Navigating Climate Change Through Climate-Smart Agriculture

This editorial is based on [“Need for climate-smart agriculture in India”](#) which was published in The Hindu on 25/11/2023. It discusses the challenges of climate change and food insecurity, and how climate-smart agriculture (CSA) can be a viable option to address them.

For Prelims: [Climate-smart agriculture](#), [Heat waves](#), [Flash floods](#), [Cyclones](#), [Paris Agreement](#), [Agroforestry](#), [Precision Irrigation](#), [Carbon sequestration](#), [The National Adaptation Fund for Climate Change \(NAFCC\)](#), [Biotech-KISAN](#), [Paramparagat Krishi Vikas Yojana\(PKVY\)](#), [Carbon Sequestration](#)

For Mains: Climate Smart Agriculture: benefits, challenges, government initiatives and way forward

The **two most important issues** facing humanity in the 21st century are [climate change](#) and [food insecurity](#). Some of the ongoing effects of climate change, such as [heat waves](#), [flash floods](#), [droughts](#), and [cyclones](#), are negatively influencing lives and livelihoods.

The world's **southern continents are reportedly experiencing severe drought** due to climate change, which negatively impacts agricultural production and farmers' livelihoods. Both **population expansion and dietary changes are contributing to an increase in the demand for food**. The effects of the environment on farm output only add to the difficulty.

As a result of climate change, **traditional farming practices are becoming less productive**. [Climate change](#) is increasing the dangers faced by farmers, prompting them to re-evaluate their practices. Farmers are taking a variety of adaptation measures to reduce the negative effects of climate change. The need for a holistic strategy is driven by climate change's dual challenges of adaptation and mitigation, and the pressing **need for agricultural production to rise by 60% by 2050** in order to fulfill food demand.

Climate-Smart Agriculture



Helps farmers build resilience to adapt to climate change



Sustainably increases agricultural production and incomes



Reduces greenhouse gases, where possible

To achieve all this, Climate-Smart Agriculture advocates for the use of farmers' local knowledge to ensure easy adoption.



Food and Agriculture Organization of the United Nations

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What is Climate-Smart Agriculture?

- **Climate-smart agriculture** is an approach that helps guide actions to transform agri-food systems towards green and climate resilient practices. It supports reaching internationally agreed goals such as the [SDGs](#) and the [Paris Agreement](#).
- It aims to tackle **three main objectives**:
 - Sustainably **increasing agricultural productivity** and incomes
 - Adapting and **building resilience** to climate change
 - **Reducing and/or removing** greenhouse gas emissions
- Some examples of climate-smart agriculture practices are:
 - **Cultivating Climate-Resilient Crop Varieties**: Growing crops that are more resistant to temperature and precipitation changes, pests, diseases, and salinity can help farmers cope with the adverse effects of climate change on crop production.
 - For instance, **drought-tolerant maize** varieties have been developed and disseminated in sub-Saharan Africa, benefiting millions of smallholder farmers.
 - **Conservation Agriculture**: No-till and reduced-tillage cultivation, employing crop residues and cover crops to keep the soil covered, and rotating crops to enhance soil fertility and biodiversity are some of the practices that fall under **conservation agriculture**.
 - These practices can **reduce soil erosion, improve water retention, increase carbon sequestration**, and lower greenhouse gas emissions.
 - **Agroforestry**: Integrating trees and shrubs with crops and livestock can create more diverse and productive agricultural systems that provide multiple benefits for farmers and the environment.
 - Agroforestry can **enhance soil quality, conserve water, diversify income**

- **sources**, provide fuelwood and fodder, and sequester carbon.
- **Precision Irrigation**: Drip irrigation, sprinkler irrigation, and collecting rainwater are all examples of effective climate-smart agriculture strategies that can be used to maximize water use efficiency and reduce negative impacts on the environment.
 - Precision irrigation can also be combined with sensors, drones, and satellite imagery to monitor soil moisture and crop water needs in real time.
- **Variable Rate Fertilization**: Applying the **right amount of fertilizer at the right time and place** can optimize crop yields and minimize nutrient losses and greenhouse gas emissions.
 - Variable rate fertilization can be **achieved by using soil testing, remote sensing, and precision agriculture technologies** to tailor fertilizer application to the specific needs of each crop and field.

What are the Benefits of Climate Smart Agriculture?

- **Increased Agricultural Productivity**: Production resources are diminishing, and **demand for agricultural products is increasing**; thus, there is a need for resource-efficient farming to cope with climate variability.
 - In India, crop yield decline owing to climate change (between 2010 and 2039) **could be as high as 9%**.
 - CSA substantially contributes to climate adaptation, mitigation, and **food security**.
 - Studies from different climate-smart techniques used in India show that they improve agricultural production, make agriculture sustainable and reliable, and reduce GHG emissions.
 - One study from the **northwest Indo-Gangetic Plain for wheat production shows that site-specific no-tillage is advantageous for fertilizer management and can boost yield**, nutrient usage efficiency, and profitability while lowering GHG emissions.
 - Furthermore, The importance of CSA lies in its ability to increase agricultural output while maintaining ecological stability.
 - This correlation is not only a desired consequence but rather **essential for long-term food security** and sustainable resource usage in a warming planet.
- **GHG Emission Reduction**: The agricultural sector produces a large amount of GHGs. The **sector's share in GHG's emissions in 2018 was 17%**. Therefore, CSA implementation is crucial for lowering GHG emissions and protecting biodiversity.
 - Furthermore, it aids in enhancing **farmland carbon storage**.
 - The Paris Agreement goal of limiting global warming by reducing GHG emissions is tied directly to the success of the CSA.
 - **Agroforestry and carbon sequestration** are two examples of CSA measures that could help India meet its international obligations and contribute to the global fight against climate change.
- **Support for Small and Marginal Farmers**: The majority of Indian farmers are small or marginal. Therefore, CSA can **play a significant role in helping them increase their profits**. The intersection of climate vulnerability and agricultural importance places India at a unique juncture where CSA adoption is not merely desirable but essential.
- **Biodiversity Conservation**: **CSA's ecosystem-based approach and different crop varieties help cropland and wild regions coexist together. This collaborative effort helps to safeguard native plant species, keep pollinator populations stable, and mitigate the effects of habitat degradation.**
- **Reduced impact of Climate Change**: CSA promotes crop diversification, increases water efficiency, and integrates drought-resistant crop types, all of which help lessen the disruptive effects of climate change.
 - By reducing exposure to climate-related dangers and shocks, CSA increases resilience in the face of longer-term stressors like shorter seasons and erratic weather patterns.

What are the Challenges before Climate Smart Agriculture in India?

- **Lack of Awareness and Knowledge**: This is a common challenge in the adoption of new agricultural practices. Farmers and extension workers may not be aware of the benefits

of CSA or how to implement these practices effectively.

- **Limited Access to Finance, Insurance, and Markets:** Financing is crucial for farmers to invest in new technologies and practices associated with CSA. Lack of access to finance, insurance, and markets can hinder the adoption of CSA.
- **Inadequate Infrastructure and Institutional Support:** The success of CSA relies on supportive infrastructure and institutions. This includes irrigation systems, storage facilities, and organizations that can provide assistance and guidance.
- **High Costs and Risks:** The initial costs associated with adopting new technologies and practices can be a significant barrier for farmers. Additionally, the perceived risks may discourage adoption.
- **Policy and Regulatory Barriers:** Policies that do not support or incentivize CSA can be a major hindrance. Regulatory barriers might also slow down the scaling up of CSA practices.

What Measures should be taken for Better Adoption of Climate Smart Agriculture?

- **Capacity Building and Awareness:** Enhancing the capacity and awareness of farmers and extension workers on the principles and practices of CSA through training, demonstration, farmer-to-farmer exchange and mass media.
- **Financial and Technical Support:** Providing financial and technical support to farmers for adopting CSA technologies and innovations, such as subsidies, credit, insurance, market linkages and digital platforms.
- **Policy and Institutional Strengthening:** Strengthening the policy and institutional framework for promoting and scaling up CSA, such as integrating CSA into national and state action plans on climate change, creating a dedicated CSA fund and establishing a CSA coordination committee.
- **Encourage the Marginalised Groups to Participate:** Encouraging the participation and empowerment of women and marginalized groups in CSA planning and implementation, such as ensuring their representation in CSA committees, providing them with equal access to resources and opportunities and addressing their specific needs and preferences.
- **Foster Innovation and Collaboration:** Fostering innovation and collaboration among different actors and sectors for developing and disseminating context-specific and demand-driven CSA solutions, such as involving farmers in participatory research, creating public-private partnerships and facilitating multi-stakeholder platforms.

Initiatives for Climate Smart Agriculture

- [The National Adaptation Fund for Climate Change](#), [National Innovation on Climate Resilient Agriculture](#), [Soil Health Mission](#), [Pradhan Mantri Krishi Sinchayee Yojana](#), [Paramparagat Krishi Vikas Yojana](#), [Biotech-KISAN](#), and Climate Smart Village are a few examples of government initiatives in India focusing on CSA.
- Various public and private sector entities such as farmer-producer organisations and NGOs are also working towards the adoption of CSA.
 - The CGIAR Research Program on **Climate Change, Agriculture and Food Security (CCAFS)**, which is a global partnership of research organizations that aims to address the interlinked challenges of food security, poverty, and climate change.
 - The World Bank Group, which provides loans, grants, and technical assistance to support CSA projects and programs in developing countries.
 - The **Global Alliance for Climate-Smart Agriculture (GACSA)**, which is a voluntary platform that brings together governments, civil society, farmers, research institutions, and private sector to facilitate knowledge sharing, policy dialogue, and investment in CSA.
 - The **Climate-Smart Agriculture Youth Network (CSAYN)**, which is a group of young people from different countries who are promoting CSA awareness and action among youth and other stakeholders.

Conclusion

Climate Smart Agriculture (CSA) has the potential to assure food security, empower farmers, and protect our delicate ecosystems by merging innovation, resilience, and sustainability. In the face of a changing climate, the path of CSA stands out as a source of inspiration and transformation for a world working to ensure a sustainable future.

Drishti Mains Question:

What do you understand by Climate-smart Agriculture (CSA)? Discuss the significance of CSA in addressing the twin challenges of climate change and food insecurity and evaluate the measures necessary for enhancing the adoption of CSA.

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Prelims:

Q1. With reference to the circumstances in Indian agriculture, the concept of “Conservation Agriculture” assumes significance. Which of the following fall under the Conservation Agriculture? (2018)

1. Avoiding the monoculture practices
2. Adopting minimum tillage.
3. Avoiding the cultivation of plantation crops
4. Using crop residues to cover soil surface
5. Adopting spatial and temporal crop sequencing/crop rotations

Select the correct answer using the code given below:

- (a) 1, 3 and 4
- (b) 2, 3, 4 and 5
- (c) 2, 4 and 5
- (d) 1, 2, 3 and 5

Ans: (c)

Q2. With reference to the ‘Global Alliance for ClimateSmart Agriculture (GACSA)’, which of the following statements is/are correct? (2018)

1. GACSA is an outcome of the Climate Summit held in Paris in 2015.
2. Membership of GACSA does not create any binding obligations.
3. India was instrumental in the creation of GACSA.

Select the correct answer using the code given below:

- (a) 1 and 3 only
- (b) 2 only
- (c) 2 and 3 only
- (d) 1, 2 and 3

Ans: (b)

Q3. In the context of India’s preparation for Climate-Smart Agriculture, consider the following statements: (2021)

1. The 'Climate-Smart Village' approach in India is a part of a project led by the Climate Change, Agriculture and Food Security (CAAFS), an international research programme.
2. The project of CCAFS is carried out under Consultative Group on International Agricultural Research (CGIAR) headquartered in France.
3. The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in India is one of the CGIAR's research centres.

Which of the statements given above are correct?

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

Ans: (d)

Mains:

Q1. Discuss the various economic and socio-cultural forces that are driving increasing feminization of agriculture in India. **(2014)**

Q2. What are the present challenges before crop diversification? How do emerging technologies provide an opportunity for crop diversification? **(2021)**

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