

Climate Smart Agronomic Practices for Sustainable Agriculture

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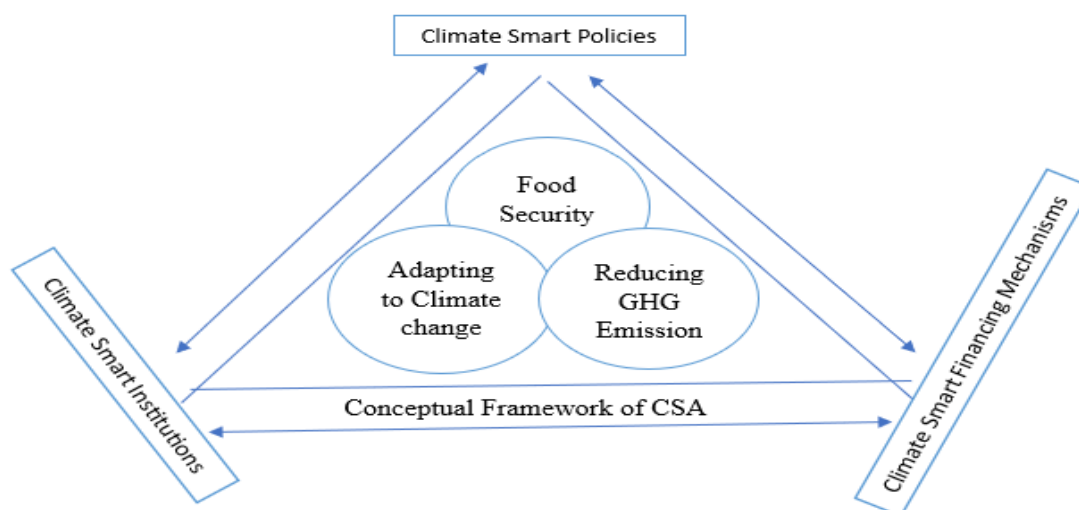
Introduction

Agricultural sectors must become climate-smart to successfully tackle out current food security and climate change challenges. Climatically smart agriculture involves practices that enhance soil carbon sequestration and reduce greenhouse gas emissions, aiming to mitigate the adverse impacts of climate change while increasing agricultural productivity and profitability. A growing global population and changing diets are driving up the demand for food. Agriculture is the primary cause of deforestation, threatening immaculate ecosystems. Climate-Smart Agriculture (CSA) is an integrated approach to managing agricultural systems aimed at enhancing productivity, resilience, and sustainability in response to climate change. In an era of climate riskiness and environmental degradation, the agricultural sector stands at the lead to both the impacts and the solutions. Climate Smart Agriculture practices are much more necessary for building a sustainable agriculture in future, increase the productivity and environmental health in the face of climate change.

Climate Smart Agriculture

Climate Smart Agriculture (CSA) is an integrated approach to managing agricultural systems that aims to increase productivity and resilience to climate change while together reducing greenhouse gas emissions. A variety of agricultural practices aimed at transforming agricultural systems to ensure food security in the face of climate change is collectively referred to as climate-smart agriculture (CSA). A Climate Smart Agriculture (CSA) approach seeks to incorporate climate change considerations into the planning and implementation of sustainable agricultural practices. It helps to managing the livestock, cropland, landscapes, forest and fisheries, which is interlinked challenges of food security and climate change. As early as 2011, India launched the National Innovations in Climate Resilient Agriculture (NICRA) to hoist climatic variability by developing improved production and risk management technologies

such as drought-resistant crop varieties and pest-resilient and carbon sequestration through the use of biochar.



Need of Climate Smart Agriculture

A diverse range of agricultural activities, encompassing crop and livestock production, fisheries, and forestry, is crucially required to address climate change and enhance agricultural productivity and incomes sustainably. Climate -smart agriculture is based on sustainable agriculture and rural development goals, which, if achieved, would contribute to reaching the Millennium Development Goals (MDGs) of reducing hunger and enhancing environmental management.

Key Principles and Practices

- 1. Developing Climate-Adapted Crop Varieties:** Cultivating crops that are more resilient to temperature and precipitation extremes can assist farmers in lessening the effects of global warming on agricultural yields. Enhancing yield stability and reducing vulnerability to climatic hazards can be accomplished through climate-smart agricultural practices, such as selectively breeding crop varieties that are well-suited to the local environment.
- 2. Agroforestry:** Agroforestry involves climate-smart agricultural and forestry practices that integrate trees with crops or livestock. Agroforestry systems, which integrate trees and shrubs into agricultural land to enhance biodiversity and soil fertility, can help develop more resilient agricultural landscapes. Incorporation of trees or shrubs into



agricultural landscapes provides multiple benefits such as soil conservation, carbon sequestration, and biodiversity enhancement.

3. **Conservation Agriculture:** Practices like minimal soil disturbance, permanent soil cover, and crop rotation help maintain soil structure, reduce erosion, and improve water retention. Some examples of climate-smart conservation agriculture techniques implemented to preserve soil quality include no-till and reduced-tillage farming, using crop residues and cover crops to maintain continuous ground cover, and rotating crops.
4. **Water Management:** Efficient irrigation techniques such as drip irrigation, micro-sprinklers, and rainwater harvesting systems optimize water use and minimize losses. Conservation practices like mulching, contour farming, and terracing help retain soil moisture, prevent runoff, and mitigate the impacts of droughts and floods. Examples of effective climate smart agriculture strategies that can be use to increase the efficiency of water consumption are drip irrigation, precision agriculture and collecting rainwater.
5. **Nutrient Management:** Application of organic fertilizers, use of precision fertilizing techniques, and practicing some crop rotation these are all examples of climate-smart nutrient management strategies which enhance soil fertility while minimizing nutrient runoff and greenhouse gas emissions from synthetic fertilizers. By managing nutrients in an environmentally conscious manner, there is less waste and more efficient use of resources.
6. **Integrated Pest Management:** IPM is a strategy to prioritize biological control methods, cultural practices, controlling pests, weeds, disease and natural enemies and minimizing reliance on synthetic pesticides. By the use of biological, cultural and chemical approaches have demonstrated that the actual reduction of the necessity for synthetic pesticides. Crop rotation, intercropping, companion planting, and habitat manipulation promote natural pest control and reduce chemical inputs. IPM main aim to conserve the ecosystem and increase the biodiversity and guard useful organism from any harm.
7. **Livestock Management:** Enhanced nutrition, reduced waste, and increased grazing capacity are the key pillars of sustainable livestock management. Practices for climate-smart agriculture, including specialized feed formulations, rotational grazing and waste management can also assist farmers to achieve their goals of reduce emissions of the methane gas while livestock productivity will increase.

Government Programmes promoting CSA in India

Govt. Programme	Climate-Smart	Energy-Smart	Nitrogen-Smart	Crop-Smart	Knowledge-smart
“Pradhan Mantri Krishi Sinchai Yojana”	Drip-Irrigation				Capacity-Building
	Conservation of water and				
	Irrigation Infrastructure				
Nation Mission for Micro Irrigation	Micro Irrigation				
National Mission for Sustainable	Rainfed Area Development		Soil health card		
“Rashtriya Krishi Vikas Yojana”	Micro Irrigation		Integrated Nutrient Management	Crop diversification and development	
“National Food Security Mission”	Conservation Agriculture	Resource Conservation Machines	Integrated Nutrient Management		Farmer’s training

Benefits and Impacts

Implementing climate-smart agronomic practices yields various benefits are there for farmers, environment and the communities:

1. Increased resilience to extreme weather events and climate variability.
2. Enhanced Agricultural productivity, soil health, fertility, and water efficiency.
3. Reduced carbon sequestration and greenhouse gas emissions.



4. Reducing pollution and other environmental hazards and relying on eco-friendly methods.
5. Biodiversity conservation and ecosystem restoration and smart water management conserves water supplies by reducing unnecessary use.
6. Enhanced food security and nutrition outcomes.
7. Improved crop productivity and livelihoods for smallholder farmers.

Conclusion

Climate-smart agriculture offers a pathway towards sustainable agriculture, where productivity, resilience, and environmental stewardship converge. By embracing innovative practices and partnerships, farmers can adapt to climate change while contributing to global efforts to mitigate its impacts. Governments, researchers, and development organizations play a crucial role in supporting farmers adoption of climate-smart practices through policy incentives, extension services, and capacity-building initiatives. Together, we can cultivate a more sustainable and resilient future for agriculture and food systems worldwide.

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