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Climate-Smart Agriculture in Rajasthan: Practices, Challenges, and the Way Forward

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Agriculture is the foundation of Rajasthan's economy and the primary source of livelihood for a large proportion of its rural population. Major crops grown in the state include pearl millet (bajra), wheat, mustard, gram, cumin, pulses and oilseeds, which contribute significantly to food security and rural development. However, Rajasthan's agriculture faces considerable challenges due to its predominantly arid and semi-arid climate. Low and erratic rainfall, frequent droughts, limited water resources, rising temperatures and declining groundwater levels adversely affect agricultural productivity. Climate change has further intensified these problems by increasing weather variability, extreme heat events, irregular rainfall patterns and the occurrence of pests and diseases. As a result, farming has become increasingly vulnerable to environmental and economic risks. In this context, Climate-Smart Agriculture (CSA) has emerged as an effective approach to improving agricultural productivity while conserving natural resources. CSA strengthens the resilience of farming systems, enhances adaptation to climate change and supports sustainable agricultural development and farmers' livelihoods.

What is Climate-Smart Agriculture?

Climate-Smart Agriculture (CSA) refers to a set of agricultural practices that help maintain farmers' productivity under changing climatic conditions while conserving natural resources. Its primary objectives are:

1. To increase agricultural productivity and farmers' income.
2. To make agricultural systems more adaptive and resilient to the impacts of climate change.
3. To reduce environmental impacts and greenhouse gas emissions from agriculture.

For a state like Rajasthan, climate-smart agriculture is no longer merely an option but a necessity for farmers.

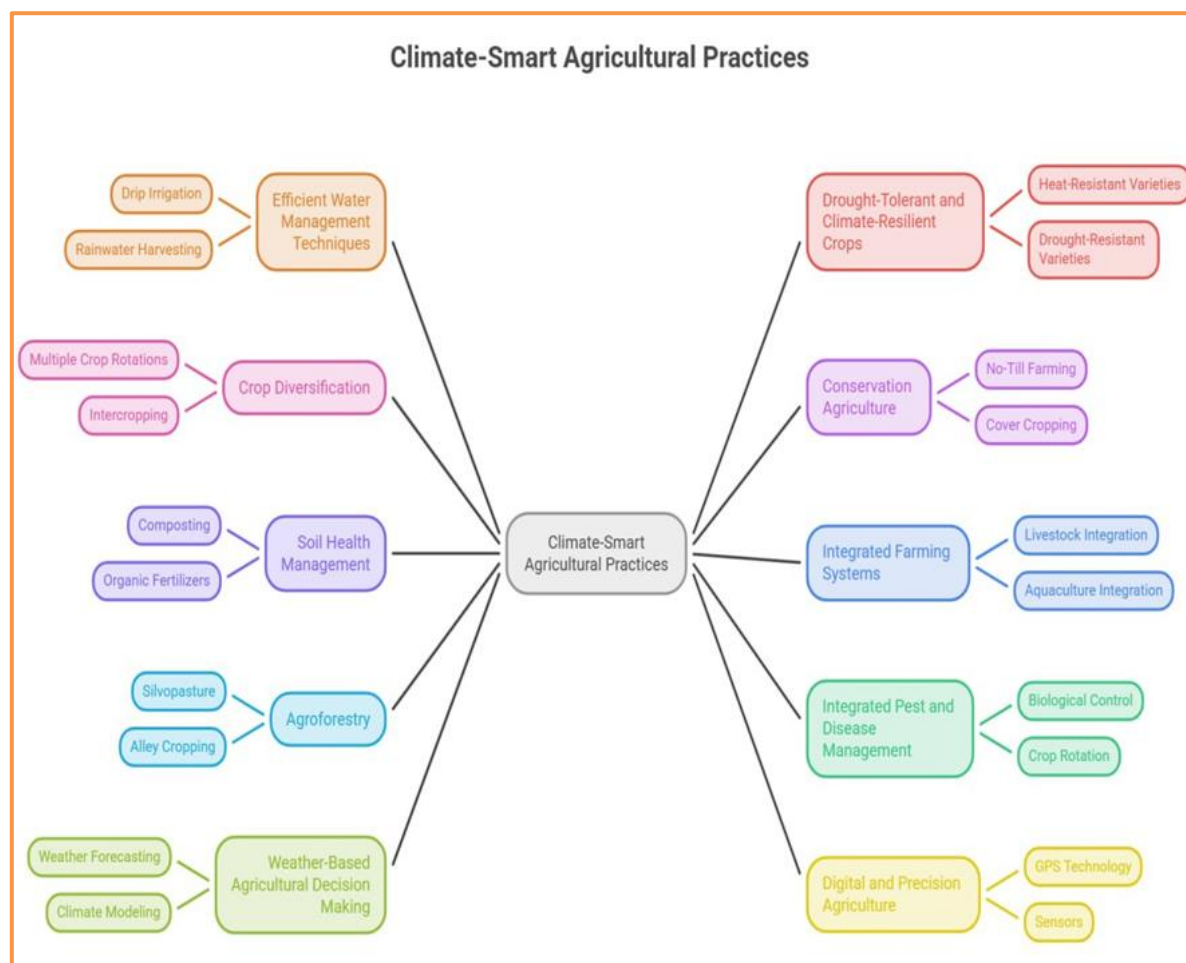
Impact of Climate Change on Agriculture in Rajasthan

Agriculture in Rajasthan is largely rainfed. Rising temperatures, erratic monsoons and declining groundwater levels have severely affected agricultural production. The western and northwestern districts of the state experience highly uneven rainfall distribution and very low average rainfall.

Climate change is increasingly causing the following problems:

- Increase in drought occurrences
- Continuous rise in temperature
- Declining groundwater levels
- Reduced crop productivity
- Increased incidence of pests and diseases
- Adverse impacts on livestock

Major Climate-Smart Agricultural Practices in Rajasthan



Policy and Institutional Support for Climate-Smart Agriculture

1. National Action Plan on Climate Change (NAPCC)

The National Action Plan on Climate Change (NAPCC) was launched by the Government of India in 2008 as a national policy initiative. Its objective is to address challenges arising from climate change and build adaptive capacity in sectors such as agriculture, water, energy and the environment. In arid and semi-arid states like Rajasthan, the primary objective of NAPCC is to strengthen agriculture against climate challenges such as drought, erratic rainfall, rising temperatures and water scarcity. NAPCC does not directly provide subsidies to farmers. Instead, support is extended through various missions and schemes.

2. National Mission for Sustainable Agriculture (NMSA) (2014-15)

This is a major program implemented under the NAPCC. National Mission for Sustainable Agriculture (NMSA) is joint participation of the Central and State Governments (60:40) in implementation. Objective of NMSA is promoting climate-resilient agriculture through conservation, agroforestry, organic farming, water conservation and resource-efficient practices.

Benefits for Farmers

- Water conservation through technologies that produce more with less water.
- Assistance in adopting organic farming, mulching and conservation agriculture.
- Promotion of agroforestry and additional income opportunities.
- Efficient use of soil, water and energy resources.
- Better management of climate risks such as drought and temperature rise.

Subsidies and Assistance under NMSA

Subsidy amounts vary across states and according to government guidelines issued from time to time.

3. Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) (2015) (ministry of Agriculture and Farmer Welfare)

PMKSY primarily aims to provide irrigation facilities and financial assistance for adopting water-saving technologies such as drip and sprinkler irrigation. Objective of PMKSY is expand irrigation, ensure water to every field, promote micro-irrigation, efficient water use and climate-smart agriculture.

Basis for Subsidy Eligibility

- Priority to small and marginal farmers.
- Ownership of cultivable agricultural land.
- Crop type and irrigation requirements.
- Installation of drip or sprinkler systems.
- State government rules and budget allocations.
- Verification of Aadhaar, land records and bank details.
- Preference for technologies that improve water-use efficiency.

Subsidy on Drip and Sprinkler Irrigation

Farmer Category	Subsidy
Small and Marginal Farmers	Up to approximately 55%
Other Farmers	Up to approximately 45%

(In some states, additional assistance may further increase the total subsidy.)

4. Pradhan Mantri Fasal Bima Yojana (PMFBY) (2016) (under Ministry of Agriculture and Farmer Welfare)

Protect farmers from climate-related crop losses through financial compensation, reducing income uncertainty and strengthening resilience.

Benefits

- Insurance coverage for notified crops and regions.
- Compensation for losses caused by natural calamities, pests, and diseases.
- Loss assessment conducted by insurance companies and government agencies.
- Eligibility for farmers cultivating in notified areas.
- Low premium contribution by farmers, with the remaining amount borne by the government.
- Requirement for timely reporting of losses.
- Direct transfer of compensation to farmers' bank accounts.

Farmer Premium Rates

- Kharif crops: Maximum 2%
- Rabi crops: Maximum 1.5%
- Commercial/Horticultural crops: Maximum 5%

5. Raj-AIMS (Rajasthan Agriculture Information and Management System)

Raj-AIMS is a digital agricultural initiative of the Rajasthan Government that utilizes Artificial Intelligence (AI), satellite data, and weather information. It aims to provide timely agricultural advice, crop monitoring, and climate risk management support to farmers.

Apps and Digital Services

- Raj Kisan Suvidha App provides information on agricultural schemes, subsidies, eligibility criteria, and application procedures.
- Raj-AIMS services are made available through agricultural department digital platforms and portals.

6. Pradhan Mantri Kisan Urja Suraksha Evam Utthaan Mahabhiyan (PM-KUSUM)

Launched in 2019, PM-KUSUM aims to provide solar-powered irrigation pumps to farmers. It reduces dependence on diesel and conventional electricity while promoting renewable energy and climate-smart agriculture.

Subsidy Structure

- Total financial assistance: Up to approximately 60% of the solar pump cost.
- Central Government contribution: Approximately 30%.

- State Government contribution: Approximately 30%.
- Farmer contribution: Approximately 10%.
- Remaining amount may be financed through bank loans.

7. Agricultural Carbon Credit Pilot Project (2023) (under Ministry of Agriculture and Farmer Welfare)

It promotes sustainable farming and rewards farmers through carbon credits. Rajasthan is among the states exploring efforts to connect farmers with carbon credit markets. The project aims to provide additional income to farmers who adopt environmentally sustainable agricultural practices.

Climate-smart farming practices help reduce carbon emissions and improve soil quality. Farmers can earn carbon credits through sustainable agricultural activities and generate supplementary income.

Benefits for Farmers

- Water and energy savings through drip irrigation.
- Increased carbon sequestration through tree plantation.
- Reduced fossil fuel dependence through solar pumps.
- Better crop residue management and reduced residue burning.
- Improved soil carbon through enhanced organic matter.

Financial Benefits

- Instead of conventional subsidies, farmers earn income through carbon credits.
- Payments depend on verified reductions in carbon emissions.
- Earnings vary according to project design, market prices and the number of certified carbon credits generated.

How Farmers Can Participate

1. Register with a project agency, company, or agricultural department.
2. Provide information about land, crops and farming practices.
3. Adopt climate-smart activities such as:
 - Drip irrigation
 - Tree plantation
 - Solar pumps
 - Avoiding residue burning
 - Using organic fertilizers and soil health improvement practices
4. Allow monitoring and verification of farm activities.
5. Generate certified carbon credits.
6. Receive a share of the income earned through carbon credit sales.

Simple Participation Process

Raj Kisan Suvidha App / Agriculture Department Information → Registration → Adoption of Sustainable Practices → Verification → Additional Income through Carbon Credits.

Rules and payment models may vary across carbon credit projects.

8. Role of the Private Sector and Non-Governmental Organizations (NGOs)

- companies are developing drought-tolerant seeds, micro-irrigation systems and modern agricultural technologies.
- NGOs play an important role in raising awareness about climate change and building farmers' capacities.
- These organizations act as a private bridge between farmers and government schemes.

Examples

Private Sector- Jain Irrigation System, Mahyco, Dehaat

NGOs- Digital Green, BAIF Development Research Foundation, Watershed Organisation Trust (WOTR)

Major Challenges in Adopting Climate-Smart Agriculture in Rajasthan



Conclusion

Rajasthan's arid climate, scarce water and erratic rainfall severely impact agricultural productivity and rural livelihoods-challenges now intensified by climate change. To build resilience, adopting **climate-smart agriculture** is essential. Key practices include efficient water management, drought-tolerant crops, diversification, agroforestry, and digital precision tools. These methods conserve natural resources, minimize climate risks and stabilize farmers' income. However, widespread adoption depends on securing adequate financial resources, expanding awareness, enhancing infrastructure and strengthening policy coordination. Seamless collaboration among governments, scientific institutions and farmers is vital to scale these practices and achieve long-term sustainable development.