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Climate Smart Farming: A Sustainable Approach for Climate-Resilient Agriculture

*Shailesh[1], Purnima Janghel[1] and Swaroop[2]
[1]M. Sc. (Ag) Department of Agronomy, Indira Gandhi Krishi Vishwavidyalaya, Raipur-492012, Chhattisgarh, India
[2]Young Professional, ICAR- Central Soil Salinity Research Institute, RRS, Bharuch-392012, Gujarat, India
*Corresponding Author's email: janghelshailesh1999@gmail.com

Climate change has emerged as a major constraint to global agricultural productivity due to increased frequency of drought, heat stress, and erratic rainfall patterns. These changes adversely affect crop yield stability and resource use efficiency. Climate Smart Farming (CSF) offers a sustainable and adaptive approach to address these challenges by integrating agronomic, soil, water, and technological interventions. This paper critically examines key components of CSF, including conservation agriculture, integrated nutrient management, climate-resilient crop varieties, efficient irrigation practices, and precision agriculture technologies. The integration of these practices improves soil health, enhances water and nutrient use efficiency, reduces greenhouse gas emissions, and ensures sustainable crop production under changing climatic conditions.

Keywords: Climate Smart Farming, Climate change, Sustainable agriculture, Resource use efficiency, Conservation agriculture, Precision agriculture

Introduction

Agriculture is highly vulnerable to climate variability and change, which directly affects crop growth, productivity, and farm income. Rising temperatures, unpredictable rainfall patterns, and increased frequency of extreme weather events have intensified production risks in many regions. Developing sustainable and adaptive agricultural systems is therefore essential to ensure food security. Climate Smart Farming (CSF) has emerged as an integrated approach that aims to sustainably increase agricultural productivity while enhancing resilience to climate change and reducing greenhouse gas emissions. It combines traditional agronomic knowledge with modern technologies to optimize resource use and maintain ecosystem balance.

Concept of Climate Smart Farming

Climate Smart Farming is based on three main pillars:
i. Sustainable increase in agricultural productivity
ii. Adaptation and resilience to climate change
iii. Mitigation of greenhouse gas emissions
CSF promotes a system-oriented approach rather than isolated practices, focusing on soil health, water management, crop diversity, and technology-driven decision-making.

Key Components of Climate Smart Farming

Conservation Agriculture

Conservation agriculture includes minimum tillage, Zero tillage, permanent soil cover, and crop rotation. These practices improve soil structure, enhance organic carbon content, and

reduce soil erosion. They also improve water infiltration and moisture retention, which is crucial under drought conditions.

Integrated Nutrient Management (INM)

Integrated Nutrient Management involves the combined use of organic manures, chemical fertilizers, and biofertilizers. This approach improves nutrient use efficiency, enhances soil microbial activity, and maintains long-term soil fertility while reducing environmental pollution.

Climate-Resilient Crop Varieties

The adoption of drought-tolerant, heat-resistant, and short-duration crop varieties helps in minimizing yield losses under climate stress conditions. These varieties ensure yield stability and adaptability to changing environments.

Efficient Water Management

Water-saving techniques such as drip irrigation, sprinkler systems, mulching, and rainwater harvesting optimize water use efficiency. These methods are particularly important in regions facing water scarcity and irregular rainfall patterns.

Precision Agriculture

Precision agriculture uses technologies such as GIS, remote sensing, and sensor-based monitoring to provide real-time field data. This enables site-specific input management, reducing wastage and improving productivity.

Benefits of Climate Smart Farming

i. Improved crop productivity and stability
ii. Enhanced soil health and fertility
iii. Better water and nutrient use efficiency
iv. Reduction in greenhouse gas emissions
v. Increased resilience to climate variability
vi. Sustainable intensification of agriculture

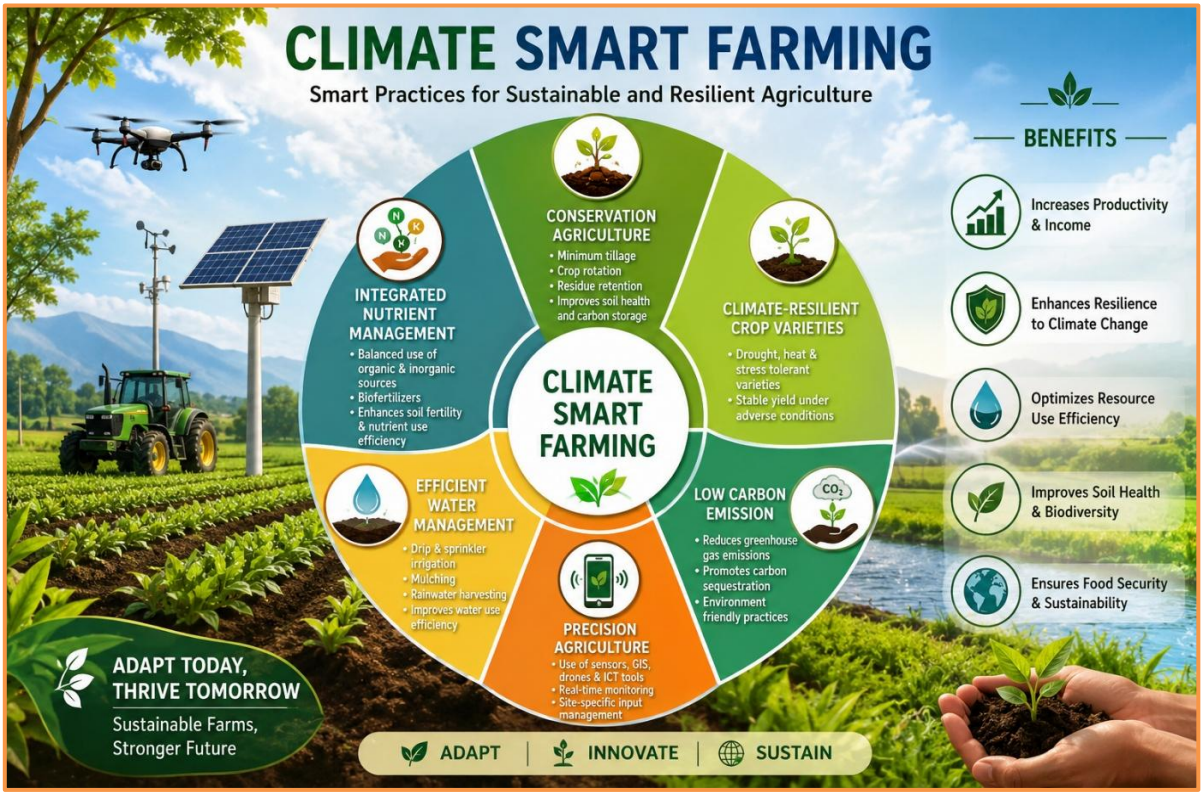

Fig.1: Climate Smart Farming

Challenges in Adoption

Despite its benefits, CSF adoption faces several constraints such as:

i. High initial cost of technology

ii. Lack of technical knowledge among farmers
iii. Small and fragmented landholdings
iv. Limited access to credit and infrastructure
v. Weak extension and advisory services

Conclusion

Climate Smart Farming represents a holistic and sustainable agricultural framework that integrates agronomic, technological, and environmental strategies to address the challenges posed by climate change. Its adoption can significantly improve productivity, resilience, and environmental sustainability. However, effective implementation requires strong policy support, capacity building, and farmer-oriented extension systems to ensure widespread adoption

References

1. Bhanuwanti., Dar, K. A., Singh, L., Saad, A. A., Rai, U., Tanwar, H. and Khatoon, A. (2024). Climate Smart Agriculture: Innovating Sustainable Practices for a Changing Climate. Journal of Scientific Research and Reports, 30(11), 568–576.
2. Food and Agriculture Organization of the United Nations. (2009). How to Feed the World in 2050. Issues Brief for the High-Level Forum on How to Feed the World in 2050.
3. Mizik, T. (2021). Climate-smart agriculture on small-scale farms: A systematic literature review. Agronomy, 11(6), 1096
4. Priyadharshini, S., Kirubha, Sankar. G., Preethika, S. and Kruthika, S. (2025). Climate-smart agriculture in India: challenges and opportunities. Krishi science – eMagazine for Agricultural Sciences, 06(03), 36-40.
5. Wakweya, R. B. (2023). Challenges and prospects of adopting climate-smart agricultural practices and technologies: Implications for food security. Journal of Agriculture and Food Research, 14, 100698.