International Journal of Advance and Applied Research
www.ijaar.co.in
ISSN – 2347-7075 Impact Factor – 8.141
Peer Reviewed Bi-Monthly
Vol. 6 No. 19 March - April - 2025

Water Conservation and Sustainable Agriculture: An Indian Perspective

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DOI - 10.5281/zenodo.15112884

Abstract:

Agriculture sector is backbone of Indian Economy which contributes 18-20% towards GDP with growing population, faces significant challenges in water conservation and sustainable agriculture. Agriculture sector covers nearly 80% freshwater resources making critical challenge of optimum use of water for conservation and sustainable agriculture. The resources of freshwater depend upon diverse environmental condition of the country. These conditions affect irregularity in Monsoon cycle which ultimately led over-extraction of groundwater, and inefficient irrigation practices have created water scarcity, soil degradation, and declining agricultural productivity. This paper discovers the current state of water conservation and sustainable agriculture in India, highlighting key challenges, strategies, and policy interventions. It also examines successful case studies and provides recommendations for achieving long-term sustainability in the agricultural sector.

Introduction:

Agriculture sector is backbone of Indian Economy which contributes 18-20% towards GDP and generate nearly 50% employment. However, the agriculture sector of India is highly dependent environmental, geographical and climatic conditions which create challenges before Indian farmers to use of optimum utilisation of available natural scare resources. One of the major resources on which agriculture is highly relying that is water resources. Nearly 80% of fresh water is used in agricultural activities. India's water resources are under immense stress due to population growth, urbanization, industrialization, and climate change. The uneven distribution of rainfall, over-reliance on groundwater, and inefficient water management practices have exacerbated the situation, leading to water scarcity in many regions. Sustainable agriculture is the way of farming where agriculture production is done with balancing natural resources and ecology ensuring viability for future period. This paper examines the interplay between water conservation and sustainable agriculture in India, focusing on the current practices, challenges, and opportunities for improvement.

Water Resources in India: Current perspective:

Water Availability: India receives an average annual rainfall of about 1160 mm but has uneven geographic distribution. Nearly 80% rain receives from southwest monsoon and remaining from northwest and winter rains. The per capita water availability has declined from 5,177 cubic meters in 1951 to 1,486 cubic meters in 2021, nearing the water-stress threshold of 1,700 cubic meters.

Usage of Ground water: India is the largest user of groundwater in the world, extracting about 250 BCM annually for irrigation. Over-extraction has led to a decline in groundwater levels, particularly in states like Punjab, Haryana, and Rajasthan

Irrigation Practices: Usage of mixed techniques traditional and modern for water irrigation. Flood irrigation is a dominant method where free flow of water during rainfall are diverted to dams however high-water wastages occurs due to lack of proper management. Additionally canal irrigation where water is diverted from rivers and dams are been highly used in different regions. Only about 40% of the irrigated area uses efficient irrigation techniques like drip and sprinkler systems. Overextraction of groundwater, mismanagement of canal and flood water are the main challenges before irrigation in India.

Challenges in Water Conservation and Sustainable Agriculture:

India is facing numerous challenges in efficient water conservation and sustainable agricultural practices. Due to different environmental condition and climate change water conservation and usage is become very significant aspect for sustainable agriculture development. The major challenges include:

Climate Change: Continuous rising temperature leads uneven rainfall even in rainy season which become challenge for the farmers to take production even according to rain patterns. Most of the crop production is depend upon pattern of rainy season which has now no definite pattern which hampering agriculture productivity

Increasing Population: Another one bigger challenge in water conservation and sustainable agriculture is increasing population and rapid urbanisation. A growing population increases the demand for food and water, putting additional stress on resources.

Gaps in government initiatives: Government has taken many initiaves for water conservation as rainfall is only one major resource of freshwater in India. Despite of this gap between policy and its effective implementation creates hurdle in water conservation. Lack of control on over extraction of ground water, proper rainwater harvesting and inefficient cannel management leads efficient water management.

Lack of awareness: Limited knowledge of micro-irrigation and poor understanding of rain water harvesting leads wastages of water. Overuse of fertilizers creates soil degradation which affects next crop. Farmers are highly relying on climates and unprepared for climatic resilient farming. Many farmers lack awareness of sustainable practices or face financial constraints in adopting them.

Soil Degradation: Overuse of chemical fertilizers and pesticides, coupled with poor water management, has led to soil degradation and reduced fertility.

Strategies for Water Conservation and Sustainable Agriculture:

To ensure water conservation and sustainable agriculture growth mixed approach of should be adapted.

Proper water irrigation techniques: For optimum utilisation and maintaining water supply modern and traditional techniques should be followed.

Promote Micro-Irrigation Technique: Promoted by government schemes like the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), it has shown significant water savings.

Cultivate climate resilient crop: Encouraging drought-resistant and less water-intensive crops like millets instead of rice and sugarcane in water-scarce regions. Shifting from water-intensive crops like rice and sugarcane to less water-demanding crops like millets and pulses.

Drip Irrigation: Delivers water directly to plant roots, reducing wastage and improving water use efficiency.

Sprinkler Irrigation: Suitable for crops like wheat and maize, it minimizes water loss through evaporation.

Rainwater Harvesting: Rainwater harvesting (RWH) is a sustainable method of collecting and storing rainwater for agriculture, domestic use, and groundwater recharge. It helps mitigate water scarcity, reduce dependence on groundwater, and improve water availability in dry regions. Collecting and storing rainwater for agricultural use can supplement irrigation needs and recharge groundwater. Successful examples include the rooftop rainwater harvesting systems in Rajasthan and Tamil Nadu.

Soil Health Management: Healthy soil ensures better water retention, nutrient availability, and crop growth, ultimately leading to higher yields and environmental balance.

Organic Farming: usage of bio-degradable compost, fertilizers, and green manure for crop growth ultimately helps in soil fertility.

Mulching and cover crops: cultivating crops through mulching will protect soil from erosion retaining moisture and fertility.

Soil Testing and Nutrient Management: Encouraging farmers to test soil quality and apply customized fertilizers accordingly.

Agroforestry and Watershed Management: Integrating trees and shrubs into farming systems to improve water retention and reduce erosion. Watershed management programs, such as those in Maharashtra and Andhra Pradesh, have successfully improved water availability and agricultural productivity.

Government initiatives for water conservation and sustainable agriculture:

1. National Water Policy (2012): Emphasizes efficient water use, conservation, and management.
2. PMKSY: Aims to expand irrigation coverage and improve water use efficiency.
3. Atal Bhujal Yojana: Focuses on sustainable groundwater management.

Initiatives across India:

Drip Irrigation in Gujarat:

The state government's subsidy program for drip irrigation has led to widespread adoption, resulting in significant water savings and increased yields for crops like cotton and groundnuts.

Zero Budget Natural Farming (ZBNF) in Andhra Pradesh:

ZBNF promotes chemical-free farming, using natural inputs and traditional practices to improve soil health and water conservation

Watershed Development in Maharashtra:

The Indo-German Watershed Development Program has transformed arid regions into productive agricultural lands through rainwater harvesting and soil conservation.

Community-Based Water Management in Rajasthan:

The Tarun Bharat Sangh's efforts in reviving traditional water harvesting structures like johads have restored groundwater levels and improved agricultural productivity.

Recommendations:

Promote Micro-Irrigation: Increase subsidies and awareness campaigns to encourage farmers to adopt drip and sprinkler irrigation systems.

Strengthen Water Governance: Establish integrated water resource management frameworks and improve coordination between central and state governments.

Enhance Farmer Training: Provide training and financial support to farmers for adopting sustainable practices.

Incentivize Crop Diversification: Offer financial incentives for growing less water-intensive crops and promote millets and pulses.

Research and Development: Support research on drought-resistant crops, efficient irrigation technologies, and climate-resilient farming practices.

Social Intervention: Involve local communities in water conservation and agricultural planning to ensure sustainable outcomes.

Conclusion:

As India in known as country of Farmers who is rich in diversified geographic condition. Agriculture sector generates 55% employment and ruled rural livelihood. For sustainable development of agriculture and water conservation is important challenge before country Water conservation and sustainable agriculture are critical for ensuring food security, environmental sustainability, and economic growth in India. While significant challenges remain, the adoption of efficient irrigation techniques, rainwater harvesting, crop diversification, and policy interventions can pave the way for a more sustainable future. By leveraging traditional knowledge, modern technology, and community participation, India can achieve a balance between agricultural productivity and water resource management, ensuring long-term sustainability for future generations.

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