

(A No. 141) Sustainable Agriculture in India: Challenges and Future Policies

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Abstract

Agriculture in India is at a crossroads, facing several challenges such as climate change, soil degradation, water scarcity, rising input costs, and decreasing farm profitability. Sustainable agriculture has become the need of the hour to ensure food security, ecological balance, and economic stability for millions of farmers. This article explores the concept of sustainable agriculture with a focus on environmental stewardship, resource efficiency, technology adoption, and farmer-centric policy development. It reviews key government initiatives such as PM-KISAN, Soil Health Card Scheme, National Mission for Sustainable Agriculture (NMSA), and Paramparagat Krishi Vikas Yojana (PKVY). The role of climate-smart practices including precision farming, agroforestry, integrated pest management (IPM), organic farming, and water-saving methods like drip irrigation is also highlighted. The article concludes with policy suggestions to strengthen sustainable farming such as market reform, MSP improvement, credit access, carbon credit markets for farmers, digital infrastructure, and local-level climate adaptation strategies. Sustainable agriculture is not just a production system but a holistic approach that secures farmer income, conserves natural resources, and ensures food security for future generations.

1. Introduction

Sustainable agriculture has emerged as a central theme in global agricultural discourse. India, with over 55% of its population depending on agriculture for livelihood, cannot afford to rely on unsustainable methods that degrade soil, exploit

water, and increase the cost of cultivation. The Green Revolution brought significant gains, but excessive chemical usage, mono-cropping, and high reliance on tube wells have affected ecological balance. Today, sustainable agriculture refers to production systems that maintain productivity while conserving natural resources and improving farmer income.

India must now shift towards climate-resilient, technology-driven, and resource-efficient agriculture. The United Nations Sustainable Development Goals (SDGs), especially SDG-2 (Zero Hunger), SDG-13 (Climate Action), and SDG-15 (Life on Land) directly connect with agricultural sustainability. Therefore, modern agriculture requires a transition from input-intensive to knowledge-intensive systems.

2. Concept and Pillars of Sustainable Agriculture

Pillar	Explanation
Environmental Sustainability	Conservation of soil, water, biodiversity
Economic Sustainability	Higher profitability, market stability
Social Sustainability	Food security & rural livelihoods
Technological Sustainability	Adoption of modern digital tools

Sustainable agriculture promotes diversification, natural resource management, scientific decision-making and farmer empowerment. It is not just about organic farming—it covers a broad spectrum

of practices aiming to increase resilience and reduce dependence on costly inputs.

3. Challenges to Sustainable Agriculture in India

3.1 Climate Change

India faces unpredictable rainfall, rising temperatures, frequent droughts, and reduced crop productivity. Heat stress reduces wheat yield by 6–10% in Northern India. Coastal areas face salinity issues.

3.2 Soil Degradation

- Nearly **30% of Indian soil is degraded**.
- Excess urea application disturbs microbial balance.
- Soil organic carbon is below 0.4% in many regions.

3.3 Water Scarcity

Agriculture consumes **over 80%** of freshwater resources. Punjab, Haryana, and Rajasthan face groundwater depletion, demanding drip irrigation, laser leveling and micro-irrigation techniques.

3.4 Low Farmer Income

Rising input costs and market volatility reduce profitability. Small and marginal farmers (86% of total) lack access to credit, insurance, and extension services.

3.5 Limited Access to Technology

Digital tools remain underutilized due to high costs, poor internet connectivity, and lack of training.

4. Government Schemes Supporting Sustainability

Scheme	Focus Area
PM-KISAN	Direct income support
PKVY	Organic farming promotion
NMSA	Climate-resilient agriculture
KUSUM Scheme	Solar pumps & clean energy
Soil Health Card	Nutrient-based practices
PMFBY	Crop insurance
e-NAM	Digital market access

These programs have improved awareness, but implementation gaps and farmer-level constraints still exist.

5. Sustainable Farming Practices

5.1 Conservation Agriculture

Minimum tillage, residue management, and crop rotation reduce soil erosion and energy consumption by 40%.

5.2 Precision Farming

Use of drones, sensors, GPS mapping, and real-time data helps optimize fertilizer and pesticide use. This increases resource efficiency and reduces costs.

5.3 Organic & Natural Farming

PKVY and Subhash Palekar Natural Farming (SPNF) promote zero chemical farming. However, certification and market access remain challenges.

5.4 Integrated Pest Management (IPM)

Uses biological control, pest forecasting, and low-toxicity chemicals. Reduces pesticide dependence and maintains ecological balance.

5.5 Agroforestry

Combining trees with crops improves soil fertility, carbon sequestration and provides additional income (e.g., poplar, eucalyptus, moringa).

5.6 Efficient Water Management

- **Drip irrigation** saves up to 45% water.
- **Rainwater harvesting** enhances water table.
- **PM-KUSUM Scheme** promotes solar-powered pumps.

6. Role of Technology & Digital Agriculture

6.1 Use of Drones

For spraying, crop monitoring, yield estimation, and disease detection.

6.2 Artificial Intelligence (AI)

Used for weather forecasting, soil analysis, crop advisory, market prediction.

6.3 Farmer Producer Organizations (FPOs)

Help small farmers access markets, reduce middlemen and improve bargaining power.

6.4 e-NAM & Agri-Startups

Digital marketplaces reduce information asymmetry and increase transparency in trade.

7. Policy Suggestions for Strengthening Sustainability

1. MSP expansion to more crops.
2. Carbon credit market for farmers.
3. Subsidy shift from chemical fertilizers to biofertilizers.
4. District-level climate adaptation plans.
5. Farmer training on drones & digital tools.

6. Soil health restoration with organic carbon targets.
7. Water budgeting at village level.
8. Strengthening crop insurance awareness.
9. Encouraging low water crops in over-exploited zones.
10. Linking farmers to agri-export markets via FPOs.

8. Conclusion

Sustainable agriculture is no longer an option but a necessity for India's future. Climate change, resource depletion, and economic uncertainty demand a structured transformation of the agricultural system. The pathway lies in combining traditional knowledge with modern technology, improving market mechanisms, and ensuring farmer-centric policies. Indian agriculture will only be sustainable when farmers are prosperous, soils are healthy, and natural resources are conserved. This requires collective effort—science, policy, innovation, and farmer participation must work together. Only then can India achieve *Atmanirbhar Krishi* and long-term food security.

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