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## New Year, New Crop: How Farmers Reset With Every Rabi Season

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### Abstract:

The Rabi season in India represents more than a winter cropping cycle; it functions as a systematic reset mechanism for farmers after the uncertainties of the monsoon-driven Kharif season. This review paper examines the Rabi season as a period of agronomic, economic, and psychological renewal. By synthesizing existing agricultural practices, technological interventions, and farmer decision-making patterns, the paper highlights how Rabi farming enables strategic planning, income stabilization, and sustainable transitions in Indian agriculture.

### Introduction

Agriculture in India is deeply seasonal, with farming decisions shaped by climatic rhythms rather than calendar years. While the New Year symbolizes renewal in social and economic contexts, for farmers, true renewal aligns with the onset of the Rabi season. Sown during winter and harvested in spring, Rabi crops such as wheat, mustard, gram, barley, and pulses provide farmers an opportunity to reassess strategies, recover from monsoon variability, and initiate improvements in farm management. This review explores how the Rabi season acts as a functional reset—allowing farmers to recalibrate production choices, adopt innovations, and strengthen resilience.

### Characteristics of the Rabi Season

The Rabi season is distinguished by relatively stable climatic conditions, lower pest pressure, and greater control over irrigation compared to Kharif crops. Key features include:

- Dependence on residual soil moisture and controlled irrigation
- Lower vulnerability to extreme rainfall events
- Longer crop duration allowing steady vegetative growth
- Higher predictability in yields for major cereals like wheat

These characteristics make Rabi farming particularly suitable for planning-intensive and resource-efficient practices.



Figure 1 :New Year, New Crop: How Farmers Reset With Every Rabi Season

## Rabi Season as an Agronomic Reset

Following the Kharif harvest, farmers evaluate soil health, crop performance, and input efficiency. Rabi sowing decisions often incorporate lessons learned from the previous season, leading to:

- Changes in crop rotation to improve soil fertility
- Adoption of improved or stress-tolerant seed varieties
- Rationalization of fertilizer and irrigation use
- Increased experimentation with conservation agriculture practices such as zero tillage

Thus, Rabi serves as a corrective phase in the annual agricultural cycle.

## Economic Significance and Income Stabilization

Rabi crops contribute significantly to household income security, particularly in northern and central India. Wheat and mustard harvests often offset financial losses incurred during erratic monsoon seasons. Moreover, alignment of Rabi harvests with spring markets enhances price realization and liquidity for farmers.

Income from Rabi farming frequently supports:

- Household consumption and education expenses
- Repayment of short-term agricultural credit
- Investment in inputs for the next Kharif season

This economic role reinforces the perception of Rabi as a financial fresh start.

## Role of Technology and Innovation

Recent years have seen increased integration of technology into Rabi farming systems. Soil testing, digital advisories, weather forecasting, precision sowing, and mechanization are now influencing winter crop management decisions.

The Rabi season, with its lower climatic volatility, provides a favorable environment for testing new technologies and practices, reducing adoption risk for farmers

## Farmer Mindset and Knowledge Renewal

Beyond agronomy and economics, the Rabi season supports cognitive and social renewal. The winter period allows farmers time for reflection, training, and peer learning. Extension programs, field demonstrations, and informal knowledge exchange are more accessible during this phase.

This learning-oriented environment contributes to incremental improvements and long-term adaptability.

## Discussion

The findings reviewed in this paper indicate that the Rabi season plays a multidimensional role in Indian agriculture. It functions simultaneously as a production phase, a planning window, and a recovery mechanism. The symbolic alignment of Rabi sowing with the New Year further reinforces its identity as a season of renewal.

Recognizing Rabi farming as a strategic reset can help policymakers, researchers, and extension systems design interventions that leverage this natural transition point.

## Conclusion

The Rabi season embodies the principle that agricultural progress is built on reflection, preparation, and steady growth. Each winter crop cycle offers farmers a renewed opportunity to optimize resources, adopt innovations, and rebuild confidence. As climate variability intensifies, strengthening Rabi systems will be critical for sustaining farm incomes and resilience. For Indian farmers, every New Year truly begins not with a date, but with a new crop in the winter fields.

## How to Grow and Care for Succulents

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### Abstract:

Succulents are a diverse group of plants characterized by their ability to store water in leaves, stems, or roots, enabling them to survive in arid and semi-arid environments. Due to their low maintenance requirements, aesthetic appeal, and adaptability, succulents have gained popularity in domestic horticulture and urban landscaping. This review paper synthesizes existing knowledge on the cultivation and care of succulents, focusing on light, soil, water management, temperature, nutrition, propagation, and common physiological disorders. The study aims to provide a comprehensive understanding of best practices for sustainable succulent growth.

### Introduction

Succulent plants belong to multiple botanical families, including Crassulaceae, Cactaceae, Euphorbiaceae, and Asphodelaceae. Their unique morphological adaptations allow efficient water storage, making them suitable for regions with limited rainfall. In recent years, succulents have become increasingly popular among gardeners, researchers, and urban households due to their resilience and minimal input requirements. Understanding proper cultivation practices is essential, as inappropriate care—particularly excessive watering—often leads to plant failure. This review examines the key agronomic and horticultural factors influencing healthy succulent growth.

### Light Requirements

Light is a critical factor in succulent development. Most succulents require bright, indirect sunlight for optimal growth.

- Ideal exposure ranges from 4–6 hours of sunlight per day
- Insufficient light causes etiolation (elongated, weak growth)
- Excessive direct sunlight may lead to leaf scorching and discoloration

Indoor cultivation near windows and outdoor placement with partial shade are generally recommended.

## Soil and Growing Medium

Succulents require well-draining soil to prevent waterlogging and root rot. Conventional garden soil retains excess moisture and is unsuitable.

Recommended soil characteristics include:

- High porosity
- Rapid drainage
- Adequate aeration

A typical succulent mix consists of potting soil combined with coarse sand, perlite, or gravel. Commercial cactus and succulent media are also effective.

## Water Management

Watering practices play a decisive role in succulent survival. Due to their water-storage capacity, succulents require infrequent irrigation.

- Water should be applied only after complete drying of the growing medium
- Overwatering leads to root rot and fungal infections
- Seasonal variation is important, with reduced watering during winter dormancy

The "soak and dry" method is widely recommended.

## Temperature and Environmental Conditions

Succulents generally thrive in moderate temperatures ranging from 15°C to 30°C. While many species tolerate heat, prolonged exposure to frost can be detrimental.

- Good air circulation minimizes disease incidence
- Protection from extreme cold and excessive humidity is essential

## Nutrient Management

Succulents have low nutrient requirements. Excess fertilization can cause abnormal growth.

- Light feeding with diluted cactus fertilizer once every 2–3 months is sufficient
- Fertilization should be avoided during winter

Balanced nutrient management supports healthy but controlled growth.

## Propagation Techniques

Succulents are easily propagated through vegetative methods:

- Leaf propagation
- Stem cuttings
- Offsets or pups

Propagation success depends on allowing cut surfaces to dry (callus formation) before planting, reducing the risk of infection.

## Common Problems and Disorders

Frequent issues in succulent cultivation include:

- Root and stem rot caused by excess moisture
- Etiolation due to insufficient light
- Pest infestations such as mealybugs and aphids

Preventive care, proper sanitation, and environmental control are effective management strategies.

## Discussion

The review highlights that successful succulent cultivation relies more on restraint than intervention. Proper environmental control, especially regarding water and light, significantly enhances plant longevity. Succulents also offer potential for sustainable urban horticulture due to their low water demand.

## Conclusion

Succulents represent an efficient and resilient plant group suitable for both novice and experienced growers. Adhering to appropriate cultural practices ensures healthy growth and long-term sustainability. As interest in water-efficient landscaping grows, succulents are likely to play an increasingly important role in future horticultural systems.

## **Artificial Intelligence in Indian Agriculture: Transforming Farming Practices for Sustainable Development**

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### **Abstract**

Artificial Intelligence (AI) has emerged as a powerful tool in transforming traditional agricultural practices into data-driven, efficient, and sustainable systems. In a country like India, where agriculture supports a major portion of the population, the integration of AI offers immense potential to address challenges such as climate variability, resource scarcity, low productivity, and market inefficiencies. This review article discusses the role of AI in Indian agriculture, focusing on applications such as precision farming, crop monitoring, pest and disease management, weather forecasting, and market intelligence. The article also highlights the challenges and future prospects of AI adoption in the Indian agricultural context.

### **Introduction**

Indian agriculture is undergoing a significant transition due to technological advancements. With increasing pressure on land, water, and labor resources, there is a growing need for innovative solutions that can enhance productivity while ensuring sustainability. Artificial Intelligence, combined with big data, remote sensing, and Internet of Things (IoT), is redefining agricultural decision-making. AI enables farmers to make timely, accurate, and cost-effective decisions, thereby improving farm efficiency and income.

### **Applications of AI in Agriculture**

#### *Precision Farming*

AI-powered precision farming uses data from satellites, drones, sensors, and farm equipment to optimize the use of inputs such as seeds, fertilizers, and water. Machine learning algorithms analyze soil health, crop growth patterns, and nutrient requirements, allowing farmers to apply inputs only where and when they are needed. This not only reduces costs but also minimizes environmental impact.

### *Crop Monitoring and Yield Prediction*

AI tools help monitor crop growth in real time using image recognition and satellite imagery. These systems can detect crop stress, nutrient deficiencies, or water shortages at early stages. Yield prediction models based on AI assist farmers and policymakers in planning storage, transportation, and marketing strategies.

### *Pest and Disease Management*

One of the major challenges faced by farmers is crop loss due to pests and diseases. AI-based image analysis applications can identify pests and diseases from leaf images with high accuracy. Early detection helps farmers take timely preventive measures, reducing the excessive use of pesticides and safeguarding crop health.

### *Weather Forecasting and Climate Resilience*

AI enhances the accuracy of weather forecasts by analyzing large volumes of meteorological data. Improved forecasting helps farmers plan sowing, irrigation, and harvesting operations. AI-driven climate models also support the development of climate-resilient farming practices, which are crucial in the face of climate change.

### *Market Intelligence and Price Forecasting*

AI-based platforms provide real-time market information, price trends, and demand forecasts. This empowers farmers to make informed decisions about crop selection, harvesting time, and selling strategies, thereby reducing exploitation by intermediaries.



Fig 1. Artificial Intelligence in Indian Agriculture

## Challenges in Adoption of AI

Despite its potential, AI adoption in Indian agriculture faces several challenges. These include limited digital literacy among farmers, high initial investment costs, inadequate infrastructure, and data privacy concerns. Small and marginal farmers may find it difficult to access AI-based tools without institutional support.

## Future Prospects

With increasing government initiatives, startups, and public-private partnerships, the future of AI in Indian agriculture appears promising. Capacity-building programs, farmer training, and localized AI solutions can accelerate adoption. Integrating AI with traditional agricultural knowledge can further enhance its relevance and acceptance among farmers.

## Conclusion

Artificial Intelligence has the potential to revolutionize Indian agriculture by making it more efficient, sustainable, and resilient. While challenges remain, strategic investments and inclusive policies can ensure that AI benefits reach farmers at all levels. The successful integration of AI into agriculture can play a crucial role in achieving food security and sustainable rural development.



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## Role of Women in Indian Agriculture: Challenges, Opportunities, and Empowerment Strategies

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### Abstract

Women play a crucial yet often under-recognized role in Indian agriculture. They contribute significantly to farm operations, livestock management, post-harvest processing, and household food security. Despite their active involvement, women farmers face several constraints such as limited access to land ownership, credit, training, and decision-making power. This review article examines the role of women in Indian agriculture, highlights the challenges they face, and discusses strategies for empowerment through extension services, policy support, and capacity building.

### Introduction

Indian agriculture is largely sustained by women, especially in rural areas where male migration is increasing. Women are involved in almost all agricultural activities, from seed selection and sowing to harvesting and storage. However, their contribution often remains invisible in official statistics and policy frameworks. Recognizing and strengthening the role of women is essential for achieving sustainable agricultural development and rural transformation.

### Participation of Women in Agricultural Activities

Women actively participate in crop production, weeding, transplanting, harvesting, and post-harvest operations. They also play a major role in allied sectors such as dairy, poultry, fisheries, and kitchen gardening. In many regions, women are the primary managers of small livestock and household nutrition, contributing directly to food and nutritional security.

### Challenges Faced by Women Farmers

### *Limited Access to Resources*

Most women farmers do not have legal ownership of land, which restricts their access to institutional credit, crop insurance, and government schemes. Lack of control over productive resources limits their economic empowerment.

### *Drudgery and Workload*

Women perform labor-intensive tasks using traditional tools, leading to physical strain and health issues. The absence of women-friendly farm implements increases drudgery and reduces work efficiency.

### *Limited Access to Extension and Training*

Agricultural extension services often fail to adequately reach women farmers. Training programs are usually designed without considering women's time constraints, literacy levels, and specific needs.



Figure 1 Role of Women in Indian Agriculture: Challenges, Opportunities, and Empowerment Strategies

## Opportunities for Empowerment

### *Capacity Building and Skill Development*

Training women in improved agricultural practices, value addition, and agri-entrepreneurship can enhance their productivity and income. Farmer producer organizations and self-help groups provide platforms for collective learning and empowerment.

### *Women-Centric Extension Approaches*

Gender-sensitive extension strategies, including women extension workers, participatory methods, and community-based approaches, can improve technology adoption among women farmers.

### *Policy and Institutional Support*

Government initiatives promoting women's land rights, access to credit, and inclusion in decision-making bodies can significantly strengthen their role in agriculture. Linking women farmers with markets and value chains further enhances income opportunities.

### **Role of Self-Help Groups and Farmer Collectives**

Self-help groups and women-led farmer collectives play an important role in mobilizing resources, facilitating access to credit, and promoting income-generating activities. These groups also enhance social empowerment and leadership among rural women.

### **Conclusion**

Empowering women in agriculture is not only a matter of social justice but also a key strategy for improving agricultural productivity and sustainability. Strengthening women-focused extension services, ensuring access to resources, and creating enabling policy environments can unlock the full potential of women farmers. Recognizing women as farmers and decision-makers is essential for inclusive and sustainable agricultural development.

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## **Climate-Smart Agriculture: A Sustainable Approach for Enhancing Farmers' Resilience**

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### **Abstract**

Climate change poses serious challenges to agricultural sustainability, food security, and farmers' livelihoods, particularly in developing countries like India. Irregular rainfall patterns, rising temperatures, frequent droughts, floods, and increased pest incidence are directly affecting crop productivity. Climate-Smart Agriculture (CSA) has emerged as an integrated approach that aims to increase agricultural productivity, enhance climate resilience, and reduce greenhouse gas emissions. This review article discusses the concept, key components, benefits, and challenges of climate-smart agriculture with special reference to Indian farming systems.

### **Introduction**

Indian agriculture is highly vulnerable to climate variability due to its dependence on monsoon rainfall and smallholder farming systems. Climate-related risks not only affect crop yields but also increase uncertainty in farmers' decision-making. To address these challenges, there is a need for adaptive and sustainable agricultural practices. Climate-Smart Agriculture provides a holistic framework that integrates climate adaptation and mitigation strategies into agricultural development.

### **Concept of Climate-Smart Agriculture**

Climate-Smart Agriculture is based on three main pillars: increasing agricultural productivity and incomes, strengthening resilience and adaptation to climate change, and reducing or removing greenhouse gas emissions wherever possible. CSA does not promote a single technology but encourages the adoption of locally suitable practices based on agro-climatic conditions.

## Key Practices under Climate-Smart Agriculture

### *Crop Diversification and Improved Varieties*

Diversification of crops and cropping systems reduces the risk associated with climate-induced crop failure. The use of climate-resilient crop varieties, such as drought-tolerant, flood-tolerant, and heat-resistant varieties, helps farmers cope with changing climatic conditions.

### *Conservation Agriculture*

Conservation agriculture practices, including minimum tillage, crop residue management, and crop rotation, help improve soil health, enhance water retention, and reduce erosion. These practices contribute to long-term sustainability and climate resilience.

### *Efficient Water Management*

Water scarcity is a major concern in Indian agriculture. Climate-smart water management practices such as drip irrigation, sprinkler systems, rainwater harvesting, and scheduling irrigation based on crop water requirements help optimize water use efficiency.

### *Integrated Farming Systems*

Integrated farming systems combine crops, livestock, fisheries, and agroforestry to enhance farm income and resource-use efficiency. Such systems reduce vulnerability by providing multiple income sources and recycling farm resources.



*Fig 1 Climate Smart Agriculture*

### *Climate Information Services*

Timely access to climate and weather information enables farmers to make informed decisions regarding sowing, irrigation, and harvesting. Agro-advisories based on weather forecasts play a crucial role in reducing climate-related risks.

### **Role of Extension Services**

Agricultural extension services are central to the successful implementation of climate-smart agriculture. Extension personnel act as a link between research institutions and farmers by promoting awareness, providing training, and facilitating the adoption of climate-resilient practices. Participatory approaches and farmer field schools enhance learning and technology adoption.

### **Challenges in Adoption of CSA**

Despite its benefits, the adoption of climate-smart agriculture faces several constraints such as lack of awareness, limited access to credit, high initial investment costs, and inadequate institutional support. Small and marginal farmers often require policy and financial assistance to adopt CSA practices.

### **Conclusion**

Climate-Smart Agriculture offers a viable pathway to address the challenges posed by climate change while ensuring sustainable agricultural development. Strengthening extension systems, promoting farmer-centric policies, and encouraging community-based approaches can accelerate the adoption of CSA practices. By integrating climate resilience into agricultural planning, India can safeguard farmers' livelihoods and ensure long-term food security.