

## Role of Chickpea in Climate-Resilient Pulse Production Systems

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### Abstract: -

*Climate variability poses increasing challenges to pulse production systems, particularly in rainfed and semi-arid regions. Chickpea (*Cicer arietinum* L.), one of the most important pulse crops globally, plays a significant role in enhancing the resilience of agricultural systems under changing climatic conditions. Its inherent tolerance to drought, low input requirement, and ability to improve soil fertility make it a strategic crop for climate-resilient agriculture. This article examines the role of chickpea in climate-resilient pulse production systems, emphasizing its physiological adaptability, contribution to soil health, resource use efficiency, and integration into sustainable cropping systems. The article also highlights agronomic strategies that strengthen chickpea-based systems against climate-induced risks.*

### Introduction:

Climate change has emerged as a major constraint to sustainable pulse production due to increased temperature extremes, erratic rainfall patterns, and frequent drought events. Pulse crops are particularly vulnerable because they are often grown under marginal environments with limited irrigation and nutrient inputs. Developing climate-resilient production systems is therefore essential to ensure nutritional security and

agricultural sustainability.

Chickpea (*Cicer arietinum* L.) occupies a prominent position among pulse crops due to its wide adaptability, economic importance, and nutritional value. It is predominantly cultivated in arid and semi-arid regions, where climatic risks are high. The crop's ability to perform reasonably well under moisture-limited conditions and its positive influence on soil health make chickpea a key component of climate-resilient pulse production systems.

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### **Climatic Adaptability of Chickpea**

Chickpea exhibits several adaptive traits that enhance its performance under variable climatic conditions. The crop has a deep and extensive root system that allows efficient extraction of soil moisture from deeper layers. Its phenological flexibility enables it to escape terminal drought and heat stress, particularly when short-duration varieties are used.

Physiologically, chickpea maintains relatively higher water-use efficiency compared to many other pulses. The crop can complete its life cycle with residual soil moisture, making it well suited for rainfed and post-rainy season cultivation. These attributes contribute to yield stability under climate-induced stress conditions.

### **Contribution to Soil Health and System Sustainability**

One of the most important roles of chickpea in climate-resilient systems is its contribution to soil fertility. Through symbiotic nitrogen fixation, chickpea enriches soil nitrogen levels, reducing dependence on synthetic fertilizers. This not only lowers production costs but also minimizes greenhouse gas emissions associated with fertilizer use.

Chickpea residues add organic matter to the soil, improving soil structure, water infiltration, and moisture retention. Improved

soil health enhances the resilience of the entire cropping system against climate extremes such as drought and heavy rainfall.

### **Resource Use Efficiency**

Chickpea is a low-input crop with high efficiency in utilizing water and nutrients. Its ability to produce acceptable yields under limited irrigation makes it an ideal crop for water-scarce environments. When integrated into pulse-based cropping systems, chickpea improves overall resource use efficiency by optimizing the use of residual soil moisture and nutrients.

The crop also fits well into conservation agriculture practices, where reduced tillage and residue retention further enhance climate resilience.

### **Role in Diversified and Climate-Smart Cropping Systems**

Chickpea plays a vital role in diversified cropping systems such as crop rotation, intercropping, and rice-fallow systems. Inclusion of chickpea as a break crop reduces pest and disease buildup, improves soil fertility, and stabilizes system productivity.

In rice-fallow regions, chickpea utilizes residual soil moisture, converting otherwise unproductive land into productive systems. Such diversification reduces climate risk by spreading production across different seasons and environments.

## Agronomic Strategies for Enhancing Climate Resilience

The climate-resilient potential of chickpea can be further strengthened through appropriate agronomic interventions, including:

- ☛ Selection of stress-tolerant and short-duration varieties
- ☛ Adjustment of sowing time to avoid terminal heat stress
- ☛ Integrated nutrient management using biofertilizers
- ☛ Efficient water management through critical stage irrigation
- ☛ Adoption of conservation agriculture practices

These strategies enhance yield stability and reduce vulnerability to climate variability.

## Conclusion

Chickpea plays a crucial role in climate-resilient pulse production systems due to its adaptability to moisture stress, contribution to soil health, and efficient use of natural resources. Its integration into diversified cropping systems enhances system sustainability, productivity, and resilience under changing climatic conditions. Strengthening chickpea-based systems through improved agronomic practices and climate-responsive management can significantly contribute to food security, environmental sustainability, and farmer livelihoods.

Promoting chickpea as a strategic pulse crop is therefore essential for building resilient agricultural systems in the face of climate change.

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