

A Review

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Physiological traits as selection criteria for climate-resilient guar genotypes : A review

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Summary

Guar (*Cyamopsis tetragonoloba* (L.) Taub.), a drought-tolerant legume native to arid and semi-arid regions, holds significant promise for climate-resilient agriculture due to its robust physiological traits and industrial value. This review explores the morphological, physiological, and biochemical adaptations that enable guar to survive extreme conditions, including high temperature, low soil moisture, and poor fertility. Key adaptive traits include a deep taproot system, osmotic adjustment through solute accumulation (e.g., proline and sugars), chlorophyll stability, and enzymatic antioxidant defense. These mechanisms support sustained photosynthetic activity and metabolic function under stress. The review further highlights seasonal influences on growth and yield, emphasizing how phenological plasticity and genotype × environment interactions influence productivity across Kharif, summer, and Rabi sowing windows. Morphophysiological traits such as relative water content, net assimilation rate, canopy architecture, and reproductive stability under stress are proposed as critical indicators of resilience. Combined drought and heat stress scenarios are shown to intensify physiological limitations, underscoring the need for integrative stress screening in breeding programs. The paper advocates for trait-based selection strategies and high-throughput phenotyping to accelerate breeding efforts. It also identifies knowledge gaps in root system architecture, chlorophyll fluorescence, and trait-environment modeling. With emerging genomic tools and transcriptome insights, trait-linked molecular breeding is now feasible. Integrating physiology, agronomy, and genomics can enhance guar's role in sustainable agriculture, particularly in water-limited regions. The findings consolidate a scientific framework for selecting climate-resilient guar genotypes and suggest future research directions to optimize yield, gum quality, and environmental sustainability.

Key words : Guar (*Cyamopsis tetragonoloba*), Climate resilience, Physiological traits, Drought tolerance

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Introduction

Guar (*Cyamopsis tetragonoloba* (L.) Taub.) is a warm-season, drought-tolerant annual legume

cultivated primarily in arid and semi-arid regions. Though widely regarded as indigenous to the Indian subcontinent, its wild progenitors are believed to have