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"Competing pathways for equitable food systems transformation: Trade-offs and synergies"

Unlocking the resilience of yacon (*Smallanthus sonchifolius*): A systematic review

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Abstract

Resilience to abiotic stress is essential for assuring sustainable agricultural practices and food security. Yacon (*Smallanthus sonchifolius*), a perennial tuberous crop native to the Andes, has garnered increasing attention due to its remarkable environmental adaptability. This review seeks to provide a comprehensive analysis of the physiological, morphological, and anatomical responses of yacon to abiotic stress to shed light on its resilience mechanisms. Twenty-five relevant studies were included in this review after a comprehensive search and selection process from Web of Science academic journal repositories. The findings revealed that yacon possesses a variety of adaptive mechanisms for coping with abiotic stresses such as drought, salinity, and temperature extremes. Yacon has efficient osmotic adjustment, antioxidant defence systems, and stomatal regulation, allowing it to maintain cell homeostasis under adverse conditions. Yacon exhibits enhanced root development, an increased root-to-shoot ratio, and altered leaf morphology, all of which contribute to enhanced water absorption and decreased transpiration rates. From an anatomical standpoint, yacon demonstrates structural modifications, such as increased periderm thickness, suberisation of cell walls, and the formation of aerenchyma, that enhances its resistance to abiotic stress. In addition, physiological and morphological responses are tightly linked to anatomical adaptations, allowing yacon to allocate resources efficiently and maintain growth under adverse conditions. This review provides a thorough comprehension of yacon's resilience mechanisms, highlighting its potential as a stress-tolerant crop. The findings highlight the need for additional research on the genetic and molecular aspects underlying yacon's abiotic stress tolerance, which could aid in the development of improved cultivars with increased resilience. Utilizing the adaptive characteristics of yacon may ultimately contribute to the development of resilient agricultural systems in the face of growing abiotic stress challenges.

Keywords: Abiotic-stress tolerance, adaptability, food security, resilience, *Smallanthus sonchifolius*

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