MiR169 enhances plant biomass production and stress resistance (2024-007)

A novel technology that uses a miRNA molecule to combat low crop yield and susceptibility to various biotic and abiotic stresses.

Market Overview

Abiotic stresses, such as salinity, drought, and heat, are important limiting factors for plant growth and development as they significantly impact crop production and agriculture economy. Plants have evolved various protection mechanisms coping with different environmental adversities. Manipulation of genes involved in plant stress regulation to genetically engineer enhanced performance in transgenics plays an increasingly important role in sustainable modern agriculture. Clemson researchers have made significant strides in understanding the role of microRNAs (miRNAs) in plant stress regulation. Their work focuses on miR169g, a conserved plant miRNA that targets NUCLEAR FACTOR Y (NF-Y) transcription factors. By focusing on genetic mechanisms that enhance crop resilience, this work has potential applications for farmers, agribusinesses, and biotechnology companies seeking to improve crop performance under adverse conditions. The findings could contribute to the development of new products and techniques in the agricultural biotechnology market.

Technical Summary

MicroRNAs (miRNAs) are endogenous small non-coding RNAs identified in plants that engage in post-transcriptional target gene regulation, crucial for plant development and environmental adaptation. The data indicates that miR169 regulates expression of the specific transcription factor genes leading to significantly altered plant biomass yield and responses to drought and salt stresses that are associated with modified plant development and physiological and molecular characteristics. The gene has also been shown to play a role in plant pest resistance. The results obtained have demonstrated the importance of miR169 as a key coordinator in plant development and stress responses, providing information for the development of novel biotechnology approaches to genetically engineer crops for enhanced agricultural production.

Application

Agriculture, crop production

Development Stage

TRL 2

Advantages

- A new approach that enhances crop resistance to biotic and abiotic stresses.
- miR169 is proven to be a key coordinator in plant development and stress responses, including drought and salt stresses.
- Significant market size as the novel approach can be applied to various crop species.

About the Inventors

Dr. Hong Luo

Professor in the Department of Genetics and Biochemistry at Clemson University

Dr. Luo received his Ph.D. in Molecular Biology from the Catholic University of Louvain, Belgium. Before joining Clemson University, he was with HybriGene, Inc. as the Director of Research, working on gene transfer for trait modification in turfgrass and rice. His work leads to the development of the first genetically engineered, environmentally safe, male-sterile and herbicide-resistant turfgrass, and the development of a new method for hybrid crop production using site-specific DNA recombination systems. He is a Faculty Fellow, Clemson Spiro Institute for Entrepreneurial Leadership, and the recipient of the 2013 Clemson University Godley-Snell Agricultural Award for Excellence in Agricultural Research.

Qian Hu

Research Associate in the Department of Genetics and Biochemistry at Clemson University

Qian Hu is a Research Associate and lab manager in Dr. Hong Luo's lab. She is an expert in plant tissue culture, plant genetic transformation and has many years of experience working on genetic transformation of turfgrass, switchgrass, rice, soybean and cotton. She has co-authored many high-impact journal papers and is a co-inventor of five issued patents.

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Xiaotong Chen is a PhD student in Dr. Hong Luo's lab. He is the first author of a recently published article on the study of miR169, and a recipient of the first-place award in student oral research presentation competition in 2023 Society for In Vitro Biology (SIVB) meeting held in June 2023, in Norfolk, VA.

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