Establishing Indices for Screening Heat-Tolerant Tomatoes Using Imaging Phenotyping

Abstract
As global climate change intensifies, crops face increasing environmental stress that adversely affects yield and quality. Tomato, a key horticultural crop worldwide, is particularly sensitive to high temperatures, which can significantly reduce productivity. Developing heat-tolerant tomato varieties has therefore become a pressing research priority. Traditional evaluation methods—such as assessing pollen viability and fruit development—are labor-intensive, time-consuming, and often require destructive sampling. To enhance the efficiency of heat-tolerance screening, this study focuses on establishing non-destructive vegetative-stage indicators, including chlorophyll fluorescence, leaf reflectance spectra, canopy temperature, and leaf angle derived from imaging analyses, and examines their correlation with flowering and fruit set during the reproductive stage.

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RESEARCH AREAS AND EXPERTISE

- General area: Crop Physiology
- Specific area: Abiotic stress resilient

SELECTED AWARDS AND RECOGNITION

- Editor, Botanical Studies, 2022-
- Outstanding Teaching Award, National Taiwan University, 2023
- Invited Speaker, The International Plant Phenotyping Symposium – PhenoVeg, 2023
- Chief of Farm Management Occupation, 113th National Senior Secondary School Students' Agricultural Skills Competition, 2024

Yu-Chang Tsai is an Associate Professor in the Department of Agronomy at National Taiwan University (NTU). He received his Bachelor and Master’s degree in Department of Agronomy at NTU, and Ph.D. degrees in Biochemistry and Cell Biology at Rice University, U.S.A. After graduation from Rice University, he became a postdoctoral researcher at University of North Carolina at Chapel Hill. In 2013, he became a faculty member in Department of Agronomy at NTU. His research centers on crop physiology, phytohormone signaling transduction, and the mechanisms underlying abiotic stress tolerance in crops. Using rice, tomato, and sorghum as model systems, his lab integrates invasive and non-invasive analytical tools to establish correlations among physiological traits, aiming to enhance both breeding efficiency and field management strategies. In recognition of his contributions, he serves as an editor for Botanical Studies (since 2022), received the Outstanding Teaching Award from National Taiwan University in 2023, was invited to speak at the International Plant Phenotyping Symposium – PhenoVeg in 2023, and served as Chief of Farm Management Occupation at the 113th National Senior Secondary School Students' Agricultural Skills Competition in 2024.