Manipulation of the Novel hsp23.8::ZmCLA4 Gene Construction to Avoid Leaf Hyponasty (Upward Leaf Bending) Caused by Heat Stress

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Under heat stress and elevated carbon dioxide (CO2) levels, tomato plants have been shown to perform leaf hyponasty, or upwards leaf curling. This causes reduced leaf area and biomass and decreased light perception, resulting in growth retardation and reduced fruit yield. Moreover, as climate change continues to increase heat temperature and CO2 levels, crop production can suffer dire consequences related to yield. One possible solution to this problem is to utilize molecular and genetic techniques to genetically modify tomatoes to overcome this hyponasty phenomenon. As such, this project focused on the usage of a novel gene construct, Lehsp23.8::ZmCLA4, to manipulate leaf angle (LA) in tomatoes. This gene construct consists of the tomato promoter Lehsp23.8, a heat inducible promoter, and the coding region of ZmCLA4, a gene that controls LA increases in maize. Using this approach, the transgenic tomato plants will express ZmCLA4 gene to prevent leaf hyponasty only when heat stress occurs, mitigating unregulated gene expression of the ZmCLA4 gene when growth conditions are favorable. Thus far, the Lehsp23.8::ZmCLA4 construct has been successfully introduced into tomato via Agrobacterium- mediated tissue-culture transformation, and evaluation of transgenic plants is in progress -- transgenic plants will be grown at 30°C/400 ppm CO2 and 37°C/700 ppm CO2. Statistical analysis will be conducted to evaluate transgenic plants resistance to leaf hyponasty; a p-value < 0.05 will indicate a statistically significant difference in LA between the two groups. The project's underlying goal is to demonstrate proof-of-concept. If successful, this could aid researchers in developing other transgenic crops that adapt to climate change- related heat stress and increasing CO2 levels.

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