

Molecular Engineering of Drought-Tolerant Crops Using CRISPR and Transcriptomic Approaches

Abstract / Summary

Drought stress severely limits global crop productivity, posing a major threat to food security. This project aims to develop drought-tolerant crop varieties by integrating **CRISPR-Cas9 genome editing** with **transcriptomic (RNA-seq)** analyses. Transcriptomic profiling will identify key drought-responsive genes, which will then be targeted for precise modification using CRISPR-Cas9. The resulting edited plants will be evaluated for physiological, biochemical, and molecular responses under drought stress. Expected outcomes include identification of crucial drought-related genes, creation of improved drought-tolerant lines, and deeper understanding of molecular mechanisms driving drought adaptation. The study will contribute to sustainable agriculture and climate-resilient crop improvement.

Objectives

1. Identify drought-responsive genes via RNA-seq analysis.
2. Edit selected genes using CRISPR-Cas9.
3. Evaluate drought tolerance in edited lines through physiological and molecular assays.
4. Develop a molecular model of drought tolerance mechanisms.

Methodology (Brief)

- Conduct drought stress experiments on a model crop (e.g., rice or maize).
- Perform RNA-seq to detect differentially expressed genes.
- Design CRISPR-Cas9 constructs to edit key targets.
- Validate gene edits via sequencing and analyze plant performance under stress.

Expected Outcomes

- Discovery of major drought-responsive genes.
- Generation of genome-edited, drought-tolerant plants.
- Molecular insight into drought tolerance pathways.
- Potential application in crop breeding programs.

Keywords:

CRISPR-Cas9, Drought Stress, Transcriptomics, Crop Improvement, Molecular Biotechnology