CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

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Project Number

S1809

Project Title

Mutants of Leucine Rich Receptor-like Kinase Proteins Show Increased Biomass: A Proteomic Study

Abstract

Objectives/Goals

The objective was to manipulate plant biomass through determining membrane protein interactions with cellulose synthase interactive protein and characterizing the mutants of the interactions.

Methods/Materials

created a 1,536 membrane protein library in yeast, transformed CSI1 (protein of interest) into yeast, conducted a mating based split ubiquitin assay with 1,536 membrane proteins in Arabidopsis Thaliana, screened for strong protein interactions, ordered mutants of these CSI1 protein interactors and planted against wild type to observe difference in phenotype

Results

I found that CSI1 has 54 strong protein interactions with the 1,536 membrane protein library. Four receptor like kinase proteins (RLK) were found to interact strongly with CSI1, two of which--RLK proteins AT1G34110 (182) and AT1G16670 (217)-- showed significant increase in biomass compared to wild type (24.68% increase in leaf area, 31.60% increase in stem length, 93.13% increase in rosette area compared to wild type for the 182 mutant). A two sample statistical t test shows that 99+% of the time, the increase biomass in the two mutants is due to the mutation in the RLK proteins.

Conclusions/Discussion

The increase in biomass due to the mutations in the two RLK proteins is directly applicable to the bioethanol industry, which harvests plant biomass to create biofuels. The increased biomass minimizes the amount of land necessary to sustain biofuel feedstocks, as countries are increasingly struggling to allocate land to grow biofuel feedstocks. In addition, these LRR-RLK proteins are present in important food crops, such as sugar cane, and in leafy vegetable food crops, such as kale and spinach. Mutating the AT1G34110 (182) and AT1G16670 (217) LRR-RLK proteins in these plants has strong potential to increase stem length and leaf area, and thus increase food production.

Summary Statement

Mutants of 2 receptor-like kinase proteins show increased biomass,i.e. greater stem length, leaf area, and rosette area--a result that'll improve biofuel production and possibly crop yield as these RLKs are present in important food crops.

Help Received

Dr. Renate Weizbauer and Dr. David W. Ehrhardt of the Carnegie Institution of Science at Stanford University provided mentorship and lab access.