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

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Cellulose synthase (CESA) complexes, which are essential for cellulose biosynthesis, are bridged to cortical microtubules that enable them to reach the cell wall by the CESA interactive protein 1 (CSI1). CSI1 is thus is a key protein required for cellulose deposition. With the larger goal to maximize biomass and further elucidate this mechanism, I focused on CSI1 and sought to determine protein interactions between membrane proteins and CSI1. I conducted a semi automated mating-based split ubiquitin (mbSUS) assay using yeast between 1536 membrane proteins and yeast transformed with CSI1. I decided to focus on six of the protein interactions, based on their predicted functions. Four of the six are receptor-like kinase (RLK) proteins, which are known to translate environmental signals and regulate growth. The AT1G34110(182) and AT1G16670(217) RLK mutants showed a stronger phenotype in A. thaliana, i.e. 31.60% greater stem length, 24.68% greater leaf area, and 93.13% greater rosette area for the 182 mutant. A two-sample T test shows that 99%+ of the time, the result in the 182 RLK protein is due to the mutation in the RLK. This result is important as the increase in biomass is applicable to the bioethanol industry, which uses cellulose as a fuel source. The increase in biomass will maximize biofuel production and minimize the amount of land necessary to sustain biofuel feedstocks, as countries are increasingly struggling to allocate land for feedstocks. In addition, these LRR-RLK proteins are present in important food crops, such as sugar cane and maize, and in leafy vegetable food crops, such as kale and spinach. Mutating the AT1G34110(182) and AT1G1667(217) has strong potential to increase stem length and leaf area, and thus increase food production.

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