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Promoter Deletion in the Soybean Compact Mutant Leads to Overexpression of a Gene with Homology to the C_{20}-Gibberellin 2-Oxidase Family

Background/Objective

Height is a critical component of plant architecture, significantly affecting crop yield. Reduced height and dwarfism are traits that can be advantageous in crop breeding and field production. Conversely, longer stems can be a desirable trait for biomass production in biofuel crops. In this study, we describe the characterization of the *Compact* mutant and provide new insights into how structural variation can drive changes in plant morphology.

Approach

We mapped the gene to a small interval of Chromosome 17 using biparental mapping. Whole-genome sequencing of the mutant revealed an 8.7 kb deletion in the promoter of the *Glyma.17g145200* gene, which encodes a member of the class III gibberellin (GA) 2-oxidases.

The *Compact* mutant of soybean (left) and wild type (right) at harvest, showing potentially increased pod set in the lower branches of the mutant.

Results

The deletion causes overexpression of the GA 2-oxidase leading to a dwarf phenotype. The dwarfing is caused by altered levels of GA precursors in the *Compact* mutant, and the mutant phenotype can be rescued with exogenous GA_3. We also showed overexpression of *Glyma.17g145200* in Arabidopsis results in dwarfed plants.

Significance/Impacts

These results provide an example of how genome structural variation can control an important crop trait. The *Glyma.17g145200* gene has a large impact on soybean architecture, and similar GA-mediated dwarfing helped create the “green revolution” in rice and wheat. The gene has potential implications for increasing crop yield in certain canopy configurations. The next step is to look at our target bioenergy crops to investigate effects on resistance to lodging or shade avoidance at high planting densities without sacrificing yield.

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