OFFICIAL ABSTRACT and CERTIFICATION

It's in the Genes! A Comparison of Drought Response Genes Between Drought Tolerant and Drought Sensitive Plants Through RNA-seq Methods

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The effects of climate change will likely increase drought conditions and threaten important drought sensitive crops in the future. Genetic engineering offers a promising method to improve drought tolerance in various crops. In order to harness the full potential of genetic engineering, it is important to understand how genes are expressed and regulated during drought conditions. The purpose of this study was to compare gene expression and regulation in a drought sensitive plant, Solanum tuberosum (potato), with a drought tolerant plant, Sorghum bicolor (cereal crop), to understand the genetic mechanisms underlying drought tolerance. We used a transcriptomic library, Gene Expression Omnibus, to identify important RNA-Seq genes in leaf adaptation during drought conditions. The RNA-Seq genes were entered into a bioinformatics program for further analysis called GALAXY Toolbox. Several important differences were observed. First, the drought tolerant cereal crop had a lower number of expressed genes than the drought sensitive potato. This suggests that during drought conditions, the drought tolerant plant species may try to "conserve energy" and enter a "survival mode" by expressing less genes. Second, of the expressed genes in both plant species, most were expressed in a different direction. Finally, the most significant drought responsive genetic process, Organonitrogen compound biosynthesis, was downregulated in the cereal crop and upregulated in the potato.
In summary, we observed significant differences in gene expression between the two plant species during drought conditions. These differences in gene expression may help provide molecular targets to improve drought tolerance among drought sensitive crops.

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