Targeted Mutagenesis of the Arabidopsis deoxyhypusine Synthase Gene via CRISPR/Cas9 Enzyme Engineering Generating an Increase in Carbon Sequestration and Photosynthetic Rate

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Our world is headed toward a severe climate crisis: predicted to rise 1.5 degrees Celsius over the next two decades. Carbon dioxide represents 80% of polluting greenhouse gas emissions (412 ppm) and is continuing to rise. This study engineered a CRISPR/Cas9 vector used to target the mutagenesis of the protein codeine deoxyhypusine synthase gene in Arabidopsis thaliana. The power of plant carbon assimilation can initiate the balance of the carbon production rate to the absorption rate in our atmosphere. The point mutation of the DHS1 gene deletion deregulates the first step in the plant Shikimate Pathway by alleviating multiple effector-mediated feedback regulation in Arabidopsis. The photosynthetic rate of five dissimilar genetic variations of T-DNA insertion mutants was analyzed, through gas exchange analysis, in the DHS1, DHS2, DHS3, EPS1, and EPS2 gene regions of Arabidopsis. The CRISPR/Cas9 vector was engineered based on the DHS1 gene region assimilating the highest original carbon sequestration levels and photosynthetic rate. The colony growth during the transformation phase of the CRISPR vector into the Agrobacterium tumefaciens cells determined the success in the engineering of the vector. The Primary transformants seedlings were screened via Yellow Fluorescent Protein detection yielding a successful genetic engineering efficiency rate of 30%. The engineered CRISPR/Cas9 vector and genome of Arabidopsis thaliana successfully targeted a point mutation of the DHS1 gene region to increase carbon sequestration levels. This provides a novel solution to overcoming the negative effects of climate change through the CRISPR-engineered carbon sequestration abilities of Arabidopsis thaliana.

Awards Won:

Fourth Award of $500