Identifying Genes Influencing the Efficiency of Photosynthesis

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PRECS Phenotypic Plasticity Research Experience for Community College Students

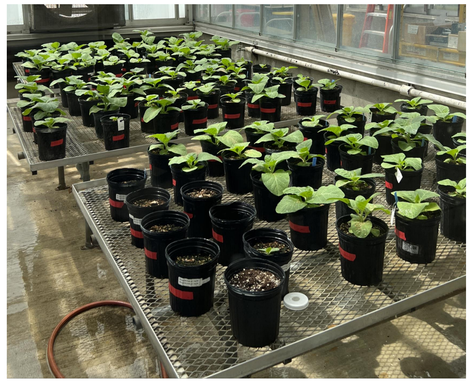
Introduction

- Photosynthesis adapts to environmental conditions over time.[1]
- Varying environmental conditions lead to stress accumulation on the plant.[2]
- A genetic library has been assembled for forward genetic screening of *Arabidopsis thaliana.*[3]
- Arabidopsis Thaliana is a model plant used as a model organism in growth experiments.
- This research project aims to identify and analyze candidate genes that impact the efficiency of photosynthesis.
- These genes can be transplanted into commercial crops to increase efficiency of photosynthesis and crop yields.

Assay Parameters

- Initial 30 min dark adaptation
- First Round of Imaging
- 3 hour long high light treatment (2000µmol photons)
- Final 30 min dark adaptation
- Second Round of imaging

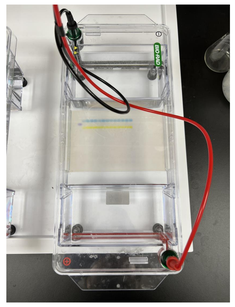
1st and 2nd row: SALK line 000586
3rd row: Col-0
4th row: CS72
5th row: CS71
6th row: SALK Control



Gene Transplant-ed Tobacco Plants: GMOs.

.Methodology

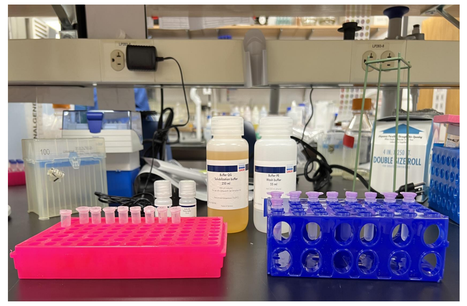
PCR +Gel Electrophoresis



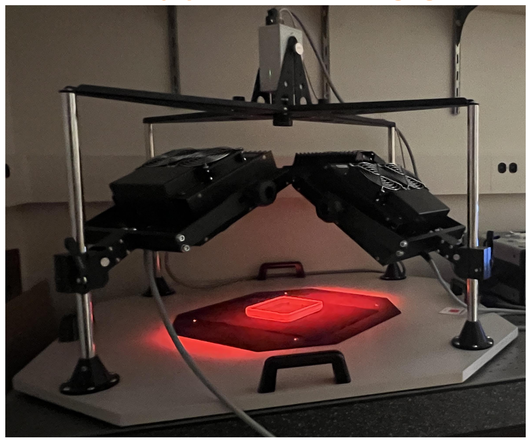
Left: Images of a Gel electrophoresis Imager and a running Gel apparatus.

Right: QIAquick gel extraction kit + Extracted samples

Gel Extraction

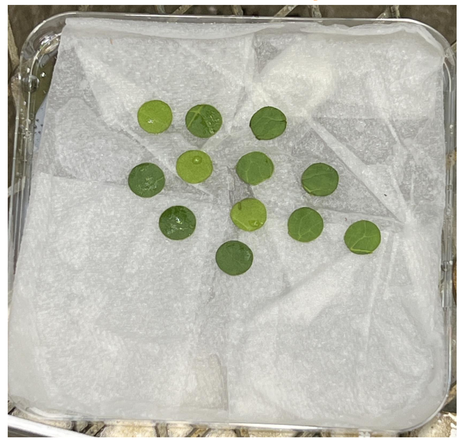


Chlorophyll Fluorescence Imaging



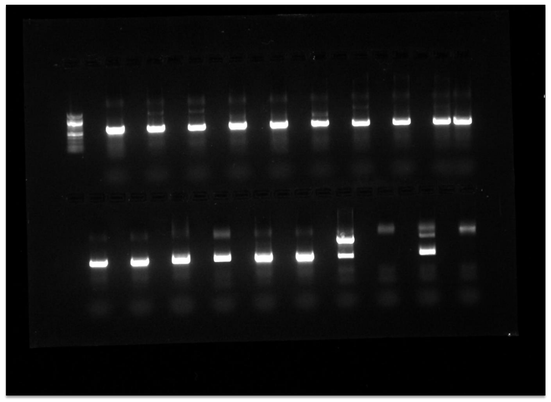
Open Chlorophyll Fluorescence Imager prepared for imaging

Tobacco Plant Analysis

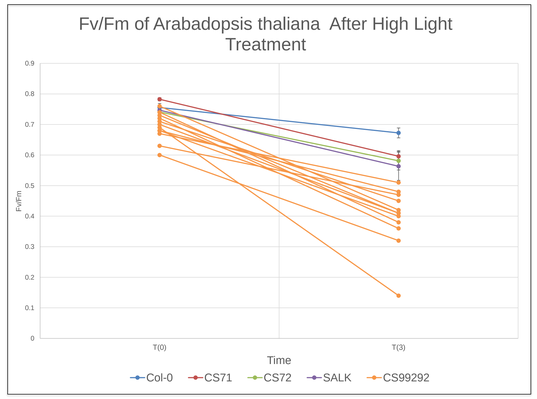


Leaf samples taken from Tobacco Plants

Results



Gel Results of plants of interest from Arabidopsis thaliana strand CS992932.



Graph of Controls for Arabidopsis thaliana line CS99292 and plants of interest

Analysis

- CS99292 plates Yielded 19 plants of interest.
- PCR and Gel Electrophoresis provided us with 18 positive results.
- CS99293 Yielded 16 plants of interest.
- 9 of the plants gave positive results after PCR.

Future Work

- Repeated identification and analysis of candidate genes based on the parameters set here.
- Expand simple parameters to introduce more Complex conditions.
- Send Purified CS99292 and CS99293 plant DNA out for sanger sequencing. s
- Continue sampling of Tobacco leaves for Chlorophyll Fluorescence imaging

References

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2. Sakoda K et al. Towards improved dynamic photosynthesis in C3 crops by utilizing natural genetic variation. J Exp Bot. 2022 May 23;73(10):3109-3121. doi: 10.1093/jxb/erac100. PMID: 35298629
3. Hauser F et al. A genomic-scale artificial microRNA library as a tool to investigate the functionally redundant gene space in Arabidopsis. Plant Cell. 2013 Aug;25(8):2848-63. doi: 10.1105/tpc.113.112805. Epub 2013 Aug 16. PMID: 23956262; PMCID: PMC3784584.

Acknowledgments

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