Genetic Analysis of SUB1: A Drought Resistant Strain of M202 Rice

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Abstract

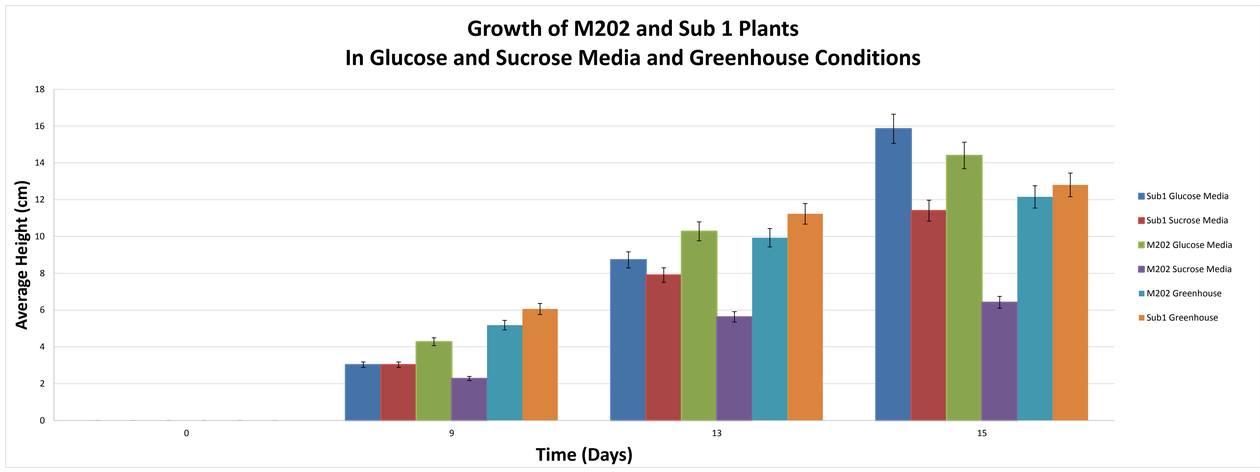
Rice is a staple food all over the world and while drought is severely damaging to this crop, flooding can be just as devastating. This project involves looking at a specific strain of rice plant that is genetically modified to resist flooding. The M202 strain is the original rice plant while the SUB1 strain is the strain we are investigating. Our objective is to determine the effectiveness of this genetically modified strain. This strain is intended to be able to grow more efficient in flooding conditions which has an adverse effect on crops and can very easily destroy crops. Determining the effectiveness of this strain can lead to less crop destruction and an increase in productivity. We looked at the growth of the plants themselves in normal conditions and in flooding conditions for both strains in both greenhouse and tissue culture settings. This also included variations in the media of between glucose-based and sucrose based media for the lab grown plants. It seems that the SUB1 strain does show to be an effective flood resistant strain to some degree. We also looked at the metabolites that are being made during these conditions. Again the SUB1 strain would show improved metabolite production in flooding conditions versus the normal strain. Finally we will used PCR to look at the gene expression of some of genes between the strains. Using these techniques to compare the strains is vital to determining the effectiveness of our SUB1 strain. Our analysis showed that while further testing may be necessary, SUB1 is an effective strain of flood resistant rice.

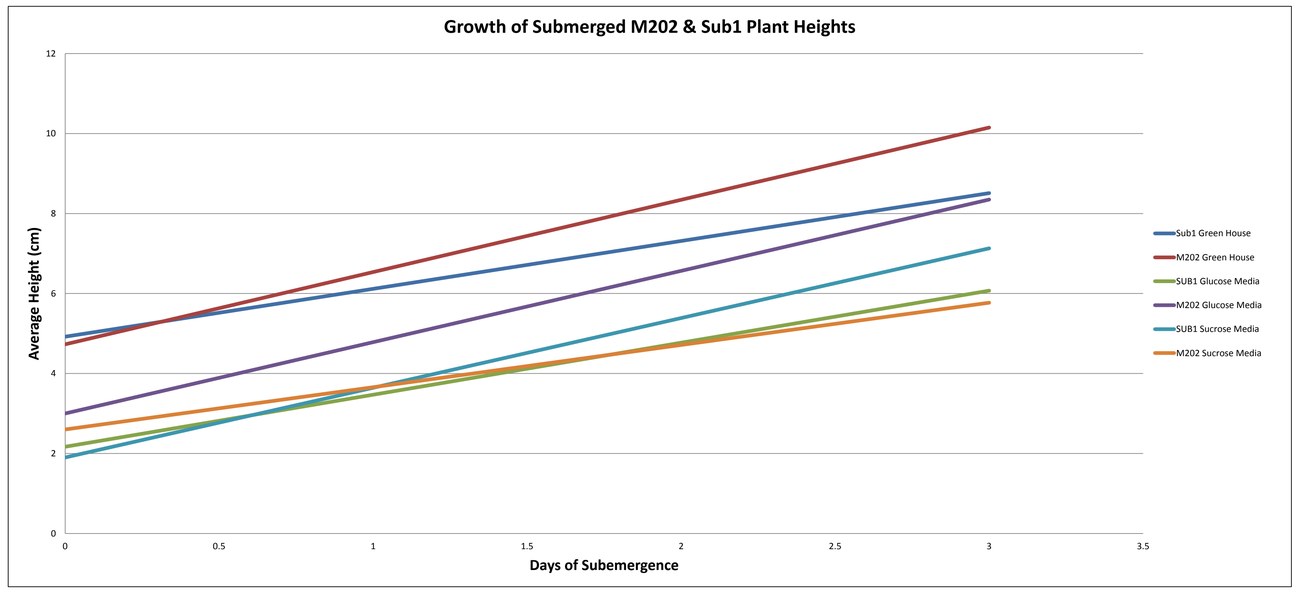
Methods

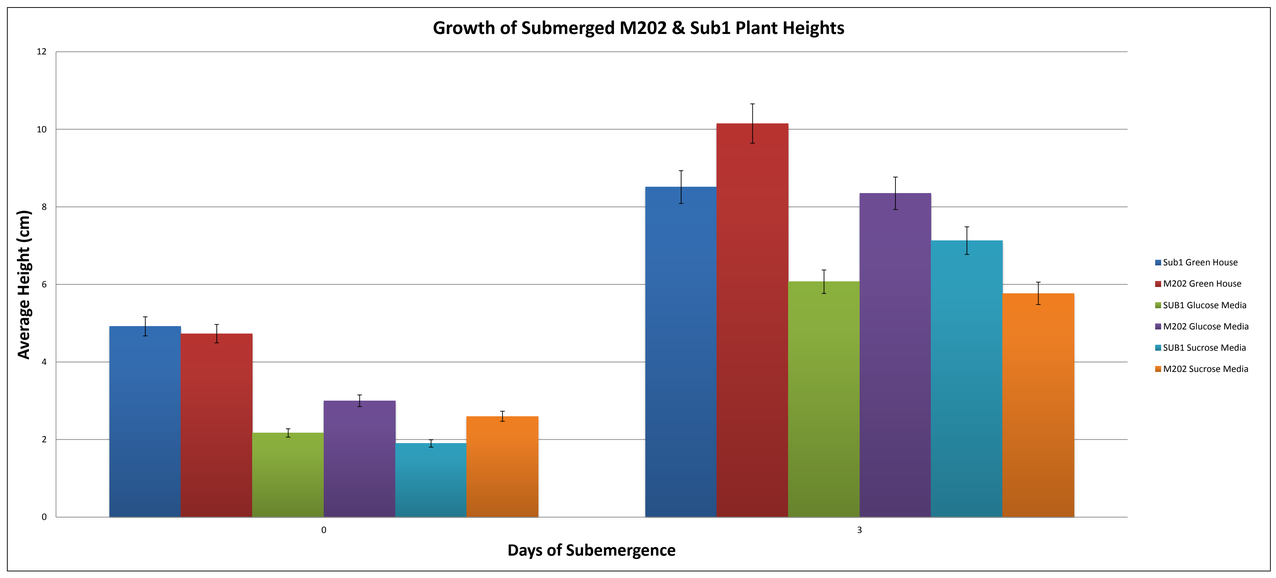
In this experiment, we grew our rice plants in several conditions. We grew both the normal M202 and the SUB1 in normal greenhouse conditions in soil. We then used tissue culture techniques in order to grow our plants in half strength glucose MS media and half strength sucrose based MS media. Plants were then measured at different times to anazlyze their growth. The non-submerged groups of greenhouse plants and the media plants were measured over a period of about two weeks. The submerged plants on the other hand were submerged for three days and were then harvested and frozen for metabolite analysis. The metabolic isolation and analysis involves grinding 100 mg samples with BSA, PVP, and B-mercaptoethanol. When isolated GCMS was performed and metabolites were analyzed. Samples were also kept in order to do RNA extraction. Using an Rneasy kit the RNA was extracted from both root and shoot samples. CDNA was then made from the RNA in order to prepare for PCR.

Results & Conclusion

We took our plant measurements and graphed them to view the relationships. Submergence severely decreases growth overall in all of the experimental groups. However, we wanted to see if SUB1 performed better than the normal M202 strain of rice. In our fifteen day growth test, it seems that the SUB1 strain was able to out grow the M202 strain for our three experimental groups. While the submergence test showed the SUB1 strain perform better in sucrose media, it didn't necessarily show a better submergence growth in the other two groups. However this doesn't discredit SUB1 as a good flood resistant strain of rice. Looking at the overall growth and even the metabolite analysis of the submerged SUB1, we can see that SUB1 is an effective flood resistant strain. Its effectiveness should continue to be measured and compared to other strains. With more work, we could develop better crops and be on the road towards crops that provide for humanity with the least risk of being spoiled by the harsh elements of nature.







Rice Plant (Greenhouse and Soil Conditions)

Rice Plant (Test Tube and Media Conditions)