Biomolecular Characterization of Agronomical Traits in Agricultural Crops

Eden Gonzalez
California State University Monterey Bay
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Faculty Advisor: Dr. Arlene Haffa, California State University Monterey Bay

Site Advisor: Dr. Mark Massoudi, Ag Biotech, San Juan Bautista, CA
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I. Executive Summary

The goal of this project was to extract DNA from agricultural crops for use in Polymerase Chain Reaction (PCR) and DNA fingerprinting. The resulting DNA profiles were used to identify trait based markers and gene variation. By performing a single nucleotide polymorphism (SNP) based assessment using PCR, plants that are resistant or susceptible to a particular virus or bacteria can be identified. This information is useful for plant growers and breeders to increase yields and decrease water and chemical usage by eliminating susceptible plants form use.

II. Project Objectives

The purpose of the project was to determine plant hybrid purity in order to determine which crops are most susceptible to disease, and which are most resistant. All of the clients and data generated from this effort are proprietary and cannot be included in this final report. A potential career pathway that was identified early in this project was that of a Biological Science Technician. This career pathway requires a broad scientific base, which includes biology, chemistry, physics and math. I will be able to complete all of these requirements by the time that I graduate. I have found that the type of work required by me to complete this project was too repetitive on a daily basis. This means that my career goals have changed. I do not think that I would be satisfied with a career that was not varied in nature. The lab manager at this small biotech company only has a bachelor’s degree, but she has several years of experience. This means, that if I were to put in more time on such an effort, I might be able to work my way up the career ladder. Additionally, I could look for another career pathway that only requires a bachelor’s degree, or I could seek additional training.

III. Project Approach

While Ag Biotech processes thousands of agricultural samples in a week (e.g. yesterday I processed 1056 plant samples), there are only 2 employees: the owner and the lab manager. Because the company is so small I was able to see all aspects of the process. It also allowed me to really experience working in a laboratory setting. In order to determine whether or not a plant had particular traits the following process was used. First, DNA was
extracted using aseptic techniques in order to avoid cross contamination of samples. Then it was quantified using a spectrophotometer and prepared for PCR. This includes adding the polymerase, buffer and nucleotides to the reaction. The PCR is performed using an instrument called a thermo cycler, which amplifies a specific sequence of DNA. Data processing includes using a program which groups susceptible or resistant plants together into clusters. Because of the large number of samples processed, there is a need for data management. This included both paper records as well as electronic databases. The data generated by my project helps plants to be more economically valuable due to better genetic resistance to disease, pests and drought. This is useful to farmers and the local economy and helps to protect water as a resource in the region.

IV. Project Outcomes

The actual results of the work that I did cannot be shared due to their proprietary nature. Working on this project has demonstrated to me that it is possible for an individual to start a small biotech with a large initial capital investment. The type of work that is done in this company is more focused that of the genetic research laboratories managed by the USDA; however, the type of work is not drastically different. I realize that in a USDA lab, the broader goals might include cloning or genetic modification of plant species. Because of my experience in this internship I feel better prepared to handle more advanced lab work required for future employment in a biotech lab.

V. Conclusions

The opportunity to have a USDA Watershed Management Internship has given me a chance to familiarize myself with a lot of expensive equipment. It has made me comfortable and capable to work in a laboratory setting. It has also made me see that I could do more than be just a general science technician. I was able to learn the tasks set before rather quickly, but due to the nature of the project I was not able to increase the types of things that I was doing on a daily basis. Perhaps in a USDA lab, my work load would include a wider variety of tasks related to plant genetics. I think that I have learned enough of the basic molecular biology skills that I would feel comfortable moving on to these tasks.
VI. Acknowledgements

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VII. Appendices

(Transferring DNA to a new 96 well plate)