CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
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Project Number
S1814

Project Title
Characterization and Utility of Resistance Sources against Resistance-Breaking Rhizomania in Sugar Beet

Abstract

Objectives/Goals
Rhizomania poses a major problem to sugar beet worldwide, as it not only causes physical harm to the roots but also reduces the quality of sugar yield by up to 95%. Rhizomania resistance sources have long been the best way to protect against beet necrotic yellow vein virus (BNYVV), but new resistance-breaking strains of Rhizomania render the commonly used resistance source, Rz1, ineffective.
1. I needed to determine which resistance source is most effective at lowering virus titer under resistance-breaking BNYVV
2. I compared composite root ELISA values, a commonly used measurement, with individual ELISA values, to determine which is more effective and so develop tools for future projects
3. I examined the effect of temperature as a confounding variable on virus titer

Methods/Materials
I had three phases in my project. In the first phase, I conducted ELISAs to determine the approximate virus titer, and then verified the results with qPCRs, from which I determined the exact virus titer in each sample. Next, I compared the composite root mass ELISA to the individual ELISA data, examining the mean virus titer as well as the spread to find out which is more informative and so useful for scientists. Finally, I examined temperature data during the course of my project and compared it to the ELISA and qPCR results to find any correlation between them.

Results
Phase 1: The Rz5 resistance source had a low average virus titer and small spread, according to the ELISA and qPCR.
Phase 2: Unlike the individual ELISA, the composite root ELISA gave no indication of spread and gave a large range for the median.
Phase 3: The temperature dropped just before the first harvest, which had two resistance sources, and the virus titer for both resistance sources was low.

Conclusions/Discussion
The Rz5 resistance source is the most effective resistance source since it consistently lowered virus titer, and so farmers should use this resistance source to combat the resistance-breaking BNYVV. Instead of using composite root ELISAs, as is traditionally used due to its speed, scientists should conduct individual ELISAs to gain more precise information on virus titer. The temperature drop before the first harvest likely caused a reduction in virus titer since Rhizomania's vector, Polymyxa betae, becomes dormant at low temperatures; hence, temperature is a confounding variable and must be considered in future projects.

Summary Statement
I have determined that Rz5 is the most effective resistance source against resistance-breaking Rhizomania, and developed protocols involving ELISA and temperature for future projects with the resistance-breaking virus.

Help Received
I thank Dr. Richardson and also Dr. Wintermantel for being my mentors for this project. They permitted me to use USDA equipment, and taught me basic laboratory procedures. The experiment was designed and conducted entirely by myself.