



CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

Name(s) Eileen Ma; Sally Zhu	Project Number J1816
Project Title The Impact of Different Types of Bacteria on the Water Conservation and Growth of <i>Lepidium sativum</i>	
<p style="text-align: center;">Abstract</p> <p>Objectives Currently, hundreds of billions of gallons of water are used daily on agriculture across the nation. This project finds how bacteria can affect environmental conditions and promote growth. In natural environments, the bacteria <i>B. subtilis</i>, <i>E. coli</i>, and <i>Serratia marcescens</i> have various interactions with plants, such as through fertilizers and soil. However, there are no rigorous studies that show the effects of bacteria on the water consumption of plants. This project explores the different ways in which these three types of bacteria can impact the water usage of the plant, <i>Lepidium sativum</i>.</p> <p>Methods First, culture the three types of bacteria and make agar plates with the bacteria. Then, plant the <i>Lepidium sativum</i> seeds on the agar plates. After they germinate, count the number of seeds that have sprouted and record the data. After two weeks of consistent watering and controlled sunlight, measure the length of the sprouts and amount of water left in the agar plates.</p> <p>Results We discovered that the seeds with <i>Serratia marcescens</i> used the least amount of water, using around 60% of the amount the control did, then <i>B. subtilis</i>, which used around 30%, the control, and lastly <i>E. coli</i>, which used almost double the amount the control did. However, the germination rates and sprout lengths were not all that different, especially for the germination rates, yet the bacteria had a slightly positive impact on the growth of the plant because the germination rates were still higher than that of the control. Although for both of these aspects, <i>B. subtilis</i> had the highest germination rates and sprout lengths. The results were that overall, the seeds in the petri dish with <i>B. subtilis</i> had the highest growth, and although the dishes had almost identical growth rates, the seeds with <i>Serratia marcescens</i> used significantly less water.</p> <p>Conclusions Because the seeds in the Petri dishes with <i>B. subtilis</i> had the highest germination frequency, this means that those plant living conditions were the best, which could be due to more oxygen, water levels, or pH levels. The seeds in <i>Serratia marcescens</i> had the lowest water consumption levels, which increases productivity in farming by lowering the cost needed to take care of the plants. Moreover, this decreases the amount of fertilizer needed to be used for farmers. Some ways that bacteria promote plant growth are that they ensure that the plants receive all the necessary nutrients, they modulate plant hormones, and protect the plants from pathogens.</p>	
Summary Statement This project tested which bacteria would be the most water conservative and promoted the most growth in Garden cress seeds.	
Help Received I used the lab equipment at The Harker School under the supervision of Ms. Peng and Dr. Engeszer. They explained the details of bacterial dilutions and growth.	