



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

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<b>Project Title</b> <b>The Power of Soil Productivity</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> The purpose of this project was to find the major cause of the growth differences between the two lemon trees in my backyard.</p> <p><b>Methods</b> I used the Carolina Physical and Chemical Properties of Soil kit to study the soil samples from the two lemon trees. I tested five factors that influence soil productivity: particle size, water-holding capacity, soil permeability, free ions (pH, N, P and K), and ion exchange capacity. I collected soil samples from 5 sites around the root spread of each tree and tested 3 repeats per sample for a total of 15 samples per tree and 30 samples total. My 3 controls were clay, sand, and humus. For particle size distribution, 30 jars were filled halfway with one sample per jar. Water was added to the brims and one drop of dish detergent was added to each jar. The jars were shaken and settled overnight. I measured the widths of the settled layers and used the Soil Analysis Triangle to determine soil type. Soil permeability was measured by timing how long it took 10 mL of water to pass through 33 dry and 33 wet soil sample columns. Water-holding capacity was measured by allowing 33 dry samples to absorb water overnight and calculating the weight of water that was absorbed. Chemical indicators were used in the analysis of free ions to determine pH, N, P and K levels. Ion exchange capacity was tested by washing Crystal Violet and Eosin Y through 33 sample columns per dye. The volume of water added, the color intensity of the filtered water, and the ion exchange chart were used to determine ion exchange capacity.</p> <p><b>Results</b> My results show that the soil samples from the good lemon tree were silty loam and contained higher levels of clay and humus compared to the soil samples from the bad lemon tree, which were sandy clay loam. The higher level of humus in the good samples resulted in higher soil permeability and water-holding capacity. The higher level of clay in the good samples resulted in higher ion exchange capacity. All the soil samples have an ideal pH level and enough N, P, and K.</p> <p><b>Conclusions</b> My results support my hypothesis that soil productivity is the major cause of the growth differences between the two lemon trees. The bad soil can be improved by adding a humus and clay mixture to increase soil permeability, water-holding capacity, and ion exchange capacity. The results of this study can benefit homeowners and farmers who are having trouble growing their plants.</p>	
<b>Summary Statement</b> I investigated the cause of the growth differences between the two lemon trees by testing five factors that influence soil productivity.	
<b>Help Received</b> My science teacher, Mrs. O'Brien, guided me through the entire process. Dr. Arthur Jia from UC Riverside assisted me with the statistical analysis.	