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The Effects of Light Intensity and Color Absorption of Diurnal Leaf Movements of Malva parviflora

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Natural microorganisms' effect on the growth of *Lasthenia californica* in post-fire soil

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Abstract:

The effect of microorganisms in post-fire soil on the growth of *lasthenia californica* was studied by comparing growth in natural soil versus autoclaved soil. It was hypothesized that the seeds from the natural soil would have more growth because the microorganisms have a symbiotic relationship with the plants. Seeds were grown in similar conditions in both autoclaved and natural soil. After 44 days, the plants were uprooted and split into shoots and roots. Shoots and roots were then biomassed. The natural soil had a total shoot biomass of 3.031g and a total root biomass of 89.554g, while the autoclaved soil had a total shoot biomass of 1.731g and a total root biomass of 21.4492g. The results were consistent with the hypothesis showing that microorganisms do have an effect on the growth of lasthenia californica. This is valuable information for any post-fire recovery. If the fire was hot enough to kill the microorganisms, it might be more conducive to *lasthenia californica* growth to add microorganisms back to the soil.

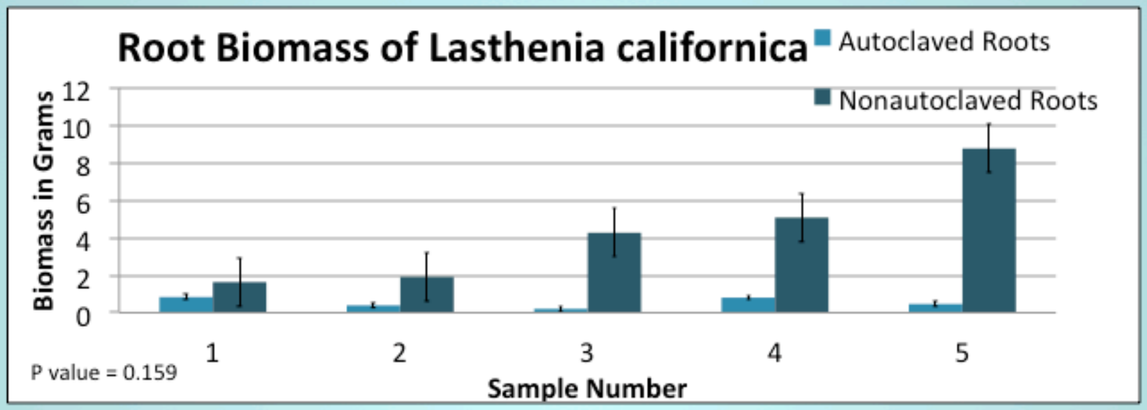
Introduction:

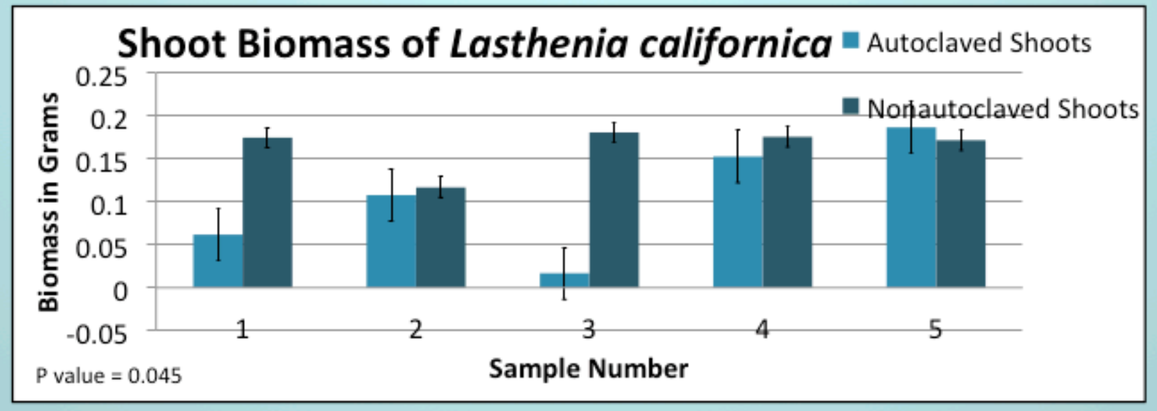
A plant's ability to produce large amounts of biomass and store carbon is dependent on their interactions with these microorganisms such as mycorrhizal fungi. These microorganisms significantly improve photosynthetic carbon assimilation by plants and approximately 85 percent of all plant species are dependent on such interactions to thrive. Mycorhizal fungi that grow on or within roots are protected from competition with other microorganisms and gains access to excess carbohydrates given off by the plant. In exchange, the mycorrhizal fungi are able to obtain necessary, but scarce, nutrients such as phosphate and nitrogen. Most of these nutrients are transferred to the growing plant, and therefore, the symbiotic relationship is established. To quantitatively test the effect of natural microorganisms on growth of a California sunflower, *Lasthenia californica*, the growth can be compared to *Lasthenia californica* growth in autoclaved soil. By autoclaving the soil all of the microorganisms within the soil will be killed, and therefore, the symbiotic relationship will not be present.

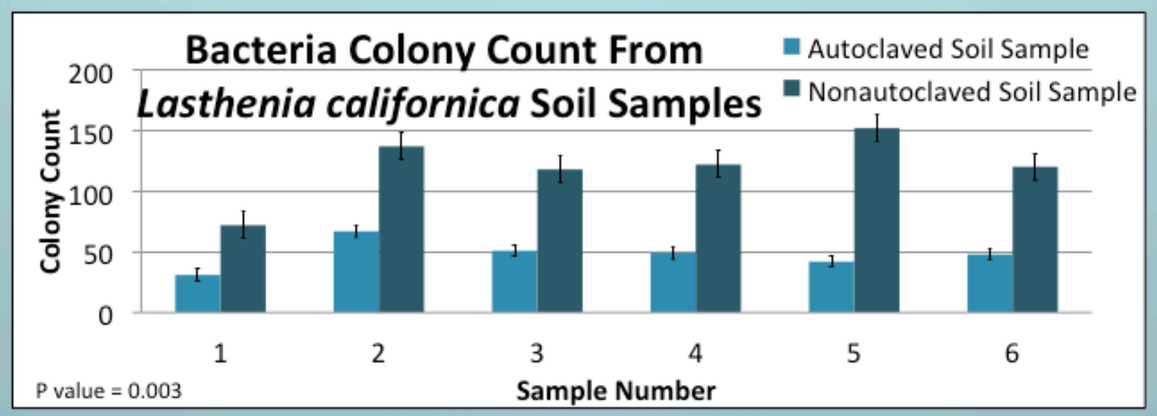
Comparing visual root growth of autoclaved (left) vs. natural soil (right) shows a significant difference

Method:

Soil was collected from a post-fire site of the Santa Monica Mountains near Pepperdine campus. After mixing the soil, half was autoclaved to kill any microorganisms in the soil. Using sterile equipment, fifteen plastic planting pots were filled with 400mL of autoclaved soil and fifteen with 400mL of the natural soil. *Lasthenia californica* seeds were planted into five holes four centimeters in depth of each container. The seeds were then allowed to germinate and grow in a controlled growth chamber for six and a half weeks receiving equal amounts of water every 2-3 days. A 1mL soil sample in 10mL of H2O dilution was applied to an agar petri dish. The dishes were allowed to cultivate and bacteria colonies were counted after 48 hours. The number of sprouts was counted, and the biomass was taken of the shoots and roots of each container.







Conclusion:

Lasthenia californica grows better in natural versus autoclaved soil due to the presence of microorganisms. Both shoot and root biomasses were significantly different between the two soil types. Also, comparisons of pots with the same number of sprouts showed the natural soil to have a higher biomass. This means that microorganisms do have a significant effect on some aspects of the growth of this plant. Results indicated that soil with more bacteria tended to yield better biomass results. Both bacteria isolation and root biomass data was statistically significant, so it can be assumed that that autoclaving the soil had a negative effect on bacterial growth and root growth. However, shoot growth cannot be considered significant. This indicates that although the plants may appear the same, plants with bacterial aid may have better root coverage giving them better survivability and a significant advantage over plants which do not have these bacteria. Our results indicated that bacteria likely play a very important role in plant development, but identification of types of bacteria is needed to determine which type of bacteria is doing what. In order to promote growth of *lasthenia californica* after a fire was hot enough to kill off microorganisms, it seems that it would be best to reintroduce microorganisms to the soil. An appropriate way to continue this research would be to actually introduce microorganisms to post-fire soil in the field and track the growth of the plants to test the hypothesis the results of this experimentation has prompted.

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