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The Effect Of Hydraulic Lift In Quercus agrifolia On The Health Of Venegasia carpesioides

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The Effect Of Hydraulic Lift In *Quercus agrifolia* *On The Health Of Venegasia carpesioides*

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Abstract

Hydraulic lift was studied in live and dead Quercus agrifolia (Coastal Live Oak) in order to test its impact on surrounding Venegasia carpesioides (Canyon Sunflower). Hydraulic lift causes soil moisture to rise around the base of deep-rooted plants where neighboring plants can utilize this excess water. We predicted that the hydraulic lift of the Coastal Live Oak would increase soil moisture, causing higher stomatal conductance and higher water potential in nearby plants. P-values of .5258 and .6392 indicated there were no significant differences in soil moisture or in stomatal conductance of the Canyon Sunflowers. A p-value of .0378 showed a significant difference between the water potentials of the Canyon Sunflowers found around the live trees and dead trees. This shows there is a correlation between hydraulic lift and surrounding plant health.

Introduction

We studied the effects of hydraulic lift in Coastal Live Oak on the health of surrounding Venegasia carpesioides (Canyon Sunflower). Hydraulic lift is the movement of water from deep roots to the topsoil as the stomata closes and the water status of the roots and leaves reach equilibrium (Horton, 1998; Hydraulic, 1993). The topsoil water becomes available to smaller neighboring plants that do not have access to deep root water (Richard, 1987). Previous experiments have shown that surrounding plants of Maple trees can obtain up to 60% of their water from the Maple (Dawson, 1996). There should be less topsoil water around dead Coastal Live Oaks because they are not able to perform hydraulic lift. We hypothesized that the increase in soil moisture around the live Coastal Live Oak would then cause higher stomatal conductance and water potential in the surrounding Canyon Sunflowers.

Figure 1 Soil Moisture Surrounding Live and Dead Oaks

Figure 2 Stomatal Conductance In Canyon Sunflower

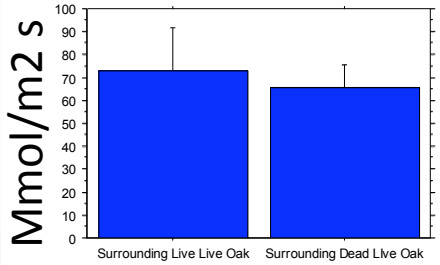
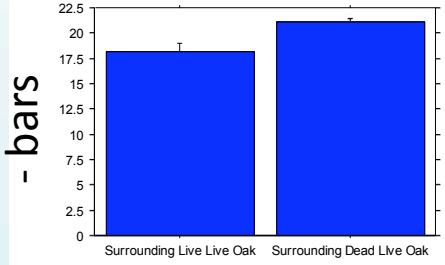


Figure 3 Water Potential in Canyon Sunflower



Methods

We worked in Solstice Canyon where a fire had burned the previous year. We tested 5 live and 5 dead Coastal Live Oak trees that were at least 15 feet apart. The dead trees had to be scarred or burned from a fire with no green leaves present. The soil moisture was tested around each Coastal Live Oak using the Hydroscence meter. Three Canyon Sunflower plants were tested around each Coastal Live Oak at distances of 1,3, and 5 feet away from the tree. The stomatal conductance was measured using a diffusion porometer (Decagon Devices, model SC-1) and then that same leaf was collected and placed in a sealed bag to be tested for water potential. Three days later we tested the water potential of the leaves using the Scholander-Hammel Pressure Chamber. We performed a two-tailed, paired t-test on each of the three sets of data, including all five sets of stomatal conductance data which were organized into three sets of means.

Discussion/Conclusions

We had predicted that the hydraulic lift of the Coastal Live Oak would increase soil moisture, causing higher stomatal conductance and a higher water potential in nearby plants. The data showed a significant difference in the water potential (Figure 3), but did not show a significant difference in soil moisture and stomatal conductance (Figure 1 and 2). There could be many explanations for this disagreement in data. For example, the amount of sunlight exposure or time of day could have been taken into account. It may be noted that regardless of the Canyon Sunflower's position under the dead or live Oak, the further the plant was from the base of the Oak, the higher the stomatal conductance, which is another factor to consider for future research. Though our hypothesis may not be supported, it may not be rejected either. The significant difference in water potential between the plants surrounding live and dead Coastal Live Oak suggests that the hydraulic lift of the Coastal Live Oak does affect nearby plants. There is still a lot unknown on this topic and we believe further research could provide more clear and concise answers to our questions.

Literature Cited

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