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Stem Mechanical Strength in Thinned versus Non-thinned Ceanothus spinosus, KSP

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Abstract

What effect does the thinning of chaparral around building structures have on plant health? More specifically, does the thinning of *Ceanothus spinosus* influence mechanical strength? The ability of our native chaparral to withstand environmental factors, such as the Santa Ana winds, and overall health is directly related to plant strength. Seeking to answer these questions, we hypothesized that a difference in water potential between thinned and non-thinned chaparral affects the stem mechanical strength of the plants. We believed that thinned *C. spinosus* due to greater hydration will be mechanically stronger than non-thinned chaparral. The knowledge of what helps chaparral to be stronger and healthier can be used to further the understanding of plant survival after a wildfire. We collected *C. spinosus* from thinned and non-thinned areas on Drescher campus at Pepperdine University and brought them back to the lab to measure the stem mechanical strength using the Instron and the Scholander-Hammel Pressure Chamber. After performing our research on the *C. spinosus*, we found that, although our data reflected higher mechanical strength in the thinned chaparral, the difference was not significant enough to support our hypothesis.

Introduction

When a fire comes, firefighters rely on thinned vegetation surrounding buildings to aid in saving the structure. In addition to fighting fires, the fire department is responsible for maintaining reduced fuel loads around building structures. This affects the water potential of the plants, causing those that are thinned to be more hydrated.

Our hypothesis is that thinned chaparral will have greater stem mechanical strength due to increased hydration. The knowledge of what helps chaparral to be stronger and healthier can be used to determine whether or not thinning can influence the plants' relationship with environmental factors. The plant specimen used was *Ceanothus spinosus*, which was collected on Drescher campus. We collected *C. spinosus* from thinned and non-thinned areas and measured the stem mechanical strength using the Instron.

Materials and Methods

In determining (and confirming) the difference in hydration levels between thinned and non-thinned chaparral, stems were collected and the water potential was recorded using the Scholander type pressure chamber. The light level and wind speed was recorded in the thinned chaparral area, as well as the non-thinned area. Sample branches were collected, each approximately the diameter of a pencil-all petioles were clipped. The Instron mechanical testing device was then used to test the mechanical strength of each sample.

Results

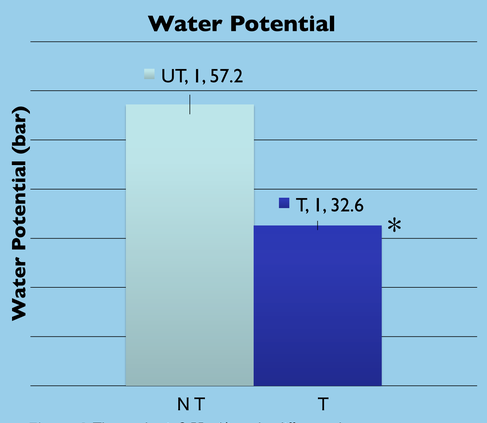

Figure 1: The p-value is 3.55e-6*, so the difference between water potential (bar) in UT and T is significant

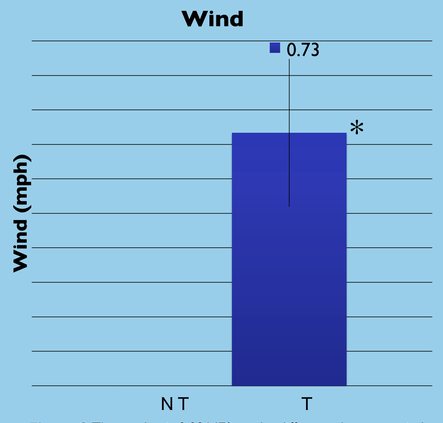

Figure 2: The p-value is 0.00647*, so the difference between wind (mph) in UT and T is significant

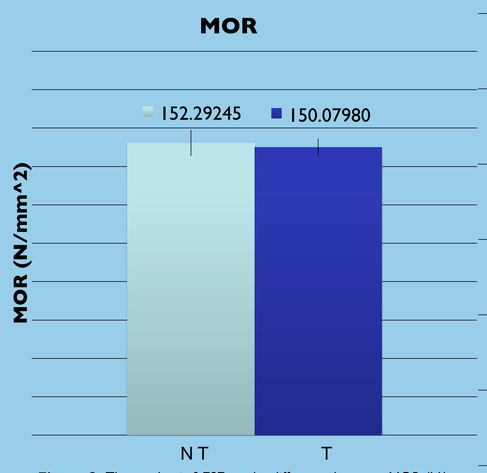

Figure 3: The p-value is 0.787, so the difference between MOR (N/mm²) in UT and T is not significant

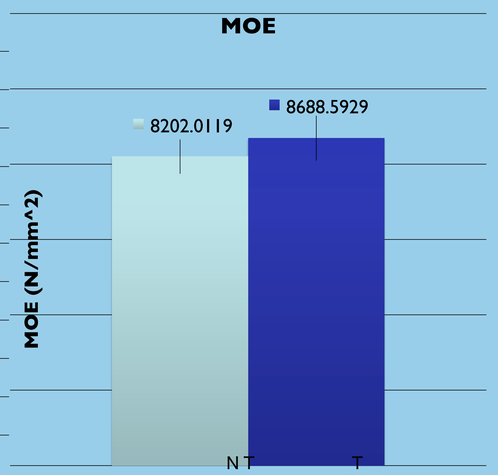

Figure 4: The p-value is 0.524, so the difference between MOE (N/mm²) in UT and T is not significant

Measuring Stem Mechanical Strength using the Instron machine

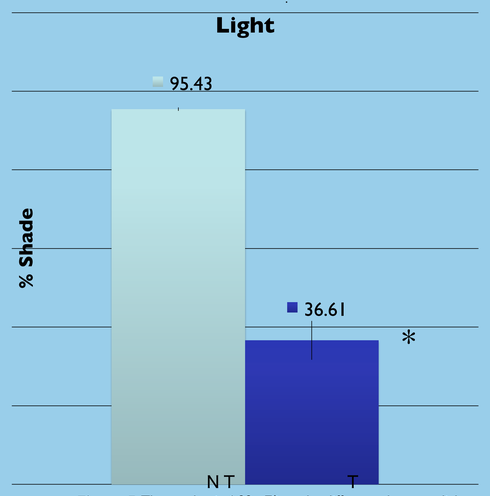

Figure 5: The p-value is 6.22e-7*, so the difference between light (% shade) in UT and T is significant

Study Site

Thinned and Non-thinned chaparral at Drescher campus

A clipped *Ceanothus spinosus* stem at the study site

Discussion

- Thinned chaparral was significantly more hydrated due to less competition among branches
- Thinned chaparral was exposed to significantly greater light and wind due to a lack of surrounding vegetation
- Slightly higher, yet insignificant, difference in mechanical strength in thinned chaparral
- Large variability in MOR (Modulus of Rupture) and MOE (Modulus of Elasticity) values could be a factor in insignificant data
- Selection of non-thinned chaparral at the edge of the thinning threshold rather than that located deeper may have influenced results due to increased hydration (less competition) at the edge

Conclusion

It was found that Light, Wind, and Water Potential do not influence the mechanical strength of the plant. No conclusions can be drawn concerning the hydration to the mechanical strength. The thinning of chaparral does not appear to influence the mechanical strength of *C. spinosus*.

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Acknowledgements

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Research Project Group Picture