

Interactions of Mycorrhizae, Native Grasses and *Quercus douglasii* in California's Blue oak woodlands

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Introduction

Many studies have been done in an attempt to answer the question of why *Q. douglasii* is not regenerating throughout California, yet to date, no solid evidence has surfaced.

Over the past 500 years the California landscape has dramatically changed. California's millions of acres of 'Golden Hills' that are found in the central valley and adjoining foothills are now 90%-95% non-native annual grasses and other plant species. As a result California's native perennial bunch grasses that once dominated the landscape are now rare.

Most all plant families have mycorrhizal associations between their roots and fungal hyphae strands existing in the soil. The roots of the plants and fungal hyphae work together symbiotically. The fungal hyphae come into direct contact with the plants roots; the penetrating endomycorrhizae contacts the cellular membrane within the plant root to increase overall surface area. These sites are known as infection sites. The fungal hyphae bring in nutrients and minerals directly into the plant root, and in exchange receive sugars that were produced by the plant.

In this study, rate of infection sites along the roots of *Q. douglasii* seedlings planted under different treatments.

H₁: Grass species affects the rate of mycorrhizal infection in *Q. douglasii* seedlings.

H₀: Mycorrhizal infection rate of *Q. douglasii* is independent of grass species.



Methods

Trial 1 (Spring 2013): 30 trees pots were split into 3 groups consisting of 10 pots each. The 3 groups were called N (Native, perennial grass), C (Control) and NN (non-native, annual grass). Native grasses consisted of a mix of *Stipa pulchra*, *Elymous glaucus* and *Bromus carinatus*. Annual non-native grass was seeded using hayseed. *Q. douglasii* acorn were placed in each of the 30 pots. Experiment was conducted at Butte Community College in the open-air greenhouse in the Horticulture department. After 3 months, root samples were taken from the saplings and stained to highlight mycorrhizae if present.

Trial 2 (Fall 2014): 90 bag pots were assembled into the same 3 groups as Trial 1, consisting of 30 pots per group. Pots were filled with soil collected from the Butte College Blue oak woodland. Experiment was conducted at the Humboldt State University Research Greenhouse in Arcata, Ca.

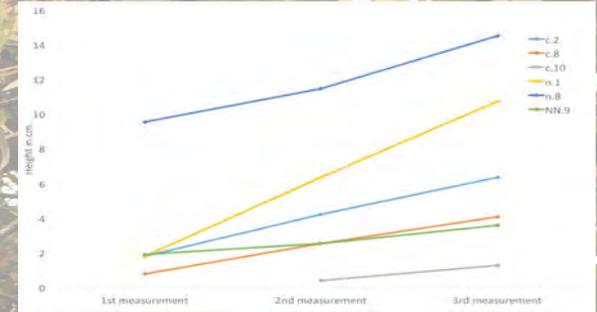
Trial 3 (Winter 2015/Spring 2016): 90 bag pots were assembled into 3 groups of 30 pots each. The 3 groups were the same as in Trial 1 and 2. Pots were filled with on site soil collected under a single Blue oak where all the acorns were also collected. Native grasses consisted of a mix of *Stipa pulchra*, *Elymous glaucus* and *Bromus carinatus*. Non-native grass plugs were used from onsite. Experiment is currently being conducted near the Table Mountain Ecological Reserve in Cherokee, Ca.

Results

Trial 1: Out of the 3 groups of trees the NN (non-native grass) group only yielded 1 tree. As such, no conclusions can be made, as there is not enough data.

Trial 2: 0% germination.

Trial 3: Experiment in progress.



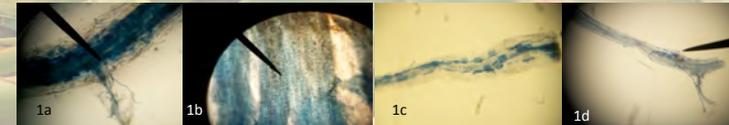
Root Staining

1a: Arbuscule C#10

1b: absence of mycorrhizal hyphae NN#9

1c: Arbuscular mycorrhizae C#10

1d: Mycorrhizae N#6



Conclusions

Trial 1: Although there appeared to be a trend in over all tree growth and health depending on treatment, there is not enough data to support any conclusions. More data needed, repeat experiment.

Trial 2: 0% germination likely due to experimental location. The average humidity for the Blue oak woodland is ~17% and Arcata has an average of 70-80% humidity. Fungus overtook the acorns before they could germinate. Repeat experiment.

Trial 3: Still in progress.