Determining the Distribution of Ectomycorrhizal Competitors in Current and Potential Truffle Orchards in Southern Idaho

Natalie Carreon
University of Idaho: College of Natural Resources

McNAIR PROGRAM
TRIO INSPIRE

INTRODUCTION

Tuber's ability to produce truffles relies on various factors, including the presence of competing ectomycorrhizal (ECM) fungi like Hebeloma and Scleroderma, which are linked to low truffle yields. Establishing truffle orchards in southern Idaho (SI) is promising due to favorable soil pH and a Mediterranean-like climate. The region's vegetation, primarily sagebrush steppe, consists of native plants that form arbuscular mycorrhizae (AM), indicating a potential lack of ECM competitors that could hinder Tuber species, thereby enhancing truffle viability. However, the distribution of ECM host plants in SI is largely undocumented, particularly as ECM hosts are typically restricted to upland mountainous areas. This highlights a critical gap in understanding the region's ECM fungal composition. This research aims to investigate the abundance of ECM host plants and their effects on ECM competitor composition and Tuber abundance, alongside the influence of soil pH and organic matter percent (SOM%) at varying depths. Seven SI sites were sampled, including four agricultural sites (R&E centers) and three aspiring truffle orchards (see Fig. 1). Soil samples were analyzed using quantitative, molecular, and bioinformatic techniques to identify ECM fungi, characterize soil properties, and assess the potential for truffle cultivation in SI

HYPOTHESIS

1. Native and crop vegetation in SI is largely not ECM, so an increase in ECM host plant abundance will lead to a corresponding increase in ECM competitor abundance.
2. A decrease in soil organic matter (SOM%) and an increase in pH will result in a decrease in ECM competitor abundance.

SOIL ANALYSIS

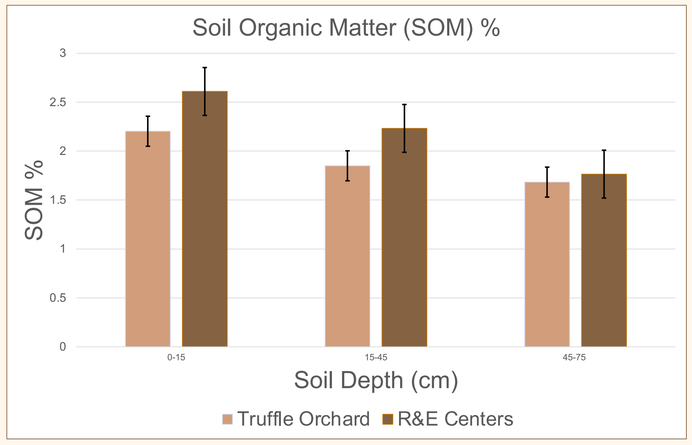

Figure 2. pH Differences between Truffle Orchards and R&E Centers

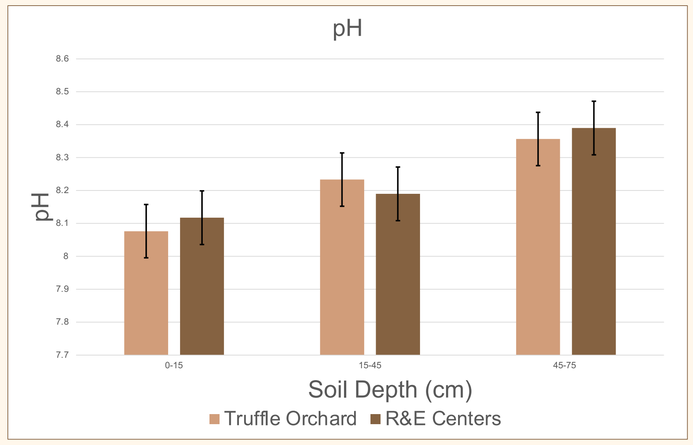

Figure 3. SOM% Differences between Truffle Orchards and R&E Centers

ECM COMPETITOR ANALYSIS

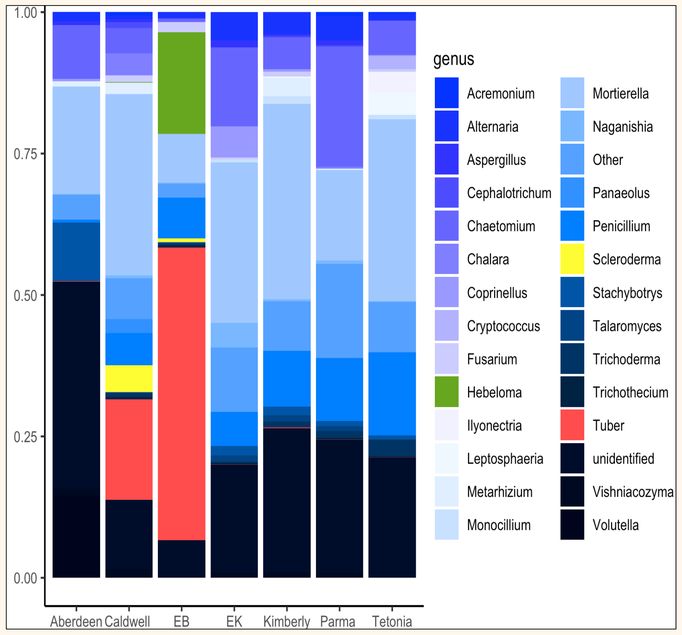

Figure 4. Relative Abundance of Fungal Genera Across all Sites, classifying genera < 0.09% as "other"

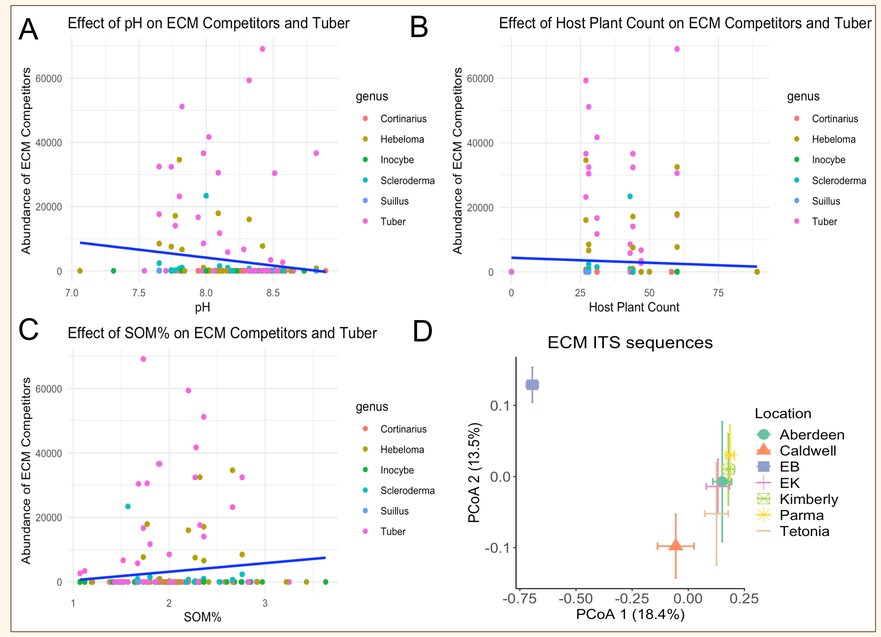

Figure 5 . A-C Effects of pH, SOM%, and Host Plant Count on ECM Competitor and Tuber Abundance. D. Principal Coordinate Analysis (PCoA) of Effects of Location on ECM ITS Sequences

METHODS

Sampling
- Agricultural sites located in Parma, Kimberly, Aberdeen, and Tetonia
- Orchards located in Caldwell and Eagle (EK and EB)

Plant Survey
- PlantNet and MycoDB Database for species identification and mycorrhizae association

Soil Analysis
- pH and LOI analysis

Molecular Analysis
- DNA Extraction and PCR
- Sequencing with illumina

Bioinformatic Analysis
- UNITE and FungTraits Database for Taxonomic and Functional Assignment

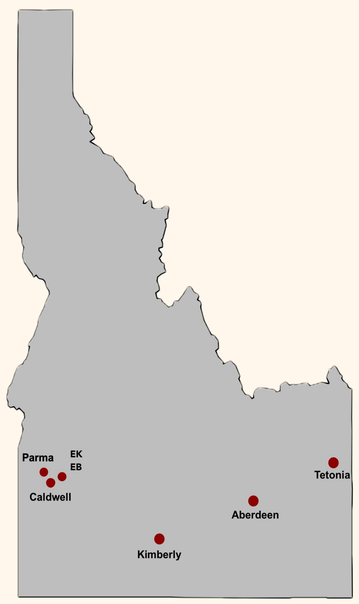

Figure 1. Sampling Sites across Southern Idaho

CONCLUSION

- Differences in pH and SOM (%) between truffle orchards and R&E centers were not statistically significant (p-values of 0.9214 and 0.15, respectively). In contrast, the count of ECM host plants showed a significant difference (p-value = 0.02894) because truffle orchards were the only sites that hosted ECM plants, including trees such as oak and hazelnut.
- Predominant ECM competitors observed in this study were *Hebeloma* and *Scleroderma*, with *Hebeloma* being the most abundant in 2 of the 3 truffle orchards.
- Results from the statistical analysis indicated that hypotheses 1 and 2 were not fully supported; however, it is demonstrated that adding ECM hosts increased ECM competitor abundance at 2 of the 3 orchard locations (see fig 4). It is important to note that EK is a young plantation, and sampling more than 0.5 m away from the inoculated trees may not yield ECM fungi. Only hypothesis 2 was not supported by the data

REFERENCES

ACKNOWLEDGEMENTS

Faculty Mentor: Dr. Mark Coleman
Contributors: Strickland Lab

Contact: Carr9017@vandals.uidaho.edu

This publication was made possible by the TRIO Inspire McNair Program