Study of Soil Microbial Biomass and Soil Moisture in Loblolly Pine Stand

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Abstract

Loblolly pine is the most widely distributed native planted tree in the southeastern United States. Many studies have suggested that limited soil nitrogen (N) level and drought can contribute to pine decline. A study was carried out to inspect the microbial biomass carbon to nitrogen ratio (MB-C: N ratio) and soil C: N ratio to determine the decomposition rate of organic matter that results in either the release of N through mineralization or its immobilization. We collected the soil samples in the winter, spring, summer and fall from fifteen different plots starting from January 2016. There was a significant difference between the MB-C:N ratio and soil C:N ratio measured during different sampling seasons. In every season, soil moisture in each plot was observed to be lower than the previous season.

Introduction

Microbial Biomass (MB)

- Organic material in living bacteria, fungi, ascomycetes, etc.
- Involved with plant residue decomposition and subsequent release of plant nutrients to the soil.
- Measured by the amount of Carbon (C), Nitrogen (N) and Phosphorus (P).

Soil C:N ratio

- When there is less N in relation to C (soil C:N>24:1) then the microbes in soil utilize the N for further decomposition. Hence, the soil N is immobilized and unavailable for plant uptake.

Fig 1:Collecting microbial biomass

Objective

- To assess soil microbial biomass C:N ratio, soil C:N ratio, and soil moisture in *Pinus taeda* stand.

Materials and Methods

- Microbial biomass was collected by taking soil samples from the top 10 cm at Eufaula, Alabama (Fig. 1 & 2).
- Microbial biomass C and N present in each plot was determined by Chloroform Fumigation Incubation (CFI) method (Fig. 3).
- Soil moisture was measured.

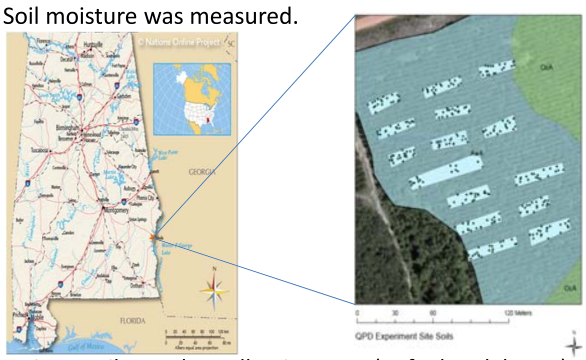

Fig 2: Soil samples collection area (Eufaula, Alabama)

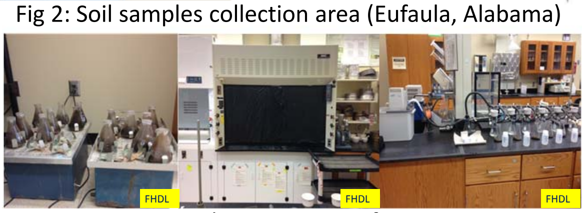

Fig 3: Laboratory setup for CFI

Results

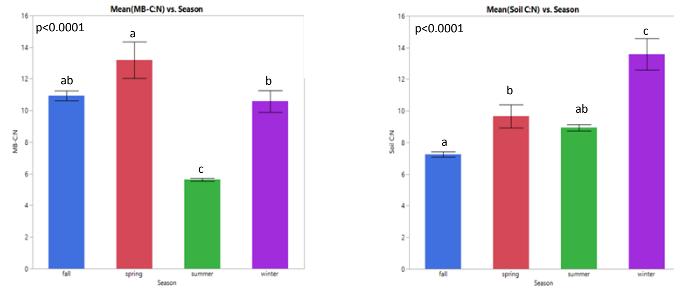

Fig 4: Mean value of MB-C:N ratio and soil C:N ratio measured during different sampling seasons. Error bars represent standard error of the mean. Letters are from Tukey's HSD at 95% CI.

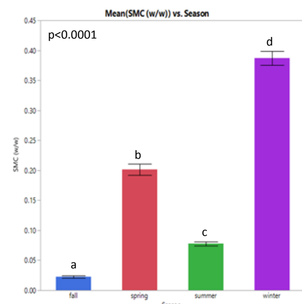

Fig 5: Mean value of soil moisture content (SMC) measured during different sampling seasons. Error bars represent standard error of the mean. Letters are from Tukey's HSD at 95% CI.

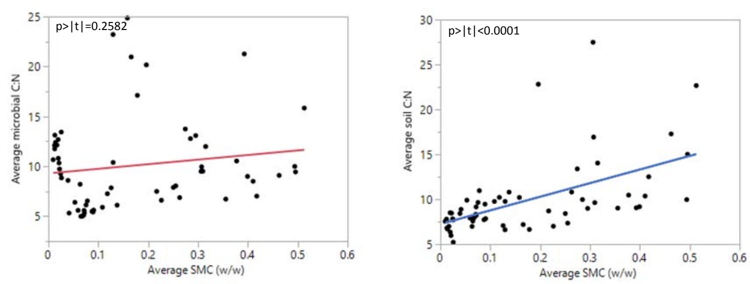

Fig 6: Bivariate fit of MB-C:N ratio by SMC and soil C:N ratio by SMC respectively.

Summary

- There is a significant difference in microbial biomass C:N ratio, soil C:N ratio and SMC measured during four collection periods (p<0.0001).
- Average soil C:N ratio< 24:1 represents that the plots are undergoing N-mineralization and N is available for plant uptake.
- MB-C:N ratio was not affected by SMC (P> |t|= 0.2582 at 95% CI) while soil C:N ratio was affected significantly by SMC (p>|t|<0.0001 at 95% CI).

Reference

- Vance, E.D., Brookes, P.C., and Jekinson, D.S. (1987). An extraction method of measuring soil microbial biomass carbon. Soil Biology and Biochemistry, 703-707.

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