# Study of soil microbial biomass and soil moisture in loblolly pine stand

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# Background



Eckhardt, 2003

# Soil microbial biomass (MB)

- Total population of active microbes in the soil (bacteria, fungi, etc.) at the time of sampling
- Measured by amount of C and N
- Residue (C) decomposition
- Nitrogen (N) cycling and mineralization
- Indicator of soil quality
- Early indicator of changes in total soil carbon and soil properties

# Objectives

- To determine the change in MB after inoculating trees with different densities of *Leptographium terebrantis*

- To determine the changes in MB during different sampling seasons

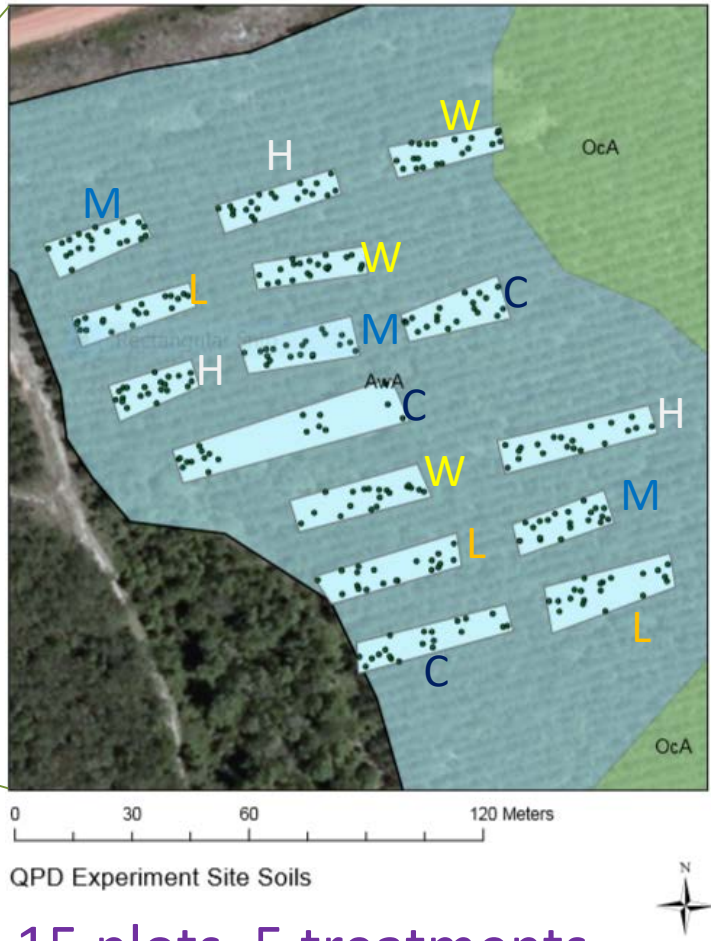
# Hypotheses

- Inoculation of loblolly pine trees with *L. terebrantis* will significantly affect the microbial community in the forest floor due to the blocking of vascular bundles, resin soaking of roots and death of fine roots which will affect the transportation of the carbon and exudates from roots into the soil

- Different inoculum densities will have different impact on microbial biomass quantity

- Microbial biomass will be affected by sampling season

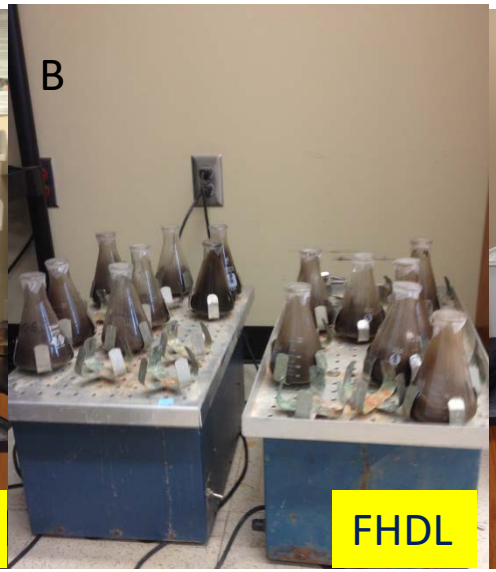
# Project site in Eufaula, Alabama


15 plots, 5 treatments and 3 replicates

# Materials and Methods (Microbial biomass)

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

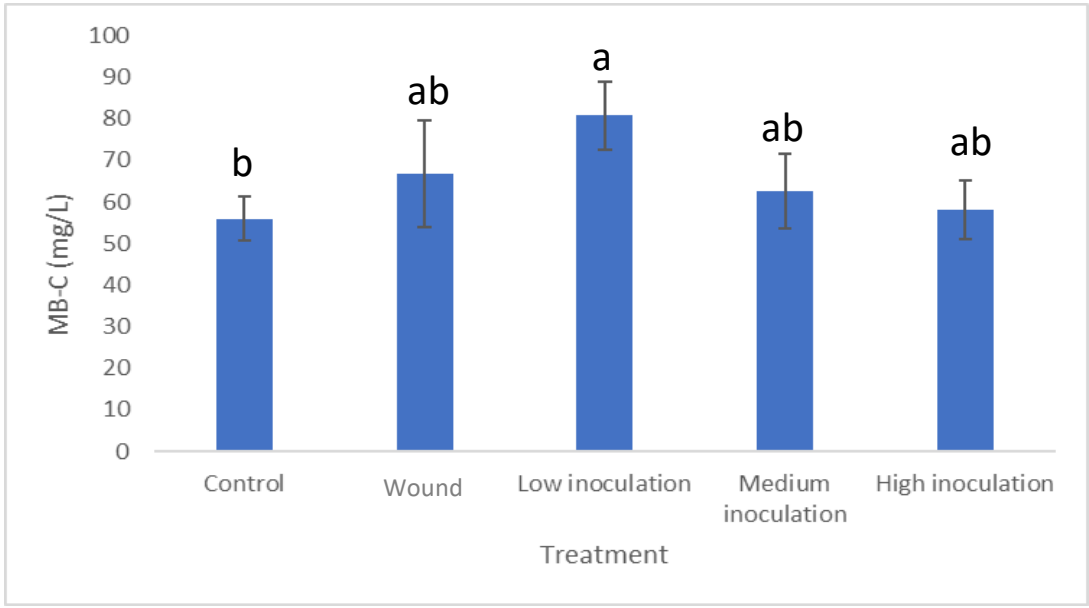




# Materials and Methods (Ectomycorrhizae)

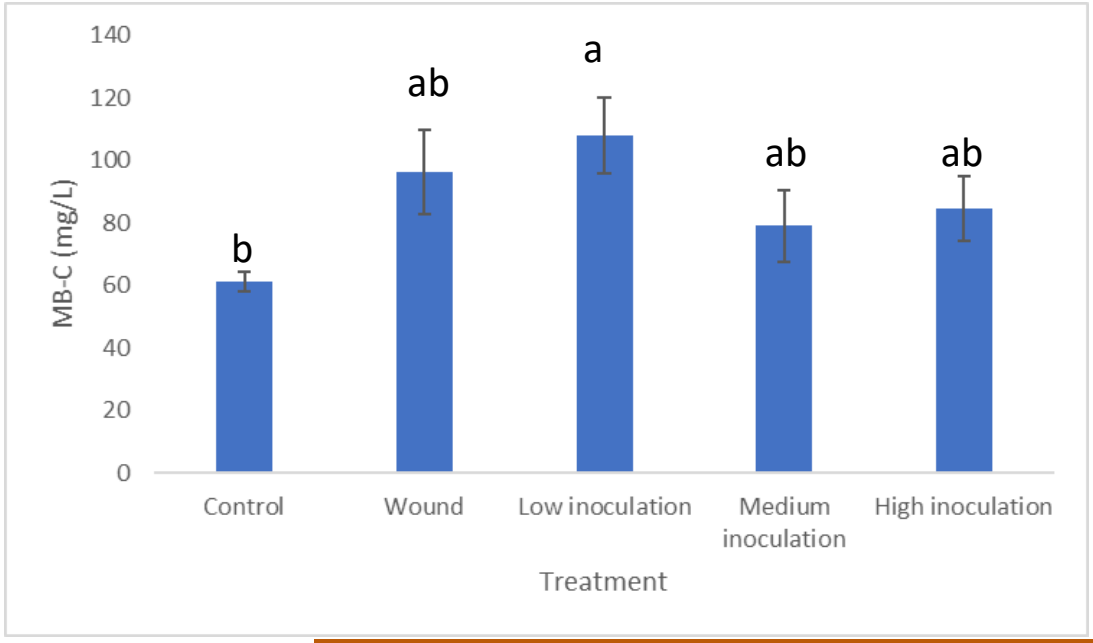
- Ectomycorrhizae (EM) was collected by taking 50 cm deep soil cores from the planting row
- Soil core was cut in 10cm increments and top 10cm was discarded
- Roots washed free of soil by running water, using 0.5mm sieve
- % fine root colonization by EM accessed by roughly sampling hundred 1-cm root segments/10cm soil core increment
- Mycorrhizal root tips identified and quantified with dissecting microscope at 10-40 times magnification, using gridline intercept method

# Results (MB-C)

Before inoculation

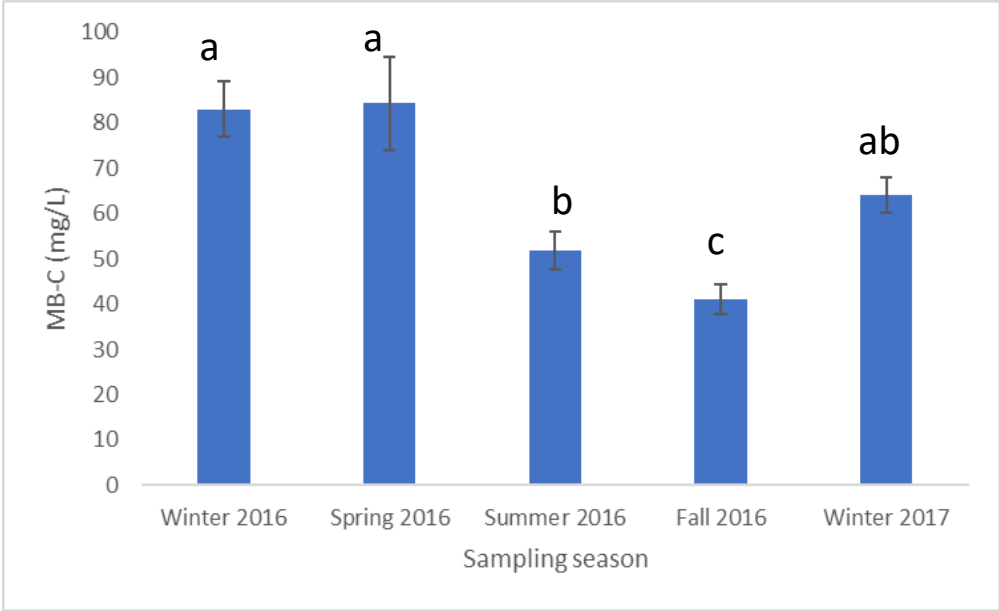



After inoculation

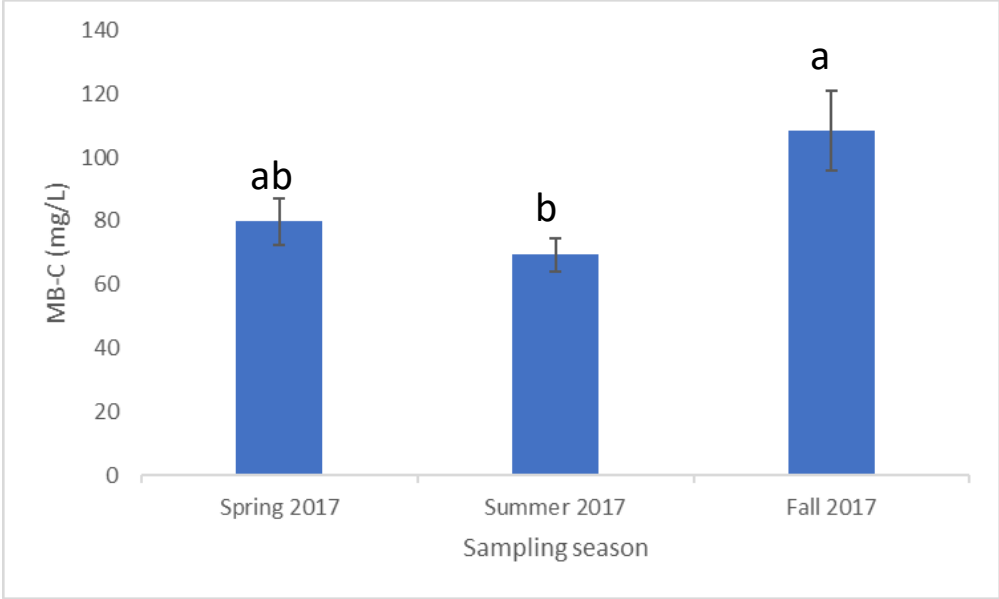


# Results (MB-C)

Before inoculation

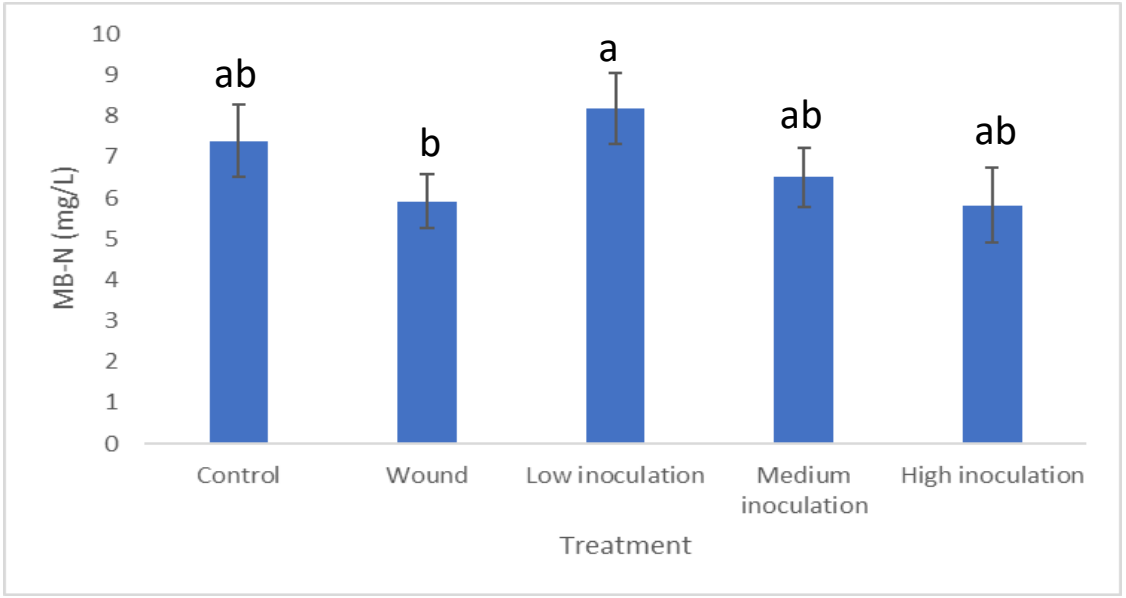



After inoculation

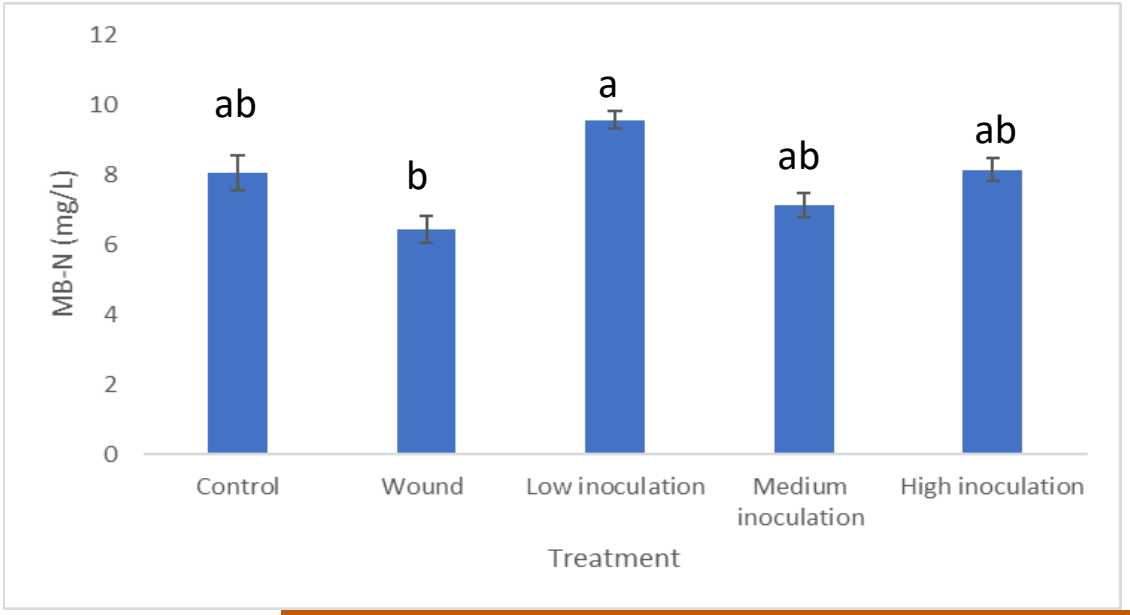


# Results (MB-N)

Before inoculation

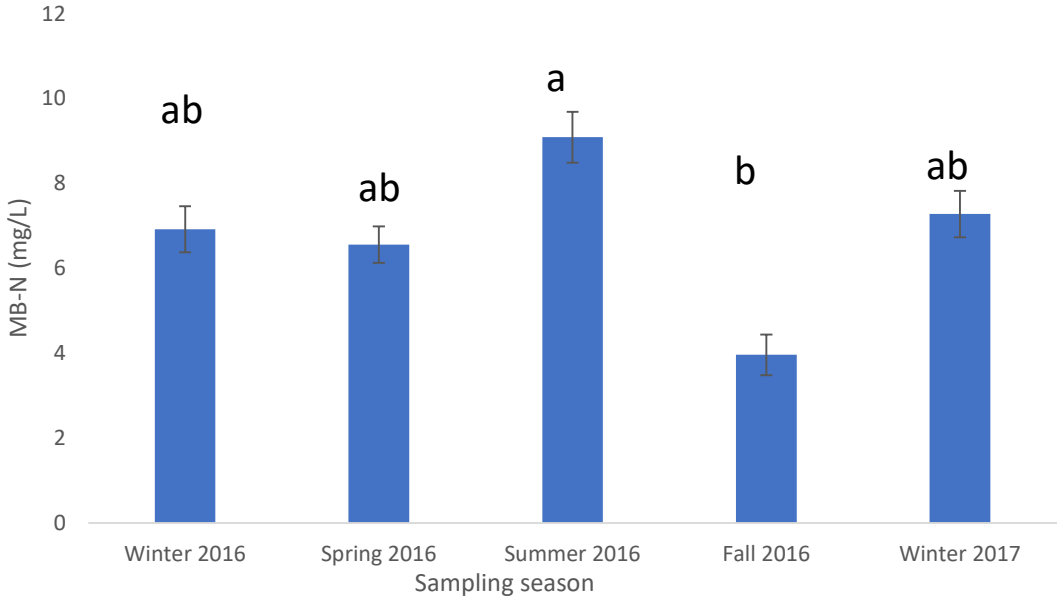



After inoculation

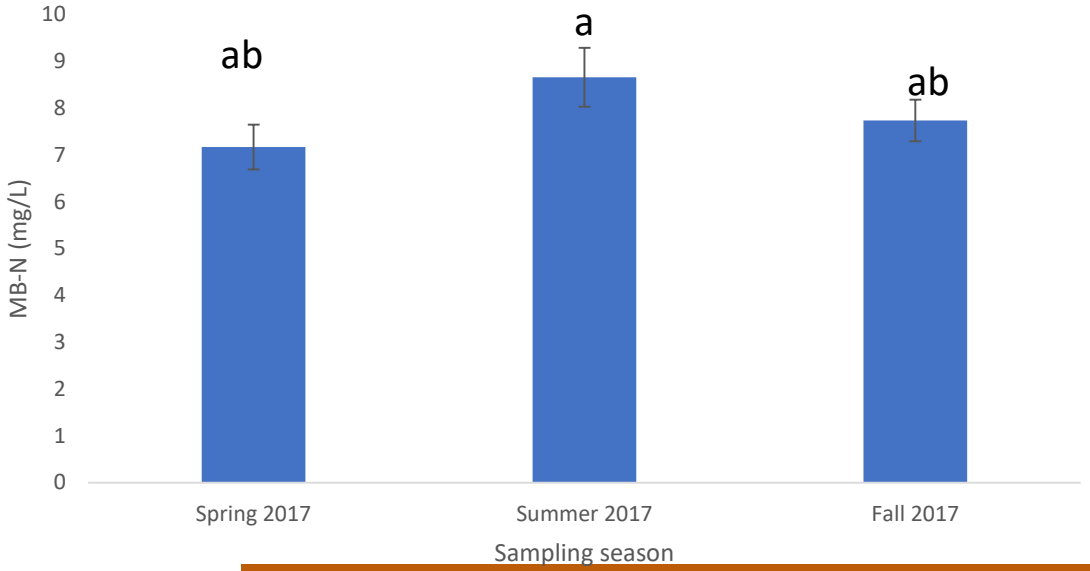


# Results (MB-N)

Before inoculation

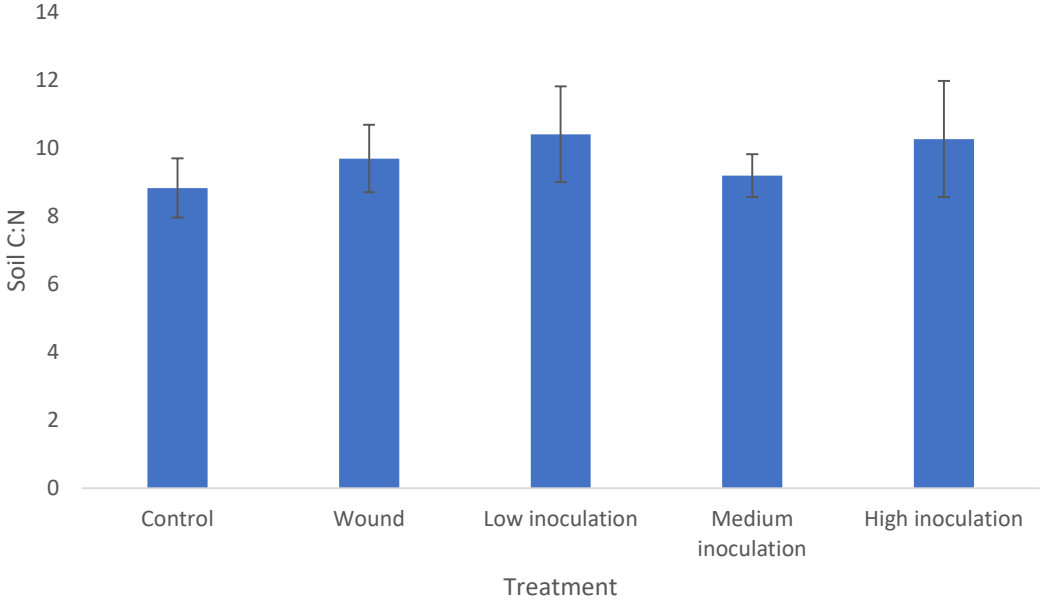



After inoculation

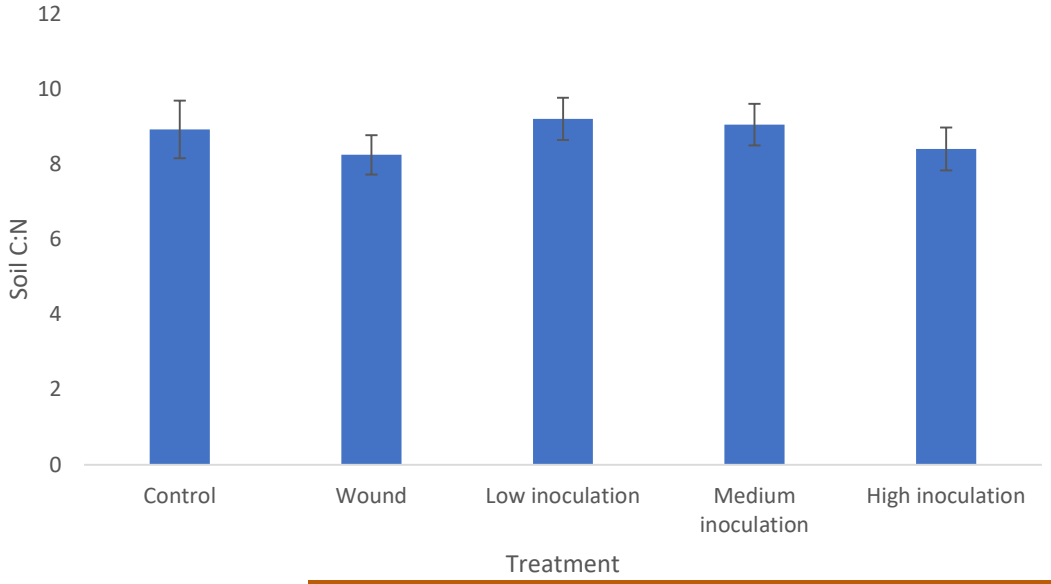


# Results (Soil C:N ratio)

Before inoculation




After inoculation



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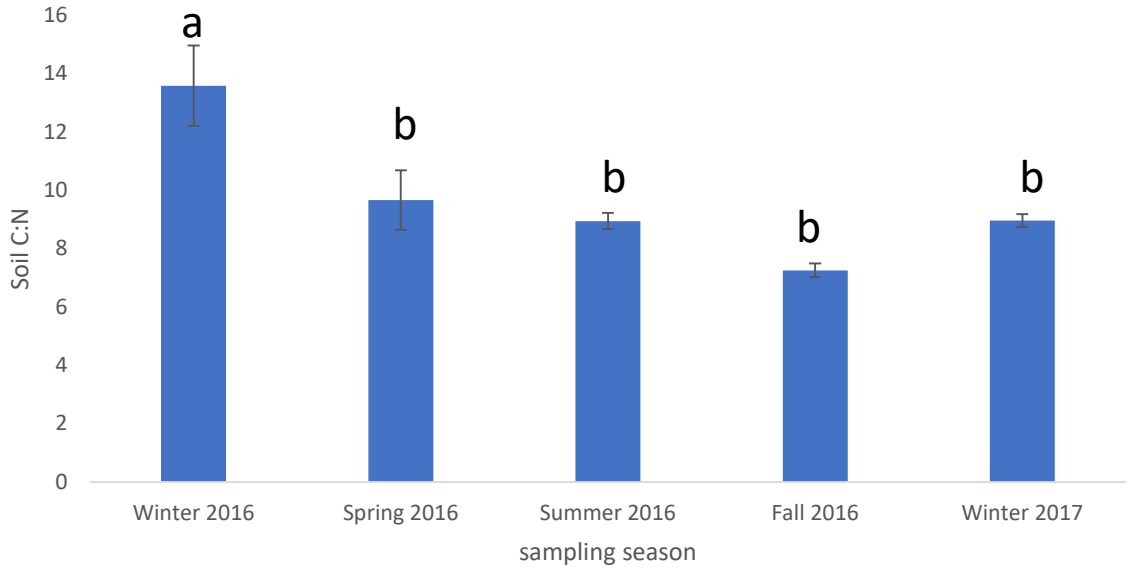
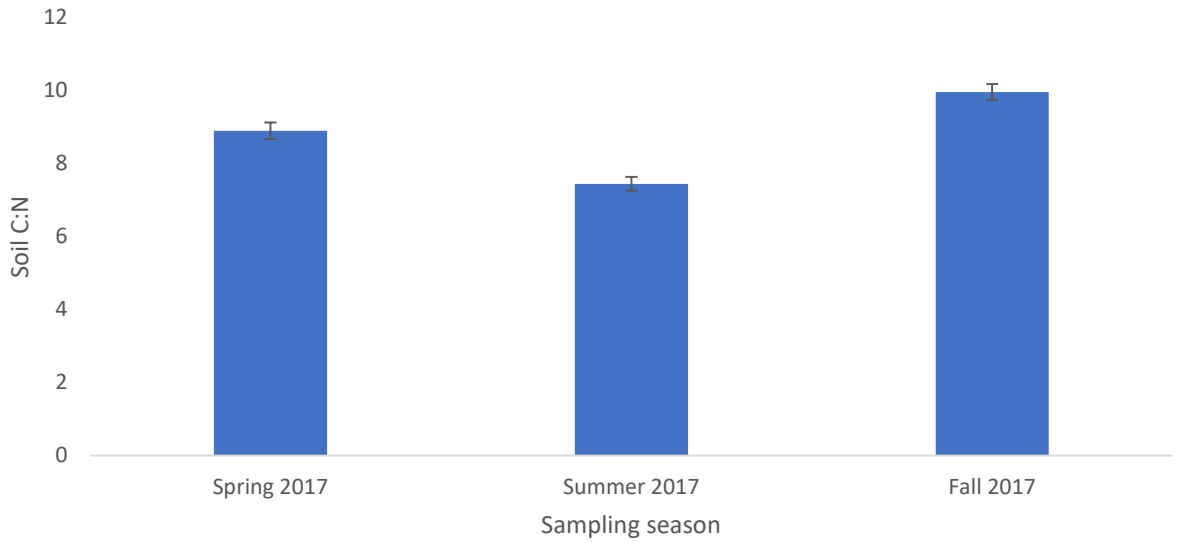



After inoculation

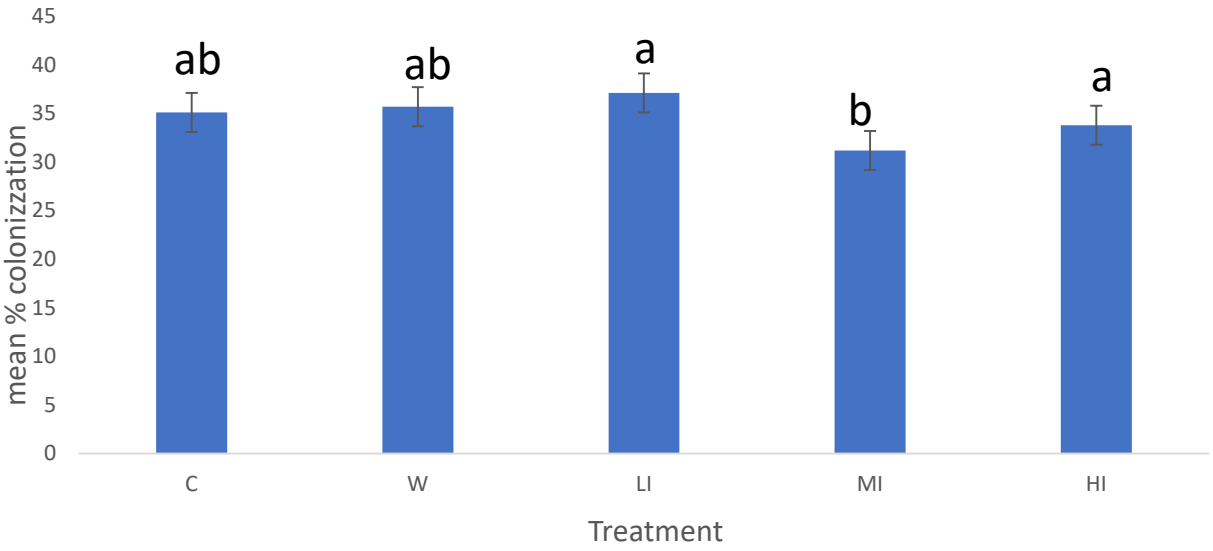


# Results (Correlation between MB and SMC)

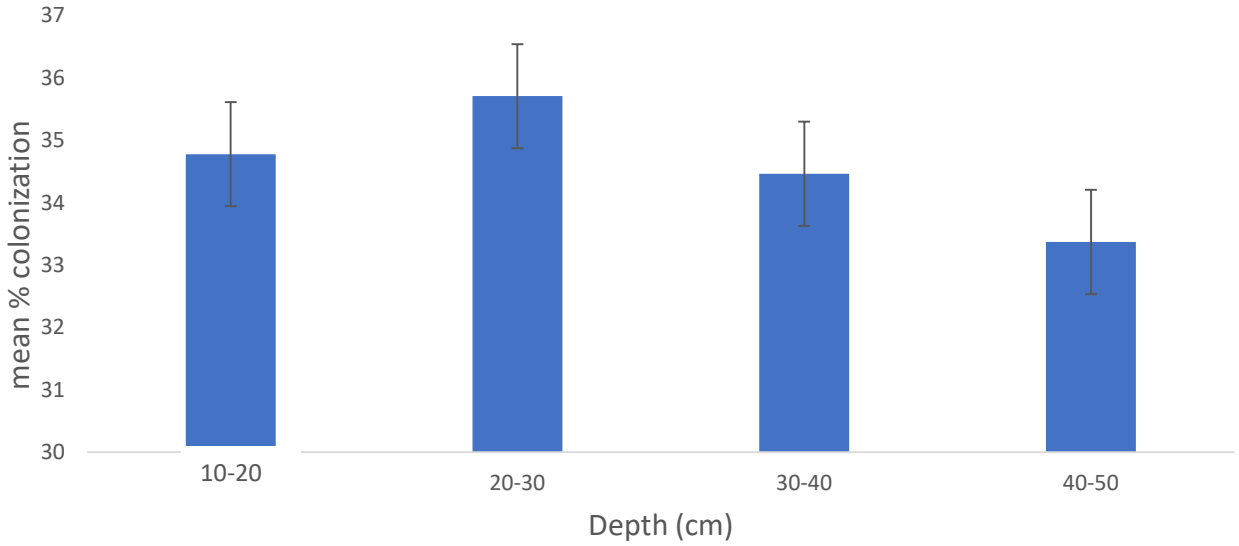
| Sampling season | Average gravimetric SMC | p-value (MB-C) | p-value (MB-N) |
|---|---|---|---|
| Winter 2016 | 0.39 | 0.1182 | 0.5778 |
| Spring 2016 | 0.20 | 0.5634 | 0.1887 |
| Summer 2016 | 0.08 | 0.0012* | 0.0003* |
| Fall 2016 | 0.02 | 0.0001* | 0.0001* |
| Winter 2017 | 0.12 | 0.0051* | 0.0082* |
| Spring 2017 | 0.16 | 0.0921 | 0.0001* |
| Summer 2017 | 0.14 | 0.3665 | 0.0001* |
| Fall 2017 | 0.13 | 0.6411 | 0.0008* |

# Results (Ectomycorrhizae)

On the basis of treatment plots




On the basis of depth



# Summary (MB)

- MB-N was significantly affected by treatment
- MB-C and soil C:N was significantly affected by sampling season
- Although the results from current study suggest no significant difference in MB concentration between the treatments within the sampling season, it is expected that over a period of time, an impact might be seen
- But in the long run, it is also possible that the stand will recover from disturbance and changes in MB might decrease
- MB-C was found to be significantly affected when the average SMC was ≤ 0.12 g/g, while SMB-N was significantly affected when the average SMC was ≤ 0.16 g/g

# Summary (Soil C:N)

- Soil C:N  was significantly affected by sampling season
- Soil C:N was higher in winter, spring and summer of 2016 compared to same sampling seasons in 2017; suggesting higher mineralization and lower immobilization in 2017
- Soil C:N was lower in fall 2016 compared to fall 2017

# Summary (Mycorrhizae)

- Mycorrhizal colonization was significantly affected by treatment
- Mean % colonization was maximum in LI plots followed by W, C, HI plots, and minimum in MI plots.
- Comparatively lower amount of mycorrhizal colonization was observed in MI and HI plots from C, W and LI plots
- Mycorrhizal colonization increased from 10-20 cm to 20-30 cm and gradually decreased up to 40-50 cm
- No significant difference in mycorrhizal colonization was observed in between different sampling depths
- No significant treatment and depth interaction was found

# Recommendation

- Controlling competing and invasive vegetations
- Managing understory plant species
- Planting drought resistant loblolly pine varieties

# Acknowledgements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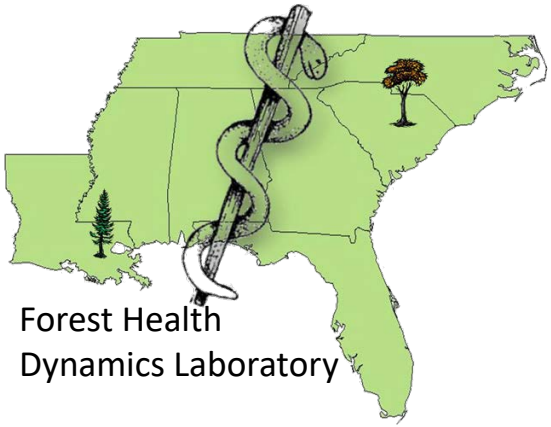

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