Soil Organic Carbon Contents in Silvopasture Planted with Native Warm Season Grasses

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USDA United States Department of Agriculture Agricultural Research Service

INTRODUCTION

- Agroforestry systems have a large potential for carbon sequestration
- Silvopasture is an agroforestry system that integrates tree plantings with forage
- Spatial distributions of soil organic carbon in silvopasture systems have largely been uninvestigated
- Important for understanding impacts of management to promote:
  - Agricultural sustainability
  - Carbon sequestration
  - System productivity

OBJECTIVES

- Determine changes in soil organic carbon fractions in response to distance from trees in a silvopasture arrangement
- Determine changes in soil organic carbon fractions in response to tree species

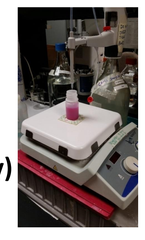
HYPOTHESES

- Surface residue mass, soil mineralizable carbon, soil microbial biomass carbon, and bulk density would vary as a function of proximity to trees
- Soil mineralizable carbon and soil microbial biomass carbon would vary as a function of tree species

MINERALIZABLE CARBON

Equipment and Method

- 1 L incubation cell
- 60 mL glass jar with 50g soil
- 10 mL NaOH (CO_2 trap)
- 10 mL vial H_2O
- Incubated at 25° C for 24 days
- NaOH traps removed and replaced at 3 and 10 days (24 days removed only)
- Traps titrated to measure total mineralized carbon

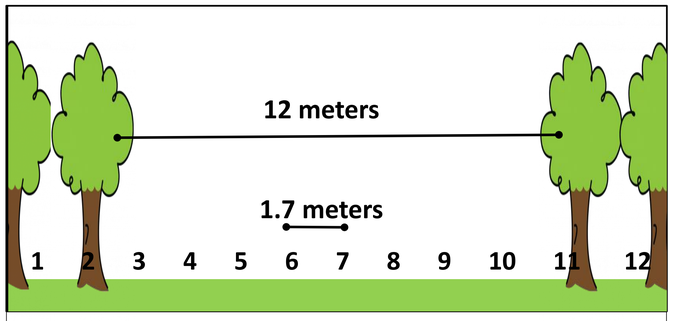


SOIL MICROBIAL BIOMASS CARBON

Equipment and Method

- 1 L incubation cell
- 60 mL glass jar with 50 g soil
- 10 mL NaOH (CO_2 trap)
- 10 mL vial H_2O
- Incubated at 25° C for 10 days
- Soil sample fumigated with $CHCl_3$ (chloroform) 24 hours
- Incubated at 25° C for 10 days
- Trap titrated to measure total SMBC

SOIL SAMPLING



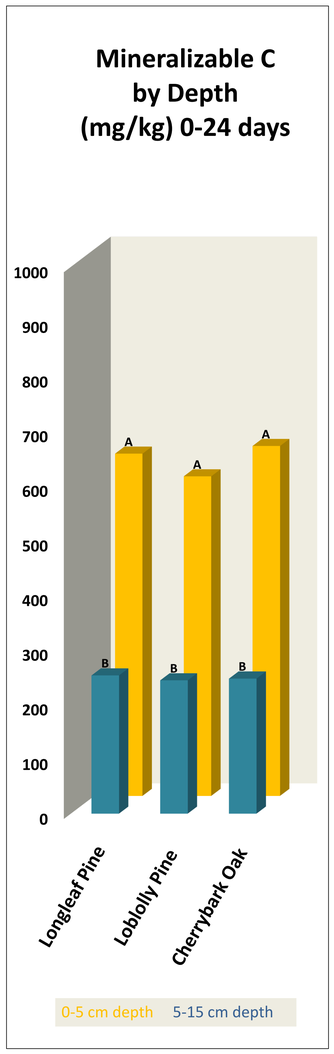
- Soil cores collected from 3 depth ranges: 0-5 cm, 5-15 cm, 15-30 cm
- Dried at 55° C
- Sieved (4.75 mm)

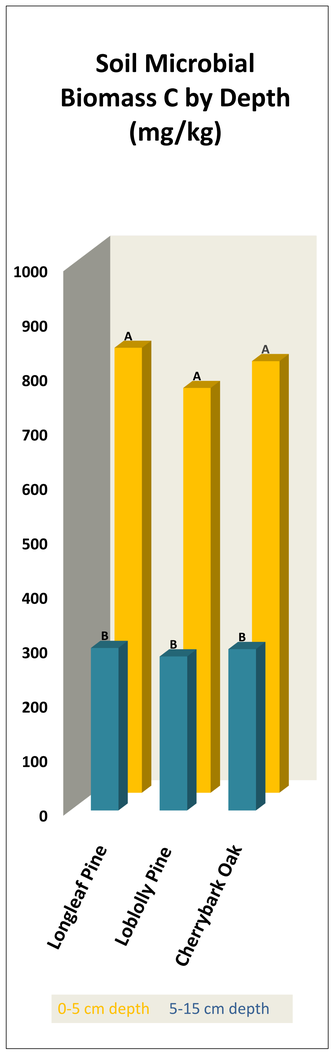
SAMPLING LOCATION

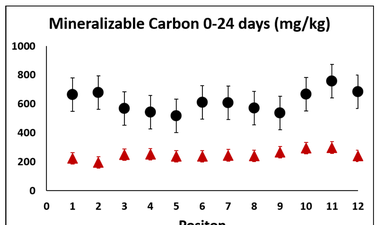
Center for Environmental Farming Systems (CEFS)
Goldsboro, Wayne County, North Carolina

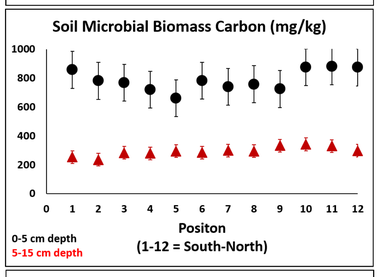
- Mean annual temp: 17° C
- Mean annual precipitation: 124 cm
- 51% Lakeland sand (thermic, coated Typic Quartzipsamments)
- 40% Coxville loam (fine, kaolinitic, thermic Typic Paleaquults)
- 7% Chewalca loam (fine-loamy, mixed, active, thermic Fluvaquentic Dystrudepts)
- 3% Leaf loam (fine, mixed, active, thermic Typic Albaquults)

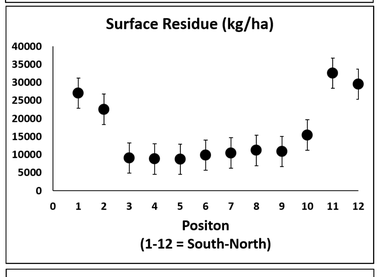
RESULTS

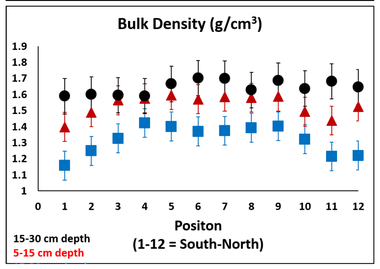


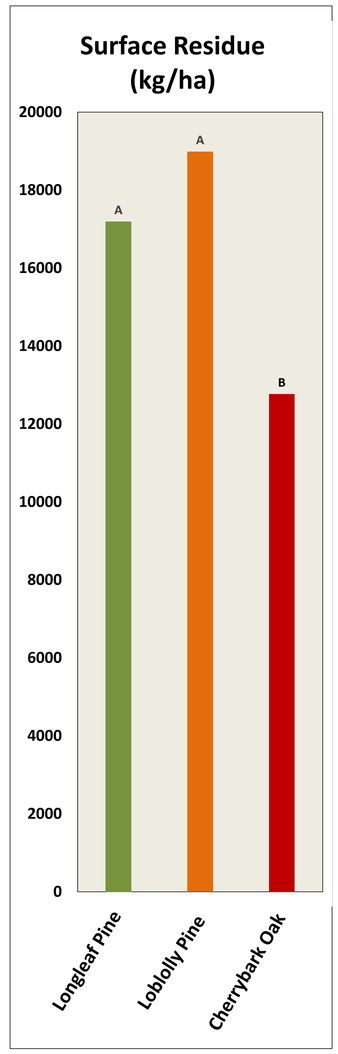


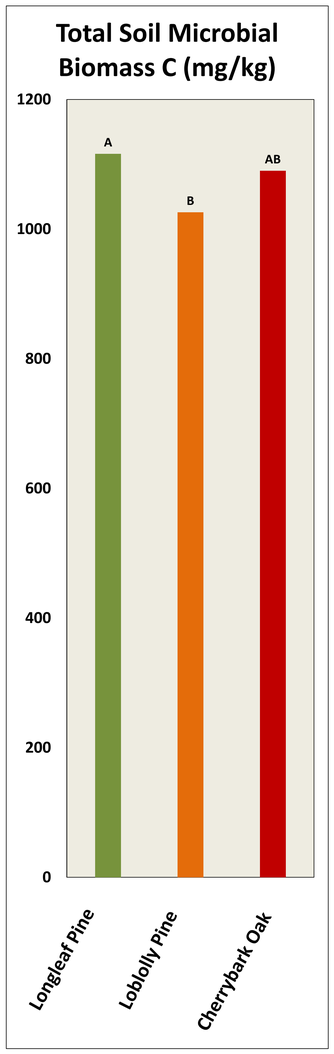












- Mineralizable carbon, soil microbial biomass carbon, and surface residue values were greatest under trees and decreased with distance from trees
- Bulk density was lowest under trees and increased with distance from tree plantings
- Total soil microbial biomass carbon values were greatest under Longleaf pine; significantly different from Loblolly pine but not from Cherrybark oak

CONCLUSIONS

- Silvopasture management techniques can be informed by a greater understanding of how spatial distributions of soil carbon fractions are affected by tree species and proximity to tree plantings
- Informed management techniques can enhance carbon sequestration, soil quality, and productivity of silvopasture systems

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