

Background

Mulch

- Mulch is used in urban forestry because it aids in water retention and weed prevention¹. If mulch increases CH₄ and CO₂ emissions, the use of mulch is potentially a large source of GHGs due to its widespread use.

Soil Sterilization

- Most soil gas flux is from biotic respiration², however abiotic gas flux is present in calcareous soils due to chemical hydrolysis of CaCO₃³. This reaction could be a large contributor to CO₂ emissions, particularly because the C stores in these soils represent geologically ancient carbon.

Research Questions

- What effect does mulch have on soil CH₄ emissions?
- What is the abiotic CO₂ flux of calcareous soil?

Methods

- Sieved soil (low-quality, fine-texture, calcareous) and mulch
 - Soil: 2mm
 - Mulch: <2cm
- Prepared soil and PVC. Treatments:
 - Sterile + mulch + soil
 - Sterile + soil
 - Control + mulch + soil
 - Control + soil
- Cleaned and sterilized components
 - Autoclaved soil; sterilized PVC with soap, ethyl alcohol, and UV light
- Assembled sterile treatments in laminar flow hood and control treatments in greenhouse
- Took flux measurements (using cavity ringdown spectroscopy instrument) and watered after each set of measurements
 - Aug 10 water was pH 5.49 to simulate rain water



Fig 1. Experimental setup, including gas flux analyzer.

Results

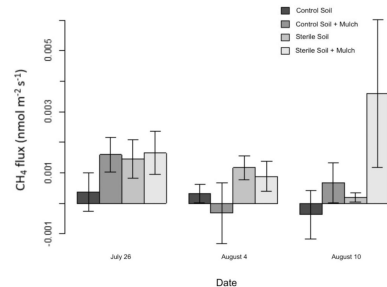


Fig 2. Methane flux of sterile and control treatments on different measurement dates (bars represent ± 1 SE). The sterile treatments showed more methane flux than the control treatments.

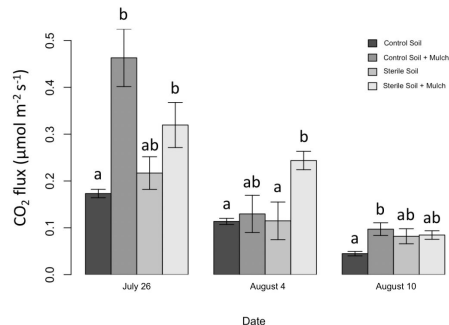


Fig 3. Carbon dioxide flux of all four treatments on different dates (bars represent Tukey HSD post-hoc test results). The mulched treatments showed significantly more carbon dioxide flux than the control soil treatments.

Discussion/Conclusions

- What effect does mulch have on soil CH₄ emissions?
 - No detectable effect was observed
 - CH₄ flux was low overall
 - Other methods are needed to identify if sterilization was successful (molecular viability probes)
- What is the abiotic CO₂ flux of calcareous soil?
 - Sterilization had no detectable effect on gas fluxes.
 - Suggests sterilization was unsuccessful
- Main conclusion:** addition of mulch increased CO₂ flux in all treatments

Future Work

Future studies should investigate whether biochar can mitigate the increased GHG emissions from mulch use.

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