

From Urban Blight To Agritourism Destinations: Examining How To Revive Brownfields With Arbuscular Mycorrhizal Fungi And Frass

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Environmental Studies

Introduction

- In the US there are over 450,000 brownfields, which are contaminated sites that pose environmental, health, and economic challenges due to the difficulty and cost of redevelopment.
- Contaminants from brownfields can spread through soil, water, and air, causing long-term health effects and environmental degradation beyond the site itself.
- Agritourism is a solution for redevelopment, using plants to remediate contaminated soils while supporting environmental restoration and local economies.
- Lavender is a resilient, popular agritourism plant well-suited for brownfields.
- While lavender is hardy, it may struggle to survive in degraded soils. Soil amendments like arbuscular mycorrhizal fungi (AMF) and insect frass may enhance plant growth, stress tolerance, and soil health.

*It is important to note that brownfields are disproportionately located in low-income and marginalized communities due to historical practices like redlining and discriminatory zoning, contributing to greater health risks and environmental injustice for marginalized groups.

Research Question

What are the individual and combined effects of AMF inoculation and insect frass application on the development, growth, and productivity of lavender grown in a brownfield?

Study System

- I chose lavender due to its hardy nature and ability to thrive in low-nutrient soils.
- Insect frass is a nutrient-rich biofertilizer that supplies nitrogen and phosphorus, boosts microbial activity, and may enhance plant immunity and soil health.
- Arbuscular mycorrhizal fungi (AMF) form symbiotic relationships with plant roots, improving nutrient and water uptake, increasing stress tolerance, and supporting plant growth.
- The combined use of frass and AMF may enhance plant growth and soil health, but interactions are complex as nutrients like phosphorus may either support or inhibit AMF, highlighting the need for further research.



Figure 1. Lavender Trails, Orrville, Ohio
Source: Lavender Trails, n.d.

Methods

- The study was conducted at Lavender Trails, a small lavender farm in Orrville, Ohio. It is owned and managed by Jim and Amy Duxbury since 2018. The area was once a brownfield, previously used as a concrete dumping ground.

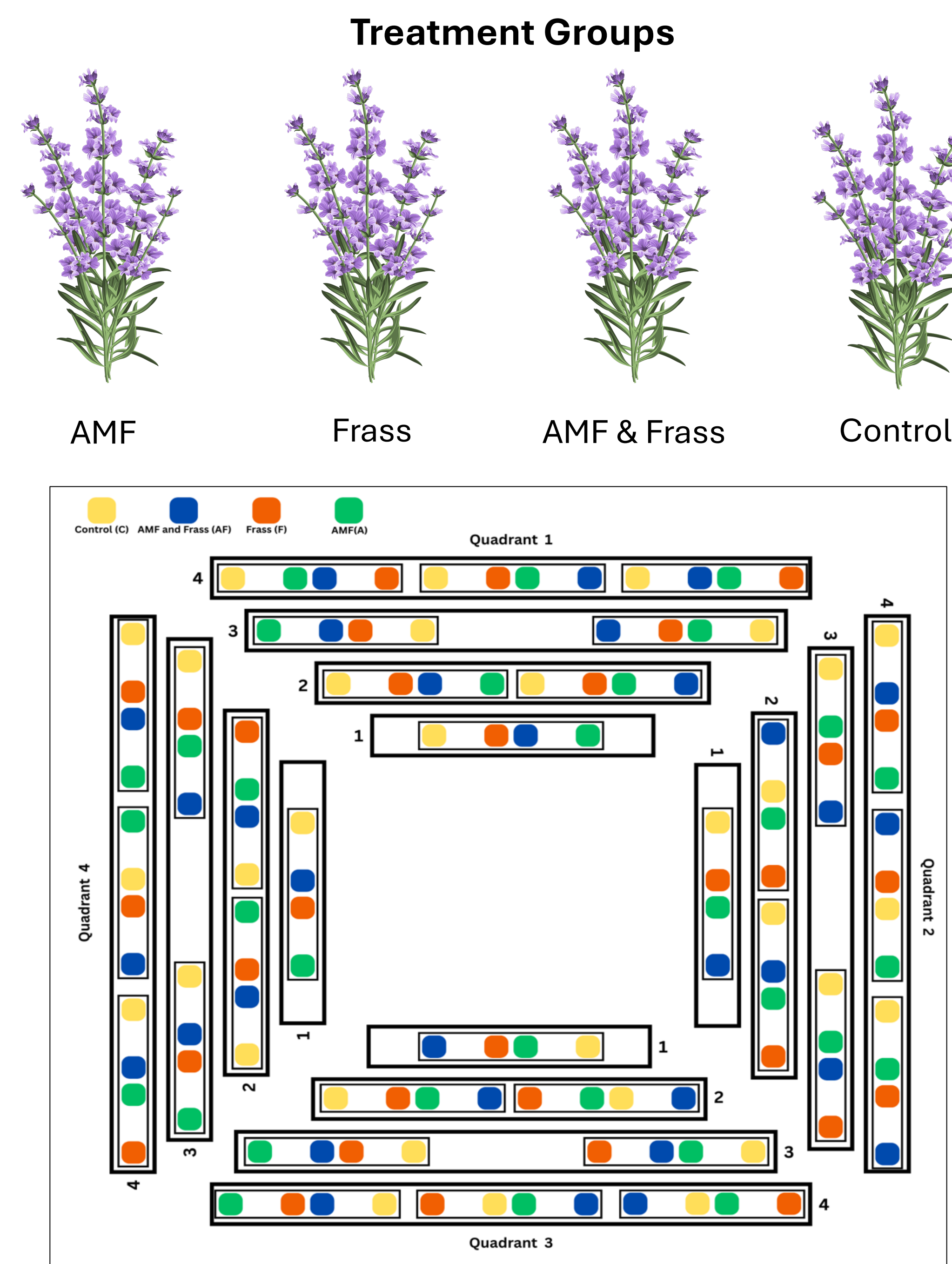


Figure 2. RCBD design. Each square represents a plant. The color of the box represents the treatment applied. Green is AMF, orange is frass, blue is AMF and frass, and yellow is control.

- Lavender was planted in May of 2025. Data was collected on four sampling dates from early June to late August of 2025. Dependent variables included leaf area index, stomatal conductance, and spike count.
- I performed three separate two-way repeated measures ANOVA tests, one for each dependent variable.

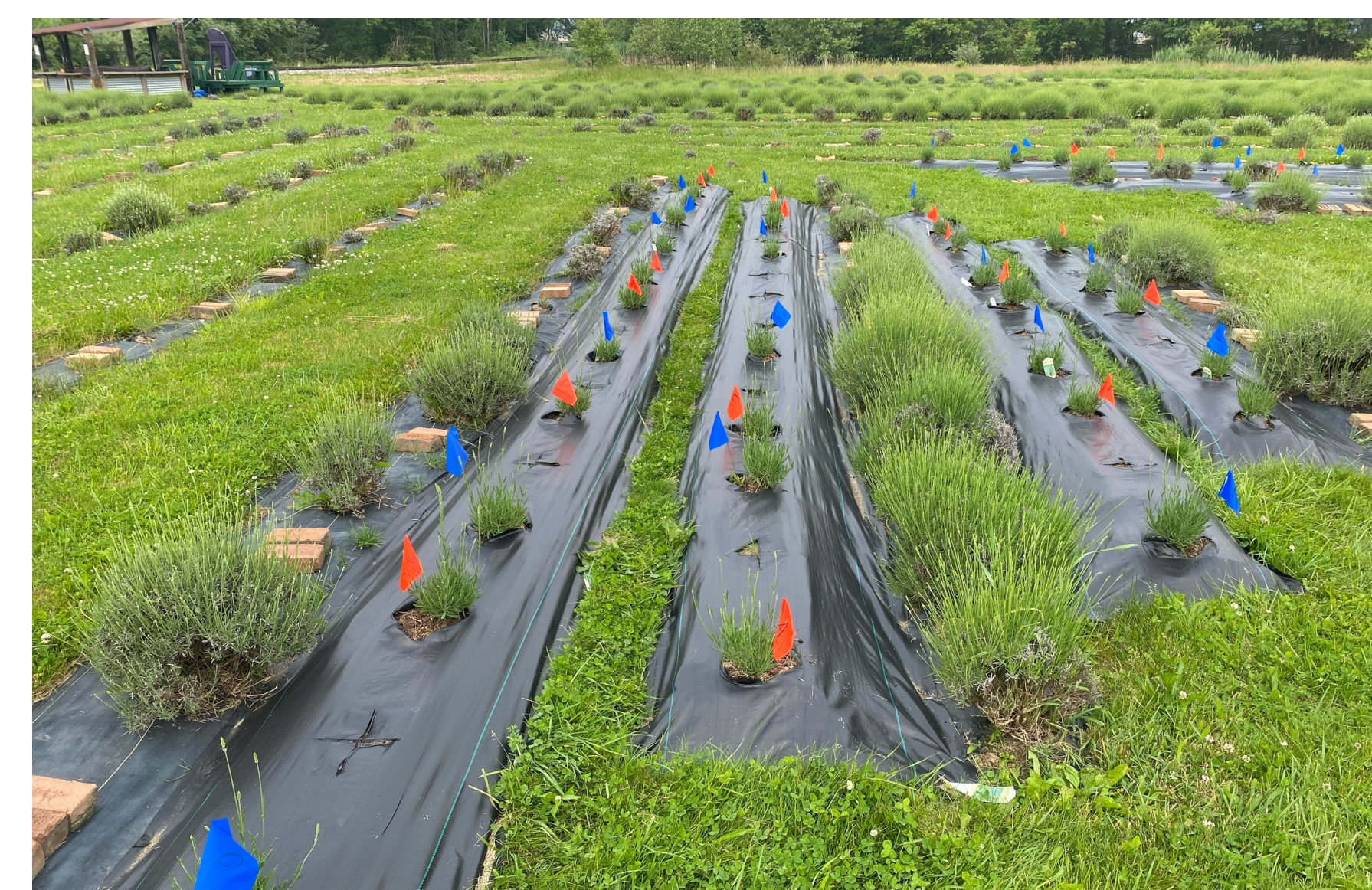


Figure 3. Quadrant three shown as a representation of the quadrants.

Results

- There were no significant interactions between treatments and between the treatments and sampling date on any of the three dependent variables. There were significant effects of sampling date on all dependent variables, indicating that values differed across sampling dates for LAI, spike count, and stomatal conductance.

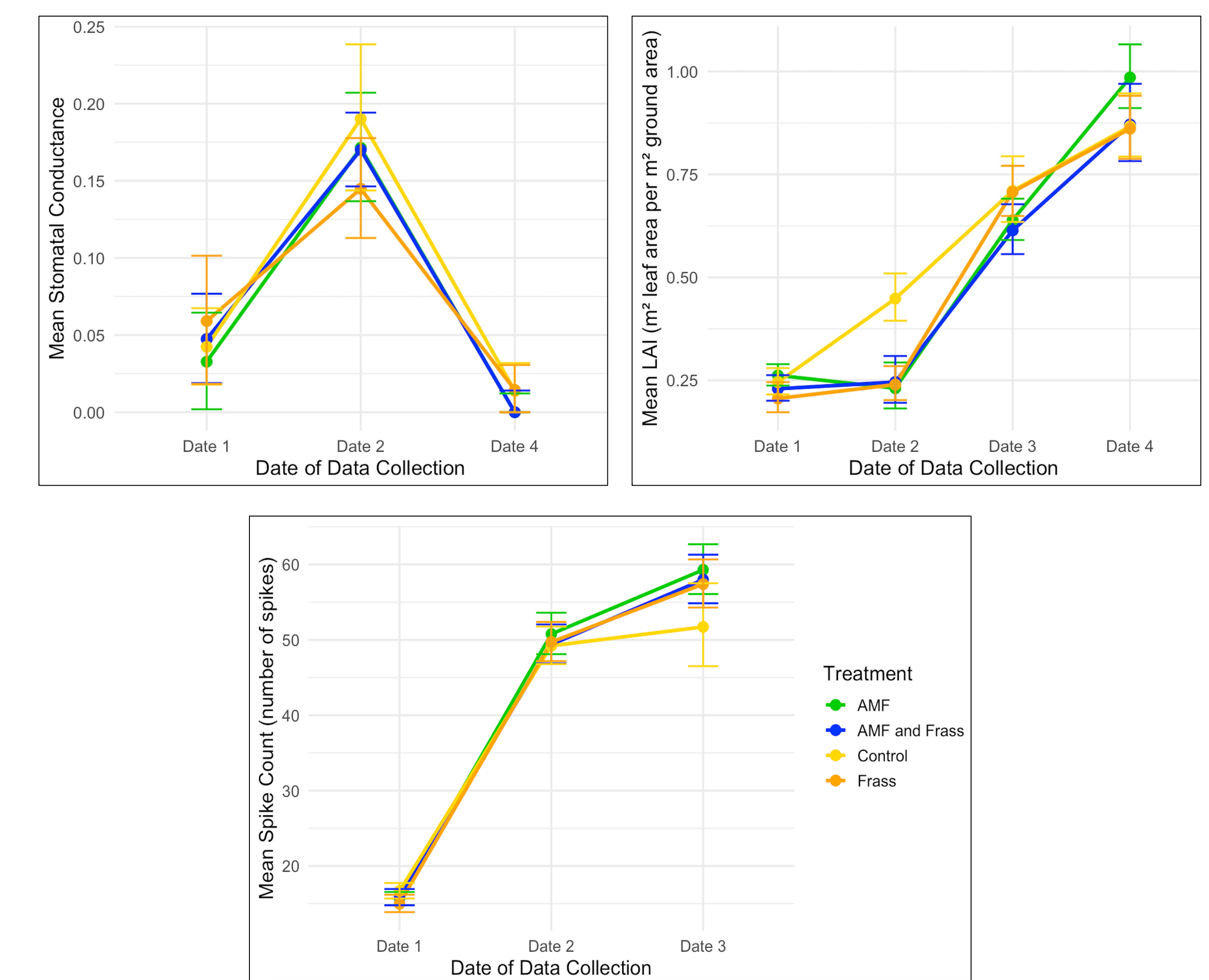


Figure 4. Mean stomatal conductance, LAI, and spike count of treatment groups and the control across sampling dates.

Discussion

- Lack of statistical significance does not mean AMF and frass are ineffective.
- The results of this study suggest that benefits may require longer-term application to become measurable, variability of conditions within the site may diminish the detection of the treatments' effects on the dependent variables.
- More research is needed to optimize use in sustainable agriculture and restoration.

Limitations

- Uneven field conditions, shown by plant mortality clustered in one quadrant, likely introduced confounding effects.
- No pre-experiment soil testing was conducted, limiting understanding of nutrient levels and microbial communities at the site.

Future Aims

- Track plant responses over longer time periods with multiple sampling points to capture delayed or time-dependent effects.

References