

INFLUENCE OF BIOCHAR DOSE, FORM, AND INCORPORATION METHOD ON *COFFEA ARABICA* NURSERY PLANTS

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Introduction

This study evaluated the effects of biochar from pyrolysis of coffee residues on coffee seedling growth over 90 days. It assessed biochar doses (0, 3000, 6000, 9000 kg/ha), forms (whole and powdered), and application methods (surface and incorporation).

The aim was to understand how biochar affects plant health and guide sustainable coffee cultivation, enhancing soil properties, and nutrient retention.



Figure 1: Coffee seedlings during biochar nursery experiment.

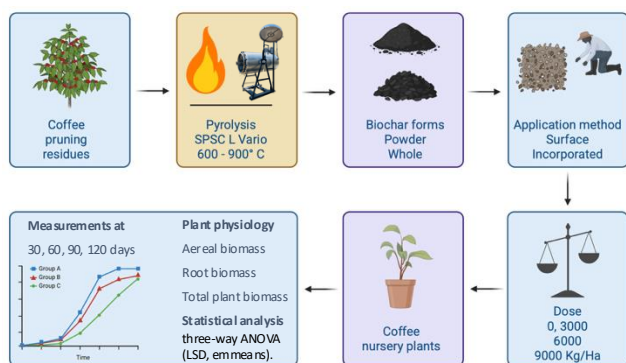
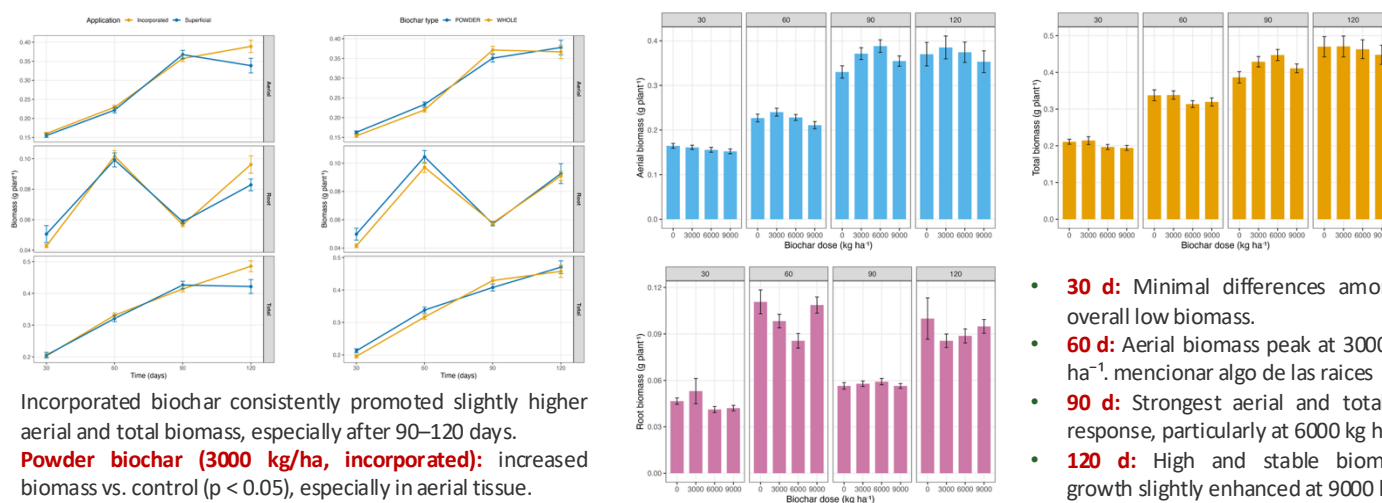


Figure 2: Experimental design for biochar application in coffee seedlings

Materials/Methods

- **Split-split plot design with three factors:**
- **Biochar dose** (0, 3000, 6000, 9000 kg/ha).
- **Form:** powdered vs whole.
- **Incorporation:** surface vs mixed.
- **16 treatment combinations:**
- 4 replicates each, plots with 60 coffee plants.
- Biomass measured at 30, 60, 120, 150 days.
- Above/belowground biomass harvested, dried, and weighed.
- Data analyzed using three-way ANOVA + post-hoc (LSD, emmeans).

Results/Discussion



- Incorporated biochar consistently promoted slightly higher aerial and total biomass, especially after 90–120 days.
- **Powder biochar (3000 kg/ha, incorporated):** increased biomass vs. control ($p < 0.05$), especially in aerial tissue.
- **Whole biochar (6000 kg/ha):** best performance; slight decline at 9000 kg/ha under surface application ($p = 0.037$).

- **30 d:** Minimal differences among doses, overall low biomass.
- **60 d:** Aerial biomass peak at 3000–6000 kg ha⁻¹. mencionar algo de las raices
- **90 d:** Strongest aerial and total biomass response, particularly at 6000 kg ha⁻¹.
- **120 d:** High and stable biomass; root growth slightly enhanced at 9000 kg ha⁻¹.
- **Dose effects** more consistent for aerial and total biomass than for root biomass

Conclusion/Perspectives

- Biochar increased total biomass, especially after 90–120 days.
- Aerial biomass responded the most, with gains at 6000–9000 kg ha⁻¹.
- Root biomass showed minor, inconsistent effects, peaking at 9000 kg ha⁻¹ (60 - 120 d).

- Powder and whole followed similar patterns with slight differences.
- Dose effects strengthened over time, highlighting cumulative biochar benefits.
- Incorporated biochar consistently outperformed surface application, especially in later stages.