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Biochar effects on microbial community profiling of a tropical sandy loam

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1A. Introduction



- Tropical soils experience high temperatures, humidity and intense rainfall.
- Consequent leaching of nutrients
- Low pH (acidity problem)
- Low organic matter content
 - Affects microbial community structure and biological activity.
- Low soil fertility and crop productivity

Economically feasible and sound environmental strategy?



Biochar proposed as one of the amendments to improve soil biology, enzyme activities and microbial community structure.



Soil microbes play critical roles in

- ❖ OM decomposition
- ❖ Nutrient cycling

Microbial diversity has paramount importance in maintaining soil health to enhance soil productivity.

1B. The Game

Environmentally-sound and cost effective soil management strategy?



Pyrolysed



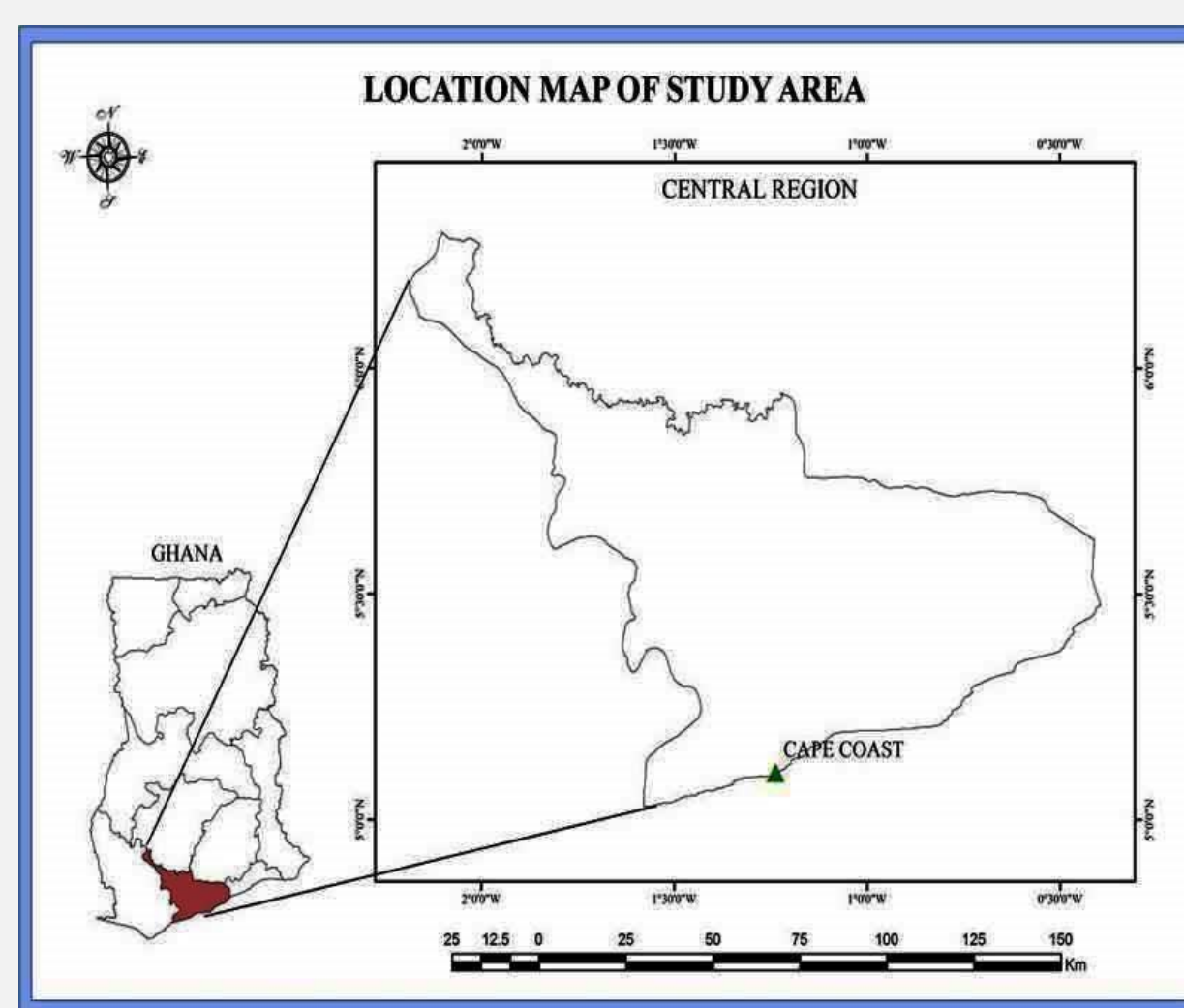
Crop residues

Biochar

2. Objective

To study the response of soil enzymes and microbial composition in soils of the humid tropics to biochar application at different rates.

3A. Materials and methods



Location map

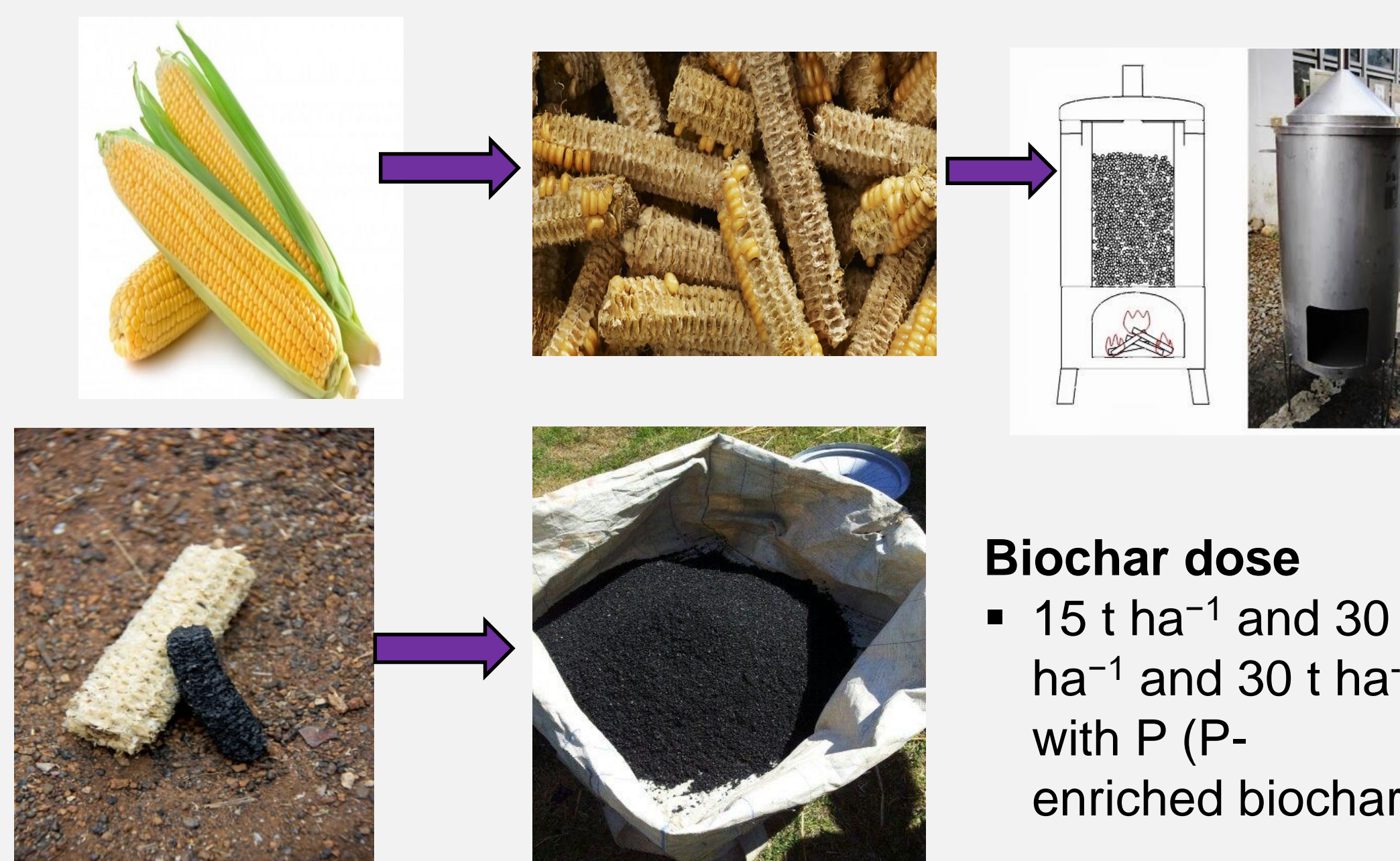
Field layout

- RCBD
- 4 treatments with 4 four replications each
- 16 plots (3 m × 6 m each)

Biochar preparation

- Feed stock: Corn cob

Pyrolytic temperature: 550°C



Biochar dose

- 15 t ha⁻¹ and 30 t ha⁻¹ and 30 t ha⁻¹ with P (P-enriched biochar).

Treatments

- The treatments are denoted by CT, BC-15, BC-30, and BC-30+P for the 0, 15 t ha⁻¹ and 30 t ha⁻¹, and 30 t ha⁻¹ with P respectively.

Soil sampling

- Biochar was applied on 7th November 2015. On 16th January, 2017, soil samples from a depth of 20cm soil layer were randomly collected by soil auger (5 cm diameter) from the sixteen plots.

Acknowledgments

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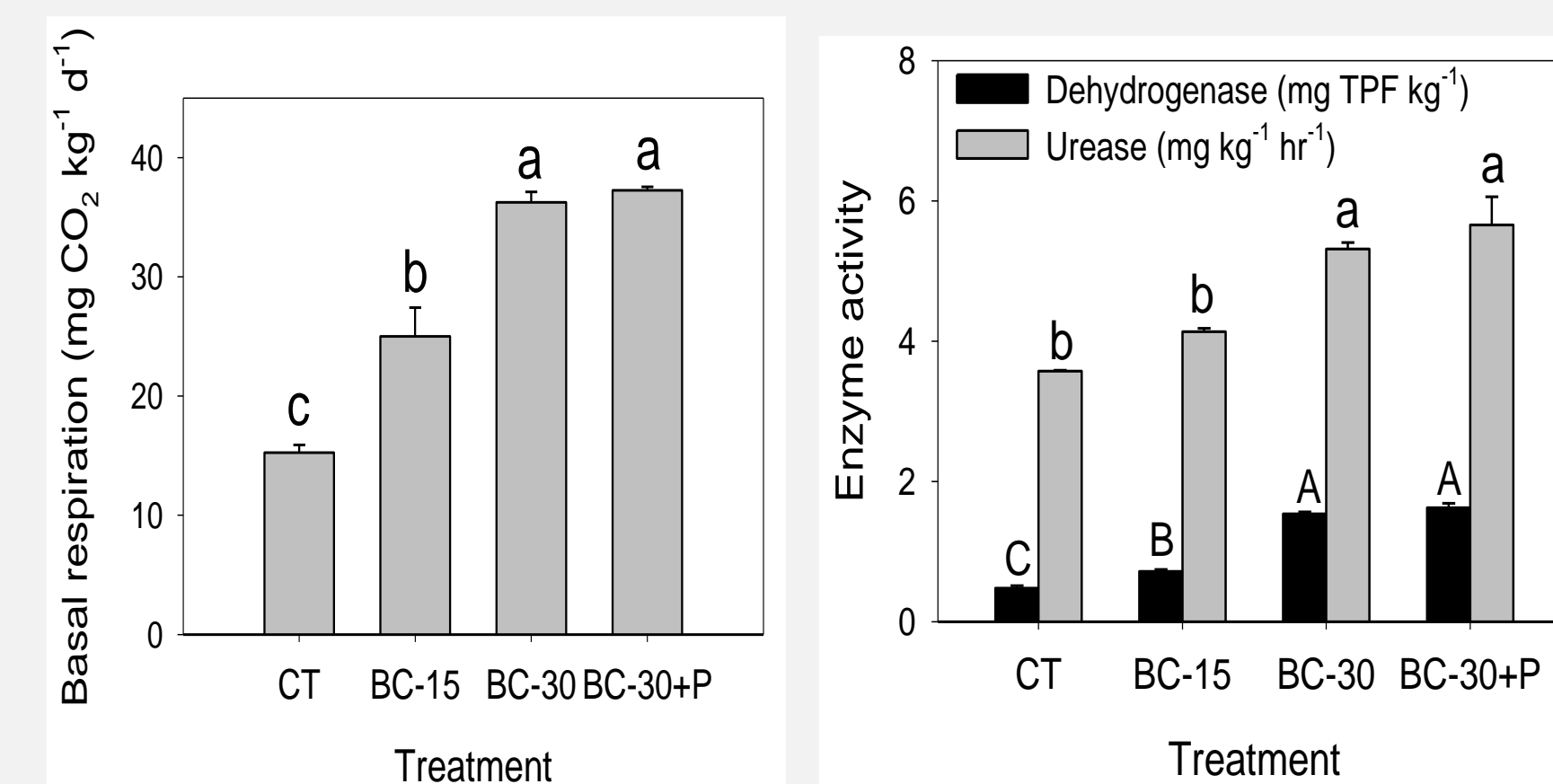
3B. Microbiological properties

Basal respiration, microbial biomass, enzyme activities and phospholipid fatty acids (PLFA), and metabolic quotients.

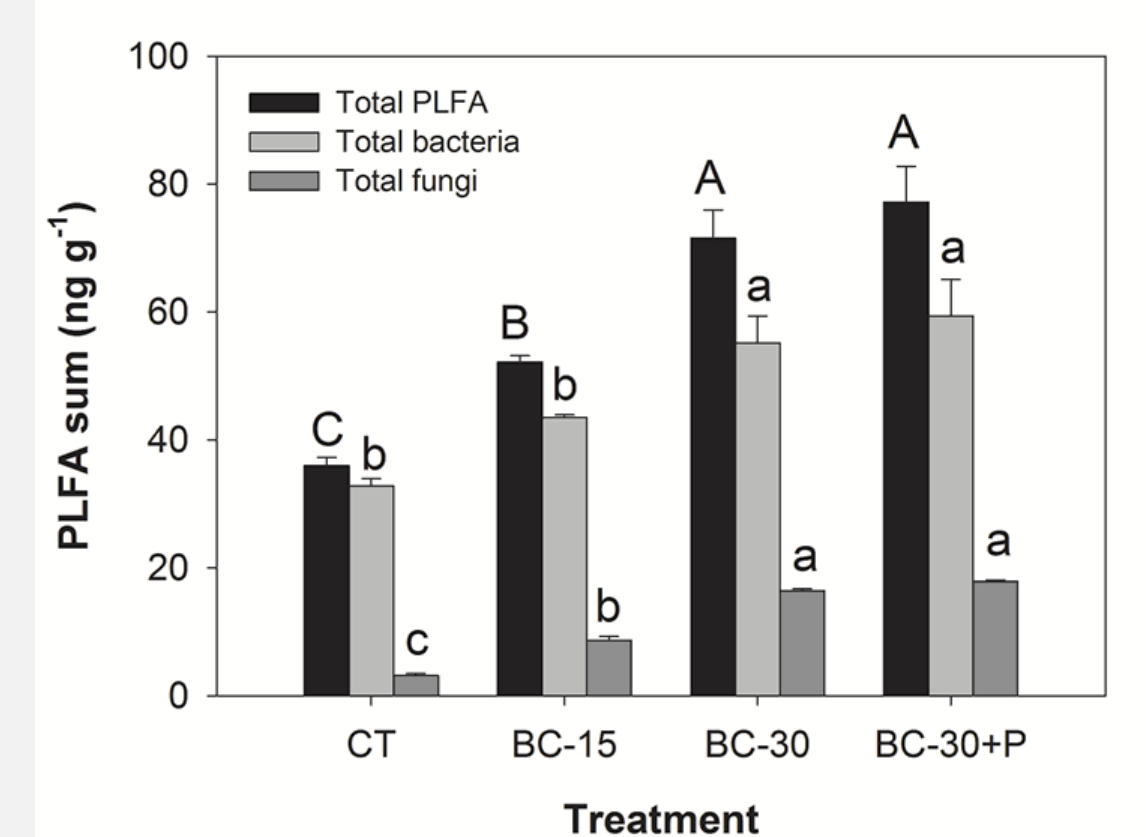


FAME detection and quantification

4. Results and discussion



Treatment	MBC (mg kg ⁻¹)	MBN (mg kg ⁻¹)	qCO ₂	PMC (mg kg ⁻¹)
CT	39.7 ± 5.88c	20.5 ± 3.55b	0.4 ± 0.07a	5.4 ± 0.53c
BC-15	177.4 ± 7.65b	29.1 ± 2.01b	0.1 ± 0.01b	6.6 ± 0.95bc
BC-30	324.6 ± 27.54a	55.1 ± 3.97a	0.1 ± 0.01b	8.1 ± 0.60ab
BC-30+P	328.50 ± 34.49a	55.68 ± 2.11a	0.12 ± 0.02b	9.1 ± 0.81a



5. Conclusion

- Soil microbial biomass and enzyme activities increased with high rates of corn cob biochar.
- Application of biochar at 30 t ha⁻¹ significantly enhanced soil basal respiration and respiratory quotient, and decreased specific maintenance respiration.
- High rates of biochar had significant effects on soil microbial community structure and total PLFA.