FARMING PRACTICE
SOIL AMENDMENT WITH BIOCHAR

IMPACT: SOIL BIOLOGICAL QUALITY

Reference 5

Xu, WH; Whitman, WB; Gundale, MJ; Chien, CC; Chiu, CY 2021 Functional response of the soil microbial community to biochar applications GCB Bioenergy 13:269–81 10.1111/gcbb.12773

Background and objective

Biochar has the potential to mitigate the impacts of climate change and soil degradation by simultaneously sequestering C in soil and improving soil quality. However, the mechanism of biochar's effect on soil microbial communities remains unclear. 1) analyze the effects of biochar application on AMF, ACT, G+, G− abundance, G+/G−, C utilization based on Biolog studies; 2) quantitatively determine the change slope of the soil microbial biomass carbon (MBC) and microbial biomass nitrogen (MBN), soil respiration, and functional diversity with different biochar loads and times since application; and 3) clarify the associations of soil properties, biochar pyrolysis temperatures, and properties with the microbial response to biochar. Here, we report only results regarding soil microbial carbon.

Search strategy and selection criteria

Data were collected from published papers describing the structural and functional responses of soil microbial communities to biochar application using the Web of Science, Google Scholar, and China National Knowledge Infrastructure. 1) At least three replicates in each treatment and control treatment were included. 2) The Biochar addition load was provided as a percentage in weight or in units of ton/ha or kg/m2. When the application rate was provided as mass per area, the data were converted to percentage of weight assuming a soil bulk density of 1.5 g/cm3 (Biederman & Harpole, 2013). 3) Only the control and biochar application treatment data were selected if the experiment included other fertilizer additions. 4) The data of the selected variables were available or could be found or calculated from the related publications. 5) Data from studies focused on charcoal rather than biochar were not considered in this study.

Data and analysis

Mixed linear models including random effects by studies were built, and the final model was selected based on Akaike information criterion (AIC) values. The candidate models were selected mainly based on whether predictors should be log-transformed. Compared with the models including interaction terms of biochar load and period, the models without interaction terms always had lower AIC values except for functional diversity (Table S1), which means better fitness.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
107	not specified	Soil amendment with biochar	No amendment	Metric: Soil microbial carbon content; Effect size: Logarithm of ratio of the considered metrics in the intervention to the considered metrics in the control	0.6875

Results

- Biochar addition increased the lnRR of MBC by 0.17 units, or 18.5% ($p < .01$).

Factors influencing effect sizes

- Biochar application rate : MBC increase by 0.04 ($p = .03$) with biochar load.

Conclusion

Soil microbial biomass carbon significantly increased with biochar application.