FARMING PRACTICE
SOIL AMENDMENT WITH BIOCHAR

IMPACT: GHG EMISSIONS

Reference 22

Zhao, X; Pu, C; Ma, ST; Liu, SL; Xue, JF; Wang, X; Wang, YQ; Li, SS; Lal, R; Chen, F; Zhang, HL 2019 Management-induced greenhouse gases emission mitigation in global rice production Sci Total Environ. 649:1299–306. 10.1016/j.scitotenv.2018.08.392

Background and objective

Mitigating greenhouse gases (GHGs) emissions from rice paddy (Oryza sativa L.) and balancing the trade-offs between reducing emission and sustaining food security have raised global concerns. The objectives of this study were to generate a global dataset on CH_4 emission under climate-smart field practices in rice production, determine the mitigation effects on GWP with consideration of attendant effects on N_2O emission, analyze the relationships between CH_4 and N_2O emission, evaluate the balancing of trade-offs between mitigating GHGs and sustaining rice yield especially in the term of yield-scaled, and advance the understandings of the potential of adjusting field management practices for reducing GHGs emissions while also enhancing rice production. Here we report only results regarding the effect of biochar application on GHG emissions.

Search strategy and selection criteria

The data were collected from research articles from Web of Science (WOS, http://apps.webofknowledge.com/) and the China Knowledge Resource Integrated Database (CNKI, http://www.cnki.net/) published before 2017 with key words of "rice or padd*" and "methane or CH_4 emission". The selected articles were those with the theme of CH_4 emission affected by field management practices conducted at the site-specific rice fields. The following criteria were used to filter the paired experiments: 1) studies should be designed as side-by-side paired-plot field experiments in rice field; 2) absolute emission of CH_4 was provided or could be calculated and conducted with closed chamber method for the entire rice growing season; 3) field management practices, treatments, and controls were described in detail in each study; and 4) the location of the experiment was provided. The data for the N_2O emission and rice yield were also extracted from filtered articles.

Data and analysis

The meta-analysis was conducted with Metawin 2.1. The weighted mean effect size and 95% confidence interval (CI) were generated by bootstrapping (4999 iterations), and the between-group heterogeneity was assessed by using randomization procedures with 4999 replications.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
13	Rice cultivation	Soil amendment with biochar	No amendment	Metric: 1) CH_4 emission; 2) N_2O emission; 3) CO_2eq emission; Effect size: Logarithm of ratio of the considered metrics in the intervention to the considered metrics in the control	0.875

Results

- Biochar tended to (non significantly) decrease yield-scaled CH_4 and N_2O emission and area-scaled CH_4 and N_2O emission.
- Biochar significantly reduced the area-scaled GWP by 13.8% ($P < 0.05$).
- Yield-scaled GWP could be significantly reduced by 18.4% by rice production with biochar.

Factors influencing effect sizes

- No factors influencing effect sizes to report

Conclusion

Biochar have no significant effect on CH_4 and N_2O emissions. However, the effect on the overall global warming potential (both area- and yield-scaled) was a significant decrease.