FARMING PRACTICE
SOIL AMENDMENT WITH BIOCHAR

IMPACT: CROP YIELD

Reference 23

Awad, YM; Wang, JY; Igalavithana, AD; Tsang, DCW; Kim, KH; Lee, SS; Ok, YS 2018 Biochar Effects on Rice Paddy: Meta-analysis Adv. Agron. 148 10.1016/bs.agron.2017.11.005

Background and objective

Rice is staple for nearly half of the world population. Biochar (BC) improves crop yields, reduces greenhouse gas (GHG) emissions, and immobilizes heavy metals in the soil. This study was aimed to meta-analyze the data from the published articles focused on the various BCs' effects on rice yield, soil acidity, GHG emissions, and bioavailability of Cd and Pb.

Search strategy and selection criteria

Data were compiled from the published articles related to the effects ofBC application on soil acidity, grain yield, GHG emissions, and bioavailability of Cd and Pb in rice paddy soils. The articles were collected and sorted by experiment types using the electronic databases of ISI Web of Science and Google Scholar. The data were selected with a limitation ofexperiment duration for a column exper- iment having longer than 45 days, a pot experiment having longer than 3 months, and a field experiment having longer than a year.

Data and analysis

The repeated measurements in the data set were meta-analyzed using the MetaWin software version 2.1 based on a mixed model effect to calculate the effect size (d stands for Cohen's measure to standardize the quantity for difference between the means). The chi-square test was per- formed to investigate the effects ofBC on rice grain yield, available Pb and Cd in soil, uptake of Pb and Cd by rice plant, and GHG emissions in each group. The data categorized in various groups were meta-analyzed to calculate the mean effect sizes (E)and 95% CI (Table 1). The meta-analysis software was run at 4999 times of iterations.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
40	Column, pot and field experiments on rice (paddy soils)	Soil amendment with biochar	No amendment	Metric: Rice yield; Effect size: Logarithm of ratio of the considered metrics in the intervention to the considered metrics in the control	0.5625

Results

- Application rates of biochar at 21–40 t ha-1 and feedstock types of rice straw and wood increased the rice grain yield with the large positive effect size (0.790–0.883 E+).

Factors influencing effect sizes

- Soil pH : With the BC addition, an increase of grain yield with medium effect size values was estimated in the different ranges ofsoil pH (neutral, acidic, and very acidic; 0.414–0.553 E+).

Conclusion

Application of biochars derived from all feedstocks at pyrolysis temperatures of 450–500°C showed significant positive changes in rice grain yield.