

IMPACT: SOIL WATER RETENTION

Reference 34

Omondi, MO; Xia, X; Nahayo, A; Liu, XY; Korai, PK; Pan, GX 2016 Quantification of biochar effects on soil hydrological properties using meta-analysis of literature data *Geoderma* 274:28–34. 10.1016/j.geoderma.2016.03.029

Background and objective

The use of biochar as a soil amendment had been increasingly advocated for its effects on carbon sequestration and greenhouse gas emission mitigation as well as on improvement of soil fertility. However, lack of a general assessment of biochar effects on soil physical properties made it difficult for the recommendations for its practical use for soil quality improvement in global agriculture. Draw a general quantification of biochar's effect on improving soil physical properties. The authors aimed to provide recommendations both for future biochar studies and for potential use of biochar in right soils around world.

Search strategy and selection criteria

Literature search of published articles was performed via Web of Science and Chinese magazine net CNCK. While in searching, key words used were of biochar and soil physical properties, and/or hydraulic conductivity, and/or aggregate stability, and/or available water capacity, and/or porosity or bulk density. Only the biochar soil studies that compared the changes between the control (without biochar) and biochar amended soils were collected to form a literature data base. The authors excluded the studies without replicated treatments and data pairs.

Data and analysis

Data treatment and processing were performed with Microsoft Excel 2010. All figures were expressed as the mean response factor and 95% confidence intervals (CIs) for each group. The 95% confidence intervals were obtained by taking the lower and upper limits that were 2 standard deviations from the mean of a particular group. Regression analysis was performed using IBM SPSS (Version 20.0) software, with a significance defined at $p < 0.05$.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
34	Field, greenhouse pot experiments and laboratory incubations	Soil amendment with biochar	No amendment	Metric: Available water holding capacity (AWC); Effect size: Logarithm of ratio of the considered metrics in the intervention to the considered metrics in the control	0.625

Results

- Biochar soil amendment very significantly ($p < 0.01$) increased available water holding capacity (AWC) by 15% on average.

Factors influencing effect sizes

- Biochar application rates : The magnitude of increase in AWC tended to increase with biochar application rates. Compared to an average increase by 10.6% at low application rates, very high biochar application rates increased AWC by 24.9%.
- Soil texture : The increase in AWC was significant (by 24.3%) in coarse textured soil but not in fine and medium textured soils.
- Experiment type : AWC was very significantly ($p < 0.01$) increased by 16.3% in lab incubation experiments and significantly (< 0.05) by 5.8% in field studies.

Conclusion

Biochar amendment could significantly improve soil physical properties, such as available water content (by 15% grand mean).