

Table S1. Included studies (k = 26) and outcomes contributed to the quantitative synthesis

Study ID	First author	Year	Title	Outlet	Outcomes contributed
R01	袁梦婷	2024	施用猪粪生物炭对酸性和石灰性水稻土颗粒态和矿物结合态有机碳含量及化学结构的影响	Journal of Plant Nutrition and Fertilizers	POC, MAOC, MAOC/SOC, POC/SOC
R02	Xi Wang	2024	Synergy Between Woody Peat and Bentonite Alters Stability of Soil Organic Carbon in Coarse Soil by Enhancing Capacity for Soil Aggregation and Hydro- Physical Properties	—	SOC, POC, MAOC, DOC, MBC, MAOC/SOC, POC/SOC
R03	Tingting Ren	2023	Organic fertilization promotes the accumulation of soil particulate organic carbon in a 9-year plantation experiment	—	SOC, POC, MAOC, MBC, MAOC/SOC, POC/SOC
R04	Shanthi Prabha Viswanathan	2023	Invasive Wetland Weeds Derived Biochar Properties Affecting Soil Carbon Dynamics of South Indian Tropical Ultisol	—	SOC, POC, MAOC, DOC, MBC, MAOC/SOC, POC/SOC
R05	Zhaorui Cheng	2018	Responses of SOC, labile SOC fractions, and amino sugars to different organic amendments in a coastal saline-alkali soil	Soil & Tillage Research	POC, MAOC, DOC, MBC, MAOC/SOC, POC/SOC
R06	Xu Yang	2017	Effects of maize stover and its biochar on soil CO ₂ emissions and labile organic carbon fractions in Northeast China	—	SOC, POC, DOC, MBC, MAOC/SOC, POC/SOC
R07	Qiang Li	2024	Biochar affects organic carbon composition and stability in highly acidic tea plantation soil	Journal of Environmental Management	POC, MAOC, DOC, MAOC/SOC, POC/SOC
R08	Yue Pan	2025	Effect of organic amendments on soil organic carbon fractions, water retention, and mechanical properties in a Chinese Alfisol	Soil & Tillage Research	SOC, POC, MAOC, DOC, MBC, MAOC/SOC, POC/SOC

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R09	Mingzhou Huang	2024	Effects of biochar on soil carbon pool stability in the Dahurian larch (<i>Larix gmelinii</i>) forest are regulated by the dominant soil microbial ecological strategy	—	MAOC/SOC
R10	Xuan Zhang	2025	Ectomycorrhizal fungi and biochar promote soil recalcitrant carbon increases under arsenic stress	Journal of Hazardous Materials	SOC, POC, MAOC, MAOC/SOC, POC/SOC
R11	Yu Yang	2025	Phosphorus-modified biochar regulates CO ₂ emissions and bacterial communities in an incubation study of manganese-contaminated soils	Biomass and Bioenergy	SOC, POC, MAOC, DOC, MBC, MAOC/SOC, POC/SOC
R12	Husen Qiu	2025	Substitution of organic fertilizer did not change the dominant role of biochar on bacterial community stability but the soil carbon fractions	European Journal of Soil Biology	SOC, POC, MAOC, MAOC/SOC, POC/SOC
R13	Guojiang Su	2025	Iron-doped biochar boosting salt marsh blue carbon via regulation of microbial metabolism and intensified mineral-associated organic carbon	Journal of Cleaner Production	SOC, POC, MAOC, MAOC/SOC, POC/SOC
R14	Xiaoying Ren	2025	Enhancing soil carbon sequestration in jasmine gardens: Differential effects of straw and biochar on mineral-associated and particulate organic carbon	Journal of Environmental Management	SOC, POC, MAOC, DOC, MAOC/SOC, POC/SOC
R15	Qiang Sun	2022	Responses of microbial necromass carbon and microbial community structure to straw- and straw-derived biochar in brown earth soil of Northeast China	—	POC, MAOC, DOC, MBC, MAOC/SOC, POC/SOC
R16	Wenjia Luo	2025	Biochar Application and Mowing Independently and Interactively Influence Soil Enzyme Activity and Carbon Sequestration in Karst and Red Soils in Southern China	—	POC, MAOC, MBC
R17	Xuehui Liu	2024	Improving soil carbon sequestration stability in <i>Siraitia grosvenorii</i> farmland through co-application of rice straw and its biochar	—	SOC, POC, MAOC, DOC, MBC, MAOC/SOC, POC/SOC
R18	廖添怀	2022	稻秆及稻秆生物炭添加对稻田红壤有机碳组分及CH ₄ 和CO ₂ 累积排放量的影响	—	POC, MAOC, DOC

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R19	JoseLuisMunera-Echeverri	2020	Effect of conservation farming and biochar addition on soil organic carbon quality, nitrogen mineralization, and crop productivity in a light textured Acrisol in the sub-humid tropics	—	—
R20	Caidi Yang	2025	Differences in the physical protection mechanisms of soil organic carbon with ¹³ C-labeled straw and biochar	Biochar	SOC, POC, MAOC, MBC, MAOC/SOC, POC/SOC
R21	HaoXia	2024	Effects of Biochar and Straw Amendment on Soil Fertility and Microbial Communities in Paddy Soils	—	POC, DOC, MBC
R22	Ruxin Zhang	2022	Soil Respiration and Organic Carbon Response to Biochar and Their Influencing Factors	Atmosphere	SOC, POC, MAOC, MAOC/SOC, POC/SOC
R23	Beatrice Giannetta	2024	Distribution of soil organic carbon between particulate and mineral-associated fractions as affected by biochar and its co-application with other amendments	Agriculture, Ecosystems & Environment	SOC, POC, MAOC, MAOC/SOC, POC/SOC
R24	Xiaoyuan Zhang	2023	Greater mineral and aggregate protection for organic carbon in the soil amended by weathered coal than by biochar: Based on a 3-year field experiment	Geoderma	POC, MAOC
R25	Kunjia Lei	2024	Biochar and Straw Amendments over a Decade Divergently Alter Soil Organic Carbon Accumulation Pathways	—	SOC, POC, MAOC, DOC, MBC, MAOC/SOC, POC/SOC
R26	Shuotong Chen	2024	Changes in aggregate-associated carbon pools and chemical composition of topsoil organic matter following crop residue amendment in forms of straw, manure and biochar in a paddy soil	Geoderma	DOC, MBC