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The Effect of sewage sledge bio-char as mulch and top-soil incorporated on Soil Physical Characteristics and plant growth in a loss soil with high specific surface area in a temperate climate.

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Incorporation of biochar into agricultural soils has been proposed as a potential best management practice (BMP) to increase crop yield and sequester atmospheric carbon (C). Furthermore, the production of biochar, referred to as pyrolysis, yields biofuel that can offset fossil fuels. Current research involving biochar and soil is field scale experiments. Here, sewage sledge biochar was incorporated into a field-scale soybean (Glycine max) system for analysis of soil mechanical and hydrological properties correlated with crop yield. A randomized complete block design was implemented with two biochar application rates: 0 Mg ha-1 (TC), and 25 Mg ha-1 (MTB25 Mulch and ITB25 Incorporated). All plots were tilled using a tractor and rotovator in order to attain uniform incorporation of biochar. A small adjacent field was managed with no-till practices (NTC) to quantify the effects of tillage. Biochar is an effective soil conditioner, evident by MTB25 soil bulk density 9% and 18.5% less than that of TC and NTC, respectively. Analysis of soil pore size distribution resulted in MTB25 with significantly increased macro-pores (1500 μm) related to water transmission and micro-pores (0.5 μm) related to water retention. Furthermore, plant available water capacity (AWC) of MTB25 significantly increased by 9.6% and 29% over TC and NTC, respectively. Biochar amendment (MTB25) increased saturated hydraulic conductivity (Ks) by 33% and 78% over TC and NTC, respectively. Soybean above-ground biomass and grain yield of MTB25 resulted in respective 12.3% and 12.5% increases over TC. The results also showed that the ITB25 was less effective than MTB25. Correlation and linear regression analysis revealed significant positive trends with AWC, soil bulk density, total porosity, among other properties. Results suggest biochar is an effective soil amendment for temperate agricultural soils, yet long-term research will provide additional insight into the potential for biochar to improve soil quality, sequester atmospheric carbon, and enhance crop yield.