Geophysical Research Abstracts
Vol. 19, EGU2017-1600, 2017
EGU General Assembly 2017

Biochar in vineyards: impact on soil quality and crop yield four years after the application

Carla Ferreira (1), Frank Verheijen (2), João Puga (1), Jacob Keizer (2), and António Ferreira (1)

(1) CERNAS, Coimbra Agrarian Technical School, Polytechnic Institute of Coimbra, Bencanta, Coimbra, Portugal (carla.ssf@gmail.com), (2) CESAM, Department of Environment and Planning, University of Aveiro, Aveiro, Portugal

Biochar is a recalcitrant organic carbon compound, created by biomass heating at high temperatures (300-1000°C) under low oxygen concentrations. Biochar application to agricultural soils has received increasing attention over the last years, due to its climate change mitigation and adaptation potential and reported improved soil properties and functions relevant to agronomic and environmental performance. Reported impacts are linked with increased cation exchange capacity, enhanced nutrient and water retention, and positive influences on soil microbial communities, which influence crop yields. Nevertheless, few studies have focused on mid-to-long term impacts of biochar application.

This study investigated the impact of biochar on soil quality and crop yield four years after biochar application in a vineyard in North-Central Portugal. The site has a Mediterranean climate with a strong Atlantic Ocean influence, with mean annual rainfall and temperature of 1100 mm and 15°C, respectively. The soil is a relatively deep (∼80cm) sandy loam Cambisol, with gentle slopes (3°).

The experimental design included three treatments: (i) control, without biochar; (ii) high biochar application rate (40 ton/ha); and (iii) biochar compost (40 ton/ha, 10% biochar). Three plots per treatment (2m×3m) were installed in March 2012, using a mini-rotavator (0-15cm depth). In May 2016, soil quality was also assessed through soil surveys and sampling. Penetration resistance was performed at the soil surface with a pocket penetrometer, and soil surface sampling rings were used for bulk density analyses (100 cm3). Bulked soil samples (0-30 cm) were collected in each plot for aggregate stability, microbial biomass (by chloroform fumigation extraction) and net mineralization rate (through photometric determination of non-incubated and incubated samples). Decomposition rate and litter stabilisation was assessed over a 3-month period through the Tea Bag Index (Keuskamp et al., 2013). The number, type and biomass of earthworms was recorded in each plot, at the soil surface (through excavation, 30cm×30cm×30cm) and sub-surface (using a mustard-tap water solution in the excavated hole). Crop yield was evaluated during harvesting (August 2016), through the number and weight of grape clusters. The potential impact of biochar on grape quality was investigated by total acidity, pH, potential alcoholic strength and total sugar in must analyses.

Four years after the application, plots with high biochar showed lowest soil resistance, slightly lower bulk density, higher crop yield and must quality, than control plots. However, the soil of biochar plots also displayed slightly lower aggregate stability, microbial biomass, number and biodiversity of earthworms, although higher net-N mineralization, decomposition rate and litter stabilization. Plots with biochar and compost showed lowest earthworms, decomposition rate and litter stabilization, but highest crop yield that the other two treatments. Nevertheless, minor differences between three treatment plots suggest that potential impacts of biochar on soil quality and crop yield may persist during a relatively short period.