Geophysical Research Abstracts
Vol. 16, EGU2014-11874, 2014
EGU General Assembly 2014

Effects of biochar and elevated soil temperature on soil microbial activity and abundance in an agricultural system

Chris Bamminger, Christian Poll, and Sven Marhan

University of Hohenheim, Institute of Soil Science and Land Evaluation, Soil Biology Section, Stuttgart, Germany (chris.bamminger@uni-hohenheim.de)

As a consequence of Global Warming, rising surface temperatures will likely cause increased soil temperatures. Soil warming has already been shown to, at least temporarily, increase microbial activity and, therefore, the emissions of greenhouse gases like CO_2 and N_2O. This underlines the need for methods to stabilize soil organic matter and to prevent further boost of the greenhouse gas effect. Plant-derived biochar as a soil amendment could be a valuable tool to capture CO_2 from the atmosphere and sequestrate it in soil on the long-term. During the process of pyrolysis, plant biomass is heated in an oxygen-low atmosphere producing the highly stable solid matter biochar. Biochar is generally stable against microbial degradation due to its chemical structure and it, therefore, persists in soil for long periods. Previous experiments indicated that biochar improves or changes several physical or chemical soil traits such as water holding capacity, cation exchange capacity or soil structure, but also biotic properties like microbial activity/abundance, greenhouse gas emissions and plant growth. Changes in the soil microbial abundance and community composition alter their metabolism, but likely also affect plant productivity. The interaction of biochar addition and soil temperature increase on soil microbial properties and plant growth was yet not investigated on the field scale. To investigate whether warming could change biochar effects in soil, we conducted a field experiment attached to a soil warming experiment on an agricultural experimental site near the University of Hohenheim, already running since July 2008. The biochar field experiment was set up as two-factorial randomized block design (n=4) with the factors biochar amendment (0, 30 t ha^{-1}) and soil temperature (ambient, elevated=ambient +2.5°C) starting from August 2013. Each plot has a dimension of 1x1m and is equipped with combined soil temperature and moisture sensors. Slow pyrolysis biochar from the C4 plant *Miscanthus was* first put on top and then manually incorporated into 20-30 cm soil depth. Differences in the isotopic signature of the biochar and the soil organic matter make it possible to trace the flow of biochar-derived carbon into different labile C pools such as CO_2 or microbial biomass. Spring barley litter of the previous growing season was mixed into soil together with the biochar. Rapeseed oil plants were sown one week after biochar application. Weekly gas sampling between the crop rows allows the determination of CO_2, N_2O and CH_4 fluxes. In addition, $^{13}CO_2$ will be measured at specific dates in order to calculate the proportion of biochar-C in emitted CO_2. First soil sampling after biochar application was in November 2013 and soil was taken in three depths (0-5, 5-15 and 15-30 cm). After the first three months we could not observe any effect of biochar on CO_2 and N_2O emissions, but elevated soil temperature increased emissions of both gases. Data on soil microbial abundance and community composition will be available soon.