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The effect of biochar amendment on the soil microbial community - PLFA analyses and ^{13}C labeling results

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The effects of biochar amendment on plant growth and on the chemical / physical soil characteristics are well explored but only few studies have investigated the impact on soil microorganisms.
The response of the soil microbial community to biochar amendment was investigated by phospholipid fatty acid (PLFA) analysis in (i) a large scale pot experiment, (ii) a small scale pot experiment using ^{13}C labeled biochar and (iii) an incubation study using ^{13}C labeled biochar. In the large scale pot experiment, three different agricultural soils from Austria (Planosol, Cambisol, Chernozem) and four different types of biochar were investigated. In total, 25 treatments with 5 replicates each were set up and monitored over a year.
The results from the pot experiments showed no significant influence of biochar amendment on the total microbial biomass in the first 100 days after biochar addition. However, discriminant analysis showed a distinction of biochar and control soils as well as a strong effect of the pyrolysis temperature on the microbial composition. The effect of biochar was dependent on the type of soil. In the Planosol, some PLFAs were affected positively, especially when adding biochar with a low pyrolysis temperature, in the first month. In the long term, microbial community composition altered. Growth of fungi and gram negative bacteria was enhanced. In the Chernozem, PLFAs from various microbial groups decreased in the long term.
Variability in the incubation study was low. Consequently, many PLFAs were significantly affected by biochar amendment. Again, in the Planosol, gram negative bacteria, actinomycetes and, after 2 weeks, gram positive bacteria increased under biochar amendment whereas in the chernozem total microbial biomass and gram positive bacteria were negatively affected in the long term.
The ^{13}C labeling studies confirmed the low degradability of the biochar, i.e. no alteration of the content and the δ^{13}C in the soil organic matter within 100 days, decreased CO_2 emission after biochar addition and little ^{13}C signature from the biochar in the respired CO_2.
The uptake of the labeled biochar into the microbial PLFAs was analysed and will provide an evidence if biochar was used as a carbon source. In addition, the long term effect of biochar amendment (beyond 100 days) on the soil microbial community is currently investigated. These results will be also presented in the oncoming meeting.