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Biochar stability and priming effect on SOM decomposition in two European short rotation coppices

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Biochar application to agricultural soils has been proposed as a promising strategy for carbon (C) sequestration and climate change mitigation. However, most of the knowledge on biochar stability is based on short-term lab incubation experiments, as field studies are scarce. Therefore, little is known about the interactions between biochar and roots and the related effects on biochar stability in field conditions. In two (Italy and UK) short rotation coppice systems (SRCs) the present study aimed to asses, through continuous soil respiration monitoring and δ13C periodic measurements, the stability of biochar in field conditions, the effect of plant roots on biochar stability, the effect of biochar on original soil organic matter (SOM) decomposition.
The percentage of biochar-derived soil respiration (fB) varied according to the site and sampling date: at the Italian site, it was between 7% and 37%; at the UK site, it varied between 12% and 32%. At both sites, fB was generally higher in the presence of roots (Rtot) than in trenched plots (Rh) where the root growth was excluded. This suggests a positive priming effect of roots on biochar decomposition. On the other hand, a decreased decomposition rate of original SOM after soil biochar addition (-10% and -14% at Italian and UK site, respectively) was observed, suggesting a protective effect of biochar on SOM. In summary, regardless of the experimental site, biochar showed a slow decomposition and a protective effect on original SOM, confirming the carbon mitigation potential of this technology. However, the mechanisms that are behind the observed results deserve to be investigated more deeply in a long-term perspective, in order to understand the real potential of biochar as a strategy for soil C sequestration.