

## Interactions of *Trichoderma* spp. in soils with biochars differed by feedstock and particle size: case studies with rye and corn

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Biochar has a potential to improve soil fertility and sequester carbon. The effects of biochar application to agricultural soils depend on the feedstock used for biochar production, pyrolysis temperature, application rates, particle size, soil type, etc. Being added to soil, the biochar influences soil microbiota that is dependent on environmental physico-chemical conditions and microbial species. *Trichoderma* is a ubiquitous fungal genus, representing versatile biocontrol agents and known as plant growth promoters.

This study was aimed at comparing the effect of *Trichoderma viride* alone and in the presence of 3% wood- or straw-derived biochar on the growth of rye *Secale cereale* L. (sandy soil, in pots) and corn *Zea mays* (loamy-sand soil, mini-field experiment), respectively. Seed germination as well as the growth and development of seedlings were monitored. Especial attention was paid to enzyme activity of soil microorganisms and the number of colony forming units for different physiological groups. Fungal abundance in soil samples was estimated with emphasis on the prevalence of *Trichoderma* spp. in *Trichoderma*-amended soils.

Corn and rye seed germination was faster in the presence of both biochar types tested in this study, irrespectively of different soil types and other experimental conditions. Experiments with corn demonstrated a stimulating effect of treatments to the plant growth in comparison with untreated soil, in the following order: [*Trichoderma viride*] > [*Trichoderma viride*+straw biochar] > [Straw biochar]. Biochar addition resulted in a considerable decrease of the percentage of saprophytic fungi. The addition of biochar and *Trichoderma viride* increased the concentration of crude proteins in the corn aboveground biomass significantly ( $p < 0.04$ ), as compared to control. Wood biochar (especially its finest fraction with  $\varnothing < 2\text{mm}$ ) positively influenced the rye growth, abundance of cellulolytics, fungi and actinomycetes in a pot experiment. The presence of *Trichoderma* was markedly elevated by the presence of biochar.