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How does biochar affect soil respiration?

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What is biochar and why we add biochar to soil?

- Biochar is defined as a biomass that has been pyrolysed in a zero or low oxygen environment.
- Biochar application to soil is expected to sequester C sustainably, and improve soil structure and functions.
- Biochar has a large specific surface area and it is good absorbent. Biochar addition increases aeration and improves water retention of soil. This is especially important during the drought.
- Change of soil properties could determine microbial activity. Higher microbial activity is usually associated with higher carbon dioxide (CO_2) production (soil respiration).

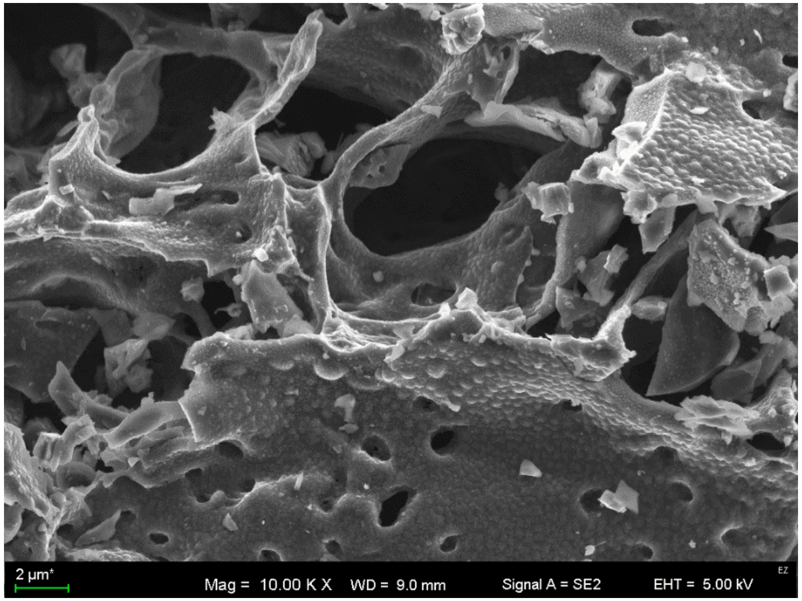


Fig. 1 Sunflower husks biochar image from SEM (Mag = 10.00 K X).

The aim of study

Fulfilling the global trend of study, an experiment was planned to assess the effect of wide range biochar doses (produced from sunflower husks) to the CO_2 emission and O_2 absorption (determining respiration) in *Haplic Luvisol* soil from fallow fields.

Materials and methods

- Tested material included soil samples (*Haplic Luvisol*) collected in 2018 from fallow fields enriched with different doses of biochar (prepared from sunflower husks) directly after biochar application.
- After collecting, the samples were air-dried, sieved by 2 mm and stored at room temperature.

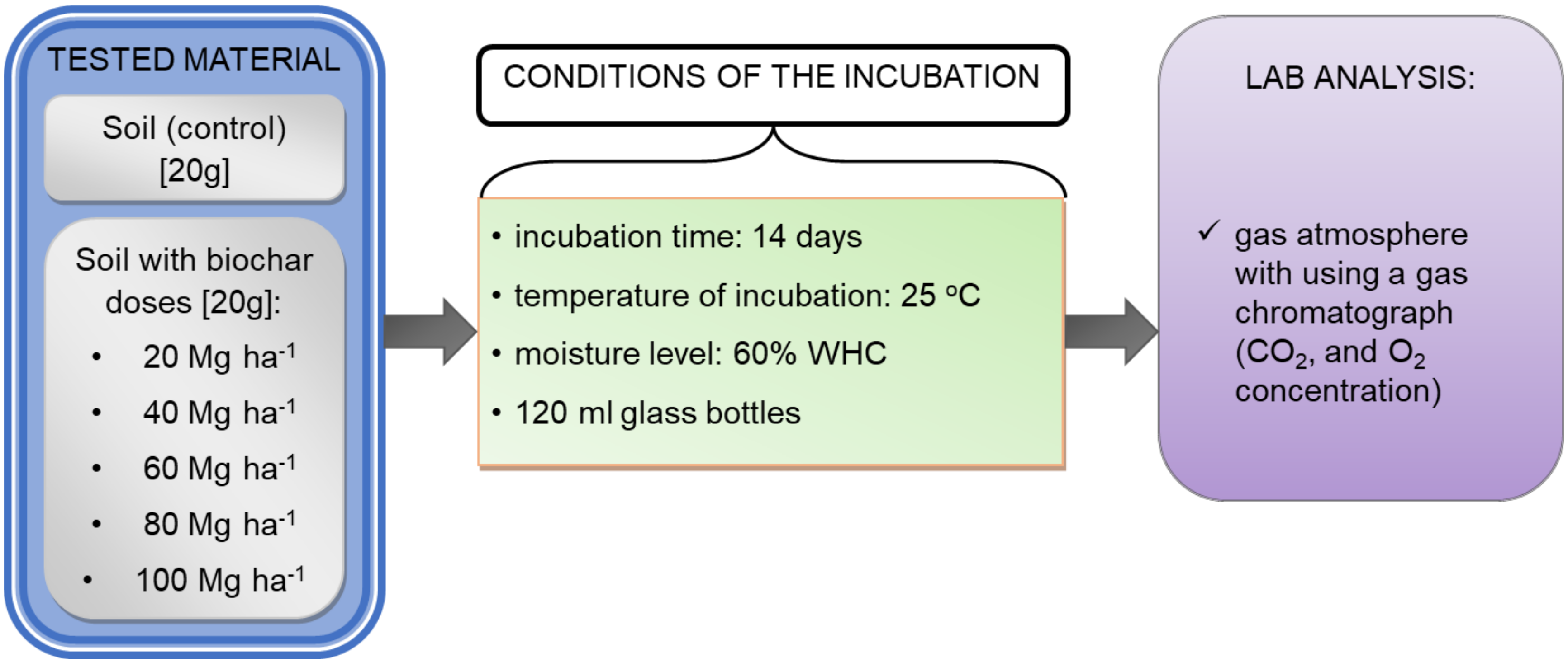


Fig. 2 Plan of experiment.

Soil respiration

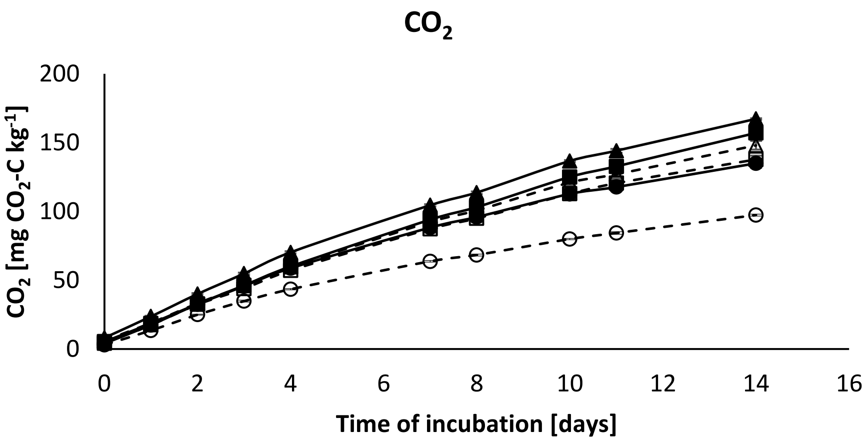


Fig. 3 Emission of CO_2 in soil with biochar addition and without biochar (as a control), incubated at 60% WHC (avg. ± SD, n=3).

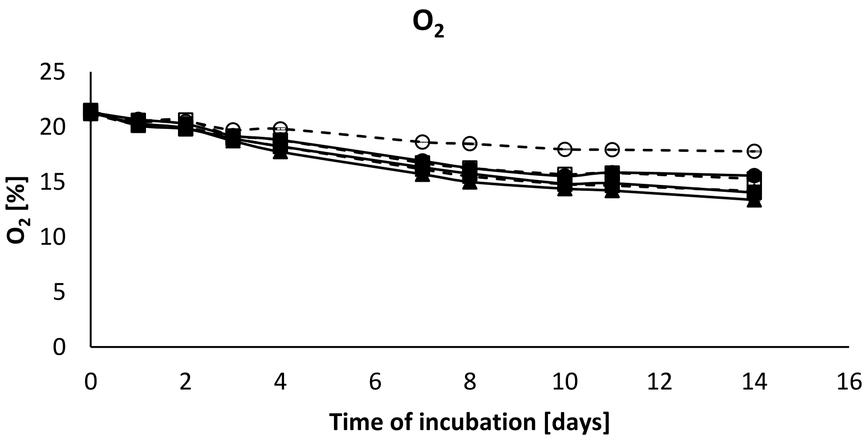
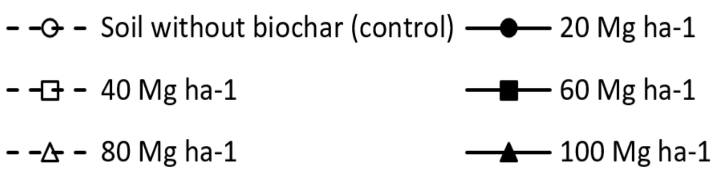


Fig. 4 Consumption of O_2 in soil with biochar addition and without biochar (as a control), incubated at 60% WHC (avg. ± SD, n=3).

Tab. 1 CO_2 production rate in soil with different biochar doses. Different letters mean significant difference among biochar doses (one-way ANOVA, Tukey test, $p < 0.05$).

Biochar dose [Mg ha^{-1}]	CO_2 production rate [mg CO_2-C kg^{-1} d^{-1}]
0	6.73 ± 0.13 (a)
20	9.36 ± 0.46 (bcd)
40	9.54 ± 0.41 (bcd)
60	10.82 ± 0.08 (def)
80	10.13 ± 0.45 (bcde)
100	11.36 ± 0.02 (ef)



Conclusions

1. **All additions of biochar stimulated *Haplic Luvisol* respiration. CO_2 emission rates after biochar application was higher (by 2.63 to 4.63 mg CO_2-C kg^{-1} d^{-1}), than in control soil (6.73 ± 0.13 mg CO_2-C kg^{-1} d^{-1}).**

2. **In soil (with and without biochar addition) emission of CO_2 corresponded to O_2 consumption.**

3. **Increase of biochar dose caused enhanced CO_2 emission and O_2 consumption.**

References

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Acknowledgements

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THANK YOU FOR YOUR ATTENTION!