

Biochar effects in agriculture

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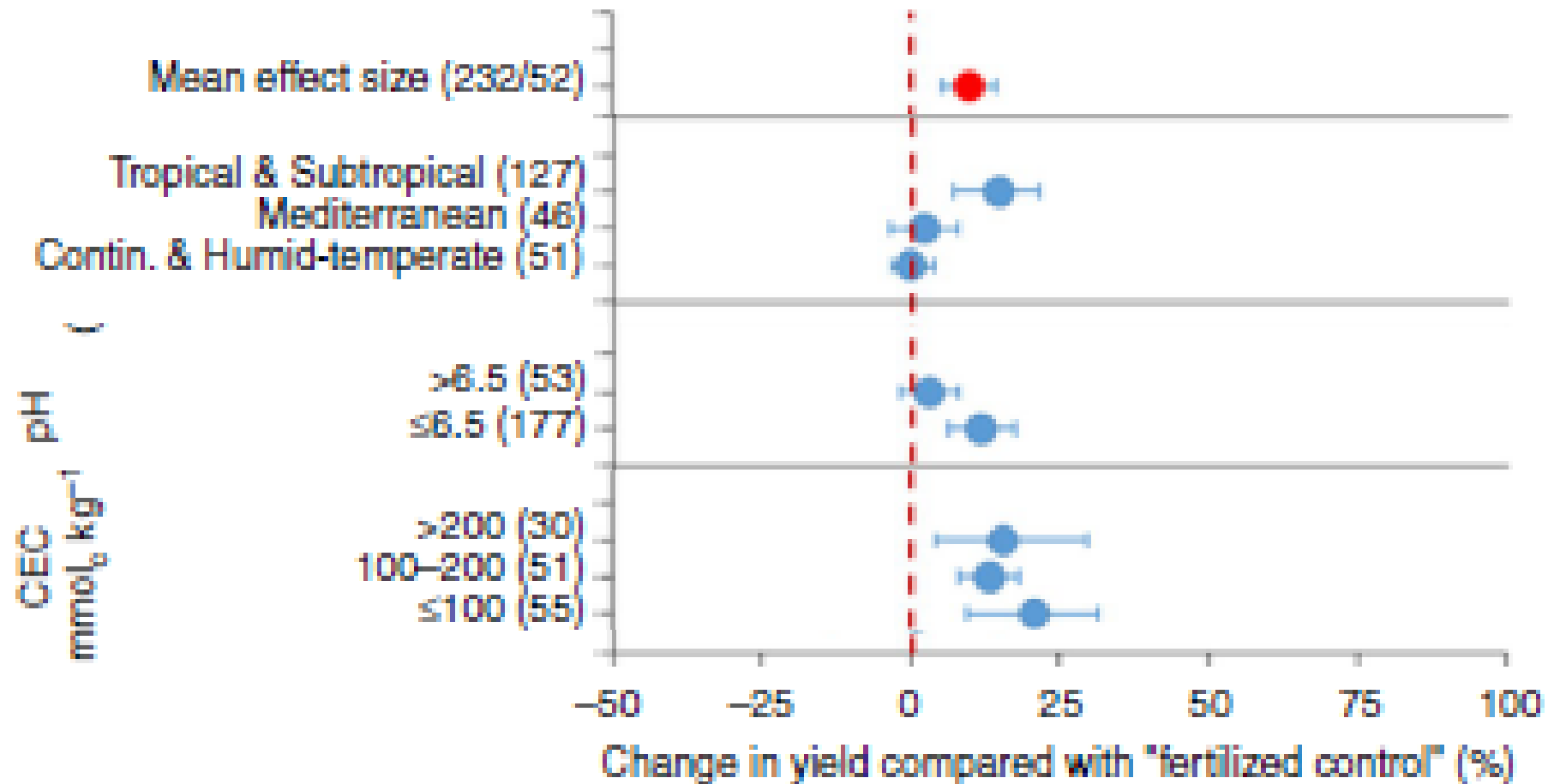
EIFER-Workshop November 3th, 2022

Outline

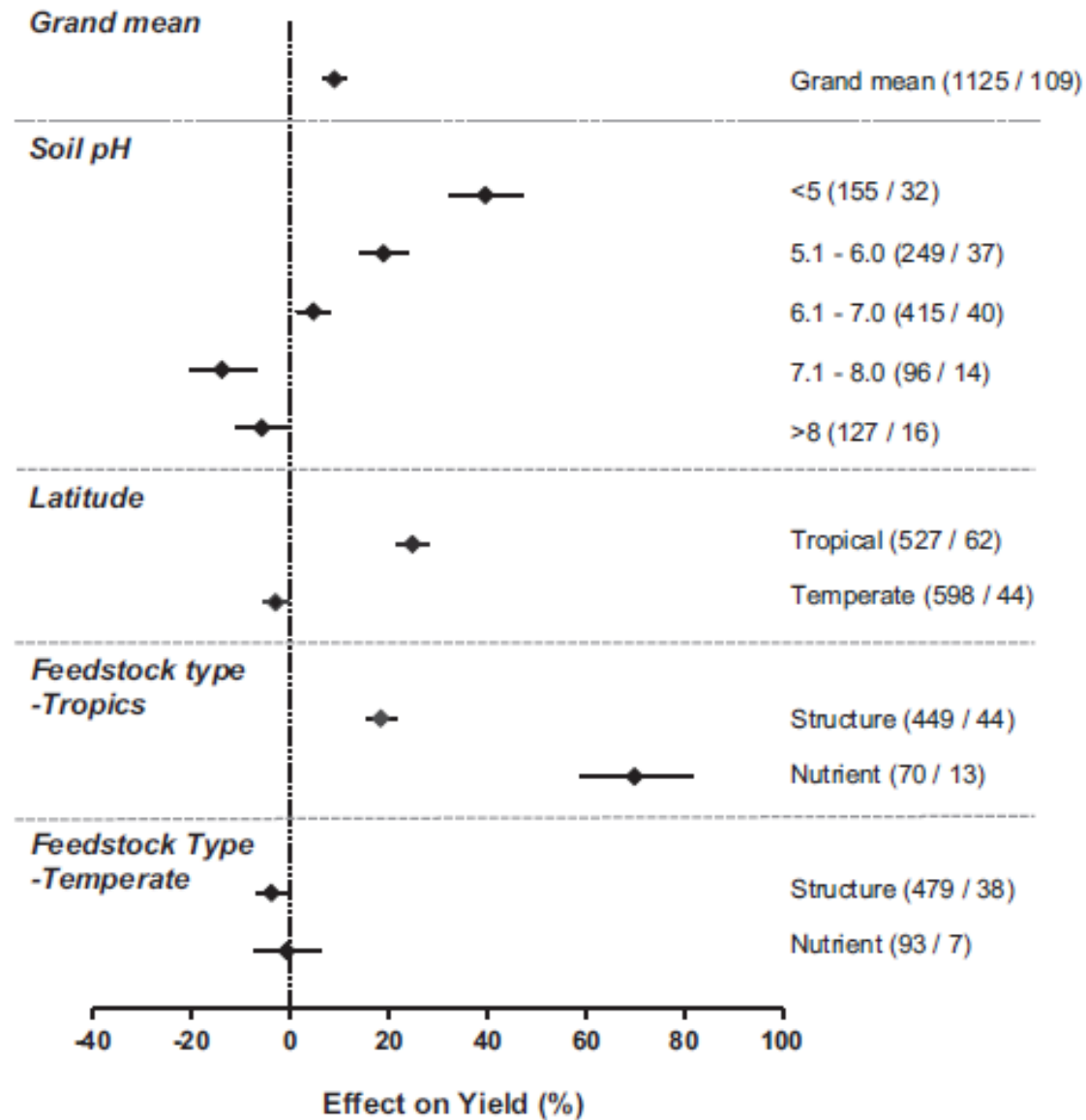
- Effects on soil productivity
- Effects on P availability
- Comparison on costs
- Conclusions

Meta-study on relative changes in crop yield caused by biochar additions depending on climate region, soil pH and soil cation exchange capacity

(Ye et al., 2020) (in parenthesis: no. of comparisons/no. of publications)



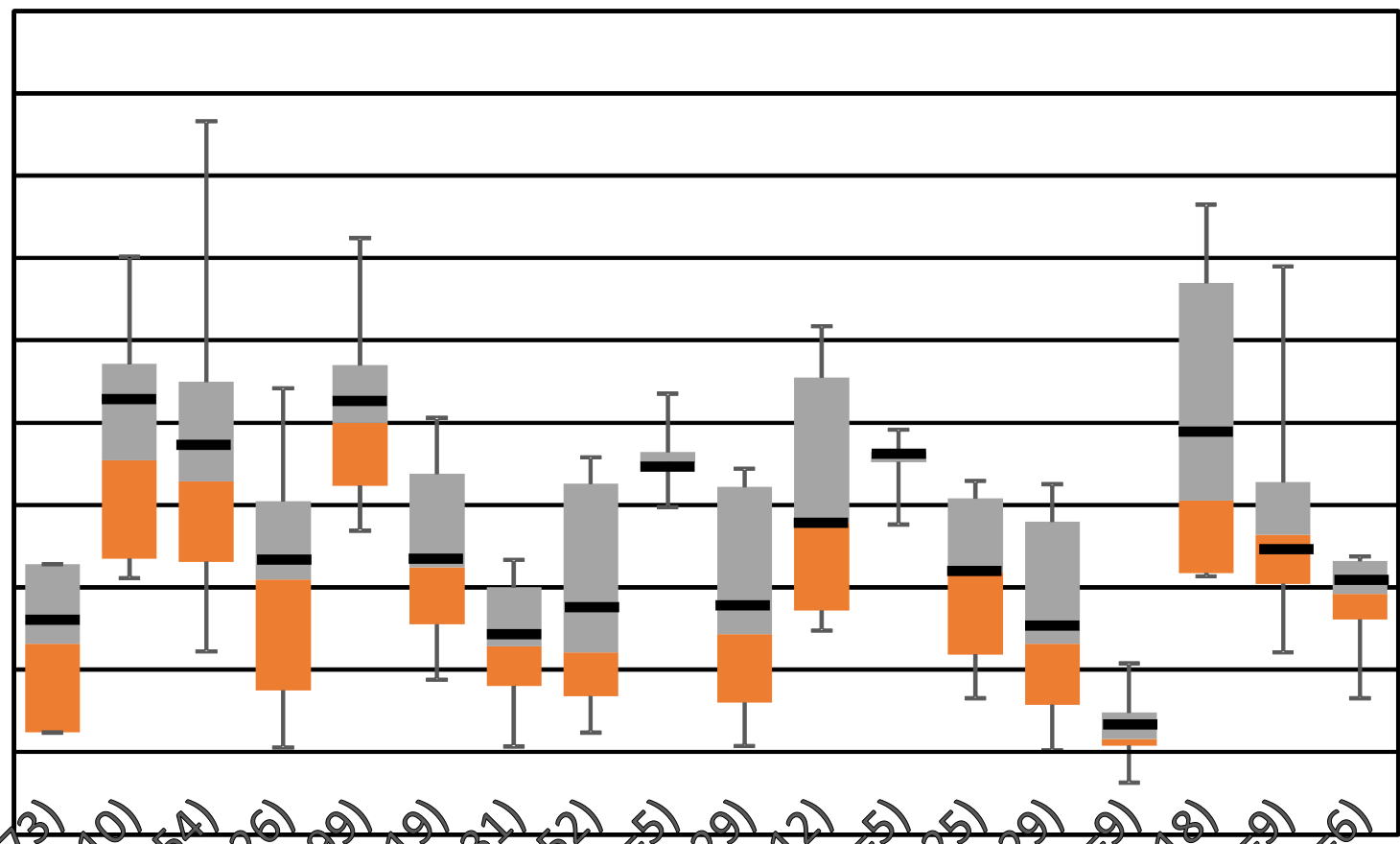
Biochar boosts tropical but not temperate crop yields (Jeffery et al. 2017)



Relative P effectiveness

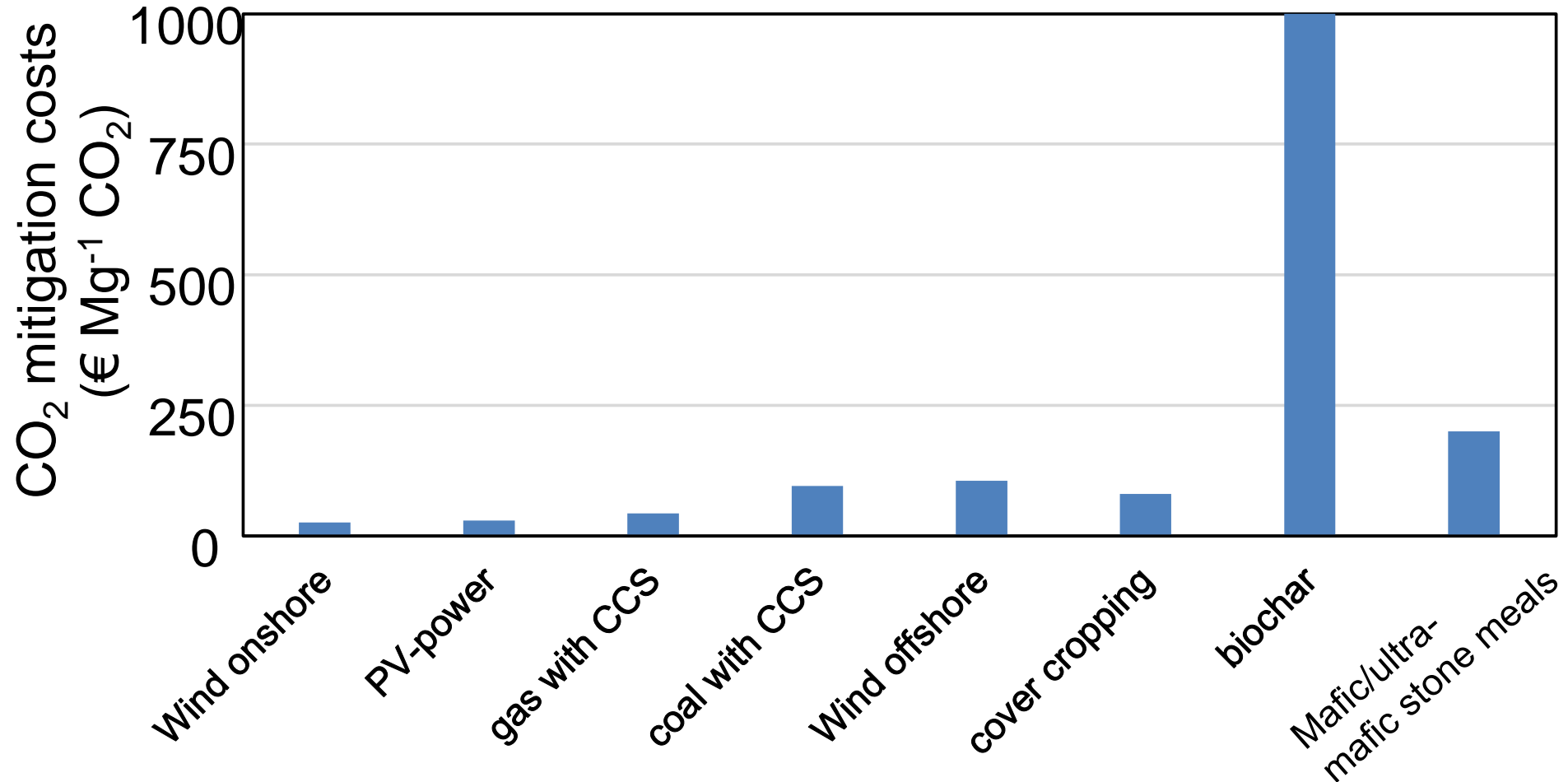
(% of TSP)

225
200
175
150
125
100
75
50
25
0
-25



Phosphate Rock (n=173)
Animal manures (n=110)
Biosolid (Bio-P rem.) (n=54)
Biosolid (chem. P rem.) (n=126)
Non H2O-sol. Ca-Phosph. (n=99)
Untreated ashes (n=19)
AshDec Mg-treated (n=31)
AshDec Rhenania (n=52)
Biochar (n=5)
Converter slag (n=29)
Solubilized biosolid ashes (n=12)
Biomass ashes (n=5)
MBM (n=25)
MBM-ashes (n=29)
Urban composts (n=9)
Urban digestates (n=18)
Fish sludge (n=9)
Fish sludge (n=6)

Comparison of CO₂-mitigation costs (based on data of Gillingham and Stock 2018, supplemented)



Conclusions

- Biochar = often a very expensive approach to sequester CO₂ with limited overall potential (feedstock availability)
- Large losses of N and S, reduction of the reactivity/ plant availability of P
- no relevant agricultural advantages under temperate climate (beside liming effect)
- advantages under tropical conditions related to liming effect (Noguera et al. 2010, Obia et al. 2016, Oguntunde et al. 2004) → an effect that can be also achieved with the original feedstock, or an ash
- organic matter not further available for many soil properties dependent on soil microbial turnover (aggregate stability, nitrogen mineralization)
- Last but not least: risk of neo-synthesis of organic contaminants

Thank you very much for your attention