

### Reference 36

Maestrini, B; Nannipieri, P; Abiven, S 2015 A meta-analysis on pyrogenic organic matter induced priming effect GCB Bioenergy. 7(4):577-90 10.1111/gcbb.12194

### Background and objective

Pyrogenic organic matter (PyOM) is considered an important soil carbon (C) sink. However, there are evidences that its addition to soil may induce a priming effect (PE) thus influencing its C abatement potential. The direction, the size and the mechanisms responsible for PyOM induced PE are far from being understood. It is still not known whether the PE is related to the type of soil and to the characteristics of the primed soil organic matter, or to the characteristics of the PyOM. It is also not known whether the PE is important on the long term, or if it is only a short-term phenomenon. The aim of this study is to assess whether PyOM induces PE, its impact on soil C budget, and which factors are driving its size and direction.

### Search strategy and selection criteria

Not reported Not reported

### Data and analysis

To estimate how soil respiration changed over time in treatments where no PyOM was added (i.e. in control treatments), the authors used a linear regression of soil respiration on log-transformed time.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
18	Lab incubations, Pot trials, field trials	Soil amendment with biochar	No amendment	Metric: Priming effect: the increase in CO <sub>2</sub> efflux derived from non-biochar C pool compared to CO <sub>2</sub> efflux in the control treatment (without PyOM amendment).; Effect size: Difference of of the considered metrics between intervention and control	0.5

### Results

- PyOM after 1 year of addition induced a cumulative positive PE equivalent to 0.3 mg C g<sup>-1</sup> soil. This loss represented 15% (0.32 mg C-CO<sub>2</sub> g<sup>-1</sup> soil<sup>-1</sup>) of the average soil respiration in control treatment, i.e. where no PyOM was added (2.1 mg C-CO<sub>2</sub> g<sup>-1</sup> soil<sup>-1</sup>).
- The mode of the addition rate was about 10 mg PyOM-C g<sup>-1</sup> soil, in this case losses by PE would represent 3% of PyOM-C added. Such addition rate would correspond in an ideal soil having 1 g cm<sup>-3</sup> and tilled down to 20 cm to an addition rate of 20 t PyOM-C ha<sup>-1</sup>.

### Factors influencing effect sizes

- Biochar labile-C content : Low-C content PyOM induce positive priming on the short term (Fig. S1). Several studies show that PyOM characterized by a low C content contains a larger labile fraction.
- Time scale : Most of the highest positive effect occurred within the first 20 days and with a low PyOM-C content, while most of the negative priming occurred on a longer time scale

### Conclusion

Over 1 year biochar induces an average positive priming effect of 0.3 mg C g<sup>-1</sup> soil on native soil organic matter and a priming effect of approximately the same size but opposite direction on fresh organic matter.