

Biochar production from forest waste as a source of nitrogen and phosphorus

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Introduction:

Plant, animal, or human waste biomass can be used as feedstock for biochar, which improves soil function and reduces CO₂ emissions. The ability of biochar to produce complex nitrogen forms is greatly influenced by the pyrolysis time during the production process. Additionally, the pyrolysis time can modify biochar's phosphorus content. Using biochar as an organic source of soil phosphorus and nitrogen would be successful if the pyrolysis time is adjusted.

Objective:

In this study, we evaluated the total concentration of nitrogen and phosphorus of biochar derived from conifers (*Pinus radiata*, *Pinus sylvestris*, *Pinus pinaster*) and broad leaves (*Betula alba*, *Quercus robur* and *Castanea sativa*) under different pyrolysis times (30 minutes, 1 hour and 2 hours).

Materials and Methods

Location	Experimental design	Treatments	Laboratory analysis	Statistical analysis
Lugo NW Spain	<ul style="list-style-type: none"> Samples were collected from forest plantations of conifers (<i>Pinus radiata</i>, <i>Pinus sylvestris</i>, <i>Pinus pinaster</i>) and broadleaves (<i>Betula alba</i>, <i>Quercus robur</i> and <i>Castanea sativa</i>) in October 2021 Dry leaves, green leaves and branches (maximum diameter of 0.5 cm) were manually separated Drying of tree parts at 45 °C. 	Each tree part was pyrolyzed separately under no oxygen conditions at 300°C for: <ol style="list-style-type: none"> 30 minutes One hour Two hours 	Total concentration of N and P in the biochar	ANOVA and LSD test

Results

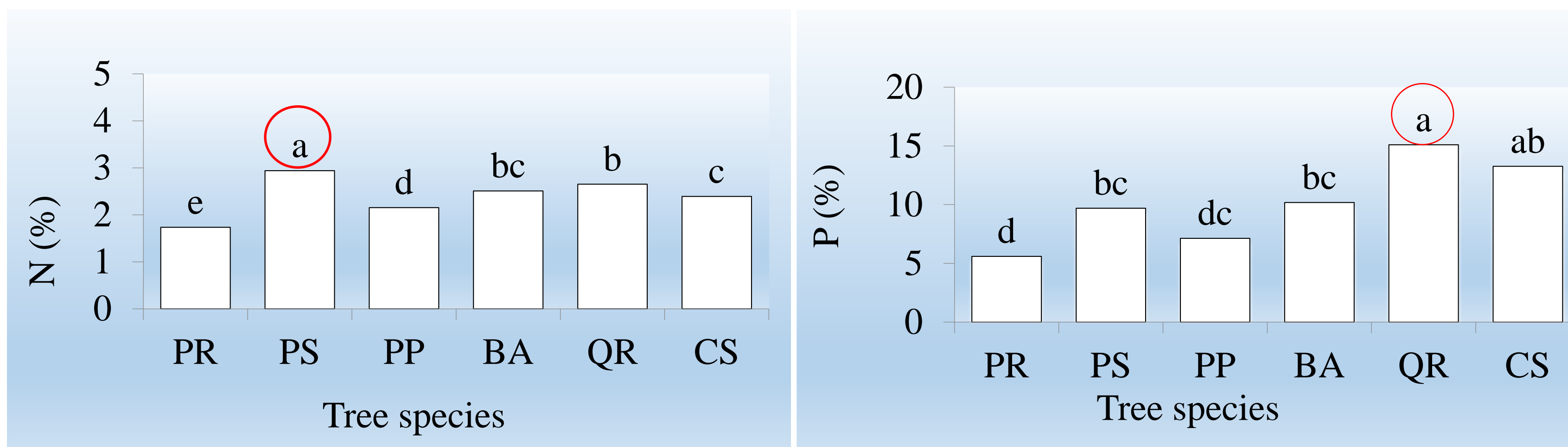


Figure 1. Total concentration of N (%) and P (%) in the biochar produced from different species (PR: *Pinus radiata*, PS: *Pinus sylvestris*, PP: *pinus pinaster*, BA: *Betula alba*, QR: *Quercus robur*, CS: *Castanea sativa*). Different letters indicate significant differences between tree species.

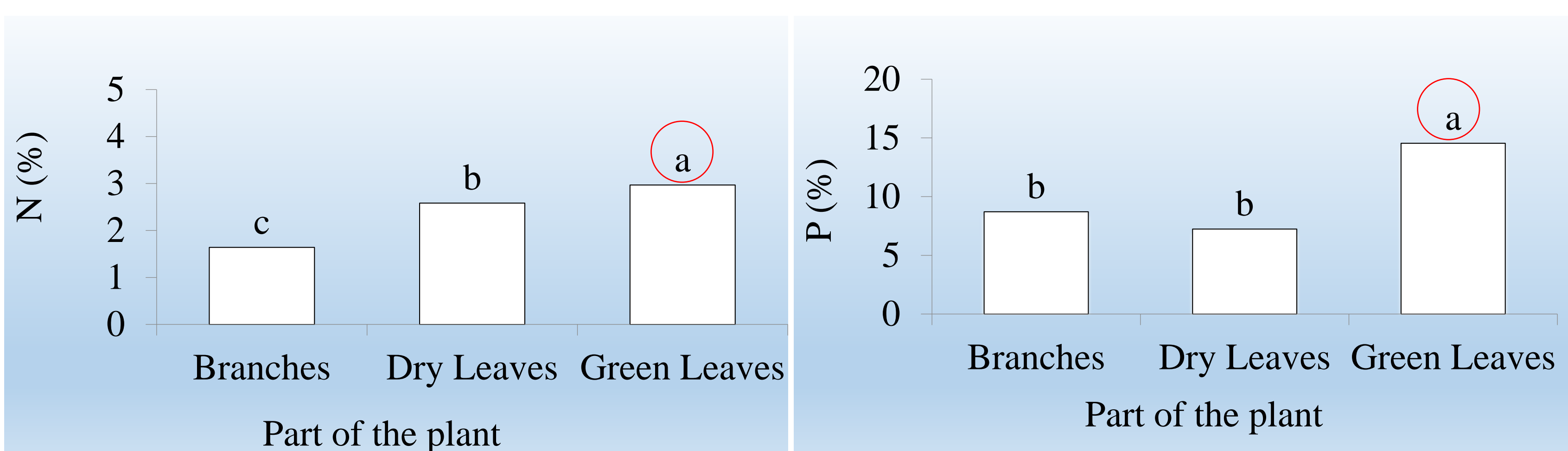


Figure 2. Total concentration of N (%) and P (%) in the biochar produced from branches, dry leaves, and green leaves. Different letters indicate significant differences between parts.

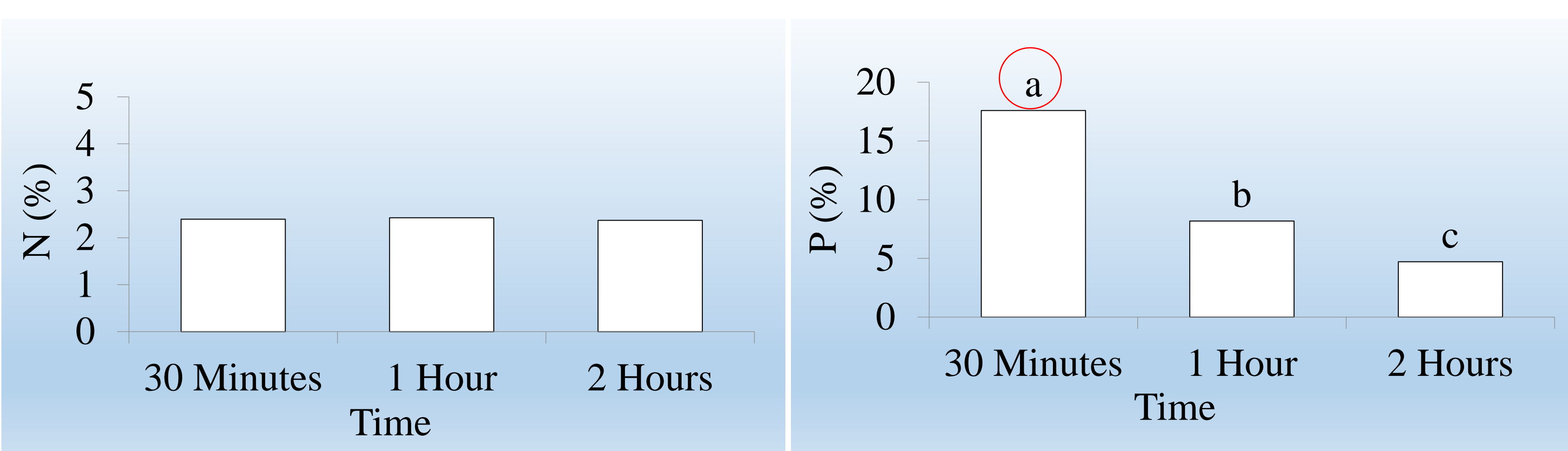


Figure 3. Total concentration of N (%) and P (%) in the biochar produced under different pyrolysis times (30 minutes, 1 hour and 2 hours). Different letters indicate significant differences between pyrolysis times.

PS ↑ N than the other tree species
QR ↑ P than the other tree species

Green leaves ↑ total N and P than the other parts of the plant

30 minutes ↑ P than the other pyrolysis times

Conclusion

In the biochar production it is important to take into account the starting material, but also the pyrolysis time that can modify the capacity of the biochar as soil amendment and fertiliser.