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Biomass ashes from pyrolytic wood liquefaction as novel soil amendments

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What happens when an old soil amendment is in fact a new one? Traditionally, ashes from biomass combustion were considered as a valuable resource, and widely used as an agricultural soil amendment. However, in recent decades we have been reluctant to apply them to soils, despite the increase in the production of combustion ashes resulting from the development of new fuels derived from biomass residues.

The production of Fast Pyrolysis Bio Oil (FPBO) out of various lignocellulosic biomass streams is one of the newest technologies for gaining a liquid biofuel that can be seen as a future substitute for mineral oils. During the pyrolysis process, the by-products (charcoal and low calorific gases) are combusted to generate energy, resulting in the production of ashes that contain the majority of the minerals and salts originally present in the feedstock. The main objective of the present work is to investigate if the recovered ashes from the pyrolysis process can be used as a soil amendment.

A greenhouse trial was set up in order to evaluate the impact of the ashes on an acid grassland soil (eutric Cambisol) from the region of Tyrol (Austria). A two-level experimental design (ash treatment, and plant effect) was set up. The ashes were mixed with the soil columns at a ratio of 1% (w:w, fresh weight). A control treatment that consisted of soil without the addition of ashes was also included. Moreover, to understand the effect that the ashes would have on crop growth, ten seeds of a traditional wheat variety (Tiroler Früher Dinkel; *Triticum aestivum* subsp. spelta), were placed in half of the columns with and without ashes, so as to determine the seed germination index and plant growth. Moreover, specific microbial groups related to N cycle were quantified by real-time PCR. A total of 24 experimental units (2 ash treatments x 2 incubation times x 2 plant levels x 3 replicates) were analysed. After an equilibration period of 24 h at 4 °C (referred as time zero), the columns were arranged in a completely randomized design and destructively sampled after 60 and 100 days.

The amendment with ashes induced a soil pH increase of almost 2 units over time and independent of the crop presence. Moreover, ash addition did also increase soil plant available P and dissolved organic carbon content; however, it also increased nitrogen loss to the soil eluates compared to the control. On the other hand, the presence of ashes enhanced both plant growth and grain yield after 60 and 100 days. Similar effects have been observed when “traditional” biomass ashes have been applied to agricultural soils, leading us to conclude that ashes derived from FPBO process might be used for agricultural purposes.

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