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# Effect of biochar on N dynamics, greenhouse gas emissions, and Komatsuna (Brassica rapa) growth in soils with different fertility

Kazuyuki Inubishi (1), Yuri Saito Saito (1), Daniel Bencsik (2), Janos Kátai (3), and Andrea Kovács (3)

(1) Graduate School of Horticulture, Chiba University, Matsudo, Chiba, 271-8510, Japan, (2) Faculty of Agriculture and Food Science and Environmental Management, University of Debrecen, Debrecen, 4032, Hungary, (3) Graduate School of Agriculture and Food Science and Environmental Management, University of Debrecen, Debrecen, 4032, Hungary

Biochar is a biological resource carbonized by pyrolysis under limited oxygen supply. Its application is expected to promote microbial activity and crop growth. However, these efficacies have been reported to be significantly affected by soil types and environmental conditions. Most of research on biochar has focused on improvement of low-fertile soils with poor organic matter, while in fertile soils, how to use biochar in temperate areas has not been established yet. In order to find better use of biochar, effects of biochar on N dynamics, greenhouse gas emissions, and crop growth were investigated by using soils with different fertilities.
Japanese Andosols and Fluvisols were used as a fertile soil and a low-fertile soil. Andosols (Total Carbon (TC): 39.17 g kg-1) and Fluvisols (TC: 6.40 g kg-1) were collected from soybean field in Matsudo, and peanut field in Yokoshiba, Chiba, Japan in March 2017, respectively. Rice husk biochar (commercially available in Japan, pyrolysis: 600 to 800 oC for 5 min) was applied at the rate of 0 - 2 % (w/w) of oven-dried soil. The treatments with and without a nitrogen fertilizer (100 kg N ha-1 as urea or ammonium nitrate) were also set-up. In incubation experiment, soil samples were adjusted to WHC: 50 %, and aerobically incubated for 4 weeks at 20 oC. Nitrification and gas emissions ($CO_2$, CH4, and N2O) were measured 4 times during the incubation. After the incubation, pH, TC, Dissolved Organic Carbon (DOC), and Microbial Biomass Carbon (MBC) were measured. In pot experiment, Komatsuna (Brassica rapa) was cultivated for 6 weeks. Growth investigation was conducted once a week, and after the harvest, fresh and dry weight of edible part were measured.
As a result, biochar application increased soil pH especially in Fluvisols by its own alkalinity. Biochar increased TC in both soils, and it was not decomposed in 4 weeks incubation. No effect of biochar on nitrification was observed. Biochar application reduced N2O emissions in Andosols in both with and without N fertilization. Biochar reduced DOC in both soils while MBC was not changed, which might be due to its adsorption abilities. Biochar application increaed the dry weight of Komatsuna in Andosols. No promotion and supression on Komatsuna growth was observed by biochar in Fluvisols. In conclusion, the effect of biochar depended on soil types and N fertilizations, but it was effective on crop growth and reduction of N2O emissions in fertile soils. Further comparisons with Hungarian soils are under processing.

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