

Soil nitrogen dynamics and *Capsicum Annuum* sp. plant response to biochar amendment in silt loam soil

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The present study investigated the growth of *Capsicum Annuum* sp. (pepper) in small-scale experiment to observe changes in plant growth and health as reflected by leaf area, plant height, yield, root density, and nitrogen usage. Based on field conditions, part of the study aimed to examine the photosynthetic and photochemical responses of plants to treatments resulting from different plant growth rates. During the 12.5 week long study, four treatments were investigated with biochar amount of 0, 0.5%, 2.5%, and 5.0% (by weight) added to silt loam soil. The plants were placed under natural environmental conditions, such that photosynthetic activities from photosynthetically active radiation (PAR) and the plants photochemical reflectance index (PRI) could be continuously measured after exposure to sunlight. In this study we found that benefits from biochar addition to silt loam soil most distinguishable occurred in the BC2.5 treatments, where the highest plant yield, highest root density, and highest leaf areas were observed compared to other treatments. Furthermore, data showed that too low (0.5%) or too high (5.0%) biochar addition to the soil had diminishing effects on *Capsicum Annuum* sp. growth and yield over time. At the end of the 12th week, BC2.5 had 22.2%, while BC0.5 and BC5.0 showed 17.4% and 15.7% increase in yield dry weight respectively compared to controls. The collected data also showed that the PRI values of plants growing on biochar treated soils were generally lower compared to control treatments, which could relate to leaf nitrogen levels. Total nitrogen amount showed marginal changes over time in all treatments. The total nitrogen concentration showed 28.6% and 17.7% increase after the 6th week of the experiment for BC2.5 and BC5.0, respectively, while inorganic nutrients of $\text{NO}_3\text{-N}$ and $\text{NH}_4\text{-N}$ showed a continuous decrease during the course of the study, with a substantial drop during the first few weeks. The present study provides evidence for impact of biochar on plant stress levels and growth function in biochar amended soils. Our findings emphasize the necessity for optimization to local parameters prior to biochar additions to soils.