Effect of Biochar Feedstock and Application Rate on Carbon and Nitrogen Mineralization

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Intensive land management and a warm humid climate have resulted in agricultural and silvicultural soils with limited fertility and low soil organic carbon in the Coastal Plain of the southeastern United States. The addition of a stable carbon source such as biochar may be able to improve fertility while adding nutrients and sequestering carbon. Biochars from different feedstocks have different carbon to nitrogen ratios and nutrient and volatile organic compound concentrations (Gaskin et al., 2008) and this may affect carbon mineralization rates and nitrogen availability.

We amended Tifton soil (Fine-loamy, siliceous, thermic Plinthic Kandiudults) with Peanut Hull (*Arachis hypogaea)* (PN) and Pine Chip (*Pinus taeda*) (PC) biochar at application rates of 22 and 44 Mg ha^{-1} and performed a 136-day mineralization study. Soil carbon mineralization rates were monitored periodically throughout the study. Total nitrogen mineralization rates were determined. After incubation, we compared mass loss curves of fresh biochar to incubated biochar using thermogravimetric analysis (TGA).

Carbon mineralization rate (k) and predicted maximum respired C (rmax) were calculated using Statistical Analysis Software (SAS) (Cary N.C.) PROC NLIN for each sample and then analyzed using SAS PROC MIXED. An inverse relationship between the k and rmax indicated insufficient substrate in controls resulting in high variance; therefore the control was removed in the carbon mineralization analysis. There was a significant difference between feedstock for k and between application rates for rmax with PN and 44 Mg ha^{-1}being higher respectively. There was only a significant effect of application rate on NH_4 mineralized with higher application rates resulting in lower NH_4; however all concentrations were very low and would not affect plant growth. TGA showed a considerable difference in mass loss curves between feedstock and fresh versus incubated chars. Our data suggest that biochar is relatively stable when added to soils.

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