Effects of Biochar Feedstock and Pyrolysis Temperature on Growth of Corn, Soybean, Lettuce and Carrot

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Biochar, the carbon-rich material remaining after pyrolysis (low oxygen) of cellulosic feedstocks, has the potential as a soil amendment to sequester carbon, improve soil water-holding capacity, and increase nutrient retention thereby enhancing soil conditions to benefit plant growth. However, biochar produced from some feedstocks also could adversely affect plant growth or result in unwanted residual materials assimilated by plants. To determine potential effects of different biochar products on important food crops, we conducted a soil-biochar-plant greenhouse study with corn (*Zea mays*, cv. Golden Batam), soybean (*Glycine max* cv. Viking 2265), lettuce (*Lactuca sativa*, cv. Black-Seeded Simpson) and carrot (*Daucus carota* cv. Tendersweet). Plants were grown in two South Carolina fertility poor- soils (Norfolk and Coxville soil series), each with biochar produced from 6 feedstocks (pine chips, poultry litter, swine solids, switchgrass, and two blends of pine chips plus poultry litter). Biochar was made from each feedstock by pyrolysis at 350, 500 and 700 ˚C. The biochar was added to the soil at 1% by weight that represents about 20 t/ha. Corn and soybean (and to a much smaller extent lettuce and carrot) produced more aboveground biomass with the heavier Coxville soil *vs.*the sandy Norfolk soil. The crops responded differently based on soil and biochar, with few effects due to pyrolysis temperature. Among the more noticeable responses, poultry litter alone and/or some mixtures of poultry litter and pine chips increased lettuce shoot and root dry weights in both soils, and corn shoot dry weight in the Coxville soil. In contrast, poultry litter (from lower temperature pyrolysis) decreased soybean shoot dry weight in the Norfolk soil, and soybean root dry weight and pod dry weight and number in both soils. Poultry litter also decreased carrot shoot, tap root and diffuse root dry weights, but only for the Coxville soil. Swine solids and some blends of pine chips and poultry litter increased lettuce root and shoot dry weights for both soils, and carrot shoot, taproot and diffuse root growth, and soybean pod number, but only for the Norfolk soil. The different responses to the higher nutrient biochar feedstocks (those containing poultry litter and swine solids) were likely associated with N, K and P requirements of the different crops. Future chemical analyses will focus on the effects of the biochar feedstocks on plant nutrients and polycyclic hydrocarbon concentrations of the plant tissues. Further characterization of soil physical and chemical properties will provide guidance for the use, establish application rates and other potential benefits/risks associated with using particular types of biochar as a soil amendment in the Coastal Plain agriculture soils.