Effects of fertilization on soil carbon stocks and sorghum/pigeon pea productivity in a Vertisol in semi-arid tropical India

Abstract

It is accepted that soil carbon stocks are formed of the organic matter of plant, animal and microbial residue; and, in terrestrial ecosystems, tillage, temperature, and soil moisture influence the rate of incorporation and the pattern of distribution of these residues in soil. Investigation of soil carbon stocks is enhanced by scientific research that provides evidence that mitigation of CO2 emissions, and increase in soil carbon storage and subsequent increase in soil quality for plant productivity is possible. Fertilizer effects on soil organic matter (SOM) and formation of soil carbon stocks are not well understood, however. Yet, fertilizer may have significant influence on microbial oxidation of residues and thus soil carbon stock formation. Soil samples collected from a field study initiated in 1976 in Vertisols in semi-arid tropical India are used to investigate long-term (12-year) changes in soil carbon stocks and crop productivity. Farm Yard Manure (FYM) and inorganic (NPK) fertilizer treatments are compared. Initial findings from this study indicate statistically significant ($P<0.05$) increase in biomass nitrogen with FYM treatment, as compared to NPK inorganic fertilizer application; and, increased organic soil carbon stocks under sorghum/pigeon pea with NPK treatment. Soil samples collected in 1997 (archived samples, retrieved in January 2010) and June 2009 soil samples are analyzed side-by-side for comparison of total carbon (TC), total nitrogen (TN), and C13 and N15 isotope signatures. Further, results show yield increases for sorghum/pigeon pea (77 kg ha-1 yr-1) as compared to sol-sorghum (26kg ha-1 yr-1).