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Long-term effects of organic and inorganic nutrient sources on soil organic carbon and major nutrients in Vertisols

Y. R. Aladakatti, S. S. Hallikeri, and R. A. Nandagavi
University of Agricultural Sciences, Dharwad, Karnataka, India (yraladakatti@rediffmail.com)

Field experiment conducted over 10 years at the University of Agricultural Sciences, Dharwad, India, assessed the long-term effects of various sources of organics (farmyard manure {FYM}, vermicompost and cotton crop residue) in conjunction with graded levels of inorganic fertilizers on the soil organic carbon (SOC), available major nutrients and seed cotton yield in cotton- (groundnut – winter Sorghum) rotation system. Main plots comprised FYM (10 Mg/ha), vermicompost (2.5 Mg/ha), cotton crop residue (2.5 Mg/ha) and combination of these organics in various proportions with an absolute control (no organics). No inorganic fertilizes, 50 and 100 % of the recommended dose of fertilizers (RDF) were assigned to the sub plots. The organics were applied every year during rainy season and the inorganic fertilizers as per the University recommended dose to each crop. Initial SOC, available N, P and K were 0.68%, 220, 22.5 and 403 kg/ha, respectively.

Results indicated that at the end of tenth year of crop rotation, application of FYM, vermicompost and cotton crop residue either alone or in combination increased the SOC (0.68 to 0.81%), available N (220 to 308 kg/ha), P (22.5 to 33.0 kg/ha) and K (403 to 530 kg/ha) compared to the control plot where no organics were applied. SOC in the control treatment decreased to 0.52% at the end of tenth year from 0.68%. Averaged over five cropping cycles, application of FYM gave significantly higher yields of seed cotton, groundnut pods and sorghum grain over all other organic sources. During fifth cycle of cotton crop or 10th year of rotation, application of FYM along with 100% RDF resulted in the highest productivity and was similar to FYM + 50 % RDF, indicating a saving of 50% chemical fertilizer in these crops. Combination of cotton crop residue and vermicompost were next best alternative sources of organics after FYM in order of preference. Our studies suggest that in the scarcity of good quality manure such as FYM, cotton crop residue could be used for not only improving crop productivity but also as an effective mechanism to sequester SOC and improve soil nutrient status.