As influenced by agricultural practices, soil organic matter (SOM) stability is imperative in maintaining soil fertility and crop production. Integrated soil management practices have been recommended for soil fertility improvement by enhancing soil organic matter. We examined the SOM stability under integrated soil management practices for six consecutive cropping seasons in the high agricultural potential area of the Central Highlands of Kenya. The experimental design was a complete randomized block design with fourteen treatments replicated four times. The treatments were minimum (Mt) and conventional tillage (Ct) combined with sole mineral fertilizer (Mf), crop residue combined with mineral fertilizer (RMf), crop residue combined with mineral fertilizer and animal manure (RMfM), crop residue combined with animal manure and Dolichos Lablab L. intercrop (RML), crop residue combined with Tithonia diversifolia and animal manure (RTiM), and crop residue combined with Tithonia diversifolia and phosphate rock (Minjingu) (RTiP), as well as a control (no inputs). SOC was higher in treatments with organic inputs and a combination of organic and inorganic inputs. Treatments with sole mineral fertilizer and no input recorded lower SOC amounts. The C functional groups followed the sequence: alkyl C (53%) > O-alkyl C (17%) > aromatic C (9%) > carboxyl C (8%) > methoxyl C (7%) > phenolic C (6%). The alkyl C proportion was higher in organic inputs treatments, while O-alkyl C was higher in organic and inorganic fertilizer treatment combinations. Methoxyl C, aromatic C, and phenolic C proportion of SOC was greater in crop residue and mineral fertilizer combination, while carboxylic C was lower than the control in most treatments. In addition, the organic inputs treatments had a higher alkyl C/O-alkyl C ratio, increased aliphaticity, and higher hydrophobicity. Applying organic fertilizers individually or in combination with inorganic fertilizers could potentially increase C storage in the soil, thereby enhancing SOC stocks.