Soil Carbon Sequestration in Silvopastoral Systems: Relative Contribution of Trees and Warm-Season Grasses

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Silvopastoral systems that integrate trees in pasture production systems are likely to enhance soil carbon (C) storage in lower soil layers due to the presence of deep tree-roots. To quantify the relative soil C contribution from woody vegetation (C3) vs. warm-season grass vegetation (C4) in silvopastoral systems, soil samples were collected from silvopastures of slash pine (*Pinus elliottii*) + bahiagrass (*Paspalum notatum*), and adjacent open pasture at six depths up to 125 cm, at two sites, representing Spodosols and Ultisols. Using stable C isotope signatures, C in whole soil and three soil fraction-sizes (250 – 2000, 53 – 250 and <53 µm) of each soil layer were traced to the plant sources. The total soil C (0-125 cm depth) was 121 kg m^{-2} near trees (SP-T) and 87 kg m^{-2} on the alley (SP-A) of silvopasture compared to 50 kg m^{-2} on the treeless pasture (OP) at the Spodosol site. The corresponding values on the Ultisol site were 56 kg m^{-2} for SP-T, 34 kg m^{-2} for SP-A and 37 kg m^{-2} for OP. Compared with the treeless pasture, the Spodosol profile between trees in a row in the silvopasture contained more C in the silt + clay fraction (<53µm) at and below the depth of spodic horizon (40 – 50 cm deep). In both soil orders, the C3 plant (slash pine) contributed more C than the C4 plant (bahiagrass) at all soil depths, particularly at the lower depth. In the relatively stable size fraction (<53µm), higher proportion of C was derived from tree components (C3 plants) in both pasture systems. The results suggest that the tree based-pasture system has greater potential for C sequestration compared with the treeless system.

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