

## Soil thermal properties affected by topsoil thickness in switchgrass and row crop management systems

### ABSTRACT

Perennial systems, such as switchgrass have been shown to improve soil hydraulic properties on degraded soils relative to annual cropping systems; however, studies of the effects on thermal properties are limited. Therefore, the objectives of this study were to determine the effects of topsoil thickness on soil thermal properties under switchgrass (*Panicum virgatum* L.) and row crop production systems. The experiment was carried out at the University of Missouri South Farm Research Center (38°54' N, 92°16' W). Research plots were re-established in 2009 with selected topsoil thickness categorized into two treatments (shallow [4 cm] and deep [36 cm]) on a Mexico silt loam (Vertic Epiaqualfs). Plots were planted to either switchgrass or a corn (*Zea mays* L.)-soybean (*Glycine max* (L.) Merr.) rotation with four replicates. Undisturbed soil cores (7.6 by 7.6 cm) and bulk soil were collected from two depths (10 cm increments) to determine thermal properties. Thermal conductivity ( $\lambda$ ), volumetric heat capacity ( $C_v$ ), and thermal diffusivity ( $D$ ) were measured at 0, -33, -100 and -300 kPa soil water pressures. In addition, soil organic carbon (SOC), bulk density ( $D_b$ ) and water content ( $\theta$ ) were also determined. The results showed that the switchgrass treatment had 23% higher SOC, 5-8% greater  $\theta$ , and 11% lower  $D_b$  than the row crop treatment. In turn, switchgrass plot exhibited a 5-7% reduction in  $\lambda$ , an 8-9% reduction in  $D$ , and a 2-3% increase in  $C_v$ . Shallow topsoil thickness demonstrated increased thermal properties ( $\lambda$ ,  $D$  and  $C_v$ ) relative to the deep topsoil thickness, likely due to higher clay content in the surface soil horizon and associated higher  $\theta$ . This study contributes to a better understanding of the impact of topsoil loss and perennial vegetation on the thermal properties of soils in degraded landscapes.

**Keyword:** Thermal conductivity; Thermal diffusivity; Heat capacity; Claypan; Biofuel crop