

Spatial Variability of Soil Organic Carbon in Oil Palm: A Comparison Between Young and Mature Stands

ABSTRACT

This study aimed at quantifying the spatial variability of Soil Organic Carbon (SOC), estimating SOC at unsampled locations and comparing the spatial variability of SOC between young and mature oil palm stands. Two study sites were chosen to represent two different palm age groups, i.e., 5 Years after Planting (YAP) and 17 YAP. A systematic sampling design was employed for soil sampling at the 0-20 cm depth based on a cluster of four palms that comprised three operational zones: Weeded Circle (WC), Frond Heap (FH) and Harvesting Path (HP). A total of 60 sampling clusters were obtained for each site. Soil samples were analyzed for SOC by dry combustion method. All measurement points were geo-referenced by differential Global Positioning System (dGPS). The SOC data were first explored using descriptive statistics, normality check, outlier detection and data transformation, followed by variography and interpolation. Spatial variability of SOC was mapped based on measured and kriged values. Results showed that all operational zones exhibited a definable spatial structure, which were described by either spherical or exponential models. All operational zones exhibited strong spatial dependence. Operational zones of 5-year old palms exhibited a shorter effective range than those of 17 year old palms. Additionally, SOC heterogeneity was evident among operational zones at both sites, where FH registered the highest SOC, followed by WC and HP. SOC concentration at 17 year old palms was found to be more stable than that from 5 year old palms. This study suggests spatial variability assessment appears to be a feasible technique to quantify the variability of SOC in oil palm cultivation.

Keyword: Soil Organic Carbon, Oil Palm, Global Positioning System (dGPS)