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6. Soil in the digital era
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GUIDED SOIL SAMPLING USING SOIL MANAGEMENT ZONES AND PROXIMAL SOIL SENSORS TO IMPROVE COST-BENEFIT RATIO OF FERTILIZER RECOMMENDATIONS

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Substantial improvements of field robotics could provide large coverages in a more uniform matter. However, this mechanized standard cannot be considered optimized as mostly disregarding within-in field soil variations. Large cropping areas require detailed sampling approaches to consider and reconcile soil property differences for field interventions. To identify soil heterogeneous zones demands an optimized sampling approach. The objective was to integrate soil data from two proximal soil sensors to improve the delineation of homogeneous soil regions using a k-means clustering algorithm defining three distinct management zones in an irrigation pivot with 72 ha in Itaí, São Paulo, Brazil. A regular sampling grid of one hectare was sampled for the attributes of CEC, V%, texture, organic carbon, and pH, as well as a second optimized sampling grid was guided by proximal soli sensor datasets. Maps of apparent electrical conductivity, apparent magnetic susceptibility, equivalent thorium, and equivalent uranium provided by two sensors were considered to guide this optimized sampling schema. These maps served as preliminary information using the spsann sampling algorithm in R. Six locations were defined for soil sampling in each of the three previously defined management zones. A dataset of 18 points collected at depths of 0–10 and 10–20 cm were subjected to analysis of variance, checking whether each zone could distinguish soil heterogeneities. Only clay, organic carbon, and calcium attributes showed significant differences between grids with 72 and 18 points at depths of 0–10 and 10–20 cm. The optimized approach shown that sensors information could improve management zone delineations, as identifying soil heterogeneities concerning clay texture and organic carbon content. The approach using sensor data and the spsann algorithm could promote a reduction of four time less sampling points, yet providing a more precise delineation of soil heterogeneities. It was observed that a very homogeneous spatial distribution of nutrient concentrations could not significantly contribute to delineate management zones.

Keywords: Management Zones, Proximal Soil Sensors, Soil Sampling, Precision Agriculture, Irrigated Crops