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Spatial Variability of Selected Soil Chemical Parameters in Low-yielding Paddy Production Block in Mahaweli System H, Sri Lanka

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Abstract

Although water availability for paddy production in Mahaweli System H is abundant, paddy yield is lower in Nochchiyagama (278 km²), chosen for soil assessment. Paddy yield data were used to identify the low-yielding division using the area-weighted average. Twenty-five random locations were generated, and soil samples were collected for pH, soil conductivity (EC), salinity, and total dissolved solids (TDS) analysis. ArcGIS software was used to create spatial distribution maps and related geostatistical analyses for each parameter. Vector files were created with their associated properties, and thematic maps were generated using spatial interpolation techniques, such as universal kriging (UK), ordinary kriging (OK), and inverse distance weighted (IDW) methods of interpolation techniques to identify the best interpolation method for soil chemical parameters mapping. The entire Nochchiyagama land was observed to have a slightly acidic pH (5.6-5.9) range that may have affected rice crop growth due to nutrient mobility and uptake issues. The spatial interpolation evaluation suggests that at least two-thirds of the area observed for lower TDS levels (591-654 mg/L) is potentially unsafe paddy production. Elevated levels of EC (3.1-7.24 dS/m) along with TDS may lead to physiological drought due to interferences in ion uptake. In overall, spatial interpolation evaluation indicators suggest that the UK method was observed with a lower mean relative error (MRE) than the other two interpolations. However, EC distribution showed low MRE in both IDW and OK interpolation techniques. The IDW method was observed to have a lower RMSE (Root mean square error). The UK spatial interpolation performed better for TDS and salinity predictions than other methods. This study found consistent regional differences in low paddy yields in Mahaweli system H using the UK method for analyzing soil chemical parameters.

Keywords: Electrical conductivity, Interpolation errors, Salinity, Spatial interpolation