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IDENTIFICATION OF SALINITY HAZARD ZONES USING DUALEM-1S PROXIMAL SOIL SENSOR

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Development of soil salinity is one of the degradation processes that affects soil productivity throughout the world. It is predicted to aggravate in the coming decades endangering food security. In Sri Lanka, soil salinity occurs in major irrigated inland areas of the dry zone and coastal areas. Information on spatial variability of soil salinity and identification of salinity hazard areas are important to apply relevant reclamation measures, to select suitable crop varieties and to minimize further degradation of productive lands. This study focuses on the potential of DUALEM-1S, an electromagnetic induction-based proximal soil sensor to explore the spatial variability of soil salinity and subsequent delineation of potential salinity hazard zones in dry zone paddy soils. Apparent electrical conductivity (EC_a) survey was performed using the DUALEM-1S sensor in a paddy field (2.5 ha) in Mahailluppallama. Top (0-30 cm) and subsoil (30-60 cm) samples were collected at 35 sample locations those identified using the Latin Hypercube sampling technique based on EC_a. Soils were analyzed for pH, EC (1:5 Soil: Water), EC of saturated paste (EC_e), texture, organic matter (OM), available Na, Ca, Mg, and CEC. The EC_a survey resulted in 6318 measurements of horizontal (EC_{aHCP}, subsoil sensitive) and perpendicular (EC_{aPRP}, topsoil sensitive) coplanar coil orientations. Both measurements were highly correlated (r = 0.95). The EC_{aPRP} and EC_{aHCP} measurements showed strong correlations with topsoil EC_e (r =0.90) and (r=0.89), respectively. The regression model fitted between EC_e and EC_{aPRP} (R^2 = 0.8) showed that latter can be used as a soft information to predict the salinity hazard of the study area. Two potential salinity hazard zones were delineated using Fuzzy k-means classification based on interpolated map of EC_{aPRP}. One zone was having comparatively low EC_a (0.1- 155 mS/m) and the other a higher EC_a (155- 309.9 mS/m). Soils were obtained from each zone for further analysis. Soil analyses revealed that the zone having high EC_a as a sodic zone (ESP > 90.1 %) and zone having lower EC_a as a salinity hazard zone. A pot experiment conducted using soils of potential salinity hazard zones revealed a zero germination of Bg 352 and At 354 rice varieties in the sodic zone and the non saline zone did not affect on the germination of both varieties. This study results justified a strong potential of proximal soil sensing for the characterization of salinity development in paddy soils in the dry zone.