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Applying Electrical and Electromagnetic Methods to Investigate Soil Salinity in Rice Production Systems in the Vietnam Mekong Delta

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Abstract

Rice is a major staple in Vietnam and more than half of its production is located in the Mekong River Delta (MRD). Due to sea level rise and seasonal fluctuations in river water levels, rice production in the MRD is threatened by salinity. Sea level rise may result in sea water intrusion into ground water tables, potentially allowing capillary rise of salt into the top soil. Low river water levels allow tidal intrusion of seawater into the irrigation canal system rendering the water unusable for irrigation. This study was conducted to investigate the suitability of two geo-electric methods to assess soil salinity in rice production systems. ARESII (electrical resistivity) and EM38 (electromagnetic conductivity) were employed at six benchmark sites of roughly 6 ha each in the Tra Vinh province of MRD to explore soil salinity as related to the cropping systems (2 or 3 rice crops per year) and distance to the sea defined via Northwest – Southeast and Southwest – Northeast transects along the peninsula. EM38, with a maximum penetration depth of 1 m, was used to characterise effects of irrigation management on top soil properties (EC in 0–1.5 m depth). ARESII, with a maximum penetration depth of 48 m was used to explore resistivity of sub-soil layers down to 40 m with different spatial resolutions (Ω in 1 m – 48 m depth). Top soil salinity was low (< 4 dSm^{-1}), for all measured sites with EC reflecting water fluxes and irrigation management. Resistivity results show high values in the upper soil layers (> 50 Ωm), and low resistivity values (0–2 Ωm) vary from 7 m – 20 m depth at all sites. An increasing trend of deep soil resistivity is evident from the coast to inland and from south to north of the peninsula. Fields with three rice crops show a lower resistivity than those that are cropped twice. Although, the electrical resistivity demonstrated potential variations in depths and space of soil salinity among rice systems, geological information of measured areas is necessary for validating results. The suitability of the two methods to assess soil salinity in MRD is discussed.

Keywords: Conductivity, *Oryza sativa*, deep soil, resistivity, top soil

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