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Leon D van Rensburg

University of the Free State, South Africa

Inferring salt and water distribution in an irrigated crop field using electromagnetic induction techniques

Statement of the Problem: Irrigation through its addition of salts poses a continuous threat to the functioning of natural resources. Estimates indicated that of the total land being irrigated in South Africa, 1-12% is severely waterlogged or salt affected, and 5-20% moderately affected. The affected areas need to be reduced through sound water management. Fortunately, recent advances in EMI technology opened new opportunities for site-specific crop management. The objectives of this study were, to evaluate the reliability of the EM38-MK2 to infer soil properties, like particle sizes, electrical conductivity (EC), sodium adsorption ratio (SAR) and soil water, and to delineate salt affected zones.

Methodology & Theoretical Orientation: The 56 crop fields are located on the banks of the Vaal River in the Northern Cape Province, South Africa. The long-term water quality of the river is good (EC of 52 mS m-1 and sodium adsorption ratio of 1:2). The soils of the field vary from sandy to clay. The field was scanned with an EM38-MK2 during September 2016 to a depth of 1.5 m with inter-row spacing of 20 m. Twelve soil profiles were sampled to a depth of 1.5 m over 0.3 m increments. The soils were analysed for soil water, particle sizes and the saturated paste was used for measuring EC, cations (to calculate SAR) and pH. These values were then correlated with the apparent EC recorded by the EM38-MK2.

Findings: Results showed that all the soil properties, except pH, correlated significantly with the measured ECa. Spatial maps for the properties were drawn and the salt affected areas delineated.

Conclusion & Significance: The research demonstrated that the EM38-MK2 can be used to infer the spatial distribution of salts in crop fields, which is a critical step in the amelioration process.

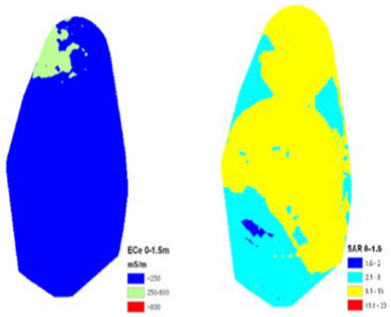

Figure 1 EC and SAR distribution over the field estimated from ECa measurements made with the EM38.

Biography

Leon D van Rensburg is a Soil Physicist, lecturing soil and water management at the University of the Free State, South Africa. He established and maintained a vibrate Post-graduate research team, which currently consisted of 2 Post-doctoral fellows, 4 Doctoral students and 8 Master's students. The team focuses mainly on soil and water management of dryland, irrigation as well as natural field and they published in the last 6 years about 45 scientific articles. He is leading two projects of national importance for South Africa, management guidelines for technology transfer to reduce salinization of irrigated land with precision agriculture funded by the Water Research Commission and the soil water balance of the Ghaap Plateau as influenced by open cast mining funded by Sishen Iron Ore Company (Anglo American Kolomela).

vrensbl@ufs.ac.za