Using multi-year remote sensing to Assess Impact of Soil Sodicity on Wheat Yield

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Soil sodicity is an important edaphic stress in Australia affecting more than 60% of cropping soils. Deterioration of soil physical properties is the major constraint to crop growth in sodic soils affecting the seed germination and emergence, the uptake of oxygen and water by plants and reducing root penetration and growth. However, most research within the area is restricted to assessing soil response to sodic conditions in simulated laboratory conditions, to pot experiments and to paddock-scale field trials. To rapidly and accurately assess the impact of soil sodicity in field conditions at fine scale is important to assist on-farm decision-making and to improve management practices. This study aims to use multi-year remote sensing to assess the impact of soil sodicity on wheat yield at sub-paddock scale over 15-year period (2000-2014) on a commercial farm near Goondiwindi in southern Queensland. Time-integrated Normalised Difference Vegetation Index (iNDVI, 30m pixels) are derived using remotely sensed Landsat imagery and calibrated to an archive of (limited) ground-based observation to derive an empirical model that predicts wheat yield for any paddock in any year over the farm. Potential edaphically constrained field locations are delineated when predicted yield consistently failed to reach the 80th percentile in a given year over a number of years. Soil data are interpolated at the same pixel grid as the yield data. The effects of sodicity on wheat yield at sub-paddock level under three scenarios (dry, moderate and wet rainfall conditions) are evaluated and quantified. This methodology provides a robust model that allows the prediction of wheat yield at within-field level. It also presents a cost-effective way to identify the presence of soil constraints in wheat-growing fields using Landsat-derived iNDVI time series compared with conventional soil sampling methods. The methodology will be extended to other farms in the future to test its robustness and applicability. The quantification of the impact of soil sodicity on wheat yield potentially allows better farm management decision-making such as variable-rate management for gypsum application.