

Prediction of salt balances in irrigated soils along the lower Vaal River, South Africa

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Abstract

In arid and semi-arid regions irrigation tends to degrade soil and water quality through salt accumulation with devastating effects on some crops. This is, according to irrigators, also the case along the lower Vaal River in South Africa. Properly calibrated and tested salinity models could assist the agricultural community in improving salinity management under irrigation.

This paper reports on, firstly, salt balances of soils in this region being irrigated for different time periods, and secondly, salt content changes that can be expected as a consequence of future irrigation. Two empirical models, *viz.* a general and specific salt-balance model were used together with existing water- and soil-quality data to generate such information. The soils selected for this study had been irrigated for periods of between 17 to 53 years. Over these periods addition of salts as a result of farming practices varied between 79 and 280 t \cdot ha⁻¹, with irrigation water being the major contributor. Between 78% to 87% of the salts added to the soils had been leached from the root zone

Despite these large amounts of salts that have been removed, certain irrigation practices have promoted the build-up of salts in some of the soils. The freely drained sandy soils irrigated by centre pivot are of particular interest. Poor management of this system can reduce crop yields. On account of inadequate leaching salts are building up to levels that impair the potential evapotranspiration level of maize. Predictions also show that irrigation should rather be withdrawn from soils with poor internal drainage properties, such as the Arcadia soil at Spitskop. In contrast, flood irrigation on certain duplex soils, such as the Valsrivier at Vaalharts, with relatively good internal drainage properties, can improve their quality.

Keywords: drained soils, root zone, soil quality, undrained soils, water quality