POINT AND REGIONAL SCALE MODELLING OF VADOSE ZONE WATER AND SALT FLUXES IN AN AREA OF INTENSIVE HORTICULTURE

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ABSTRACT

The introduction of a large volume of reclaimed effluent water for irrigation in the Northern Adelaide Plains (NAP) horticultural area has altered the regional water and salt balance, raising concerns regarding the effects of these on shallow water table elevation and root zone salinity in the highly valued and productive soils.

A methodology is described for constructing and calibrating numerical models of vertical fluxes of soil water and solutes to achieve simulations which match a number of monitored study sites. Extension of these simulations to a period of 20 years, and incorporation of measured soil chemistry variables, enables an examination of the influence of differing irrigation strategies and temporal variations in weather conditions on year-to-year variations in soil water fluxes and root zone salinity. Application of these models to the whole NAP horticultural area was achieved using a system of multiple one-dimensional simulations with variables altered according to their spatial distribution.

The results show large temporal variability in drainage fluxes beneath irrigated plots. Fluxes occur mainly in winter, with annual variations depending primarily on differences in rainfall distribution and evapotranspiration. Annual drainage flux totals were found to correlate poorly with annual rainfall totals.

Spatially, drainage fluxes varied both within and between study sites. Simulations of fluxes at observation points within monitored study sites varied owing to variations in soil hydrological properties. Results of the whole-area simulations suggest that over a larger scale, the majority of variation in drainage fluxes is due to differences in land use and irrigation practices, with a smaller but significant spatial variation due to differing soil types.

Additional simulations, representing the NAP prior to irrigated horticulture, indicates the introduction of irrigation has significantly increased drainage fluxes, but that the major change to the soil water budget in irrigated land areas has been to evaporation from the soil surface, with significant implications for soil salinity development.

DECLARATION OF ORIGINALITY

I certify that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

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Graham Paul Green

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