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An Investigation of the Return Flow from Irrigated Land

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- Full Text

Recent trends in agricultural have lead to the intensification of crop production in areas with long growing seasons and ample solar radiation. Unfortunately, these areas also often have limited water supplies, and the water available is often salty. When this water is used for irrigation, the salts are concentrated in soil solution. The application of fertilizer also increases the concentration of certain salts in soil. Thus, the water that leaches from an irrigated field will have greater concentrations of ion than the irrigation water applied. Little information exists, however, on the flux of ions or soil solution below the root zone of cropped fields. Such information is needed before we can learn how we might better manage our activities to minimize the pollution that may be associated with the leachate from agricultural fields.

This project included both a field study and a modeling effort both directed at elucidating the influence of irrigation water quality on the quantity and quality of irrigation return flow by leaching below the root zone.

The field work consisted of the installation of six large buried monolith lysimeters equipped with appropriate drainage devices. Suction water samples were collected for 8 months including the cropping season. The sorghum crop grown on paired lysimeters was irrigated with a high salt and low salt water and was fertilized with different levels of nitrogen.

Although care was taken to secure lysimeters with similar soil, large differences between the volume of leachate and the concentration of ions in the leachate were found. During the period the measurements were made, the changes in concentration of leachate were not attributable to the treatments applied.

The modeling effort was directed toward assembling and testing the following components of an overall water-salt-nutrients balance model: a.: Water and heat flow model to calculate the influence of moisture and temperature gradients on the movement of water between the source(s) and sinks within the system, b. An ion exchange equilibrium model to calculate the salt balance, c. A nitrogen model to calculate complex nitrogen transfers which take place within the soil, and d. A root oxygen supply model to calculate the sink strength for oxygen and ultimately the distribution of root water uptake within the soil profile.

These components of the overall model have been programmed, tested, documented, and are presented in this report.

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