

**REGIONAL SCALE DISTRIBUTED MODELING  
FOR CONJUNCTIVE USE IRRIGATION  
PLANNING TO MANAGE SALINITY AND  
ALKALINITY IN AGRICULTURAL FIELDS**

by

**MALHARIMARTAND JAGANNIVAS KALEDHONKAR**  
Civil Engineering Department

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## CERTIFICATE

This is to certify that the thesis entitled "**Regional Scale Distributed Modeling for Conjunctive Use Irrigation Planning to Manage Salinity and Alkalinity in Agricultural Fields**" being submitted by Mr. Malharimartand Jagannivas Kaledhonkar to the Indian Institute of Technology, Delhi for the award of the degree of Doctor of Philosophy is a bonafide record of research work carried out by him under my supervision and guidance. The thesis work, in my opinion, has reached the requisite standard, fulfilling the requirements of the said degree. The results contained in the thesis have not been submitted, in part or full, to any other University or Institute for the award of any degree or diploma.



Dr. A.K. Keshari  
Assistant Professor  
Department of Civil Engineering  
Indian Institute of Technology, Delhi  
Hauz Khas, New Delhi -110016 (India)

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topsoil. To assess the threat of alkalinisation, dimensionless  $\text{Na}^+$  concentration ( $f_{\text{Na}}$ ) of irrigation water is proposed as new indicator. The regression coefficient between ESP and  $f_{\text{Na}}$  is 0.82. The effects of irrigation water quality parameters such as SAR (sodium adsorption ratio),  $\text{Cl}/\text{SO}_4$  ratio,  $\text{Mg}^{++}/\text{Ca}^{++}$  ratio on soil salinisation process are investigated. It is observed that a linear relation exists between weighted average of irrigation water salinity and root zone salinity. The saturated water content has more influence on salinisation than saturated hydraulic conductivity. Different conjunctive use practices (modes) are compared on the basis of temporal changes in root zone salinity with reference to the sensitivity of the wheat crop to salinity to decide the preference of one conjunctive use practice over the other. Root zone salinity changes, under long-term saline water use, are also studied. One-dimensional UNSATCHEM model is employed for long-term simulations related to regional scale salinity modeling with distributed data on soil, irrigation supply, its quality and crop rotation for the Kheri command of Bhakra system. CROPWAT model is used to determine the evapotranspiration requirements of crops, while soil water retention parameters are estimated by the RETC model. Results of regional modeling help in identifying critical areas in the command on the basis of irrigation water availability and root zone salinity criteria. Guidelines for sustainable conjunctive use planning are provided to get good agricultural production despite of saline water use for irrigation.

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