

Optimal Crop Water Allocation in Case of Drought Occurrence, Imposing Deficit Irrigation with Proportional Cutback Constraint

Mehran Homayounfar · Sai Hin Lai ·
Mehdi Zomorodian · Ali Reza Sepaskhah · Arman Ganji

Received: 24 October 2012 / Accepted: 5 May 2014 /
Published online: 31 May 2014
© Springer Science+Business Media Dordrecht 2014

Abstract Optimal crop water allocation has become more challenging in drier areas of the world (short of rainfall) due to increased water scarcity and more frequent droughts. alternative cropping patterns, reallocation of water resources and modification of irrigation are some of the strategies used to address droughts. A new optimization model is used in this study to find the optimal cropping patterns during droughts, while benefiting from deficit irrigation to decrease the total allocated water. Moreover, the proposed model is subjected to a proportional cutback constraint to meet optimized proportional water allocation under limited water condition. As a real case study, two related districts, namely Neku-abad and Abshar located in Zayandeh-rud River basin are considered. Zayandeh-rud river basin is located in the central part of Iran. For better illustration of model outputs, the proposed model was checked using various irrigation efficiency values (60–100 % in 10 % interval), water reduction ratios (0.0–0.4) and cutback parameters ($\lambda_a=0.3, \lambda_n=0.7, \lambda_a=0.51, \lambda_n=0.49$ and $\lambda_a=\lambda_n=0.5$). The results showed that the values of $\lambda_a=0.51, \lambda_n=0.49$ presents the maximum proportionality in terms of water reduction among all the allocation units or users. Although different values of cutback parameters (e.g.: $\lambda_a=0.3, \lambda_n=0.7$) maximize net benefits, they are not considered as proportionate decisions in the considered study area.

Keywords Deficit irrigation · Drought · Optimal crop pattern · Water allocation

M. Homayounfar · S. H. Lai (✉) · M. Zomorodian
Department of Civil Engineering, University of Malaya, 50603 Kuala Lumpur, Malaysia
e-mail: laish@um.edu.my

A. R. Sepaskhah
Irrigation Department, College of Agriculture, Shiraz University, Shiraz, Iran

A. Ganji
Desert Regions Department, College of Agriculture, Shiraz University, Shiraz, Iran