Contents
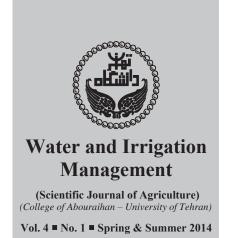
Evaluation of operational charachteristics of spray sprinklers equipped with various deflector pads

Habib Sayyadi[1], Amir-Hosein Nazemi[2]•, Ali-Ashraf Sadraddini[3] , Reza Delirhasannia[4]

1. Ph.D. Candidate, Department of Water Engineering, Agricultural Faculty, University of Tabriz, Tabriz , Iran
2. Professor, Department of Water Engineering, Agricultural Faculty, University of Tabriz, Tabriz, Iran
3. Associate Professor, Department of Water Engineering, Agricultural Faculty, University of Tabriz, Tabriz, Iran
4. Assistant Professor, Department of Water Engineering, Agricultural Faculty, University of Tabriz, Tabriz, Iran
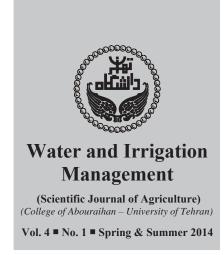
Abstract

The variety of sprinkler devices available for the center pivot and linear irrigation systems has been increased dramatically in recent years. In the current study, via conducting some indoor experiments, one type of fixed pad spray sprinkler (D3000) and two types of moving pad spray sprinklers (R3000 and S3000) with various configurations (working pressure, nozzle size and type of deflector pad) were comprised to evaluate discharge-pressure relations, wetted diameter, and average application rate. As well as, using field test data of distribution pattern of R3000 sprinkler in various wind speeds and directions, the effects of wind on the varying of wetted diameter were evaluated. Experimental equations for predicting wetted diameter in no-wind conditions in addition to nozzle sizing equation for hydraulic design of center pivot system were presented. Predicted wetted diameters of no-wind conditions were compared with observed values that were not used in developing experimental equations so R^2 and *RMSE* values of validation data were between 0.68-0.88 and 0.83-1.64 m, respectively that shows relatively good accuracy of proposed equations. Experimental coefficient of *C* as a function of the wind velocity introduced for prediction of the wetted diameter of the sprinkler affected by wind. Comparison of the predicted wetted diameters using the coefficient of *C* with observed values in the field conditions showed that proposed equation with R^2 of 0.66 and *RMSE* of 1.27 m have relatively more accuracy than Kincaid (13) equation.

Keywords: application rate, discharge-pressure relations, precipitation profile, wetted diameter, wind.

* Corresponding Author: ahnazemi@yahoo.com

The drought tolerance assessment in order to increase irrigation water productivity in linseed

Parvaneh Asgarinia[1], AghaFakhr Mirlohi[2]*, Ghodratollah Saeidi[2], Mahdi Gheysari[3], Ali Akbar Mohamadi Mirik[4], Vahideh Sadat Razavi[5]

1. PhD Candidate, Department of Agronomy and Plant Breeding, College of Agriculture, Isfahan University of Technology, Isfahan, Iran
2. Professor, Department of Agronomy and Plant Breeding, College of Agriculture, Isfahan University of Technology, Isfahan, Iran
3. Assistant Professor, Department of Water Engineering, College of Agriculture, Isfahan University of Technology, Isfahan, Iran
4. Assistant Professor, Department of Agronomy and Plant Breeding, College of Agriculture, Valiasr University of Rafsanjan, Rafsanjan, Iran
5. Graduated MS, Department of Agronomy and Plant Breeding, College of Agriculture, Isfahan University of Technology, Isfahan, Iran
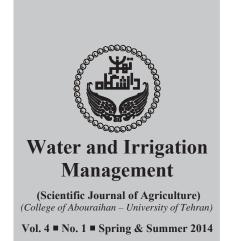
Abstract

The selection of high yielding and stress tolerance plant genotypes with the highest water use efficiency and productivity is one of the most important tools for field water management in arid and semi-arid regions. This study was conducted to identify drought tolerant flax families with the highest irrigation water productivity (IWP) among a population of 119 F_3 families derived from a cross between KO37 (an Iranian flax cultivar) and SP1066 (a Canadian cultivar) under water stress and non-stress conditions. The mean comparison showed that the segregating population had sufficient diversity for drought tolerance and grain yield. Finally, based on IWP, families no. 38, 39, 72, 74 and 119 that had high IWP in both stress (moderately 0.47 kg/m^3) and non-stress (moderately 0.63 kg/m^3) conditions, were introduced as the most drought tolerant families. The results of triplot analysis based on STI index and IWP in stress and non-stress conditions introduced the families as the most favorable families. The advanced generations derived from the families can be used in the future breeding programs to improve and produce high yielding-drought tolerant inbred lines in linseed in order to increase water use efficiency and to economize water resources in the field management.

Keywords: drip irrigation, F_3 population, oilseed plant, STI index, water stress.

* Corresponding Author: Mirlohi@cc.iut.ac.ir

Water requirement single and dual crop coefficients of (*Rosmarinus officinalis* L.) determination in a semi-arid climate

Houshang Ghamarnia[*1], *Sajad Amiri*[2], *Mahmood Khoramivafa*[3]

1. Associate Professor, Department of Water Engineering, College of Agriculture and Natural Resources, Razi University, Kermanshah, Iran
2. MSc. Student, Department of Water Engineering, College of Agriculture and Natural Resources, Razi University, Kermanshah, Iran
3. Assistant Professor, Department of Agronomy, College of Agriculture and Natural Resources, Razi University, Kermanshah, Iran
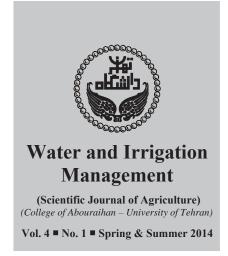
Abstract

For a suitable irrigation programming and an efficient management, crop coefficient determination for different plant growth stages are necessary. In this investigation water requirement, single and dual crop coefficient of *Rosmarinus officinalis* L. was determine by drainable lysimeter in a semi-arid climate condition. By using of drainable lysimeter, the exact water requirement and also K_C values can be obtained. For this objective five drainage lysimeters were used. In those three available lysimeter, (*Rosmarinus officinalis* L.), in one grass and in the last one no any plant were cultivated. During investigation the enough irrigation water were used and soil lysimeter were kept in the field capacity condition. The water balance equation was used to determine the evapotranspiration in all lysimeters. Finally, the total water requirement, single and dual (*Rosmarinus officinalis* L.) were determined as 495.63 mm, (0.30, 0.63, 0.96) and (0.32, 1.20, 1.05) respectively.

Keywords: crop coefficient, drainable lysimeter, Rosemary, water requirement, water balance equation.

---
[*] Corresponding Author: hghamarnia@razi.ac.ir

Derivation of pedotransfer function to estimate parameters of double-exponential equation for soil water retention curve

Majid Homapoor Ghoorabjiri[1], Ali Rasoulzadeh[2]*

1. Former M.S. Student of Soil science Department, College of Agriculture, University of Mohaghegh Ardabili, Ardabil, Iran

2. Assistance Professor of Water Engineering Department, College of Agriculture, University of Mohaghegh Ardabili, Ardabil, Iran
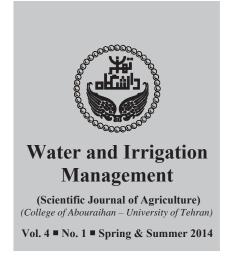
Abstract

Soil water retention curve is one of the crucial input parameters in any modeling study on water flow and solute transport in soils. Direct measurement of soil water retention curve is time-consuming and costly. Alternatively, pedotransfer functions (PTFs) may be used to indirectly estimate the soil water retention curve from easily measured soil properties. Many equations for the soil water retention curve are presented by researchers. Recently, Dexter *et al.* introduced a new double-exponential equation for soil water retention curve that its parameters have distinct physical meaning. The objective of this study was derivation of PTFs to estimate parameters of double-exponential equation from easily obtainable soil properties. This objective was carried out using data of 27 soil samples including particle size distribution (sand, silt and clay), bulk density, and soil water retention curve. PTFs were derived by two softwares SPSS and DATAFIT using data of 27 soil samples. Nine data of 9 soil samples were used to evaluate derived PTFs. The results showed that soil water retention curves estimated using derived PTFs agreed well with measured soil water retention curves. In addition, DATAFIT with the mean absolute error (MAE), modified coefficient efficiency (E'), and modified index of agreement (d') 0.020, 0.878, and 0.744, respectively, with respect to SPSS with MAE , E' , d' 0.025, 0.852, and 0.684, respectively, had better accuracy.

Keywords: dexter equation, double-exponential equation, easily obtainable soil properties, pedotransfer functions, soil water retention curve.

*Corresponding Author: arasoulzadeh@gmail.com and rasoulzadeh@uma.ac.ir

The effect of different levels of drought stress and nitrogen fertilizer on some characteristics of strawberry plants (*Fragaria ananassa* Duch. cv. selva)

*Davood Akbai Nodehi** *

Department of irrigation, Qaemshahr Branch, Islamic Azad University, Qaemshahr, Iran
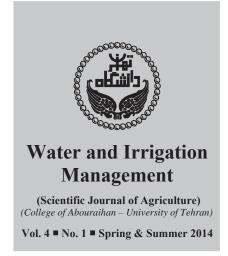
Abstract

In order to evaluate the effect of different levels of drought stress and nitrogen fertilizer on growth of strawberry plants, present study was conducted in the Mazandaran province in 2010. Experiment was carried out as factorial based on randomized complete block design with three replications. Drought stress treatments (30, 50 and 70% Maximum allowable depletion of moistur (MAD)) and nitrogen fertilizer (0, 100 and 150 Mg per Kg dry soil) were allocated to main and sub-plots, respectively. The results showed that the effect of of different levels of drought stress and nitrogen fertilizer were significant on sam indices as, number and length of stolons, number and leaf area, fresh and dry weight of root, length and total yield of plant, fresh and dry weight of plant, diameter and fruit weight under drought stress. In all indices, the highest averages were obtained in treatment of 30% MAD and 100 mg nitrogen. The highest fruit yield was obtained in treatment of 30% MAD and 100 mg nitrogen fertilizer with 9.17 and 8.15 gr, respectively. In intraction of drought stress and nitrogen fertilizer the highest fruit yield with 9.69 gr was obtained by 30% MAD and 100mg nitrogen fertilizer. Minimum fruit yield with 35% reduction was related to 70% MAD and without the use of nitrogen fertilizer.

Keywords: growth, fruit yield, fertilizer use efficiency, water depletion, water productivity.

* Dakbarin@yahoo.com

Monthly simulation of groundwater fluctuations using wavelet and dynamic neural network

Taher Rajaee[1]•, Hadi Ebrahimi[2]

1. Assistant Professor, Department. of Civil Engineering, University of Qom, Qom- Iran
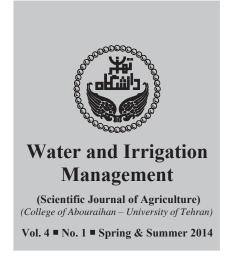2. Former M.Sc. Student, Department of Civil Engineering, University of Qom, Qom- Iran

Abstract

Simulation of groundwater fluctuations plays a crucial role in management of watersheds and water demand balancing. Recently, wavelet analysis has been used widely in time series decomposition and coupling with neural networks for hydrological modeling. In this paper, the ability of the wavelet-dynamic artificial neural networks (W-ANN) model was applied in forecasting one-month-ahead of groundwater level and compared to regular artificial neural networks (ANN) and multi linear regression (MLR) models. The only variable used to develop the models was monthly groundwater level data recorded for ten years at two piezometers in the Qom plain, Iran. The results show that the MLR model overestimate the observed data and the performance of ANN model hasn't enough accuracy, whereas the W-ANN model with Meyer mother wavelet and two decomposition levels, could predict one-month-ahead with Nash-Sutcliffe coefficient equal to 0.993 and 0.974 for piezometers 1 and 2 respectively.

Keywords: forecasting, groundwater depth, multi linear regression, Qom plain, time series.

* Corresponding Author: trajaee@qom.ac.ir

Performance evaluation of AquaCrop model to predict yield production of wheat, soil water and solute transport under water and salinity stresses

Afshin Khorsand[1], Vahid Reza Verdinejad[2]*, Ali Shahidi[3]

1. MSc Candidate, Irrigation and Drainage, Department of Water Engineering, Urmia University, Urmia, Iran
2. Assistant Professor, Department of Water Engineering, Urmia University, Urmia, Iran
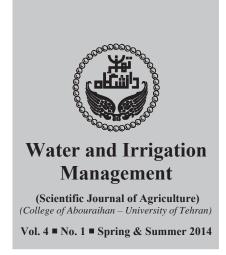3. Assistant Professor, Department of Water Engineering, University of Birjand, Birjand, Iran

Abstract

In this study, the performance of AquaCrop model to predict yield production of winter wheat (Roshan and Gods varieties), water and solute balance of soil profile was evaluated under water and salinity stresses. Field experiments were conducted with three levels of saline irrigation water including: S_1, S_2 and S_3 corresponding to 1.4, 4.5 and 9.6 dS/m, respectively, and four levels of irrigation depth including: I_1, I_2, I_3 and I_4 corresponding to 50, 75, 100 and 125 percent of crop water requirement, respectively, with three replications in Birjand region for 2005-2006 period. The AquaCrop model predicted the grain yield with a high precision in both of the varieties. The mean relative error of the model calibration for grain yield prediction of Roshan and Ghods were calculated 2.98 and 4.82 percent, respectively. The average normalized root mean square error of calibration and validation in soil water content prediction for Roshan variety, were calculated 14.58 and 15.1 percent, respectively, and Ghods variety, were calculated 14.6 and 15.3 percent, respectively. The average normalized root mean square error of calibration and validation in EC_e prediction for Roshan variety, were calculated 34.6 and 36.8 percent, respectively, and Ghods variety, were calculated 34.5 and 36.8 percent, respectively. Results indicated that the AquaCrop predicted EC_e with more error compared with soil water content and grain yield.

Keywords: Birjand, water balance, solute balance, simulation model.

* Corresponding Author: verdinejad@gmail.com

Assessing soil and water resources management strategies using a planning support system and multi-criteria evaluation technique

Behnam Ababaei[1]*, Farhad Mirzaei[2], Teymour Sohrabi[2], Hadi Ramezani Etedali[3]

1. Young Researchers and Elites Club, Science and Research Branch, Islamic Azad University, Tehran, Iran.

2. Associate Professor and Professor (respectively), Department of Irrigation and Reclamation Engineering, Faculty of Agricultural Engineering and Technology, College of Agriculture and Natural Resources, University of Tehran, Karaj, Iran.

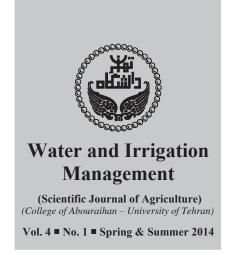3. Assistant Professor, Department of Water Engineering, International University of Imam Khomeini, Qazvin, Iran.

Abstract

The first step in policy making is describing the objectives and choosing the policy instruments and management strategies and then, analyzing and assessing the impacts of them. In this study, farmers' responses to selected policy instruments and management strategies were assessed using a semi-distributed planning model in Qazvin irrigation and drainage network. The proposed model, simulates the choice of different combinations of crop, irrigation treatment and planting date for each land unit. Multi-criteria evaluation techniques were used for the assessment of each management scenarios from economic, social and environmental point of view. Analyzing the impacts of management scenarios using a planning support system showed that the S2 (reducing bank interest rate for promoting pressurized irrigation systems) and the S3 (setting different water prices for surface and pressurized irrigation systems) scenarios can be considered as the best scenarios, after the S5 scenario (combination of all policy instruments). Uncertainty analysis (±30% error in determining the assigned weights) showed that the final ranking on the management scenarios has insignificant sensitivity to the assigned weights to the selected criteria and from an economic point of view, these two scenarios will be chosen and the second and third best management scenarios with the probabilities of 100% and 61%, respectively. The results revealed that different policy instruments and management strategies can have mutual effects and the combination of these instruments may not be the best option from some viewpoints.

Keywords: linear programming, management scenarios, policy making, resource analysis, uncertainty.

---

* Corresponding Author: Behnam.Ab@Gmail.com

Determination of Crop Water Stress Index for Pistachio Trees under Subsurface Drip Irrigation Using Canopy-Air Temperature Difference

*Akram Seifi[1]***, *Seyed Majid Mirlatifi[2], Hossien Dehghanisanij[3], Manouchehr Torabi[4]*

1. Ph.D Candidate, Department of Irrigation and Drainage Engergy, Tarbiat Modares University, Tehran, Iran
2. Associate Professor, Department of Irrigation and Drainage Engergy, Tarbiat Modares University, Tehran, Iran
3. Assistant, Department of Irrigation Systems Research Department, Agricultural Engineering Research Institute, Karaj, Iran
4. Assistant, Department of Irrigation Systems Research Department, Agricultural Engineering Research Institute, Esfahan, Iran

Abstract

This study was conducted to determine the possibility of a crop water stress index (CWSI) to schedule irrigation for Pistachio tree under subsurface drip irrigation. The effects of two irrigation intervals consisting 3 (I_3) and 14 (I_{14}) days based on measuring soil water content were investigated on the CWSI. From 22 May (DOY 143) to 22 September (DOY 266), the evapotranspiration in I_3 and I_{14} treatments varied from 795.45 to 490.79 mm, respectively. The CWSI was calculated using the empirical approach from measurements of infrared canopy temperatures, air temperatures and vapor pressure deficit values for the two irrigation levels. The lower baseline (non-water stressed baseline) was calculated as ($T_c - T_a)_{LL}$ = -1.642 VPD + 1.432 with R^2 = 0.49. This equation had a correlation coefficient equal to 0.77 (P<0.01). An average threshold CWSI value of about 0.5 and 0.49 was calculated for I_3 and I_{14} treatments, respectively. Duncan test showed the effect of irrigation levels on CWSI was significant at P<0.05. Linear relationship between evapotranspiration and monthly CWSI calculated as ET = -804.7 CWSI + 680.1with determination coefficient equal to 0.6 (P<0.05). The CWSI can be employed as a useful tool for assessing crop water stress for Pistachio.

Keywords: canopy-air temperature difference, crop evapotranspiration, infrared thermometer, irrigation interval, vapor pressure deficit.

* Corresponding Author: seifi.akram@gmail.com

Compare the now performance of irrigation and drainage network Varamin with off night scenario

Mina Sadat Seyedjavad[*1] *Mahmoud Mashaal*[2]

1. Graduated University of Tehran, College of Abureyhan, Pakdasht, Iran.

2. Professor University of Tehran, College of Abureyhan, Pakdasht, Iran.

Abstract

One of the consequences of poor management and operation of irrigation systems, poor water delivery and distribution channels and divisions and consequently improper distribution of water level downstream. The study of simulation and performance evaluation software using hydrodynamic Sobek Varamin irrigation is done. In order to evaluate the network performance and compare the results of simulation, the parameters are used Molden and Gates. Simulation has been defined for the three channels degree in elementary, middle and end of irrigation network ranges, scenario for seven days and off nights. According to the results of the indicators of efficiency, adequacy, equity and reliability of the distribution network can be expressed in Varamin irrigation off night scenario is better. The result can be expressed that downstream network in the scenario of off night is better than seven days scenario and put enough water available to downstream farmers, and they can also fair to the farmers upstream, the water networks to harvesters.

Keywords: hydrodynamic model Sobek, indicators of performance evaluation, operation, second channel, simulation.

[*] Corresponding Author: sadatm@ut.ac.ir

فهرست مطالب