

Modeling Basil Response to Water Stress under Different Soil Water Levels

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ABSTRACT

Root water uptake when under water stress conditions can be quantitatively explained through appropriate mathematical functions. These functions can act as very useful tools in irrigation scheduling and field water management if they could adequately predict the plant response to water stresses. The objective followed in this study was to evaluate some root water uptake reduction functions when the plants under water stress conditions. Towards this end an extensive experiment was conducted with four different irrigation water levels including 120%, 100%, 80% and 60% of crop water requirement each in three replicates. The plants were subjected to water stress when they were at their three leaf stages. The daily matric potential was recorded through Theta Probes and plotting of soil water retention curve. The relative transpiration was obtained by measuring daily soil water contents. A comparison of the calculated statistics of maximum error, normalized Root Mean Square Error, modeling efficiency, coefficient of residual mass, and coefficient of determination indicated that all models are overestimating the daily root water uptake. However, the nonlinear model of Homaei et al., (2002) provided more reasonable results for root water uptake than the other models. The results further indicated that linear model of Feddes et al., (1978) and either of the nonlinear models of van Genuchten (1987) and Homaei et al., (2002) bear acceptable accuracy for estimating the accumulative relative root water uptake during the growth period.

Keywords: Basil; Irrigation management; Root water uptake models; Water stress

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Use of Combined Saline and Fresh Water for Cultivation of Sorghum and Sunflower in Sistan Region

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ABSTRACT

In recent years, use of brackish water in agriculture, through either mixing fresh and saline water prior to irrigation or through an alternate use of saline and fresh water has become the focus of attention. The aim followed in this study was to investigate the effect of different levels of saline and non-saline water and as well the way of their being mixed on the sunflower and sorghum crops and also on the control and adjustment of salts within soil profile. To follow the aim, an experiment was performed within a randomized complete block design of six treatments and three replications for either of sorghum and sunflower crops (36 blocks in total) in the experimental fields of Zabol University within 2012-2013. Treatments included control (100 % freshwater), treated with two-third salty, one-half salty, one-third salty, 90% salty, and finally 100% salty water. The investigated cropping indices were comprised of dry weight of stem, leaf and aerial organs of the plant, plant height, and leaf area index. The results indicated that, for both crops, one-third salt treatment had the second most acceptable performance in terms of agronomy measures and also the abundance of salt in the soils profile, as after control. However the difference between one-third and both one-half and two-third treatments for most attributes as for sunflower was not statistically ($p \leq 0.05$) significant. Also, for sorghum the average dry weight and leaf area index in one-third treatment was not significantly different from control. Moreover, one-third treatment for either plant has the second lowest EC in layers 0-20 and 20-40 cm (about 2.5 dS/m) and 0-60 cm (less than 2 dS/m), after control. According to the results, it seems that the proposed method of salt and fresh water mixing in any way, highly decreases salt stress on plant, and diminishes salt accumulation in the soil profile.

Keywords: Saline and non-saline water mixing, Salt adjustment, Physiological properties, Sorghum, Sunflower, Zabol

Integrated Assessment of Climate Change Impacts on Water Resources and Agricultural Systems in Hashtgerd Plain, Using System Dynamics Approach

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ABSTRACT

The population of Hashtgerd plain is rapidly on the growth, as a result of socio-economic developmental activities. This excessive population growth leads to increased groundwater withdrawal and water shortages especially in the agricultural sector. Furthermore, climate change can also exacerbate the water shortages in the coming decades. Thus, on assessment of water resources along with agricultural systems on this plain which requires a comprehensive and multidisciplinary approach is demanding. The objective followed in this study was to simulate the qualitative and quantitative impacts of climate change and population growth on water resources and agricultural systems in Hashtgerd plain, employing system dynamics model. HadCM3 model made use of to evaluate climate change impacts under B1 and A2 emission scenarios as well as a model based on system dynamics approach were developed by considering the interaction and feedbacks among sub-systems. The results revealed that, during the period of 2020 to 2039 the vulnerability index in agricultural sector increased from 0.1 to 0.27 under A2 emission scenario while it was fixed in either of the domestic or industrial sectors. It was finally concluded that the, agricultural sector will be more vulnerable to climate change and population growth in comparison with the other two sectors.

Keywords: Climate change, System dynamics, HadCM3, Hashtgerd plain.

Effects of Split Application and Different Amounts of Area Fertilizer in Furrow Fertigation on Yield and some Quantitative and Qualitative Attributes of Sugarcane, Variety CP69-1062

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ABSTRACT

Fertigation offers ease and efficient application of fertilizers, in contrast with the traditional application methods. In fertigation, the volume amount of fertilizer applied is about 94% to the actual amount of nutrient need and, uptake by the plant. Nutrient leaching can be controlled by adjusting the fertilizer application rate in each and every fertigation event as based upon crop root depth. The aim followed in this study was to investigate the effects of split application of different rates of urea on yield and on some quantitative as well as qualitative attributes of furrow-irrigated sugarcane in a plantation 25 hectare of a newly planted farm belonging to the Dehkhoda Sugarcane Agro-Industry. A split plot experiment was conducted in the framework of a randomized complete block design of three replications. The main factor consisted of split application of fertilizer at three levels of: two, three and four splits. The sub-main factor was comprised of different amounts of fertilizer applied (350, 280 and 210 kg of urea corresponding to 100%, 80% and 60% fertilizer requirements, respectively). The results revealed that the two split treatment of with 60% fertilizer level was the most preferred treatment in terms of all the quantitative and qualitative attributes and while two split treatment was the most acceptable treatment in terms of water use efficiency of sugarcane, extraction as white sugar as well as fertilizer use efficiency, with the figures of 7.474 and 0.710 kg/m³ and 437.7 kg/kg of urea, respectively. Moreover, the treatment of 60% fertilizer level performed better in terms of water use efficiency of sugarcane, white sugar and fertilizer use efficiency, amounting to 6.533 and 0.628 kg/m³ and 454.9 kg/kg of urea, respectively. The proposed methodology for optimum management of fertilizer application may result in a reduction of fertilizer use and nitrogen leaching from sugarcane agro-industry companies, farm soils. This would reduce groundwater pollution while increasing the community's health.

Keywords: Fertigation, surface irrigation, Nitrogen, water use Efficiency, Fertilizer use Efficiency, white sugar, plant, Deh- khoda Agro- Industry

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Dynamic Simulation through Aqua Crop of Maize Growth under Different Management Decisions of Water Application and Nitrogen Fertilizer Use

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ABSTRACT

The performance of crop growth simulation model, Aqua Crop was evaluated to predict grain yield, biomass and canopy cover in maize growth under different management conditions of depth of irrigation (I) and nitrogen (N) application. A field experiment was conducted with three levels of N comprise of : 0, 150 and 300 kg N ha⁻¹ (N1, N2 and N3) along with four depths of irrigation, corresponding with 60, 80, 100 and 120 percent of soil water depletion (I1, I2, I3 and I4), in the framework of a randomized complete block design of three replications during 2002-2004. AquaCrop model was calibrated and then validated as based upon field data collected respectively from the first and second year of the experiment. Based upon the results obtained the AquaCrop model simulated the maize's grain yield with a high precision under different levels of nitrogen fertilizer and irrigation depths. In total, the AquaCrop model exhibited a high precision in simulation with respect to maize growth. However, the model indicated low precision in the I1 irrigation level treatment for biomass prediction and N1 nitrogen level as regards canopy cover prediction. The average normalized Root Mean Square Error of grain yield prediction for the calibration and validation cases were calculated as 7.89 and 4.86 percent, respectively. For biomass growth in a special nitrogen fertilizer level, increasing water stress causes an increase in the biomass prediction error as reflected by the model. Biomass (in all treatments) was predicted as over-estimated with the average normalized Root Mean Square Error for calibration and validation being obtained as 18.7 and 20.9 percent, respectively. AquaCrop model predicted canopy cover growth of maize under N2 nitrogen level with a high precision; but within the N1 and N3 nitrogen levels they were under and over-estimated, respectively. The average Root Mean Square Error (RMSE) of percent canopy cover for all the treatments in calibration and validation were obtained as 11.7 and 7.33 percent, respectively.

Keywords: Canopy Cover Growth, Biomass Growth, Shiraz, Grain Yield, Crop Growth Model

Simulation of 2D Soil Moisture Distribution under Subsurface Drip Irrigation

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ABSTRACT

Information on water soil content and its distribution is vital for field water management in subsurface irrigation. The objective followed in this study was to simulate the extent of wastewater distribution taking into account root water uptake and evaporation from the soil surface under, subsurface drip irrigation system. In this regard, a field experiment was conducted with lettuce as the crop, to collect the required data. Soil hydraulic properties were obtained through an assessment of in-situ soil water pressure heads as well as water contents. Soil matric potentials, under tensiometry range, were obtained by use of tensiometers and the related water contents by a TDR instrument. For the simulation purposes, the HYDRUS-2D model was made use of. The model performance was evaluated by comparing the measured us the predicted values using Root Mean Square Error (RMSE) statistics. The results of the spatial simulation revealed that this model provides more appropriate results in locations farther away, and deeper than The drippers (RMSE=0.03) as compared with the points adjacent to the droppers and less deeper ones (RMSE=0.008). The results of the temporal simulation showed that the model worked more accurately within 48 hrs after irrigation (RMSE=0.005) rather than one following the start of irrigation (RMSE=0.029). Therefore, it can be concluded that soil water content in subsurface drip irrigation system can be reasonably simulated while root water uptake and evaporation processes are both actively going on.

Keywords: simulation; subsurface irrigation; wastewater; HYDRUS

Geostatistical Stochastic Simulation of Soil Saturated Hydraulic Conductivity

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ABSTRACT

Soil saturated hydraulic conductivity is a key parameter needed in many projects including drainage. So it necessitates knowing about the spatial distribution pattern of hydraulic conductivity. However, to obtain the knowledge, it is needed to have a lot of field measurements carried out which is time consuming, tedious, and costly. Different types of kriging can be used for estimating and mapping hydraulic conductivity over a study area. However, the estimated results contain some uncertainties. Unlike kriging, stochastic simulation can be used to model the estimation uncertainty and incorporate it into the decision-making processes. In this paper, Sequential Gaussian Simulation (SGS) and non-parametric Sequential Indicator Simulation (SIS) approaches were employed to model the uncertainty attached to the hydraulic conductivity estimates in KheirAbad plain in Khuzestan. A number of 200 equally probable simulated maps of hydraulic conductivity were generated through either of the methods. The results revealed that unlike the kriged map, the simulated maps could reproduce the histogram and semivariogram of the raw data, reasonably well. Regarding local uncertainty, the results showed that the kriging variance does not depend on the actual data values and so there is a limitation in its use. The accuracy plot and width of probability interval plot indicated that the uncertainty model obtained through SGS is more accurate than that obtained through SIS; however the goodness coefficient was slightly smaller for SGS (0.88) than for SIS (0.94).

Keywords: Hydraulic conductivity, uncertainty, geostatistical stochastic simulation, probability map

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Effect of Polypropylene Fibers on the Mechanical Properties of Gypsiferous Soils

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ABSTRACT

The presence of gypsiferous soils classified as problematic soils in the context of hydraulic structures may cause structural damage within either local or global measures. Soil stabilizing and improving is considered as a method or technique of dealing with these types of soils. Methods of soil reinforcing could be conducted through the followings: utilization of steel strap, geotextile, geosynthetics, as well as fibers. The effect of polypropylene fibers (6 and 12 mm in length) of different percentages (0.05, 0.1, 0.15, and .25) on shear parameters, density specifications, Atterberg limits, and soil bearing capacity is investigated in the present study. The obtained results were statistically analyzed in a completely randomized design, with their means compared at a statistical level of 1% ($P < 0.01$). Results show that none of the polypropylene fibers significantly affects water content, maximum dry weight per unit volume and soil adhesion. This is while either length of the mentioned fibers significantly increase the angle of internal friction, bearing capacity, as well as the liquid and plastic limits of soil (Atterberg limits).

Keywords: Gypsum soil, Polypropylene fibers, Standard density, Atterberg limits, CBR, Direct Shear Test

Optimization Parameters of Rainfall-Runoff Model of HEC-HMS through PSO Algorithm

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ABSTRACT

Structural constraints of hydrological models and a lack of access to all the parameters of watershed along with an impossibility of determining the boundary and initial conditions, necessitates the need for calibration of hydrological models. As manual calibration is tedious, especially in the face of limited data and plenty of parameters, automatic calibration methods, employing a systematic search in a multidimensional space, could be in finding suitable parameter sets through at least one objective function. Throughout the present work HEC-HMS acts as the simulation model and PSO as the optimization one. The HEC-HMS programming was done through MATLAB. The proposed integrated model was implemented for Kardeh dam basin in Khorasan Razavi province. The Model calibrated through RMSE objective function in three-event different scenarios led to the bunch of different parameters. All scenarios were validated and a comparison of objective function values as well as correlation coefficient between the observed and simulated discharge done. Results indicated three sets of solutions as an optimal solution, which emphasized the impossibility of obtaining unique parameters for a river basin. This method of solution, because of non-unique solution for calibration, would be helpful as an inverse problem which can limit the number of candidate answers.

Keywords: Swarm intelligence algorithms of PSO, HEC-HMS simulation model, Automatic calibration.

Drought Monitoring Assessment Using a Probabilistic Approach and a Combinational Reservoir Index (MSUI)

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ABSTRACT

Assignment of appropriate indices constitutes an important component of a monitoring system necessary for the planning of drought encounter plans. The probabilistic approach and the combinational reservoir index methods were assessed and compared, to monitor the drought period of 1998-2000 in Zayandeh Rud basin. To follow the purpose, the MSUI index was initially selected from among the combinational indices for the mentioned basin and then the drought classified accordingly. Within the next stage probabilistic approach was determined as based on the site conditions itself based upon, the classification done. The results revealed that the probabilistic approach performed faster in early warnings and so the index was more suitable in indicating the drought occurrence. On the other hand MSUI index revealed a more appropriate performance during the drought period. Finally it is recommended that a joint application of the two indices can be more useful for management and taking of the necessary measures during, and as well, within the initiation span of a drought.

Keywords: Drought monitoring, Probabilistic approach, Combinational reservoir index

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An Investigation of the Effect of Controlled Drainage Management (in Soil Setting of Rice Husk Envelope) on the Drain Water's Content of Nitrate in Situations Similar to Paddy Rice Fields

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ABSTRACT

On paddy rice fields, as practiced in the case of the use of nutrients or chemical fertilizers is indispensable for high yields. The use of chemical fertilizers in paddy rice fields together with their being leached through either irrigation, or rain water leads to ground water pollution. Optimum design and management of drainage systems including the reuse of controlled drainage water play an important role in reducing slots as well as other contaminants in the drain water. Throughout the present study, the effect of controlled drainage with an application of rice husk envelopes on the quantity of drain water's nitrate and nitrite (in similar conditions prevailing on paddy rice fields) was investigated. Controlled drainage together with rice husk envelope of 10cm thickness, installed at 40cm of soil depth was scrutinized within the scope of the physical model. The effects of two fertilizer treatments at two levels of 10 and 20 mgr/l as well as drainage management at three levels of: opening the drain to reach saturation, field capacity or 50% saturation, on drain water's nitrate, nitrite and acidity parameters were investigated. The results revealed that the 50% saturation management together with a concentration of 10 mgr/l of fertilizer presented the most acceptable performance in reducing the drain water's nitrate (12.08 mgr/l). Also the treatments of field capacity moisture at a concentration of 10 mgr/l of fertilizer and 50% saturation moisture at a concentration of 20 mgr/l of fertilizer respectively led to the highest and lowest nitrate seepages through the drain water. With a lapse of time, the drain water's acidity shifted to a normal.

Keywords: Acidity, Carbon envelope, Humidity, Nitrogen Fertilizer, Salinity.

Application of Reinforcement Learning Algorithm for Determining the Operational Instructions of the On-Request Method for Optimal Water Distribution and Delivery

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ABSTRACT

The on-request system is considered as one of the effective water distribution and delivery systems. It can be applied to currently available irrigation networks but, the main challenge for its application is the extraction and provision of appropriate operational instructions. The main objective followed in the research the development of Fuzzy Sarsa reinforcement Learning (FSL) model for extracting operation al scheduling for the on request irrigation systems. The FSL is to be evaluated in the E1R1 canal of Dez network. Requested discharges are the input of the algorithm and the output comprised of the optimum operational instructions. Water depth and flow performance indicators were made use of for an evaluation of the two performed scenarios. In scenario No. 1, as an exemplary sample, in which turnouts No. 5 and 6 demands increase from 0.1 to 0.2 m³/s while the other turnouts are closed, the minimum values of efficiency and adequacy indicators were recorded as 0.989 and 0.994; and while maximum and average values of water depth deviations being obtained 8.4% and 7.4%, respectively. Considering the results, FSL can be applied as manual adjustment of the structures available on the present irrigation networks for a determination of the operational instructions.

Keywords: Fuzzy Sarsa Learning, Operational instructions, Water Distribution and Delivery

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Effect of Scale on SWAT Model Performance in Simulation of Runoff (Case Study: Haraz Catchment in Mazandaran Province)

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Abstract

The performances of the hydrological models differ in simulating runoff within basins of various areas. The main objective followed here was to perform a multi-site (spatially distributed) calibration and validation of SWAT using monthly observed flows from 4 gauging stations in Haraz River and as well to assess the model's capability in performing reliable simulations at spatial scales smaller than those in the calibration phase. To follow the purpose, sensitivity analysis performed, making use of SUFI2 method indicated which parameters to be used in autocalibration. CN parameter was chosen as the most sensitive one. The model simulated the time to peak as well as peak flow discharge with a highly suitable performance in the studied areas. The predicted monthly streamflow matched the observed values, with R^2 and NS of 0.80 and 0.77, respectively during calibration along with 0.87 and 0.75, respectively during validation. However, values of NS for sub catchments ranged from 0.55 to 0.73 during calibration, and 0.70 to 0.77 during validation. Findings indicate that the model performance works more appropriately in large area basins.

Key words: Calibration, Sensitivity analysis, SUFI2 Method,

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Mapping of Cation Exchange Capacity Using Geostatistics and Particle Component Analysis

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ABSTRACT

Soil Cation Exchange Capacity (CEC) is an important vital indicator of soil fertility and as well, of pollutant sequestration capacity. Throughout the present study, spatial variability of soil CEC was investigated Through Kriging and cokriging with the principal components derived from soil physico-chemical properties including texture, (clay, sand, and silt content), organic carbon, electrical conductivity as well as pH. To follow the purpose, 247 soil samples were collected from central areas of Guilan province. Seventy five percent of the soil samples were used for training and 25% for testing. The first two Principal Components (PC1 and PC2) together explained 68.54% of the total variance of soil physico-chemical properties. PC1 explained the highest significantly positive correlation with CEC ($r=0.81$, $P<0.01$), whereas there was no significant correlation observed between CEC and PC2 ($r=-0.19$). PC1 was then used as an auxiliary variable in cokriging method for the prediction of soil CEC. Root mean square error of kriging for the test dataset was found 0.159 and that of cokriging for the dataset amounted to 0.118. The cross-validation determination coefficient (R^2) for the test dataset was recorded 0.49 for kriging while 0.71 for cokriging at a 0.01 level. The results show that interpolation through cokriging, with an auxiliary variable PC1 derived from soil physico-chemical properties, proves more reliable than through kriging. In addition, the principal components that bear the highest positive significant correlation with the dependent variable are of the most potential for prediction through cokriging.

Keywords: Cokriging, GIS, Interpolation, Kriging, Semivariogram.

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The effect of organic matter removal on desorption and retention characteristics of phosphorus in some calcareous soils

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ABSTRACT

The effect of organic matter removal on retention and desorption characteristics of phosphorus (P) was studied in 12 calcareous soils. Soil organic matter was removed through an application of sodium hypochlorite (NaOCl) solution at room temperature. To evaluate the characteristics related to P release, desorption experiments following adsorption ones were performed at the highest initial concentration of phosphorus (100 mg P L⁻¹). The results revealed that the amount of P desorption decreased following a removal of organic matter. P retention data were adequately described through Freundlich, Langmuir, Temkin, Gunary and Dubinin Radushkevich equations, but the most appropriate model was found to be the Langmuir Equation. Phosphorous retention maxima,b, calculated from Langmuir equation after soil organic matter removal ranged from 392.1 to 757.5 with a mean value of 560.8 mg/kg, which showed an increase of 7.4 % over the previously soil organic matter removal. Phosphorus retention and sorption isotherm showed hysteresis which indicates retention and desorption mechanisms not being the same. The mean hysteresis indices calculated from Freundlich decreased from 29.7 to 18.1 % after a removal of organic matter. Also, after organic matter removal, maximum P retention (qm) calculated from Dubinin Radushkevich equation increased by 8.6 %. The energy of P retention calculated from Dubinin Radushkevich model was 19 and 25 kJ mol⁻¹, before and after organic matter removal, respectively, which, according to this equation, represents the chemical retention mechanism of P in the studied soils. The P standatd requirement, P_{0.2}, a measure of the P fertilizer required for optimal production, increased more than twice following soil organic matter removal.

Key words: Desorption, Isotherm, Organic matter, Phosphorus, Sodium hypochlorite

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DEMs Resolution Effect on SCS Curve Number Derived through WI_CN Method Based on Saturation Excess Concept.

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ABSTRACT

The effects of DEM resolution on the curve number values as. Based on WI_CN method is addressed in the present research. This method, due to a use of TOPMODEL's excesses saturation concept, is considerably dependent on the topographic index and subsequently on DEM cell sizes. The results of WI_CN method application in the Kasilian watershed for different DEM cell sizes indicated that the watershed averaged curve number in DEMs with resolutions of 50 and 300 meters amount to 59.8 and 71.8, respectively, which means when DEM resolution gets coarser the difference between WI_CN method and common methods (derived CN using GIS and RS techniques) increases. For instance the maximum differences observed between the two methods (in 50 and 300 meter cell sizes) are 8.3% and 29.9%, respectively. Therefore, when making use of the saturation excess based methods for deriving curve number raster maps, especially in ungauged watersheds, DEM resolution effects should be defined with respect to data resolution.

Keywords: DEM Resolution, SCS Curve Number, WI_CN method, Semi distributed Model: TOPMODEL.

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Evaluation of Qazvin Plain Irrigation Systems Through an Assessment of Classical vs Neoclassical Irrigation Efficiencies

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Abstract

One of the most important performance indicators in an evaluation of the irrigation systems is the efficiency. The objective followed in this study was to evaluate surface and sprinkler irrigation systems with the neoclassical concept of efficiency, net efficiency and effective efficiency, and to compare the results with those of evaluation through systems of classical approach. Two thousand ha of land under Qazvin irrigation network (equipped with various types of irrigation systems) were selected. Evaluation of the systems was performed in two stages, of initial and mid-crop growth during the summer season of 2012. The results of the evaluation, using classical approach for furrow irrigation system were recorded as 5.9 and 27.8% for primary vs middle growth stages, respectively. The lowest efficiency for sprinkler systems was related to Linear-move system (11.8 and 45.6 % within the primary vs middle growth stages, respectively). The most conspicuous difference between neoclassical vs net efficiency was related to furrow irrigation system (41.2 and 44.9 % for primary vs middle growth stages, respectively). The values of effective efficiency were less than those of net efficiency, for all the irrigation systems and for both stages of the evaluation. The differences for furrow irrigation system were obtained as 22.2 and 37.1% within the primary vs middle growth stages, respectively. The results obtained finally indicated the concept that the effective efficiency presents a suitable expression regarding irrigation management and method at a farms, scale whereas net efficiency considers the concept of the reuse of waste water on spatial scales, larger than the field size.

Keywords: Classical efficiency, Effective efficiency, Net efficiency.

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Hydraulic Evaluation Center-pivot Sprinkler Irrigation System and Solid-set Irrigation System with Portable Sprinkler (Case Study: Teaching and Research farm of Tehran University)

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ABSTRACT

Evaluation of sprinkler irrigation systems while in operation is indispensable for the assessment purposes. Throughout the present study, the performances of hydraulic center-pivot sprinkler irrigation systems (A,B) and solid-set irrigation system equipped with portable sprinklers were evaluated. Within this concept, the common indicators of assessment were made use of. The results indicated that the solid-set irrigation system with Cu 65.52 and PELQ 47.5 is of a lower performance in comparison with the others. Also, sprinkler irrigation system B with a Cu of 88.36 and PELQ of 74.28 is of a better performance than the others. Soil moisture uniformity coefficients under irrigation systems A, B along the lateral pipes were respectively recorded as 81.35 and 85.77 which are very acceptable. The results also indicated that an irrigation system is the most sensitive to wind, which can best be the reason for low coefficients of uniformity.

Keywords: Efficiency, Sprinkler irrigation, Uniformity distribution, Center-pivot, Applied efficiency, Soil moisture.

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Permeability and Molecular Diffusion Effects on Convective Flow Pattern in Fractured Porous Media

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ABSTRACT

Local differences in fluid density have important role in contaminant transport. Study of variable-density flow and solute transport in fractured porous media is necessary to figure out phenomena like contaminant transport of high density. In this research, the effect of permeability and molecular diffusion, respectively as a characteristic of porous medium and solute, on convective flow in fractured porous media has been studied using numerical modeling by FRAC3DVS/Hydro Geosphere (HGS) model. Conceptual model has been considered as a porous medium contained regular vertical and horizontal fractures. Four scenarios of different porous matrix permeability and free-solution diffusion coefficients have been taken account into the modelling process. The results indicated various patterns of solute transport in fractured porous medium in four different scenarios. So that, in the first one with high molecular diffusion coefficient, the solute is diffused into porous matrix from fractures symmetrically. While in the second scenario, with low molecular diffusion coefficient, the solute is transported in deeper depth and is diffused into porous matrix from fractures in an uprising way, in opposite direction of the contaminant entrance direction. In the next scenario, the more porous matrix permeability, the more convective flow velocity and solute transport in porous matrix. Finally, less differences between the matrix and fracture permeability in the last scenario leads to decrease of the fracture effects on the convective flow pattern, so that flow pattern in the fractured porous medium becomes similar to flow pattern in the homogenous porous medium.

Key words: fractured porous media, density dependent flow and solute transport, convective flow, numerical modeling, FRAC3DVS/HydroGeoSphere (HGS) model.

Comparison of actual evapotranspiration obtained from lysimeter data and SEBAL algorithm in Kerman plain by use of MODIS sensor images

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ABSTRACT

Determination of evapotranspiration in broad zones and within appropriate time intervals is an efficient tool for optimal management of water resources. SEBAL model is one of the algorithms, being paid much attention to in estimating evapotranspiration by use of satellite images. In this paper, we estimated the actual rate of evapotranspiration was estimated by use of fifteen elected images of MODIS sensor, belonging to year 1386, with the obtained results being compared with ground data recorded through region lysimeters. These studies were carried out in an area located on the Shahid Bahonar University farm (latitude and longitude of 30°15'N and 56°58'E) equipped with electronically weighing lysimeters and other meteorological parameter measuring devices. The acceptable results of RMSE, NOF and EF were obtained respectively about 0/62419, 0/09079 and 0/87636. Also, coefficient of determination (R^2) of 0/71 between the observed and computational data was indicative of the fact that, this algorithm benefits from a high accuracy in estimating actual evapotranspiration. Following an estimation of the parameters of the Earth's surface temperature, albedo, vegetation cover indices, surface emissivity and net radiation (according to the separation of lysimeter pixel in the region), spatial distribution map of the daily evapotranspiration in the area was drawn.

Keywords: Actual evapotranspiration, SEBAL, remote sensing, lysimeters, MODIS