Effect of Tillage Direction and Slope Position on Some Physical and Chemical Properties and Aggregate Stability of Soil

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ABSTRACT

Soil tillage is among some of the most important practices in the production of agricultural products. Farming and tillage on sloped lands not only increases soil loss, but also causes the decrease of soil organic carbon content with a consequent reduction in the aggregate stability as on steep slope lands. The aim followed in this study was to investigate the effect of tillage direction, slope condition and direction on soil aggregate stability and as well as some physical and chemical properties of a soil. Soil samples were collected from an area (with contour tillage) located in the Soil and Water Conservation Research Station of Kuhin and its adjacent area outside the station with down slope carried out tillage. The area was comprised of a north southern shallow valley. Soil samples of either tillage types were taken from upper, middle and lower sites of the slope within two depths and three replications (72 samples). Data were analyzed based on the nested design. The results indicated that most of the soil evaluated properties were highly affected by soil tillage in which, downward tillage caused reduction in the soil quality. The results also demonstrated that the slope direction and position can only affect soil aggregate stability index, while all the four indices of aggregate stability were significantly affected by tillage type. Organic matter content is a major factor of increasing soil aggregate stability in the contour tillage practice. The position and direction of slope in addition to field management practices, seriously affect soil properties at its various depths. Finally it was concluded that soil aggregate stability is significantly influenced by all types of changes including the position and direction of slope as well as soil depth.

Keywords: Fractal dimension, Organic matter, Mean weighted diameter, Geometric mean diameter

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A Field Study of the Efficiency of Vegetative Buffer Strips in Water and Soil Conservation

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ABSTRACT

Vegetative buffer strips include a special plant being passed by the flow before entering the waterways; so, it causes runoff volume reduction, accumulates pesticides and other pollutants out of the flow through infiltration, uptake and sediment deposition. The present study has been conducted with the aim to evaluate and compare the impact of vetiver grass vs native turf grass of Sari (Mazandaran) and a combination of the two mentioned species on the efficiency of vegetative buffer strips in reducing the surface water pollutants including sediments, nitrate and phosphate. The experiments were carried out, employing 1×10 m experimental plots and producing artificial runoff with a flowrate of 1.65 l/s during a one year. The vegetative buffer strips used throughout the study reduced the runoff volume by 35-90%, sediment concentration by 42-94%, nitrate concentration by 35-88% and phosphate concentration by 28-95% so that, all maximum efficiencies were related to the treatment of vetiver grass-turf grass. According to the results, the vetiver grass benefits from a high efficiency in reducing and controlling the runoff pollutants; but, due to the probability of the creation of concentrated flow among the bushes of vetiver grass, using a resistant plant adapted to the region climate with a density as well as uniformity similar to the turf grass is recommended to make the flow uniform and sheet and consequently increasing the efficiency of vegetative buffer strips to reduce runoff volume and diminish pollutants before entering the runoff to the surface waters. Also, periodic mowing of the plants is proposed as an effective strategy to deal with the role of vegetative buffer strips as the source of nutrients as well as sediments.

Keywords: Vetiver grass, Experimental plots, Nitrate, Phosphate, Sediment concentration

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An Investigation of the Change Trend of Moisture vs Volume of Unsaturated Silty Soil as During Consolidation

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ABSTRACT

Variations of moisture vs volume of an unsaturated silty soil were investigated under different suctions through experimental tests in triaxle apparatus specialized for unsaturated soils. The tests were carried out on specimens of silty soil made by slurry method in modified triaxle cell (double ring triaxle cell) under 5 different suctions from 0 to 300 kPa. Application of the target suction was done by axis translation technic and loading the specimen under constant suction was carried out through increment loading. The results show that preconsolidation pressure will increase by increasing suction .Furthermore according to the obtained results, creation of Yielding Curve (LC) in space of stress- suction is possible. Also investigation of variation in slope and intercept of normal compression line revealed that then variation of volume vs moisture of the soil is a function of suction changes.

Keywords: consolidation, soil moisture, preconsolidation pressure, suction, unsaturated soil

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The Effect of NanoClay on piping Erosion in Earth Dams

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ABSTRACT

Scouring and internal erosion have always created problems for structures, including earth dams. This is so that internal erosion or piping is known as the second serious cause of earth dam failures. Throughout the present study, nanoclay is used as a newly discovered additive with no serious environmental problems, to reduce the piping erosion of silty sand soils. To investigate the erodibility, samples containing nanoclay of 0, 1, 2, 3, 4, 5and 6 weight percent of dry soil were taken to run the Hole Erosion Test (HET). The impact of compaction, moisture content and hydraulic gradient on erosion of samples containing 1% nanoclay were investigated. The results indicated that by adding 1% nanoclay, erosion rate index increased to more than twice, and meaning that the erodibility was reduced. Erodibility in samples containing 1% nanoclay when at the most hydraulic gradient changed from a very fast to moderately slow group.

Keywords: Hole Erosion Test, Erodibility, Hydraulic Gradient, Silty Sand Soil

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Evaluation of Spatial Changes in Soil Infiltration Using Experimental and Geostatistical Methods in Coastal plain of Behshahr-Galugah

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ABSTRACT

Infiltration plays an important role in surface and subsurface hydrology and as well is a key factor in the whole rain fall-run off equations. This research was carried out Behshahr- Galugah coastal plain. With regard to most agricultural crops grown in the region and the importance of soil water permeability, studies in this area are of paramount importance. A 10 × 8 km grid was employed to take samples with the grid cell sizes of 1000 m2. Measurement of water infiltration was performed using a single cylindrical ring, considering infiltration height of 1cm and time as variable. Following the measurements, the infiltration rate of soil was estimated, using both Horton and Kostiakov equations and compared with the observed values. For selection of an appropriate model for evaluation criteria, RMSE, RE and NSS were employed for each equation. The values of these criteria for Horton equation were recorded as 5.55, 24.61 and 0.98 and for Kostiakov equation amounted to 8.5, 64.14 and 096, respectively. The results indicated that Horton equation was more accurate in estimation of infiltration, than Kostiakov's as compared with the observed values in this region. Also an investigation of spatial variability of permeability rate with GS+ version 5 software revealed that semivariogram of the variable was isotropic and there existed strong spatial dependence as regards water permeability.

Keywords: Geostatistic, Horton equation, Infilteration, Kostiakov equation, Single Ring.

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Application of the Central Composite Design for Predicting the Effects of Surface Rock Fragments on Soil Loss and Surface Flow Velocity

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ABSTRACT

The effect of surface rock fragments on soil erosion processes has been an important challenge in erosion studies during the last two decades. Rock fragment characteristics including size, position and coverage may affect soil erosion causing a complication in predicting their effects on soil loss. The aim followed in this study was to model the effects of rock fragment coverage, size and the flow rate on soil loss and surface flow velocity employing response surface method and central composite design. Two sets of run-on simulation experiments were carried out in a laboratory flume (6×0.5m). The range of the independent variables were 0-45 percent for rock fragment coverage, 3-9cm for rock fragments diameter (size) and 1.67-5 $cm^3cm^{-1}s^{-1}$ for flow rate. The second set of experiments was employed to develop the predictive model based on the central composite design and the results of the first set of experiments were applied to validate the predictive model. Results indicated that the central composite design models benefit from a high performance in predicting flow velocity (R^2=0.993) and soil loss (R^2=0.994). Models, validation through the first data set also indicated a good agreement between the predictive values of flow velocity (R^2=0.887) and soil loss (R^2=0.851) through the experimental values of these two variables. Rock fragments, coverage, flow rate and the size of the rock fragments exert the highest influence on soil loss and flow velocity, respectively. There was a significant interaction between the flow rate and rock fragment coverage, which should be considered in their modeling of the effects. A linear relationship was, too, observed between the flow velocity and soil loss.

Keywords: Soil surface cover, Run-on simulation, Response surface methodology, Soil erosion, Modeling

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Binary K-Ca Exchange on a Clay Separated from a Soil with Dominant Illite (mica) Mineralogy: 1- Effect of Depletion-Collapse of Illite (mica) on the K-Ca Selectivity

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ABSTRACT

Effects of K-depletion on K-Ca exchange equilibria were studied in clay separated from a soil with dominant illite (mica) mineralogy. Treatment of clay with NaTPhB+NaCl for periods of 6, 25 and 150 hours resulted in release of 22.1, 30.8 and 40.7% of total K, respectively. Potassium release was much faster at the beginning and then gradually decreased with passage of time. Cation exchange capacity (CEC) of the clay increased with K-depletion, indicating that at least some of the element K was released from the interlayers of the clay. Mineral weathering contributed significantly to the total extracted Ca. Thus, exchangeable Ca values were overestimated by 31.2 to 76.7% when weathering was neglected. Anion adsorption was found to be more prominent than the negative adsorption. A comparison of the exchange isotherms of K-Ca with non-preference isotherm indicated that K was preferred over calcium up to $\tilde{E}K \leq 0.8$ in non-depleted clay and up to $\tilde{E}K \leq 0.76$ in depleted clays. Slight preference of Ca over K was observed on $\tilde{E}K > 0.8$. Comparison of K-depleted clay's exchange isotherms demonstrated that selectivity's of exchangers were not affected by K-depletion. A study of XRD patterns of the K-depleted clays following the treatment of the clay with a solution carrying 0.05 equivalent fraction of potassium showed that during the K-Ca exchange, layers were collapsed, but CEC values of these clays indicated that the layer collapse of the clays were not fully complete. Apparent K preference was increased with ionic strength, and with a dilution of equilibrium solution, more Ca was absorbed. The difference between the two exchange isotherms at the two different ionic strengths was a result of valence-dilution effect.

Keywords: K-Ca exchange, K-depleted illite, Ionic strength, NaTPhB, Selectivity

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An Evaluation of Some Chemical Extractants for Determination of Available Zinc for Pistachio Seedlings in Some Calcareous Soils of Rafsanjan

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ABSTRACT

Vast parts of the world soils including the soils of Iran are calcareous. Due to high pH accompanied by fixation of many micronutrients including zinc, the deficiency of these nutrients in plants are observed. Total Zn content in soils does not lead to any substantial information regarding it's availability to plants. Therefore, zinc available in 28 calcareous soils of a wide range of physical and chemical properties was evaluated with DTPA-$CaCl_2$, EDTA-NH_4OAc, DTPA-NaOAc, DTPA-NH_4HCO_3, EDTA and Mehlich3, using pistachio seedlings as the test plant. Experiments were carried out within a completely randomized design of three replications and 28 soil types in greenhouse conditions. The results showed that the zinc extraction decreased according to the following order: Mehlich3 > DTPA-NaOAc > EDTA> EDTA-NH_4OAc > DTPA-$CaCl_2$ = DTPA-NH_4HCO_3. Multiple regression equations indicated that the level of Zn extracted by some extractants exhibited significant correlations with some of the physical and chemical properties of soils, such as clay, CEC and CCE. There was a significant correlation observed between zinc concentration and its uptake by leaves and stems of the plant and Zn extractable by the extractants. So that the highest positive correlation was observed between DTPA-NH_4HCO_3 Zn extractable and leaf Zn concentration of pistachio seedlings. Therefore, DTPA-NH_4HCO_3 is introduced the most suitable chemical extractant for evaluation of bavailable zinc for pistachio in calcareous soils.

Keywords: Calcareous soil, Chemical Extractants, Pistachio, Zinc

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Organic and Inorganic Carbon Distribution within the Particle Size Fractions of Soils Developed in an Arid-Semihumid Climosequence

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ABSTRACT

Soil carbon changes are amongst the most important indicators exposing climate change impacts on soil genesis. A study of soil carbon, either organic or inorganic (carbonates), and as well investigating the impact of soil carbon on other soil characteristics within different climates are essential for the proper management of soil carbon on a global scale. Also, a balance of different contributor parts of carbon sources is of high importance from an environmental point of view. Throughout the present study, the distribution of soil organic vs inorganic carbon in the primary particles (at the sizes of sand, silt and clay) were investigated for 9 soil profiles along a climosequence representing three different climatic zones of arid (Eshtehard), semiarid (Qazvin) and semihumid (Roodbar) with typic aridic, dry xeric and typic xeric moisture regimes and thermic, thermic as well as mesic temperature regimes, respectively. The statistical analysis of organic carbon components of particle size in the three studied regions revealed the trend of clay (semihumid $1.36a^{ns}$, semiarid $1.32a^{ns}$, arid $0.63a^{ns}$)> silt (semihumid $0.85a^{*}$, semiarid $0.79ab^{*}$, arid $0.4b^{*}$)> sand (semihumid $0.44a^{*}$, semiarid $0.19b^{*}$, arid $0.05b^{*}$). This was when the trend of silt (semihumid $18.2a^{ns}$, semiarid $14.03a^{ns}$, arid $11a^{ns}$)> sand (semihumid $18.96a^{*}$, semiarid $11.79ab^{*}$, arid $5.59b^{*}$)> clay (semihumid $13a^{*}$, semiarid $7.56ab^{*}$, arid $3.85b^{*}$) was observed by the statistical analysis of inorganic carbon components related to a particle size. Results showed that, the organic carbon contents of the soils in all clay, silt, and sand components decrease with increase in profile depth. Also, clay components carry more organic carbon contents within all the depths as compared with the other components of the soil. In contrast to that of organic carbon, inorganic carbon content is lower in the uppermost horizons than in the subsurface in all the three components of particle size and while increasing with increase in the profile depth. The results showed that in an arid-semihumid climosequence, with increasing humidity, soils containing a larger share of fine particles, due to their higher specific surface area, are able to store more carbon.

Keywords: Semiarid climate, Carbonate, Organic carbon, Soil genesis.

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Three-Dimensional Mapping of Soil Texture Using Spline Depth Functions and Artificial Neural Networks

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ABSTRACT

Quantitative, continuous and three-dimensional soil data at their appropriate scales are prerequisites for modeling of natural resources and environment. Despite the importance of soil texture, its legacy soil maps are often provided for the surface layers in which vertical and lateral variations of soil properties are not taken into consideration. A combination of Digital Soil Mapping (DSM) and soil depth functions is an alternative to cope with these challenges, especially in countries of limited data such as Iran. Therefore, equal-area spline depth function and DSM techniques were employed to assess the vertical and lateral distribution of soil texture in Silakhor Plain, located in Lorestan a western province of Iran. By fitting the depth function to the assessed clay, silt and sand percentages in 103 sites down to a depth of one meter, their estimated percentages were obtained at five standard soil depths of Global Soil Map project (0-5, 5-15, 15-30, 30-60 and 60-100 cm). Also artificial neural network model was employed to predict lateral distribution of soil texture fractions employing the auxiliary variables derived from satellite image and Digital Elevation Model (DEM) within the standard depths. The results of the sensitivity analysis showed, although the relative importance of auxiliary variables in predicting soil texture was different according to the depth and texture fractions, the performance of artificial neural network in upper layers was more pronounced than that in lower layers. R^2 values for clay, silt and sand from top down to the bottom were recorded 0.73 to 0.49, 0.43 to 0.76 and 0.26 to 0.68, respectively. Results also indicated; for an estimation of soil texture, auxiliary variables derived from satellite image was of more importance in surface layers while those of DEM of more importance within subsurface layers.

Keywords: Digital soil mapping, Silakhor Plain, Scorpan model, Remote sensing

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Investigation of Gravel Fragment Effect on Runoff Yield and on Soil Erosion Using Rainfall Simulation (Case study: Watershed of Almas Bridge, Ardabil)

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ABSTRACT

Soil erosion is one of the basic environmental problems in such developing countries as Iran and can have destructive effects on the ecosystem. The aim followed in the present study was to investigate the effect of gravel fragments on runoff and on soil loss in the watershed of Almas Bridge, Ardabil. Following the surveys in the area, three class slopes (6, 15 and 22%) were identified in the region. In each class of the slopes, treatments consisting of zero gravel coverage, 10, 20, and 30% were applied. A factorial experiment was carried out in a randomized complete block design. Results revealed that the maximum runoff volume, soil loss, sediment concentration as well as runoff coefficient were found in the control treatment (with no gravel fragment coverage) within the slope of 22% and the minimum in the treatment with 30% of gravel fragment coverage within the slope of 6 percent. The results depicted that the runoff volume and soil loss decreased by 96% and 519%, respectively, applying 30% gravel fragment coverage when compared with the control treatment. On the other hand, the findings of the research illustrated that the generated volumes of runoff within the slope of 22% were 37 and 107 percent more than those in the slopes of 15% and 6%, respectively. In addition, 20 and 30% of gravel fragment coverage within the slope of less than 15% were shown to have the most effect on the soil loss, sediment concentration and runoff volume.

Key words: Sediment Yield, Runoff coefficient, Gravel fragment coverage, Soil loss

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Quantitative Modeling of Potassium Release from Feldspar by *Bacillus sp*

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ABSTRACT

Potassium (K) is one of the essential nutrients in plant growth and it is found in the structure of many soil silicate minerals. Such soil microorganisms as bacteria, fungi, algae and lichens are of high efficiency in silicate decomposition and releasing such elements as potassium. The purpose followed in this study was to model and evaluate the effects of pH, incubation time and varying amounts of feldspar on K release by *Bacillus sp*. For this purpose, different ranges of these three variables, including pH (5-9), incubation time (1-17 days) and feldspar (1-7 $g.l^{-1}$) were considered and a central composite design with 20 experiments was used to evaluate the effects of the coded independent variables on K release from feldspar. Results indicated that the central composite design is of a high efficiency (R^2= 0.982, RMSE= 1.96mgl^{-1}) in predicting soluble K concentration. Sensitivity analysis of the central composite design revealed that the pH and treated feldspar concentration are the most important factors in K release and the effect of these factors on K release were recorded 37.48 and 31.80 percent, respectively. The highest concentration of K was observed at high concentrations of feldspar vs lowest levels of pH. Incubation time also presented a significant effect on potassium release. In the early stages of the incubation time, the trend of potassium release was increased. Within middle stages, K level decreased but it was accelerated at some long times past of incubation. In general, increasing of feldspar concentration and incubation time along with low initial pH lead to high levels of K release from feldspar.

Keywords: Soil microorganisms, Potassium release, Central composite design

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Improvement of Runoff Prediction Applying WAPABA Model

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ABSTRACT

This paper is aimed at increasing the accuracy of runoff predictions applyinf WAPABA model and comparing its efficiency with SALAS model outputs, involving hydrometric runoff data related to North Markazi Province-Iran, for year 2010-2011. The above mentioned models were applied and calibrated using the gothered historical data. The performance of each model was evaluated using different criteria including; CE, RMSE, R2 and MAE. Also,a comparison of the models, predictions with the measured data were made. Results indicated that the predicted runoff data using SALAS model carry values more than the measured ones, which can be due to the weighting the values related to this model. In other words, in SALAS model the weights which are related to precipitation exceed the other parameters. While WAPABA runoff model of the same weights, which are considered for all the parameters, benefit from better and more accurate predictions. However, as through this study and for the Ghet-e-Char station of the case study WAPABA model did not render aaceptable predictions.

Keywords: Precision, performance, runoff, SALAS

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Temporal Variations of Runoff Production under Various Slope Gradients within Different Soil Textures

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ABSTRACT

Initiation time and production rate are two of the major runoff characteristics which can be affected by the changes in soil physical properties as during rainfall. Temporal variation of these characteristics could be controlled by the factors of soil texture and slope gradient. This study was carried out to investigate the temporal variations of runoff in the conditions of different soil textures, namely clay loam, loam, and sandy loam vs various slopes of 5°, 10°, 15°, 25and 30° under a 40 mm h^{-1}simulated rainfall in the lab. Soil texture and slope steepness constituted the important factors influencing runoff initiation time ($P<0.01$) and production rate ($P<0.01$).Clay loam offered the lowest runoff initiation time (16 min) whereas sandy loam the highest (46 min). Runoff initiation time was negatively affected by increase in slope gradient. Significant relationships were observed between runoff initiation time and slope gradient in clay loam ($R^2=0.86$), loam ($R^2=0.86$) and sandy loam ($R^2= 0.98$). The highest effect of slope gradient on decrease in runoff initiation time occurred in sandy loam (63%) while clay loam rendered the lowest (28%). Significant relationships were found between runoff production and slope in clay loam ($R^2=0.89$), loam ($R^2=0.95$) and sandy loam ($R^2= 0.94$). Runoff temporal variation patterns were strongly varied among the soils within the different slope gradients. Runoff steadily increased in clay loam during the initial rainfall times. This temporal variation of runoff was due to increase in water content and disruption of soil structure.

Keywords: Simulated rainfall, Runoff initiation time, Disruption of soil structure, Runoff production rate.

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Effect of Different Levels of Magnetized Wastewater on Yield and Water Use Efficiency in Maize and Some of Soil Physical Properties

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ABSTRACT

The effects of different levels of wastewater plus a magnetized mixture of water and wastewater were investigated on yield and on water use efficiency in maize cv. Maxima and as well on some of soil physical properties. The research work was carried out as a factorial experiment of two factors based upon a complete randomized block design of 3 replications as from June to October 2014 in the Research Farm of Zanjan University. The required wastewater was provided from the refinery of Zanjan and distributed in plot at 5 levels comprised 0% (well water as control), 25, 50, 75 and 100%. Magnetic treatment included the crossing vs non crossing of the water-wastewater mixture through a magnetic field. The magnetic field was made of a weir-pipe of 0.1 tesla intensity. Based upon the results, leaf area and relative water content of leaf were not significantly affected by different levels of wastewater. Maximum value of maize wet mass and water use efficiency for wet mass treatment occurred in 100% wastewater treatment, significantly different from control by 23.9 tone/ha and 7.6 kg/m^3 respectively. The difference between maize wet mass and water use efficiency of wet mass for magnetized vs non magnetized water-wastewater mixture were 14.6 tone/ha and 4.7 kg/m^3 (respectively) which were statistically significant. The effect of different levels of wastewater was not significant on soil physical properties within 15-30 cm depths. The effect of magnetic water-wastewater mixture on soil physical properties was significant within the 0-15 cm of soil depth but there was no significant influence observed within 15-30 cm depth. Results revealed that, in 0-15 cm of soil depth, magnetic water-wastewater mixture increased soil bulk density; volume moisture and soil saturate degree while decreasing soil porosity as compared with non-magnetic treatment by 19%, 3%, 10% and 8% (respectively).

Keywords: magnetic water-wastewater mixture, maize cv. Maxima, soil physical properties, treated wastewater, water use efficiency.

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Aqua Crop Model Evaluation to Estimate Maize Yield and Soil Salinity under Different Agricultural Management Practices and Irrigation with Saline Water

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ABSTRACT

FAO has recently proposed the version 4 of AquaCrop model that can simulate the effect of irrigation with saline water on yields and on soil salinity. Throughout the present study, AquaCrop model was evaluated under different agricultural management practices and irrigation with saline water for the case of Maize (SC.704). Field experiments were in carried out in the agricultural farms of Shahid Chamran University. Different crop management practices, including no crop residue, use of crop residue, on soil surface as mulch as well as a mix of crop residue (in surface soil layer down to 30 cm depth) and water irrigation salinity at three levels of : water salinity of Karoun river (On the average 2ds/m), 4.5 and 7 ds/m. following model calibration to adjust some input parameters, model validation was performed. The level of determination coefficient (R2), relative error (RE), Coefficient of Residual Mass (CRM) and Normalized Root Mean Square Error (NRMSE) in validation for soil salinity were respectively recorded 0.83, 10.6%, 0.04 and 11.64, while for yield they were respectively recorded 0.93, 5.2%, 0.01 and 5.58, and as for biomass they were respectively found out to be 0.99, 4.2%, -0.02, and 4.48 and whereas for canopy they cover were respectively obtained as 0.97, 16%, 0.08 and 14.71. The average error for either use or non-use of wheat residues for soil salinity were respectively recorded 9.6% and 12.7%, As for yield they were respectively found out 6% and 3.5%, and for biomass respectively 4.8% and 3.1% For canopy cover there were respectively found out to be 14.6% and 18.8%. The results showed that soil salinity, yield, biomass and canopy cover were well simulated. However, the model accuracy was lower in estimation of soil salinity and canopy cover and it decreased with increase in salinity. Also, the model accuracy was increased in soil salinity and canopy cover estimation while getting decreased in yield and biomass estimation under the agricultural management practices applied.

Keywords: Biomass, Canopy Cover, Crop Residues, Mulch.

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Comparison and Evaluation of Different Methods for Inverse Estimation of the Infiltration Equation Parameters in Vegetated Furrows

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ABSTRACT

The parameters of infiltration equations play a key role in evaluation and design of irrigation systems. In order to enhance irrigation efficiency, it is necessary that these parameters be accurately estimated. In this study, four inverse estimation methods to predict the coefficients of infiltration equations namely two-point method, multilevel optimization, SIPAR-ID, and IPARM in the vegetated furrows were assessed and compared together making use of the field data. The field study to collect the required data was conducted in Karaj in 2014. Seven irrigation events were performed during the growing season of maize with two inflow discharges of 0.29 and 0.44 l/s. Based on the estimated coefficients of infiltration equation, the IPARM model with average relative errors of 1.24 and 1.52 %; as well as the multilevel optimization method with average relative errors of 1.44 and 1.58 % presented the mast appropriate performance for inflow discharges of 0.29 and 0.44 l/s in estimating infiltrated water volume, respectively. The SIPAR-ID model rendered a poor and fluctuating performance in estimating the coefficients of infiltration equation in the vegetated furrows. Moreover, the two-point method presented an acceptable performance with average relative error less than 10 percent in estimating the infiltrated water volume.

Keywords: Surface irrigation, Parameters of infiltration equation, Runoff, Advance, IPARM, Multilevel optimization.

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Effect of Soil Salinity on the Wheat and Bean Nutrient Concentrations in Low Matric Suctions

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ABSTRACT

The effects of soil matric suction (2−33 KPa) and salinity (EC: 0.7−8 dSm^{-1} for bean and 2−20 dSm^{-1} for wheat) on the wheat and bean nutrient contents in two soil media, naroely sandy loam and clay loam (at green house conditions) was evaluated. Potassium concentration increased while sodium decreasing with matric suction in either of the plants. The nitrogen and calcium concentrations in bean and wheat increased with matric suctions reaching their maximum values at suctions 6-10 KPa. Concentration of nitrogen was reduced while concentration of calcium remaining nearly constant at higher suctions. Maximum concentration of iron and zinc occurred at the suction of 2KPa in either plant. As matric suction increased from 2 to 6 KPa, iron and zinc heavily decreased while remaining nearly constant at higher suctions in either soil. Salinity caused increase in concentrations of iron and calcium while reducing the concentration of potassium in both plants. This did not affect concentrations of nitrogen, sodium and zinc. The low soil matric suctions amplified the salinity stress due to aeration deficit. Also a comparison of the two plants revealed that because of high sensitivity of bean to stresses, changes of its nutrient concentrations under different levels of salinity and matric suction were greater than those in wheat.

Keywords: Aeration porosity, Aeration stress, Salinity stress, Soil matric suction

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Application of Multi Temporal Satellite Images for Improvement of Maize Phenology Models' Prediction

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ABSTRACT

Crop phonological stages are commonly predicted through the accumulated growth degree days(AGDD).In this study a combined model of AGDD and remotely sensed NDVI has been developed for prediction of maize (cv. K407) phenology in Karaj applying a nine year (2002 to 2010) dataset. For softening the existing noises of image processing, a combination of double logistic and weighing average (WLS-DL) approaches was employed. The results of combined phenology model were compared by two frequently used methods based on AGDD and date of sowing. The findings indicated that in general, the developed model predicted the first 7 phenological stages of emergence up to milky stage. More accurately as compared with the other approaches (with average 2 and 2.5 days difference with the observed dates, respectively) but was inaccurate for the maturity stage. The present study highlights the need for further improvements in the needed observations in the region.

Keywords: NDVI, Double logistic, weighing regression, Phenology, maize

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Critical Nitrogen Equation for Maize in Pakdasht Region

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ABCTRACT

The nitrogen demand during the growing period is varied for plants, but most farmers apply large amounts of nitrogen without the proper knowledge of the time to achieve maximum yield. This pattern of fertilizer application causes environmental pollution. The optimum demand of nitrogen during growing period could be determined by use of the critical nitrogen equation. The main objective followed in this study was to determine the coefficients of the critical nitrogen equation for maize in Pakdasht region of Karaj. Comparing these coefficients with the suggested coefficients from France and China was the second objective of this research. The crop maize (single cross 704) was planted for a growing season on the research farm of Aburaihan campus. The aboveground biomass (W) and its critical nitrogen concentration (Nc) were recorded within six different times, as from 26 days following planting to the harvesting time. The coefficients of critical nitrogen equation were determined using theory of critical nitrogen dilution curve. Finally, the equation of $Nc = 2.9\ W^{-0.27}$ (as nitrogen critical dilution curve) was proposed for maize in the Pakdasht region. The results demonstrated that the nitrogen status was mispredicted in 21% and 14% of measured data points, by France and China equations respectively, while this figure was only 9% by use of equation presented in this study. The main reasons for these occurred errors are due to the differences in climate and prevalent varieties of the crop in these different areas.

Keyword: Nitrogen demand, Critical nitrogen dilution curve, Maize

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