

The Combined Effect of Seasonal Fluctuations of Persian Gulf and Mediterranean Sea Surface Temperature on Monthly Streamflow Forecasting of Karkheh River, Iran

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ABSTRACT

In the current paper, the combined effect of seasonal fluctuations of Persian Gulf and Mediterranean Sea Surface Temperatures (SSTS) on the forecast of monthly streamflow of Karkheh River has been investigated. To follow the purpose, Singular Value Decomposition method (SVD) has been made use of to determine the effective nodes of the seas on the climate of the region and to produce the correlated series of sea surface temperatures vs streamflow's. Moreover, Generalized Regression Neural Network method (GRNN) based on cross-validation technique has been applied to determine the most appropriate predictors from same several combinations of predictors for each month. Results for the forecast of the inflow in to Garsha dam show that the Mediterranean sea SST, during autumn, affects the streamflow from February to April, and while summer and autumn SSTs of Persian Gulf affect the streamflow in April and May such that applying these two indices for streamflow forecast in April and May results in an average increase of 118% vs 282% in Nash-Sutcliff index during calibration vs validation phases, respectively.

Keywords: Monthly streamflow forecasting, SVD, Persian Gulf, Mediterranean Sea, GRNN.

Time and Lag Correlation Analysis between Climate Drought and Hydrological Drought in Hashtgerd Plain

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ABSTRACT

The aim followed in this research work was a study of effects the of temporal climatic drought on the hydrological drought, the study being carried out in Hashtgerd plain, karaj. Throughout the study the SPI (Standardized precipitation Index) for climatic drought and GRI for the hydrological drought were assessed. Mann-Kendall trend test was applied to assess data (rainfall and water level). Pearson correlation was determined through cross-correlation between SPI and GRI. For a detailed study of the correlation, the SPI time scales were calculated from 0 to 200 months and the monthly lag time from 0 to 150. The results indicated a high correlation related to interaction between SPI and the lag time with the GRI. Also, the behavior patterns of piezometers led to three groups of time actions within the study area.

Keywords: SPI, GRI, piezometer pattern

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Streamflow Reconstruction Using Tree Rings Chronology, Modeling and Classification of Hydrological Drought in the Karkheh Basin

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ABSTRACT

Through an assessment of the annual growth of tree rings and making up of the chronology, the possibility of the study and reconstruction of streamflows in the habitats could be provided. The aim followed in this research was to reconstruct streamflow, applying dendrochronology, modeling, and classification of hydrological drought in Karkheh basin. Throughout the research the chronology indexes of two oak species, *Quercus brantii*, and *Quercus infectoria*, in the central Zagross region during the period 1840-2010 were used to reconstruct streamflow in Karkheh basin. Three gage stations were selected within the basin and their high flow periods determined. Correlations between streamflow, in high flow periods, as well as regional chronology index for gage stations were found out as positive and significant at 1% confidence level. With regard to these data average streamflows at high flow periods recorded at these gage stations (from year 1840 to 2010) were reconstructed. The values of the observed and reconstructed streamflows. Within the timely common statistical periods are well consistent with each other. Hydrological conditions during the chronology period were studied and accordingly, hydrological drought analyzed within Karkheh Basin for the years 1840 to 2010. Severity and duration of the droughts as well as low vs high flow decades were determined. In addition, the results were compared with those obtained by other researchers as well. Following the reconstruction of streamflow a probabilistic neural network model was employed to classify the periods of very low, low, high, and very high flows. The results revealed that through the provided model it would be possible to recognize the mentioned periods with a high accuracy within the region.

Keywords: Streamflow reconstruction, dendroclimatology, tree ring, drought classification, Karkheh basin

Comparative Analysis of the Effects of Rainfall Intensity and Experimental Plot Slope on Raindrop Impact Induced Erosion (RIIE)

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ABSTRACT

Splash detachment and transport of soil particles through the impact of raindrops on the soil surface form the initiating mechanisms of water erosion. However, mechanistic analysis of different affecting factors has less been taken into account. The present study was therefore formulated for a comparative analysis of the effective intensities as well as slopes on Raindrop Impact Induced Erosion (RIIE) components within a laboratory scale and for a sandy clay loam soil. Towards this end, a total of 81 rainfall simulation experiments were conducted in a set of 1 × 6 m plots with varying slopes of 5, 15 and 25% while using the current situation prevalent in the region. The experiments were performed in three replications and with simulated rainfall intensities of 30, 60, and 90 mm h⁻¹ using region IDF. The experiments were also adopted while using rainfall simulation system along with upward as well as downward Morgan's splash cups placed at upper, middle and lower parts of the plot. Results indicated that all the study variables viz. total vs net splash and upward downward splash were significantly ($p \leq 0.01$) influenced by rainfall intensity and cups' locality, but net splash was not statistically influenced ($p \geq 0.13$) by spatial variation of cups. In addition, the results showed that slope did not affect any study variables ($p \geq 0.11$) except the phenomenon of net splash ($p \leq 0.01$).

Keywords: Erosion factors, Rainfall erosion, Rainfall simulator, Soil erosion process

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Two Hundred Year Based Tree-ring Reconstruction of Maximum Temperature Koliak, Nowshahr

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ABSTRACT

One of the ways to reconstruction of climatic variables, especially temperature, is dendroclimatology or the use of tree-ring width chronology. There did not so far exist any tree-ring based reconstruction of long term temperature in Caspian Ecosystem. Throughout the present research, temperature was reconstructed using *Fagus Orientalis* tree-ring chronology samples collected from high elevated regions of Koliak (Nowshahr). To follow the target, a correlation between annual tree ring width and meteorological variables in local and as well in global scales was considered. Correlation analysis revealed that drop in maximum temperature is a limiting factor of tree growth, particularly in the period March-September. So, the average of March-September maximum temperature (based on data taken from Nowshahr's station) was reconstructed. The results of temperature reconstruction showed that this region has experienced very cold years more than it has very warm ones within the past two centuries. Also the first decade of 20th century and years, 1950-1970 vs the decade of 1830th, and years 1930-1950 formed the warmest vs coldest periods, respectively. Besides, the significant effect of negative NAO on temperature rise in the early months of growth period was revealed. Reconstructed temperatures of this research as like the results obtained by other researchers in Eastern Mediterranean didn't show any warming trend within recent years.

Keywords: *Fagus orientalis*, Reconstruction of temperature, Tree rings, NAO, Noshahr.

Determination of Longitudinal Dispersion Coefficient Involving Tracer Experiment Data

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ABSTRACT

Longitudinal dispersion coefficient is normally affected by many hydraulic parameters. So far three approaches namely, integral method, dye tracing filed measurements and empirical formulae have been widely employed to estimate the above mentioned coefficient in rivers and streams. In this paper a new equation of the longitudinal dispersion coefficient is devised and evaluated using an environmentally safe tracer plus the basic empirical equations. To achieve the aim, a length of 500 meters of a manmade concrete canal was chosen, to be used in carrying out the tracer tests. A set of experiments were conducted in Feb.2015, within three different mixing lengths, of: 45, 75 and 100 meters. The results show that differences of average, variance and maximum concentration between the measured vs estimated data using the lastly available equation) are equal to 79, 6, and 99 mg/lit while using the newly equation found in the present study they are respectively equal to 66, -1 and 44 mg/lit.

Keywords: Empirical Equation, Hydraulic Parameters, Mixing Length, Tracer

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Comparison of Different Discharge Estimation Methods for Sharp-Crested Semi-Circular Side Weir under Subcritical Flow Regimes

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ABSTRACT

Side weir is a flow control structure that used extensively in irrigation and drainage as well as sewer networks. Throughout the present research, a study comprised of 162 experiments was done on sharp-crested semi-circular side weir. Since the height in this side weir varies along its length, this feature enables it to more properly control flood than rectangular side weirs in various flood conditions. The governing differential equation of the circular side weir has no analytical solution, and thus it is necessary to use numerical methods to be solved. Since numerical methods bear computational costs, normal weir equation along with linear assumption of water surface profile are employed in solving the problem. Lastly, by doing three other experiments under completely different conditions from the former ones, it was found that the method of considering linear water surface profile is of less error in comparison with other methods employed in the current research.

Keywords: Discharge estimation, Semicircular side weir, Discharge estimation, Subcritical flow.

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Investigation of Vegetative and Reproductive Characteristics of Damask Rose in Different Irrigation Regimes through Surface and Subsurface Drip Irrigation

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ABSTRACT

Throughout the present study some vegetative and reproductive characteristics of *Rosa damascene* fewer than three different irrigation regimes (100, 70 and 40% of potential evapotranspiration) through an application of surface vs subsurface drip irrigation systems were investigated. Some morphological characteristics investigated, included the number of branches per plant, shading diameter, plant height, number of blooms, petals, weight, fresh weight of a single flower, percentage dry matter of a flower as well as its total dry weight. The experiment was performed in the framework of a split plot design based on randomized complete blocks of three replications at the Research Center for Agriculture and Natural Resources of Kerman (Joopar Research Station) during 2012 and 2013. Results revealed that the plant height, number of blooms, fresh weight of one flower, petals, weight and percentage dry matter of flower were not significantly different for the two types of irrigation systems but all the plant traits (except percentage of dry matter of flower) significantly differed under different irrigation management regimes. Due to severe limitations of water resources in the study area, the 70% potential evapotranspiration treatment was recognized as the most appropriate one because of having a 30% decrease in irrigation water use. There were only 5.8% and 15% decrease observed respectively in the number of blooms and in the shading diameter, the most effective traits on yield (correlation coefficient = 0.99).

Keywords: *Rosa damascene*, Drip irrigation, Deficit irrigation, Morphological characteristics, Correlation

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Assessment Aquacrop Model to Predict the Sugarcane Yield and Soil Salinity Profiles under Salinity Stress

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ABSTRACT

Several models have within the recent years been presented for water, soil and plant relationships one of which is AquaCrop model, and which in this study was employed to predict sugarcane yield as well as soil salinity profiles under salinity stress in southern Khuzestan. In order to attain some of the required number of input factors, the model was calibrated, i.e. the surface of soil covered by individual seedlings, at their 90% emergence, maximum canopy cover as well as harvest index was determined. These coefficients were recorded as 7.2 (cm²), 90% and 40% respectively. The model was then performed and simulated with the measured values being compared, using statistical indicators. The coefficient of determination between the measured vs simulated yield data was obtained 0.97, the normal Root Mean Square Error 8%, Nash-Sutcliffe efficiency 0.83 and the coefficient of residual mass -0.09. The results indicated that the model is of acceptable performance to estimate sugarcane yield and that the model, in the conditions of the current study, had overestimated the figure. Also, the coefficient of determination of soil salinity was estimated at over 80% and that the model had estimated the level of soil salinity more than that found through measurement.

Keywords: Salinity stress, Aquacrop model, Sugarcane.

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Investigation and Analysis of Flow and Geometric Variables on Optimal Performance of Border Irrigation Using WinSRFR Model

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ABSTRACT

Low irrigation application efficiency is the major problem confronted with in surface irrigation systems due to weak management and poor designs. The purpose followed in the present study was an improvement of border irrigation performance as based upon four variables of: inflow rate cut off time, slope as well as border length. To this end, 8 series of open-end downstream field experimental borders were considered. Calibration of infiltration parameters regarding borders were conducted as based on multilevel optimization method. The results indicated that the multilevel optimization method, for prediction of infiltration parameters in border irrigation, was an acceptable one. According to the multilevel optimization method, the mean relative error for the volume of run-off prediction was determined as 0.5% and the average Root Mean Square Error for advance and recession times predicted about 3.1 and 3.2 minutes, respectively. The performance of borders was optimized using application efficiency and distribution uniformity performance contours of the WinSRFR. Based on flow variables (inflow rate and cut off time), the average application efficiency could be promoted for about 12 % (with adequacy equal to 100%) for the 8 series of the field experiments as compared with the current situation. Results finally indicated that with a consideration of the geometric variables (slope and border length), and as well the flow rates as decision variables, the average application efficiency could be promoted by about 13.35 % as compared with an evaluation of the prevalent situation.

Keywords: Multilevel Optimization Method, Surface Irrigation Model, Irrigation Management

Interaction of Duration and Underground Drainage Distance in Mid-season Drainage on Yield and Yield Components of Rice, *Hashemi* Cultivar

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ABSTRACT

This study was conducted in 2014 to determine the most appropriate drainage distance and duration in mid-season drainage of paddy fields. The experimental field was located in Rice Research Institute of Iran, Rasht, Guilan Province, at 49.63° E and 37.16° N and an altitude of 24.6 m above sea level. The experiment was carried out on *Hashemi* cultivar in the plots of 3×4 m as a completely randomized design in three replications with the factors of drain distance at three levels of 7.5, 10 and 15 m and depth of 90 cm plus drainage duration within two levels of 7 and 11 days. Such characteristics as plant height, number of tillers, panicle length, filled grains, 1000-grain weight, dry matter, harvest index, yield, soil moisture and discharge of drains were determined. As a result, the effect of mid-season drainage duration on yield showed that the maximum yield was gained in the case of 7-day drainage duration with an amount of 3987 kg ha⁻¹. Also, based on the effects of drains' distance on yield, a distance of 15m obtained led to a maximum yield of 3446 kg ha⁻¹. Statistical analysis of drainage distance and mid-season drainage duration interaction on yield revealed that the maximum yield (4384 kg ha⁻¹) was gained in the treatment of 7-day mid-season drainage duration and drains, distance of 15m, finally recommended for the study area.

Keyword: Paddy fields drainage, Drainage duration, Drains distance, Yield and yield components

Development a regression relationship between rainfed wheat yield and soil properties in a semiarid region, Zanjan Province

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ABSTRACT

Rainfed wheat is the main source of staple food for people in the developing countries. Various factors contribute to and affect the production of this crop. The aim followed in the present study was to develop a model to estimate rainfed wheat grain yield as based on physico-chemical properties of the soil. Therefore, wheat grain yield and soil physico-chemical properties were separately determined in triplicates at 53 rainfed wheat fields throughout Zanjan Province in growing season. Year 2014 Making use of partial least square regression, a model was developed to explain the relationship between rainfed wheat grain yield vs soil properties ($n=40$, $R^2= 0.6$). Silt and calcium carbonate equivalent were the most effective soil properties affecting the crop's grain yield, with the standardized coefficients of the estimating model equal to 0.23 and -0.24, respectively. The results of the research revealed that some soil physico-chemical properties including silt, calcium carbonate and potassium, in order of priority, affected most the rainfed wheat grain yield.

Keywords: Cross validation, Principal Component Analysis, Partial least square regression.

Evaluation of the Performance of Multiple Regression vs Neural Network Models to Predict the Activity of Antioxidant Enzymes in Shoots of Wheat (*Triticum aestivum*) when under Cadmium Toxicity

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ABSTRACT

The aim followed in this study was to compare the performance of multiple regression vs neural network models to predict the activity of antioxidant enzymes Super Oxide Dismutase (SOD), CAT alase (CAT), Ascorbate Pero Xidase (APX) and PeroXidase (POX) in the shoots of wheat (*Triticum aestivum*), Alvand cultivar in a soil polluted with cadmium. The treatments consisted of four levels of cadmium (0 (control), 25, 50 and 100 mg kg⁻¹ soil), respectively. After 30 days (almost simultaneous with the stage of the plant's stem elongation) plant samples were harvested. The following ten different parameters namely: wet and dry weight, chlorophyll a and b, concentrations of cadmium, copper, iron, manganese, zinc and potassium, were determined. The activities of the enzymes SOD, CAT, APX and POX were assessed. As a next step, the correlation coefficients between the ten parameters and the activity of antioxidant enzymes were determined. The results of multiple regression and neural network models optimized, showed that the efficiency of Artificial Neural Network, in predicting the activity of SOD and POX enzymes, was more pronounced than those of the Multiple Regression models. Coefficients of multiple determinations (r^2) between measured and predicted values of SOD activity for Multiple Regression and Neural Network models were recorded as 0.76 and 0.87 respectively. Coefficients of Multiple Determination (r^2) of POX activity for Multiple Regression vs Neural Network models were 0.96 and 0.98 respectively. Also the coefficients of Multiple Determination (r^2) between the measured and predicted values of CAT activity for multiple regression and neural network models were 0.97 and were 0.98 respectively. With regard to the APX enzyme, coefficients for Multiple Regression and Neural Network models were 0.97 and 0.99 respectively. According to the results of the research, in general the efficiency of artificial neural network model in predicting the activity of antioxidant enzymes in wheat shoots, and under toxicity of Cd was more than that of the multivariate regression model.

Keywords: Heavy Metals, Modeling, Soil Pollution

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Effect of Calcium Carbonate and pH on the Kinetics of P Fixation in Different Soils

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ABSTRACT

Effects of calcium carbonate and pH on the kinetics of P fixation were studied on four non-calcareous soils treated with different levels of pure CaCO₃, and also on six soils which were adjusted for pH within the range of 5 to 9. Soils were also treated with K₂HPO₄ at the rate of 45 mg P/kg before they were incubated for a period of 100 days at 25°C. Soil samples were taken at certain predetermined times and the concentration of P measured through Olsen method. It became evident that the reaction of P with soil was biphasic, composed of a set of fast reactions vs a set of slow ones. The rate of reduction in available P (Olsen-P) was very fast during the first day, and then it gradually diminished for duration of 50 days, thereafter approaching zero in most of the soil samples. In addition, an increase in the level of CaCO₃ content of the soils resulted in a significant (5% level) increase in the mean P recovery from the soils, however, the effect was not observed as the same in all the soils. It occurred that in one of the soils, an increase in CaCO₃ up to 35% had no effect on P recovery. The effect of pH on P availability was not the same in different soils. In some soils an increase in the pH from 5.2 to 8.8 had no significant effect on P availability, while in others; the amount of Olsen-P was either higher or lower at higher pH values. The different effects of pH on P availability was explained by the variable effects of a change in pH on such available-P related parameters as solubility of P minerals, charge characteristics of the soil surface, speciation of soluble P and change in concentration or activity of P species and as well the rate of organic P mineralization. It was finally proved that the net effect of these changes, as a result of a change in pH, could be different in various soils.

Keywords: Available phosphorus, Calcium Carbonate Equivalent, Olsen, Recovery

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Effects of Municipal Solid Waste Compost and Petroleum Hydrocarbon Decomposing Bacteria on Nutrient uptake by *Cordia myxa* L. Seedlings in Soil Contaminated with Crude Oil

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ABSTRACT

Extraction and refinement processes of fossil fuels have led to contamination of soil resources and consequently causing a considerable part of lands get out of profitable reach. This study aimed at an evaluation of the effect of different levels of organic matter and hydrocarbon decomposing bacteria on nutrient uptake of *Cordia myxa* seedlings. Treatments included crude oil (0, 3 and 6 w/w) municipal solid waste compost (0, 5 and 10% v/v) and bacteria (with bacteria of psu141 and psu27ps vs no bacterial content). The results indicated that the highest nitrogen concentration in shoot, along with phosphorus, potassium, manganese, iron and zinc concentrations in shoot and root were found in samples with compost level of 10%, with the figures of: 3.69%, 0.22%, 0.15%, 1.82%, 1.52% and 94.91, 123.66, 110.15, 1086.01, 32.44, and 79.67 mg/kg, respectively. The concentrations of these elements, in the presence of bacteria, were significantly higher than those in the control. In total, the presence of biological factors caused an increase in the absorption of nutrients and as well the improvement of the nutritional status of the plant when under oil pollution stress conditions.

Keywords: Biological factors, Growth promoting, Remediation, Soil contamination

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Effects of the Number of Wetting-Drying Cycles on Structure Stability, Particle Size Distribution and Pore System of Soil

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ABSTRACT

Soil wetting and drying cycles are important environmental processes that often act as mechanisms of soil pore system change. Also, clay and organic matter contents are two of the soil intrinsic properties involved in soil structure building properties. The aim followed in this study was to investigate the relationship of a number of wetting and drying cycles, clay content and soil organic matter with the soil structure stability, particle size distribution as well as soil pore system. Some soil physical properties were determined after one (T1), three (T3) and five (T5) wetting and drying cycles and compared with the aggregate stabilities of initial untreated soils (soil undergoing no wetting and drying cycles). The results showed that the improvement in aggregation was most pronounced in the clayey soils especially when containing a high level of organic matter. Following once and thrice wetting and drying cycles, only two clay soil samples more aggregated than soils with less clay content; but further wetting and drying cycles (5 cycles) resulted in a decrease in stability of aggregates. The findings indicated that the macro aggregation depended mostly on soil texture attributes rather than organic matter content; and the former were more effective in aggregating when combined with high amount of clay content. Also it became evident that the compaction caused by sampling could be amended through wetting and drying cycles and the alternation of these cycles is an important mechanism for soil structure improvement.

Keywords: Aggregation, compaction, sampling, Intrinsic properties.

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Effect of Tillage Erosion on Soil Displacement and Productivity (Case Study: Tutkabon, Guilan)

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ABSTRACT

This research was conducted in a part of the dry farming lands of the southern Guilan Province, aimed at examining the impact of tillage erosion on the soil displacement and consequently its productivity. In order to achieve the research aims, 18 sampling points were spotted in some different locations of the landscape in seven adjacent fields, based on the adjacency to the field ridges (borders). Soil fertility characteristics at 0-30 cm depth as well as components related to wheat yield were determined at each sampling point. Cluster analysis by the Ward method grouped the soils in three as based on their fertility as well as productivity. The criteria considered in grouping soils' fertility consisted of nitrogen, phosphorous, potassium and organic carbon contents. The productivity of the soil was classified as based on ear number, one thousand grain weight, number of grains in ear as well as grain yield. There was no significant relationship found between the grouped points, in terms of fertility and productivity, probably due to differences in crop management in the adjacent fields. The terrace elevation formed between two fields was observed to be 1 to 3.2 meters in the slope direction, and 1 to 1.3 meters in the lateral direction. In addition, the soil volume displaced in the two directions was estimated to be 8 to 36 and 5 to 22 tons per hectare per year, respectively.

Keywords: Embankment, Long- term tillage, Lynched, Mechanical erosion, Soil displacement.

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Effect of Citric Acid on Characteristics of Zinc Sorption in Calcareous Soils

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ABSTRACT

Zinc (Zn) is an essential micronutrient needed by plants, animals and humans. Bioavailability of Zn to plant root is controlled through sorption process in soils. To evaluate the effect of citric acid on Zn sorption, a batch experiment was conducted with two soil samples (S1, S2), that differed in their clay and calcium carbonate contents. Three levels of citric acid (0, 0.5, 1 mM) and twelve various Zn concentrations (0 to 450 mg L⁻¹) in a medium of 0.05 M NaCl solution were applied to the soils. Adsorption data were fitted to Langmuir ($R^2=0.76-0.95$), Freundlich ($R^2=0.83-0.95$), Temkin ($R^2=0.62-0.92$), Dubinin-Radushkevich ($R^2=0.44-0.92$) and Elovich ($R^2=0.54-0.90$) isotherm models. Sorption parameters including maximum adsorption of Langmuir (q_{max}), Freundlich capacity and intensity factors (K_F , n), coefficients of Temkin equation (A , K_T) and maximum adsorption capacity Dubinin-Radushkevich (q_m) decreased by application of citric acid. The above mentioned sorption parameters related to S1 (low clay and calcium carbonate) were lower than those belonging to S2 (high levels of clay and calcium carbonate). The sorption energy parameter of D-R isotherm and Gibbs free energy change (ΔG_r) indicated that the Zn adsorption processes were physical and spontaneous. The results of the experiments revealed that the application of citric acid significantly decreased Zn sorption by soil particles, probably due to formation of soluble complexes, and consequently increased Zn availability to plants. Therefore, through a modification of plants to secrete higher levels of citric acid, one can expect the absorption of Zn by this plants. To be further promoted.

Keywords: Zinc, Citric acid, Sorption, Low molecular weight organic acid

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Evaluation of Trends in Mineral Nutrition Uptake in Balangu (*Lallemantia iberica*) under Different Copper and Zinc Application Rates

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ABSTRACT

Zinc and copper are among the essential micronutrients needed by plants. They, on the other hand (when at extra high concentrations) can act as stress factors, limiting a plant's uptake of other nutrients, and consequently stunting the plant's growth. The aim followed in the present study was to investigate the effect of different concentrations of Cu and Zn on micronutrients (Cu, Zn, Fe and Mn) and on macronutrients' (P and K) uptake in Dragon's Head plant with the soil in a state of Zn and Cu deficiency, sufficiency or toxicity level. The treatments consisted of three levels of Cu (0, 5 and 25 mg/Kg obtained from CuSO₄ source) and three levels of Zn (0, 10 and 50 mg/Kg obtained from a ZnSO₄ source) plus across combination of the two. The study was carried out to the effect of different concentrations of Cu (zero, 5 and 25 mg per kg of soil) and Zn (zero, 10 and 50 mg per kg of soil) on the uptake of Cu, Zn, Iron (Fe), Manganese (Mn), Potassium (K) and Phosphorus (P) within the roots and shoots of Balangu (*Lallemantia iberica* F. & CM). The results indicated that all the treatments positively affected the uptake of either Cu or Zn in roots, but in shoots, and when Cu and Zn at their low concentrations (5 and 10 mg per kg of soil, respectively) vs high concentrations (25 and 50 mg kg soil), had respectively positive vs negative effects on the uptake of these element. The negative effect of high levels of Zn on Cu absorption was more pronounced than the similar levels of Cu on zinc absorption within plant's shoots. Potassium uptake by root and shoots increased in all the treatments except in those of high levels of Cu and Zn combined with the treatment of high levels of copper. These nutritional findings could be used as useful alerts in controlled use of Cu and Zn in Balangu cultivation.

Keywords: Balangu, Uptake, Medicinal plants, Stress

Some effects of spent mushroom compost and bagasse biochar on alkaline phosphatase activity and phosphorus availability in some calcareous soils

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ABSTRACT

Phosphorus deficiency is a common disorder for agriculture in calcareous soils. To study the effects of spent mushroom compost (SMC) and sugar cane bagasse biochar (B) on alkaline phosphatase activity and phosphorus availability in three soil types (that is) loam, clay loam, and sandy loam, an incubation experiment was conducted. The treatments included levels of biochar B1 and B2 (15 and 30 ton.ha⁻¹), levels of spent mushroom compost SMC1 and SMC2 (20 and 40 ton.ha⁻¹) and the control (C). After applying treatments in 14, 60, and 120 days, T₁, T₂, and T₃ respectively, available phosphorus and pH were measured and alkaline phosphatase activity at T₃ period was also measured. The results indicated that in all soil samples SMC increased phosphatase activity, But biochar was ineffective in sandy loam soil. Average phosphatase activity in control treatment was 2090, 2931 and 2888 µg PNP.g⁻¹Soil. h⁻¹ at sandy loam, loam and clay loam, respectively and was increased to 3034, 3709 and 3533 µg PNP.g⁻¹Soil. h⁻¹ in SMC2 treatment, respectively. Both levels of SMC also caused increase in phosphorus availability, while biochar was less effective on that. SMC2 treatment showed the best effectiveness on increasing phosphorus availability. So that available phosphorus average was increased from 19.4, 8.8 and 3.9 mg. Kg⁻¹ in control treatments to 37, 28 and 22 mg.Kg⁻¹ in SMC2 treatment for sandy loam, loam and clay loam soils respectively. Application of SMC reduced soils pH while biochar increased that. Results indicated that SMC has a positive effect on phosphorus availability and improves other properties including pH in calcareous soils.

Keywords: alkaline phosphatase, biochar, mushroom compost, phosphorus availability.