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Original Article

The Effect of Wastewater Sirjan Golgohar Industrial on the Characteristics of Cultivated Soils in Several Species of Pasture Trees

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ABSTRACT

Collection and reuse of wastewater and sewage in agriculture, natural resources and green environment is one way to conserve water resources and environmental. The aim of this study were to investigate the effects of wastewater Sirjan golgohar industrial on the characteristics of cultivated soils in several species of pasture trees. This study was performed at the Sirjan city which is located in southwest of kerman province (1766 meters above the sea level, 29º 27 N latitude and 55º 40 E longitude, and 162 mm annual rainfall). This experiment was conducted a completely randomized design block testing in split factorial with 5 treatment and 3 replicated. In this study, we used different ratios of water and wastewater including control (normal water), 25% wastewater + 75% water, 50% water + 50% wastewater, 75% waste water + 25% water and wastewater of sirjan golgohar industrial. These treatment were used for irrigation of several species of pasture trees (*Pestasia atlantica*, *Amygdalus scoparia*, *Amygdalus elaegnifolia and Acer monspessulanum*). Data were analyzed by ANOVA using general linear model procedure of SPSS software. Significance between means was tested using Duncan Multiple Range Test. A probability value of $P \leq 0.05$ indicated that the difference was statistically significant. Results showed that the difference between mean treatments in the study was significant ($P<0.05$). Comparison of heavy metal concentrations in soil before and after treatment showed that the using of waste water sirjan golgohar industrial were increased heavy metals in soils. Between treatments in terms of ECe, SAR and pH was observed difference significantly, the amount of ECe, SAR was highest and lowest in control and wastewater treatments respectively. With the increasing of waste, the amount of organic materials have also increased, the treatment with wastewater have the largest amount of organic matter. In generally, we can conclude that the using of wastewater treatments due to decrease salting and increase organic matter than to control treatments can improve the soil for the plants.

Key Words: Wastewater, Sirjan golgohar industrial, Cultivated soil, Pasture trees

Introduction

This rapid development of irrigation translates into a sharply increasing water demand and the most accessible water resources, such as rivers and shallow aquifers are now almost entirely committed. Alternative water resources are therefore needed to satisfy further increases in demand. This is mainly a necessity in regions which are characterized by severe mismatches between water supply and demand, often associated to generally low water resources availability and asymmetries of avail-ability and demand in a temporal and regional basis and a peculiar relationship among water and environment raise specific problems. Irrigation with wastewater also appears to give some very interesting effects on the soil and on the crops. As a result, the use of reclaimed wastewater for irrigation has been progressively adopted by virtually all Mediterranean countries (Marecos do Monte *et al*., 1996). Because irrigation is by far the largest water use in the world and the quality requirements are usually the easiest to achieve among the various types of wastewater reuse, it is by far the largest reuse application in terms of volume. However, wastewater is often associated with environmental and health risks. As a consequence, its acceptability to replace other water resources for irrigation is highly dependent on whether the health risks and environmental impacts entailed are acceptable. It is therefore necessary to take precautions before reusing wastewater. As a result, although the irrigation of crops or landscapes with sewage effluents is in itself an effective wastewater treatment method, a more effective treatment is necessary for some pollutants and an adequate water storage and distribution system must be provided before sewage is used for agricultural or landscape irrigation (Asano *et al*., 1985). The use of treated sewage effluents (TSE) for agricultural irrigation is an old and popular practice in agriculture (Feigin *et al*., 1991). The soil-plant system, if adequately managed, encourages retention of effluent components mainly due to the incorporation of elements in the dry matter (DM) of plants (Bouwer & Chaney, 1974), leading to decreasing element concentrations in ground and surface waters (Feigin *et al*., 1978). Harvest and removal of plant material withdraw the accumulated elements, which further contribute to prevent leaching of elements, mainly nitrogen (N) and phosphorus (P) and enrichments in the subsoil solution and the groundwater concentrations (Quin & Forsythe, 1978; Hook, 1981). Although irrigation with TSE may mitigate the damage and utilization of natural water resources and enables the diversion of nutrients from waterbodies, it may result in risks that need to be considered in more detail, particularly in the tropics (Fonseca, 2005). Focussing on agronomical-environmental aspects the objectives of this text were to present an overview of the effects of TSE irrigation on yield production and plant nutrition (annual crops, orchards, forests and forages) as well as on chemical, physical and microbiological soil characteristics. Historically the question of wastewater treatment has largely been approached from the standpoint of pollution control. However, there is now growing interest in treatment for water conservation and re-use (for crop or grass turf irrigation) to take advantage of the nutrients contained in sewage water (Smith and Walker, 1991). Such re-use offers numerous advantages: reduced demands on ground and surface water supplies, lowering capital and operating costs for wastewater treatment compared to conventional approaches. Biological uptake by plants and retention by soil reduces potential contamination of the water table (Al-Mutaz, 1989). In addition, the economic products from wood harvested from the trees and creation of areas of treed wetlands for wildlife and human recreation are benefits to offset costs of implementing the system. Conventional wastewater treatment plants employ a sequence of physical settling and separation, biological (microbial) digestion and chemical treatment (generally with a halide, most frequently a chlorine compound) before release into the environment. Microbial activity is insufficient to achieve complete uptake of nitrogen and phosphorus because of the high concentrations of these elements in the organic material contained in sewage waters. There is thus incomplete reduction of nutrients contained in the sewage waters in conventional wastewater treatment plants which rely exclusively on microbes for their biological activity. Thus, even discounting the widespread, especially in developing countries, discharge of completely untreated wastewater into natural water bodies, the effluent from modem treatment plants typically releases waters excessively enriched with nitrogen and phosphorus. This has resulted in widespread eutrophication of rivers, lakes and marine environments, especially shallow coastal waters causing loss of valuable aquatic species and other environmental degradation (Hamer *et al*., 1989). It will facilitate later discussions to review the terminology of wastewater treatment so that the frequently used terms, such as primary, secondary and tertiary treatments, are clearly understood when we consider various options for use of fast-growing tees as a wastewater treatment technology. There are generally accepted standards of water quality which the proposed system must fulfill to be an acceptable option for secondary or tertiary treatment. In this study, "wastewater" is synonymous with sewage, or the combined water stream from households and commercial/industrial wastewater flows. Wastewater is thus a mixture of metabolic excretions (feces, urine) and gray water (laundry, kitchen). Therefore, the aim of this study were to evaluating the effect of wastewater Sirjan golgohar industrial on the characteristics of cultivated soils in several species of pasture trees.

Materials and Methods

This study was performed at the Sirjan city which is located in southwest of kerman province (1766 meters above the sea level, 29º 27 N latitude and 55º 40 E longitude, and 162 mm annual rainfall). This experiment was conducted a completely randomized design block testing in split factorial with 5 treatment and 3 replicated. In this study, we used different ratios of water and wastewater including control (normal water), 25% wastewater + 75% water, 50% water + 50% wastewater, 75% waste water + 25% water and wastewater of sirjan golgohar industrial. These treatment were used for irrigation of several species of pasture trees (*Pestasia atlantica*, *Amygdalus scoparia*, *Amygdalus elaegnifolia and Acer monspessulanum*). After leveling, land tested and divided into 15 plots, each main plot was divided into four sub-plots. Annuals seedlings were randomized cultivation in plots at February 2009. The complete watering plants were doing for established until March 15. From 15 March 2009 to 15 July 2010 the irrigation was applied with different ratios of water and wastewater treatments.

Sampling of soils cultivated plants

To evaluate the effect of treatment on soil the samples were perform from depths of 0 to 10, 10 to 30 and 30 to 60. After sampling the soil samples were transported to the laboratory in plastic bags. Then with the maul was crushed and passed through a 2-mm sieve.

Chemical analysis of soil samples

Soil chemical properties were measured in this study include: soil pH, electrical conductivity, soil organic matter, sodium, chloride, total concentrations of heavy metals, calcium and magnesium. Before testing, the concentration of heavy metals in soil were measured.

Statistical analysis

Data were analyzed by ANOVA using general linear model procedure of SPSS software. Significance between means was tested using Duncan Multiple Range Test. A probability value of P ≤ 0.05 indicated that the difference was statistically significant. Least square treatment means were compared if a significant F statistic (5% level of P) was detected by analysis of variance.

Results and Discussion

The means comparison between different treatments on concentration of zinc in soils are presented in Figure 1. This figure indicate that maximum concentration were observed in 5 treatment. Results also showed that the concentration of zinc between treatment were significant (P<0.05).

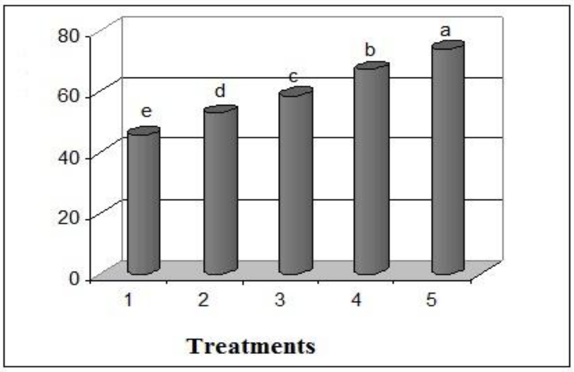

Figure 1. The mean concentration of zinc in soils under different treatments

The means comparison between different treatments on concentration of Nickel in soils are presented in Figure 2. This figure indicate that maximum concentration were observed in 5 treatment and minimum concentration were observed in 1 treatment. Results also showed that the concentration of Nickel between treatment were statistically significant (P<0.05).

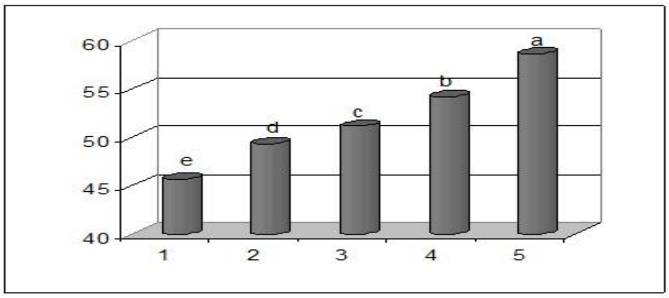

Figure 2. The mean concentration of Nickel in soils under different treatments

The means comparison between different treatments on concentration of copper in soils are presented in Figure 3. This figure indicate that maximum concentration were observed in 5 treatment and minimum concentration were observed in 1 treatment. Results also showed that the concentration of copper between treatment were statistically significant (P<0.05).

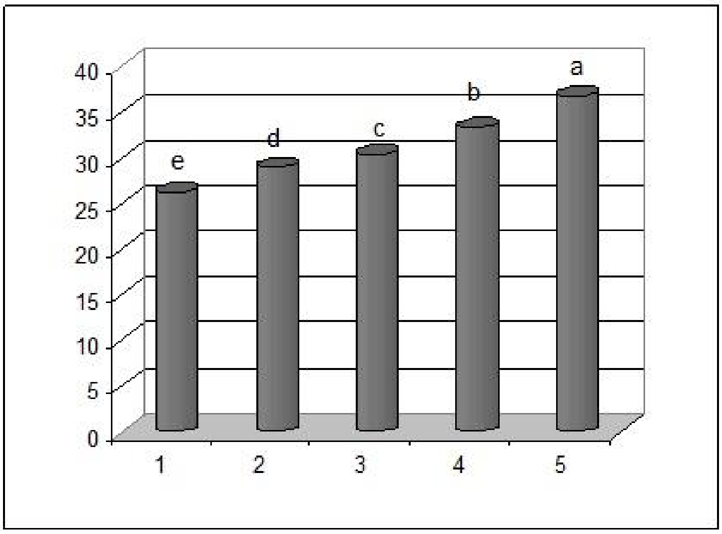

Figure 3. The mean concentration of copper in soils under different treatments

The means comparison between different treatments on concentration of plumb in soils are presented in Figure 4. This figure indicate that maximum concentration were observed in 5 treatment and minimum concentration were observed in 1 treatment. Results also showed that the concentration of plumb between treatment were statistically significant (P<0.05).

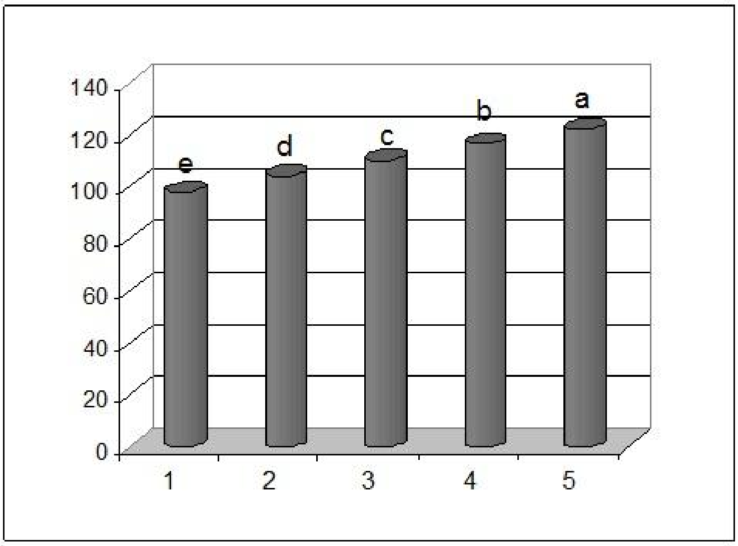

Figure 4. The mean concentration of plumb in soils under different treatments

The means comparison between different treatments on concentration of kadium in soils are presented in Figure 5. This figure indicate that maximum concentration were observed in 5 treatment and minimum concentration were observed in 2 treatment. Results also showed that the concentration of kadium between treatment were statistically significant (P<0.05).

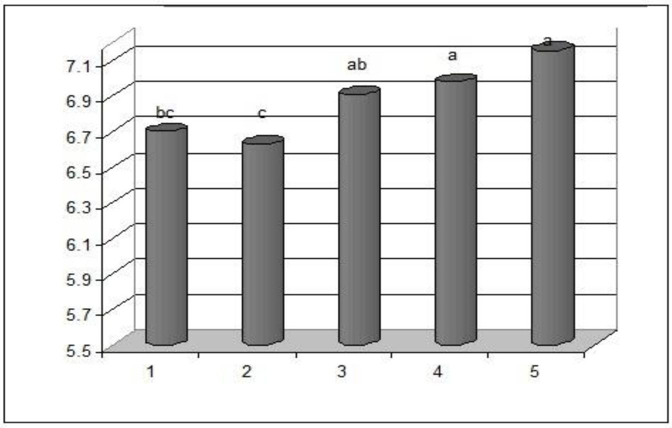

Figure 5. The mean concentration of kadium in soils under different treatments

The means comparison between different treatments on concentration of chloride in soils are presented in Figure 6. This figure indicate that maximum concentration were observed in 5 treatment and minimum concentration were observed in 1 treatment. Results also showed that the concentration of chloride between treatment were statistically significant (P<0.05).

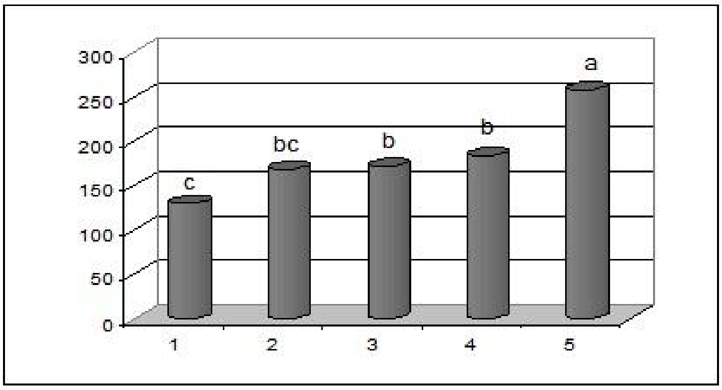

Figure 6. The mean concentration of chloride in soils under different treatments

The concentrations of heavy metals in soil for the plants were higher in 5 treatment because this treatment received the more amount of waste water. With increasing levels of waste water the concentrations of heavy metals in soil were increased. The concentration of heavy metals between treatment were statistically significant (P<0.05). It was conclude that the using of wastewater treatments due to decrease salting and increase organic matter than to control treatments can improve the soil for the plants.

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