

The Influence of using Compost Leachate on Soil Reaction

Ali Gholami, Shahram Ahmadi

Abstract—In the area where the high quality water is not available, unconventional water sources are used to irrigate. Household leachate is one of the sources which are used in dry and semi dry areas in order to water the barer trees and plants. It meets the plants needs and also has some effects on the soil, but at the same time it might cause some problems as well. This study in order to evaluate the effect of using Compost leachate on the density of soil iron in form of a statistical pattern called "Split Plot" by using two main treatments, one subsidiary treatment and three repetitions of the pattern in a three month period. The main N treatments include: irrigation using well water as a blank treatments and the main I treatments include: irrigation using leachate and well water concurrently. Some subsidiary treatments were DI (Drop Irrigation) and SDI (Sub Drop Irrigation). Then in the established plots, 36 biannual pine and cypress shrubs were randomly grown. Two months later the treatment begins. The results revealed that there was a significant variation between the main treatment and the instance regarding pH decline in the soil which was related to the amount of leachate injected into the soil. After some time and using leachate the pH level fell, as much as 0.46 and also increased due to the great amounts of leachate. The underneath drop irrigation ends in better results than sub drop irrigation since it keeps the soil texture fixed.

Keywords—Compost Leachate, Drop irrigation, Soil Reaction

I. INTRODUCTION

THE developments of the cities and wrong consumption patterns have caused an increase in the ooze and sewage. The Leachate found in them is so high due to the dampness in the households. Leachate includes some floating organic substances, nutrients, and solid metals. These metals cause soil pollution and are a threat to the environment [1]. Using sewage as a water resource in farming is very widespread and it started long time ago since it contains the substances essential for the plants [2], [3]. Studies in Shiraz show that an unsystematic and uncontrolled use of ooze would increase the solid metals density in the soil over a long time [3]. The studies revealed that using ooze over a long time would increase the amount of Cadmium and other solid metals in the soil which increase the plant's intake and consequently cause such poisonous metals to enter the humans' food chain [4]. In underneath watering in the depth range of 15 – 20 cm the evaporation seems insignificant compared to the surface system. The wet surface would increase after the watering and it would increase as the time [5].

Ali Gholami is with Department of Soil Science, Science and Research Branch, Islamic Azad University, khouzeestan, Iran(phone: 0098-611-4457612; fax: 0098-611-4435288; *corresponding author e-mail: a.gholami@khouzeestan.srbiau.ac.ir)

Shahram Ahmadi is with Department of Soil Science, Science and Research Branch, Islamic Azad University, khouzeestan, Iran(phone: 0098-916-611-5587; fax: 0098-611-4435288;e-mail:(sh.ahmadi1@gmail.com)

II. MATERIALS AND METHODS

A. Study area

The present study is conducted in east Isfahan. The height from the sea level was 1555 meters, the average rainfall 120 ml, and the average annual temperature 16 Celsius. The soil is of Golshahr type and belonged to Aridisols class. The soil texture in the selected region is Loamy, and based on Aiers–Wescat guidelines for evaluating the water quality, the water amount is considered to be average [6].



Fig. 1 Position of study area in Isfahan province and Iran

B. Methods

Number First a suitable areas was selected for Pilot Performance and the research conducted using Factorial – Split plat including two major treatments, and two subsidiary ones in a three month period and was repeated three times. The treatments include; N; irrigating using well water as an instance, I; irrigating using leachate and well water, DI (Drop Irrigation), and SDI (Sub Drop Irrigation) as an underneath drop irrigation. Before that, two types of trees; cypress and pine two year old shrubs were planted. About 200 liters of leachate was transferred to a 1000 liters tank and was diluted by the well water after that the EC reached 4 ds/m. This leachate was the main one used in the treatments. The average output from the dropping tube was 10 liters per hour and the irrigation was performed every two days. In each round about 20 liters of leachate was injected to the tree. So the amount of the consumed leachate for the rotation treatment (I) was 150 liters per month. The irrigation period lasted 2 hours and it was 0.17 liter per minute.

C. The Analysis Procedures:

- Soil Reaction

The Soil Reaction (acidity) of the soil samples in the extract was calculated by a pH device to be 632 Metrohm [7].

- Data Analysis

The study was done in a form of Factorial–Split plat design. the results were calculated using MSTATC software. Duncan test was applied to determine if the changes were meaningful and Excel software was used to draw the diagrams.

III. RESULTS AND DISCUSSION

The average pH level in the leachate sample under the study was 7.88 the sewage was alkaline which can cause some troubles in absorbing nutrients and also in drop irrigation especially in place of dippers. FAO in 2000 determined the standard pH range in the sewage to be used in irrigation to be 6.5– 8.5 [8]. So the average and the change scope are acceptable.

The Effects of treatments on Soil Ph pH Level Variations:

Using leachate decreases the soil pH in the depths of 0-30 cm and also in 30-60 cm. The underground pH decreased from 7.92 to 7.58 and on the surface from 7.85 to 7.63. So there is more variation on the surface than under the surface. The difference between pH levels shows a meaningful difference in the depth of 0-3 cm and 30-60 cm. as the time went by, the average pH showed a meaningful difference in the same depth range and at the end of the 2nd period it reached 7.59 (as much as 0.99 degree decrease) and at the end of the 3rd period although the amount of leachate intake and time were the same its average reached 7.53 which showed a 0.03 unit decline regarding the previous periods. This can be due to too much lime (59%) in the soil which increased the soil buffering capability. There is also another possibility that if the irrigation using leachate continues its decline rate would stop at a specific point and began to increase again. This point is known as ¹ZPC. Different irrigation methods would decrease pH level compared to instance. In the instance, it was 7.76 which reached 7.45. It means its decline was related to the amount of leachate. The comparison between different irrigation methods and time (figure 3) revealed that the treatment would decrease the underneath pH more significantly than instance. Comparing the mutual effects of irrigating methods and depth (figure 5) shows that the alternating treatment would decrease the underneath pH more significantly than the instance. Comparing the mutual effects of time and the depth (figure 6) revealed that pH level on the surface layers decreases more significantly than in the underneath layers. But the changes in the underneath layers were more frequent. The comparison between time, depth, and irrigation (figure 7) shows that in watering using leachate, pH decreases more in the underlying layers than on the surface and these changes are more meaningful in the treatments than in the instance.

TABLE I
ANALYSIS OF TREATMENT EFFECTS VARIANCE ON SOIL
CHEMICAL FEATURES

Total	Error	× depth	× depth	× depth	depth	×Time	Irrigation	Error	time	Replication	Variation
		× Irrigation	Irrigation	Time		Irrigation					DF
35	18	2	1	2	1	2	1	4	2	2	
	0.002	.001*	0.05**	0.0023*	0.027**	0.016**	0.902**	0.001	0.07**	0.016*	pH

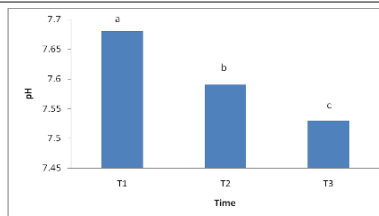


Fig. 2 Time Effect on Soil

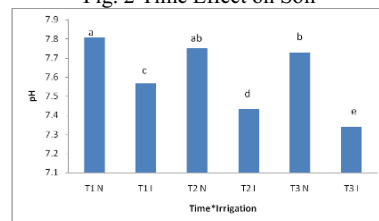


Fig. 3 Time and Irrigation and their effects on pH Level

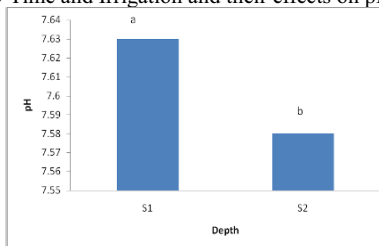


Fig. 4 Effects of Using Leachate in Different Depth range on pH Level

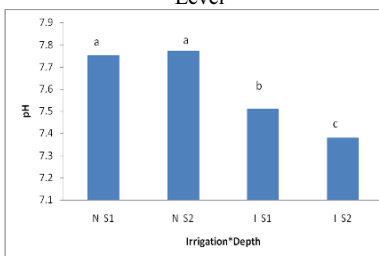


Fig. 5 Depth and Irrigation and Their Effects on pH Level

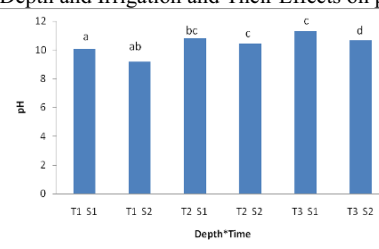


Fig. 6 The Effects of different Time and Depth on pH Level

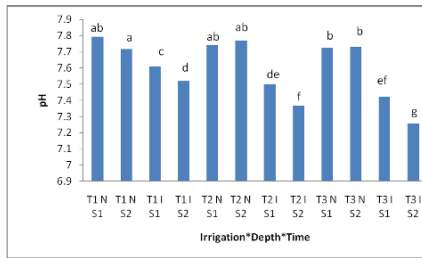


Fig. 7 The Effects of Time, Depth, and Irrigation on pH Level

As it is seen in the figures, a decline in pH level, but this is not true for the depth factor. This is due to the fact that in deeper points, pH would be modified by Irrigation but the great part of it would remain there as a result of high evaporation and intake in the region under the study. Leachate would infiltrate into the deep points and consequently Cadmium would be dissolved in the soil following a low pH level (near the plants' root). Conclusion that irrigating using ooze would lower the pH level and increases the Cadmium amount significantly in the soil [9]. Due to the high buffering capability in lime after adding leachate, the pH level would be restored [10]. Adding Compost Manure to some types of soil in Isfahan showed that the pH decreased and after some time it again showed an increase [11].

IV. CONCLUSION AND RECOMMENDATIONS

- After adding household leachate to the soil, its density increases as the leachate amount increases.
- By using household leachate in the soil the pH level would decrease.
- Findings revealed that solid metals in the soil can be managed using irrigation and the meaningful difference between the irrigating methods is indicative of this fact, therefore, by applying underneath watering and lowering the evaporation, it would be possible to control their intake by the soil and also It would be possible to maintain the soil wetness and consequently water can be consumed more logically. This would provide the necessary nutrients for the plants and also it would improve the soil quality and allow for creating forests around the cities. The household leachate from the process of making Compost is an unnecessary thing which pollutes the underground watersheds and the environment as well. It is suggested that a study be conducted to turn it into a more useful liquid manure rich in nutrients for plants. In the present study, two treatments including alternation irrigation and instance in two the depth ranges were applied and the availability of the underground watersheds was also investigated. It is recommended that different densities of leachate should be investigated to get the best water – leachate combination regarding the regional water quality.

REFERENCES

- [1] Najafi, P. 1386. Effect of Leachate Made in Isfahan Organic Manure Company on Soil Chemical Features around Lagoon. (In Persian)
- [2] Feigin, A., I. Ravina and J. Shalhevet.1991. Irrigation with treated sewage effluent. Pub by springer- verlay, Berlin.
- [3] Pescod, M . B. and A. Arar , 1992. Wastewater treatment and use in agriculture. FAO Irrigation Drainage paper 47, Rome, Italy.
- [4] Jones, R . L ., T. D. Hinesly, and E. L. Ziegler. 1985. Cadmium content of soybean grown in sewage sludge amended soil. J. Environ. Qual. 14:351-353.
- [5] Sakellariou, M ., D. Kalfountzons and P . Vyrlas. 2002 . Water saving and yield increase of suger beet with subsurface drip irrigation. Global nest theint. J. Vol 4, No. 2-3;85-91.
- [6] Shirani, M. 1387. The Effect of Irrigation Systems and Methods Using Household Leachate From Isfahan Compost Factory on Soil Pollution. M.A. Thesis. Khorasegan Azad University. (In Persian)
- [7] Page A . L ., R. H . Miller. And D. R. Keeny, 1986. Method of soil analysis, part2: Chemical and microbiological, Second Edition, Soil. Sci. SOC. Am Inc.,1159 pp .
- [8] Siebe, C. 1994.Accumulation and disposal of heavy metals on irrigated soil with wastewater in the irrigation district03, tula, Hidalgo, Mexico, REWINT, CONTAN.AMBIENT.Vol10, No 1,15-21pp.
- [9] Esteki, kh. 1389. Studying the Soil Salts Motion Pattern in Irrigated Land Using Home Ooze and Its Effect on Olive Tree. M.A. Thesis. Khuzestan University of Science and Research. (In Persian)
- [10] Mohammadnia, Ghazanfar. 1374. Household Compost Chemical Combination and Its Effect on Soil and Plant. M.A. Thesis. Isfahan Industrial University. 184 pages. (In Persian)
- [11] Rahimi, Ghasem. 1371. Studying Compost Manure on Soil Salinity and Pollution and Solid Metals Intake in Corn Using Compost Manure. MA. Thesis. Isfahan University. 110 pages. (In Persian)

Dr. Ali Gholami (19 February 1976) born in city of Tehran - Iran. He was graduated with bachelor degree in Agriculture Engineering-soil science on 2000 and in Master of Science in soil science on 2005 from Islamic Azad University, Science and Research Branch, Tehran, Iran He was accepted as PhD student in Faculty of Agriculture and Natural Resources, Department of soil science, Islamic Azad university, science and research Branch in Tehran on 2006 and academic member of Islamic Azad university, Khuzestan Science and Research Branch in Ahwaz city of Khuzestan province) on 2007 and he studied his dissertation in field of "land use changes and its influence on soil physical, chemical and mineralogy characteristics".He has studied 15 university research design, and 41 printed papers in national and international conferences and journals.Mr. Ali Gholami has graduated with first grade in Msc degree and PhD coarse book. He was selected as the manager of soil science department and research office in Islamic Azad University, Khuzestan Science and Research Branch in 2009 and it now. Also he is assistant professor in department of soil science now.