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Article

Effect of liquid organic fertilizer on lemon transplants exposed to water stress

Ashwaq Wadi Majeed[1*], *and Altifat Fadhil Altaai*
[1] *Al-Rasheed University College, Iraq*
* *Correspondence: ashwaqalwadi90@gmail.com*
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ABSTRACT
This experiment was carried out in a canopy belonging to the Department of Horticulture and Landscape Engineering / College of Agricultural Engineering Sciences / University of Baghdad in 2019. A two-factor factorial experiment was designed according to randomized complete block design (RCBD). The first factor included irrigation for two periods (3 days and 6 days), and the second factor included organic fertilizer (Fulviegrow) with three concentrations (0, 2.5, 5 ml.L-1). Intending to know the effect of adding organic fertilizer on the endurance of these transplants exposed to water stress, It includes 6 treatments, three replications, and two transplants for each experimental unit. The number of transplants is 36. The results showed that the irrigation periods had a significant effect, as it gave (the irrigation period every 3 days) a significant increase in shoot and root dry weight, percentage of vegetative mass dry weight to root system dry weight, leaves area (cm2), leaves calcium content, As for the organic fertilizer, it was significantly superior in most of the mentioned characteristics compared to control treatment.
Keywords: Water Stress, Irrigation Period, Organic Fertilizer, Citrus Lemon.

INTRODUCTION

Organic fertilizers effectively promote environmental sustainability and plant growth after long-term use. Abundant organic matter and soluble nutrients in liquid organic fertilizer can maintain soil sustainability and plant health [1, 2]. Special compounds in liquid organic fertilizers, such as chitin, humic and fulvic acids, and other biopolymers, can be biostimulants for plants [3]. In addition, the integration of irrigation and fertilization patterns can improve nutrient use efficiency and reduce the risk of nutrient loss. Citrus Lemon belongs to the genus Citrus, and the regions of northeastern India and southwestern China are the original home of this species. Lemon is the third most important type of citrus [4]. Scientific studies have indicated that the root used for grafting in citrus has a role in influencing many characteristics of the grafted variety. Including the shape, size and nature of the growth of trees and fruits and other growth indicators, nutritional status and tolerance to environmental factors such as soil, climate and common diseases [5], As [6] mentioned, citrus trees are planted on specific assets in order to benefit from the advantages of these assets and species as some of these assets have good qualities that may not be available in other types.

One of the most important methods of good management in the optimal use of water is to control the number of irrigations in each season or to give a small number of irrigations by defining the period between one irrigation and another. The irrigation intervals method is the most common method in water use efficiency for irrigation scheduling to reach the highest yield. The period of irrigation is the use of alternating irrigation during the growing season. It is considered the most important way to provide irrigation water without reducing growth and productivity [7]. [8] obtained when using 10% liquid humic acid with irrigation water to increase the leaf content of chlorophyll, nitrogen, phosphorous and potassium for Eureka lemon trees. Several studies have been conducted on the role of nutrient solutions in the growth of fruit transplants and trees, [9] found an increase in leaves number and leaves area of "Salemi" pomegranate seedlings in response to foliar application of nutrient solution (Pro. sol) at 4 $ml.L^{-1}$**,** [10] recorded, highest increased in leaves area and highest leaves carbohydrates content it was in "Wazeri" fig cultivar treated with nutrient solution (Folia Ratal) at 30 $ml.L^{-1}$ as foliar spray.

MATERIALS AND METHODS

This experiment was conducted in a canopy belonging to research station B of the Department of Horticulture and Landscape Engineering / College of Agricultural Engineering Sciences / University of Baghdad in 2019. To study the effect of organic fertilizer and irrigation periods on the vegetative growth of local lemon transplants. The first factor included exposing plants to two irrigation periods: irrigation every 3 days (W1) and irrigation every 6 days (W2). This was calculated by adding the irrigation water down to the total weight of the pots with their contents at the field capacity depending on the weighty method of the pots from each treatment, completing the water shortage and estimating the decrease in the moisture content .The equation calculated the total weight of the anvil at field capacity = weight of dry soil in the oven + weight of typical water to reach field capacity + weight of empty pot + weight of filter + weight of fertilizer + weight of seedlings according to growth stages. Total weight at field capacity = 13.404 kg + 2480 ml 0.700 + g + 0.400 g + 5 g + 9800 kg) = 25690 kg. This weight is maintained at every 3 or 6-day irrigation period, and it is completed to this number and compensates for the moisture deficiency that occurs in each period. The weight of the plant during the growth stages must be considered and compensated for by the calculations. As for the second factor, the liquid organic fertilizer (Fulvigrow) (Table 2) was used, adding soil six times between one application and another 15 days, which are (1/3, 15/3, 1/4, 15/4, 1/5 and 15/5) with three concentrations, control treatment (adding water only) (F0) and 2.5 $ml.L^{-1}$ (F1) and 5 $ml.L^{-1}$ (F2). Three years old of lemon transplants in plastic pots with a capacity of (10) 25 kg.

A factorial experiment was designed with two factors according to randomized complete block design (RCBD) and three replications with two transplants for each experimental unit, and number of transplants is 36. The results were analyzed using the Genstat program, and the means were compared using the least significant difference at the 5% probability level.

Adjective	ratio
Total nitrogen (N)	3.10 %
Potassium oxide (K2O)	3.04 %
Free amino acids	3.07 %
Fulvic acids	25.00 %
pH	5.5 %
Density	1.22 g.ml

Table 1. Components of the organic fertilizer (Fulviegrow)

Studied attributes

1. Vegetative parts and root system dry weight (g) and ratio between them: The vegetative parts (stem, leaves and vegetative branches) and roots were placed separately in perforated paper bags for each experimental unit and dried aerobically, then placed in an electric oven at a temperature of 65 degrees until the weight was fixed at that time. You weighed on a sensitive scale. The ratio between them was calculated according to the Racey et al. (1983) method by dividing the vegetative parts' dry weight and the root system's dry weight.

2. Leaves Calcium content: Calcium was measured after digesting samples with concentrated acids (H2SO4, HClO4) by an atomic absorption device (Absorption Spectrophotometer).

3. Leaves area (cm^2): It was calculated by multiplying the area of one leaf multiplied by the average number of leaves in each plant.

RESULTS

Vegetative Dry weight (g):

It is noted from Table (2) that the irrigation period had a significant effect on increasing vegetative dry weight. The duration of irrigation (W_1) was significantly distinguished from the treatment (W_2) by giving the highest vegetative dry weight of 43.28 (g). It is also noted from the same Table that the organic fertilizer (Fulviegrow) had a significant effect in increasing vegetative dry weight, as the (F_2) treatment gave the highest weight of 37.17 (g), which was significantly distinguished without adding (F_0), which amounted to 28.74 (g). Interaction treatment (W_1F_2) gave the highest vegetative dry weight of 48.21 (g) compared to interaction treatment (W_2F_0), which amounted to 19.68 (g).

irrigation intervals (W)	Fulviegrow (ml.L^{-1}) (F)			(W)
	F0	F1	F2	
W1	37.80	43.84	48.21	43.28
W2	19.68	21.72	26.13	22.51
L.S.D 5%		2.10		1.21
F)(	28.74	32.78	37.17	
L.S.D 5%		1.49		

Table 2. Effect of organic fertilizer and irrigation periods and their interaction on the vegetative dry weight of lemon transplants (g).

2. Root system dry weight (g):

Table (3) shows that the duration of irrigation had a significant effect on increasing root system dry weight, as the irrigation period (W_1) was significantly distinguished from the treatment (W_2) by giving the highest weight of 21.20 (g). It is also noted from the same Table that the organic fertilizer (Fulviegrow) significantly increased the root system's dry weight. The (F2) treatment gave the highest weight, 19.21 (g), which was significantly distinguished from the other treatments. Interaction treatment (W_1F_2) gave the highest average root system dry weight of 23.55 (g) compared to the interaction treatment (W_2F_0), which amounted to 9.97 (g).

irrigation intervals (W)	Fulviegrow (ml.L^{-1}) (F)			(W)
	F0	F1	F2	
W1	18.70	21.34	23.55	21.20
W2	9.97	13.31	14.87	21.20
L.S.D 5%		1.59		0.92
F	14.34	F	19.21	
L.S.D 5%		1.12		

Table 3. Effect of organic fertilizer and irrigation periods and their interaction on root system dry weight of lemon transplants (g).

Vegetative parts dry weight/root system dry weight (%)

It is clear from Table (4) that the irrigation periods had a significant effect in increasing this percentage, as the irrigation period (W_1) was significantly distinguished from the treatment (W_2) by giving the highest percentage of 2.040 (%). It is also noted from the same Table that the organic fertilizer (Fulviegrow) did not affect vegetative parts' dry weight or root system dry weight percentage. Interaction treatment (W_1F_2) gave a higher percentage of 2.050%, which did not differ significantly from the treatment (W_1F_1) compared to interaction treatment (W_2F_1) which gave the lowest rate of (1.630)%.

irrigation intervals (W)	Fulviegrow (ml.L^{-1}) (F)			(W)
	F0	F1	F2	
W1	2.020	2.050	2.050	2.040
W2	1.983	1.630	1.753	1.789
L.S.D 5%		0.265		0.153
F	2.002	1.840	1.902	
L.S.D 5%		0.187		

Table 4. Effect of organic fertilizer and irrigation periods and their interaction on Vegetative parts dry weight/ root system dry weight of lemon transplants (%).

Leaves Calcium content (%).

Table (5) shows that the irrigation periods had a significant effect in increasing leaves' calcium content, as the irrigation period (W_1) was significantly distinguished from the treatment (W_2) by giving the highest content of 1.66%. It is also noted from the same Table that the organic fertilizer (Fulviegrow) had a significant effect in increasing the leaves' calcium content, as the (F_1) treatment gave the highest content of 1.638%, which was significantly distinguished from the other treatments. Interaction treatment (W_1F_1) gave the highest leaves calcium content of 1.827% compared to interaction treatment (W_2F_0), which amounted to 1.293%.

irrigation intervals (W)	**Fulviegrow (ml.L^{-1}) (F)**			**(W)**
	F0	**F1**	**F2**	
W1	**1.477**	**1.827**	**1.680**	**1.66**
W2	**1.293**	**1.450**	**1.423**	**1.38**
L.S.D 5%		**0.105**		**0.061**
F	**1.385**	**1.638**	**1.552**	
L.S.D 5%		**0.074**		

Table 5. Effect of organic fertilizer and irrigation periods and their interaction on leaves calcium content of lemon transplants (%).

Total leaves area (cm^2)

Table (6) shows that the duration of irrigation had a significant effect on increasing leaf area, as the irrigation period (W_1) was significantly distinguished from the treatment (W_2) by giving the highest leaf area of 2772 (cm^2). It is also noted from the same Table that the organic fertilizer (Fulviegrow) had a significant effect in increasing the leaves area, as the (F_2) treatment gave the highest leaves area of 2473 (cm^2), which was significantly distinguished from the other treatments. Interaction treatment (W_1F_2) gave the highest leaves area of 2926 (cm2) compared to interaction treatment (W_2F_0), which amounted to 1321 (cm^2).

irrigation intervals (W)	Fulviegrow (ml.L^{-1}) (F)			(W)
	F0	**F1**	**F2**	
W1	**2795**	**2594**	**2926**	2772
W2	**1321**	**2117**	**2020**	1819
L.S.D 5%		**597.0**		344.7
F	**2058**	**2355**	**2473**	
L.S.D 5%		**422.1**		

Table 6. Effect of organic fertilizer and irrigation periods and their interaction on leaves area of lemon transplants (cm^2).

DISCUSSION

The irrigation interval had a significant effect on the vegetative growth of the plant. The three-day irrigation interval significantly increased all the aforementioned vegetative traits. The reason may be due to the abundance of sufficient water for the plant, which enables it to carry out its vital operations in the different stages of growth, especially in the vegetative stage. It leads to an increase in the speed of photosynthesis and the solubility of the nutrients added to the soil and already present in it, making it more ready [11]. As for exposing plants to water stress, an interval of irrigation for six days led to a decrease in vegetative growth indicators. It may be due to the lack of water absorption from the roots and the loss of water through transpiration, and this leads to a loss or disruption of the ionic and osmotic balance of plant cells, causing changes in the physiological features of the plant. Hence, it reduced photosynthesis and weak plant growth [12]. As for the effect of organic fertilizer on increasing the vegetative and root characteristics, it may be due to its content of organic compounds, amino acids and nutrients, especially potassium (Table 1), which plays an important role in many processes in plant, including regulating stomata [13], It may be due to the role played by these fertilizers in improving the physical properties of the soil, which provides a suitable environment for the growth and spread of roots, and then increase and absorption of nutrients [14], Or perhaps this increase is due to the role of nitrogen and potassium in the added solution (table 1), As these elements increase the dry weight and leaves area [15]. As well as the role of organic acids in maintaining soil moisture and ventilation, which is reflected in plant growth and forming a radical group capable of absorbing nutrients and stimulating vegetative growth [16].

CONCLUSION

The study concluded to find out the effect of organic fertilizer on local lemon transplants exposed to water stress.

Reference

1. Hou, S. Q., He, J. J., Parikh, A., Kahl, D., Bertulani, C. A., Kajino, T., & Zhao, G. Non-extensive statistics to the cosmological lithium problem. *The Astrophysical Journal*, **2017**; *834*(2), 165.
2. Dorda, A., Sorantin, M., von der Linden, W., & Arrigoni, E. Optimized auxiliary representation of non-Markovian impurity problems by a Lindblad equation. *New Journal of Physics*, **2017**;*19*(6), 063005.
3. Canellas, L. P., Olivares, F. L., Aguiar, N. O., Jones, D. L., Nebbioso, A., Mazzei, P., & Piccolo, A. Humic and fulvic acids as biostimulants in horticulture. *Scientia horticulturae*, **2015**; *196*, 15-27.
4. Al-Khafaji, M. A., S. A. Atara and A. A.Muhammad. Evergreen perennial fruit. University of Baghdad - Ministry of Higher Education and Scientific Research, Republic of Iraq. **1990**.
5. Agustí, M. Citricultura , Ed. Mundi-Prensa. Madrid, España. **2003**.
6. Al-Alaaf, A H. I. Why do we grow citrus trees on specific rootstock? Horticulture and landscape Gardening Department. College of Agriculture and Forestry / University of Mosul / Iraq. **2018**.
7. Smith, M., Kivumbi, D., & Heng, L. K. **2002**. Use of the FAO CROPWAT model in deficit irrigation studies. In *Deficit irrigation practices*.
8. Hameed, A., Fatma, S., Wattoo, J. I., Yaseen, M., & Ahmad, S. **2018**. Accumulative effects of humic acid and multinutrient foliar fertilizers on the vegetative and reproductive attributes of citrus (Citrus reticulata cv. kinnow mandarin). Journal of plant nutrition, 41(19), 2495-2506.
9. Al-Sereh, E.A; A.N, Okash and M.A, Ibrahim.**2020**. The effect of foliar spray of Pro.sol fertilizer and licorice extract on some vegetative growth indicators for young pomegranate (*Punica granatum* L.) seedling CV. Salemi. Int. J. Agricult. Stat. Sci. 16(2): 739-744.
10. Al-Shareefi, A.H.H; M.M, Hasan and S.H, Takheal.**2020**. Effect of adding urea fertilizer and spraying with nutrient solution (Folia Ratal) on some vegetable and chemical traits and fruit weight for fig seedlings (Ficus carica L.) Wazeri cultivar. Int. J. Agricult. Stat. Sci. 16(Supplement 1): 1243-1247.

11. Taiz, L., and E. Zeiger, .**2002**. Plant Physiology Third Ed Sinauer Associates Inc. Sunderland, MA, USA.
12. Caddell, D. F., S. Deng, and D. Coleman-Derr, **2019**. Role of the plant root microbiome in abiotic stress tolerance. In seed endophytes (pp. 273-311). Springer, cham.
13. Dumas, Y., S. Smail and A. Benamara, . **2004**. Effect of potassium fertilization on the behavior of three processing tomato cultivars under various watering levels . Acta hort.13 .
14. Jones Jr, J. B., **2012**. Plant Nutrition and Soil Fertility Manual. Crc Press.
15. Al-Hadethi, Mustafa E.A; Fadia, H. Taha and Shamil, M. Abbood. **2020**. Effect of compost prepared from plant residues on olive transplants growth. Int. J. Agricult. Stat. Sci. 16(Supplement 1): 1385-1389.
16. Taiz, L., and E. Zeiger, .**2010**. Plant Physiology.5th (Ed.), Sianauer Associates, Sunderland, UK: P 629.

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