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Effect of Water Irrigation pH Different Scales on Citrus Seedlings Growth under Several Fertilizer Levels.

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VALENCIA orange (*Citrus sinensis*) seedlings on Sour orange (*Citrus aurantum*) " SO" or Volkamer lemon (Citrus Volkamariana) " VL" fertilized with three nutrient doses 50 ; 75 and 100 percentage of nursery recommendation and irrigated with water at four pH levels : the control ; pH_5 ; pH_7 and pH_9. .Results showed that; Valencia orange seedlings on both SO or VL stocks gave the best stem: height and diameter; leaf area; root length and width; under 50% or 75 % nutrient doses of nursery recommendation when irrigated with water at pH_7. SO stock fertilized with 50% nutrient dose and irrigated with water at pH_7 gave the highest leaf Chl. a content , also, VL stock under 50% or 75% nutrient dose and irrigated with water at pH_7 gave the same trend. Whereas, both stocks under 50% or 75% dose and irrigated with water at pH_7 gave the highest leaf Chl. b content. SO or VL stocks fertilized with 50% or 75% of the control and irrigated with water pH_7 significantly gave the highest leaf carbohydrates contents, both citrus stocks fertilized with 100% the control and irrigated with water pH_9 was the lowest. SO or VL stocks fertilized with50% or 75% doses and irrigated with water pH_7 significantly increased N , P & K percentage, but which fertilized with 100% dose and irrigated with water pH_7 or pH_9 was the lowest.

Keywords: Citrus stocks, Valencia orange, Nutrient doses, Water pH.

Introduction

Citrus is one of the most important fruit crops grown under tropical and subtropical conditions in many countries. At this moment, there is about 3.6 million fed. of citrus spp. cultivated at commercial scale in the world yielding nearly 40 million metric tons of oranges, lemons, limes,… etc. In Egypt, citrus has great attention due to its importance for local consumption and consider a popular fruit for it's low acidity, juicy pulp and good flavor. All over, citrus fruits have an important role to prevent human cardiovascular diseases, and source for foreign currencies by exportation to the world markets. Recently, citrus cultivated area has increased rapidly with the reclamation of new desert lands reaching about486650 fed. And Valencia orange occupied 139851 fed. (28.74 % of total area) (Ministry of Agriculture and Land Reclamation, 2018). Fruit harvested through March to June period. In Egypt many Citriculture regions suffer from a low organic matter and high alkaline with limited phosphorus availability which causes, many problems are encountered that threatening some citrus growers and been among the difficulties hindering more extension. Generally, alkaline soil is a serious problem especially in arid or semi-arid regions. Irrigated water pH value is an important feature of water. Predecessors have reported the effects of different pH treatments on plant growth in Metroxylon sagu (Anugoolprasert et al., 2012), Camellia sinensis (Ruan et al., 2007), Chlamydomonas acidophila (Gerloff-Elias et al., 2005), Anabaenopsis elenkini (Santos et al., 2011)

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and so on, and their results are not identical. Plants irrigated with different pH levels will produces change of rhizosphere pH levels , which reflected on plant growth performance as morphology, photosynthesis, nutrient absorption (Clark and Burge, 2002; Ruan et al., 2007; Kang et al., 2011; Santos et al., 2011 and Anugoolprasert et al., 2012). Moreover, Poor plant growth and low yield under acidic soils conditions is usually due to the combination of toxicities of H+, Al, and manganese (Mn) and a lack of nutrients-namely phosphorus (P), calcium (Ca), magnesium (Mg), potassium (K), and molybdenum (Mo)- and reducing of water uptake (Von Uexküll and Mutert, 1995 and Bian et al., 2013). Under tropical regions at USA, over 70% of the acidic soils display Al-toxicity and Mg and Ca deficiencies, and almost all the acidic soils are P-deficient or have a high P-fixation capacity (George et al., 2012). Forest ecosystems with acidic soils are often restricted by low Ca and Mg availability (St Clair and Lynch, 2005). Schubert et al. (1990) showed that when beans (Vicia faba L. cv. Kristall) plants transferd from pH 7 to pH 4 led to reducing of N, P, K, Ca, Mg, and sulfur (S) uptake . Malkanthi et al. (1995), However, Anugoolprasert et al. (2012) reported that N, P, K, Ca, and Mg, and their concentration uptake in roots, leaflets, petioles and whole plant, were not altered over the range of pH 3.6 to 5.7 for 4.5 months, this possibly explains the normal growth of sago palm seedlings at pH 3.6. Kidd and Proctor (2001) have suggested that the direct toxicity of H+ was the primary cause the poor growth in H+-intolerant plants growing under very acidic soils conditions. Fertilizer plays a major role in the production of citrus nursery seedlings. Whereas, N is the most important element in the most fertilization programs applications. and is especially critical in the nursery where high plant densities exist and rapid .Thus, N fertilization levels lower than those normally applied in commercial citrus nurseries may be adequate for optimal growth of container-grown nursery plants (Maust & Williamson1994). The problem is further compounded by the fact that nutrient inputs are either unavailable; too expensive or chemically unstable and harmful. When we learn that the nutrients that we are using are: not readily available to the plants; lack essential trace elements; are subject to hydrolysis, volatilization and leaching and are being used in an inefficient manner. We thus realize that we are effectively wasting our meager cash resources. We must understand that seedlings growth rate and it's quality are not increased by adding more and more chemical macro nutrient fertilizers. It is important to realize that less is more when availability of nutrients is timed with actual requirements. We need to completely change our thinking and understanding of nursery management. Small nursery holdings; expensive inputs of nutrient applications or the lack of an integrated strategy for serving seedlings will returns have combined bad results. Moreover, irrigated water pH level will play an important role for nutrient elements Availability in root area and mineral uptake. With respect, many soils in the semi-arid regions of Egypt have a naturally high pH . They may contain significant quantities of "free calcium carbonate." However, these areas are not the only ones with problems associated with high pH . Irrigation well water may contain significant quantities of calcium and/or magnesium carbonate in certain regions of the Egypt. In areas of the west Delta for example, some irrigation well water contains in excess of 3 to 5 milli-equivalents of bicarbonate per liter and 3 to 5 milli-equivalents of calcium. An Acre-foot of water or more per year can deliver more than 125 to 250 kg of calcium and /or magnesium carbonate (lime) per fed. In effect, the soil is limed by the irrigation water. If the water distribution and delivery are the same over several years, the soil may become alkaline, with soil pH levels rising to 7.0 and above. Soil pH increases may approach 0.2 pH units per year, until equilibrium is reached with atmospheric carbon dioxide levels. Such soil pH increase will occur more rapidly on coarse and medium-textured soils than on clays, which are more highly buffered .Whereas, the desirable pH range for optimum plant growth varies among crops. While some crops grow best in the 6.0 to 7.0 range, others grow well under slightly acidic conditions. Soil properties that influence the need for and response to lime vary by region. Knowledge of the soil and the crop is important in managing soil pH for the best crop performance. Moreover, soils become acidic when basic elements such as calcium, magnesium, sodium and potassium held by soil colloids are replaced by hydrogen ions. Soils formed under conditions of high annual rainfall are more acidic than are soils formed under more arid conditions. Soils formed under low rainfall conditions tend to be basic with soil pH readings around 7.0. Intensive farming over a number of years with nitrogen fertilizers or manures can result in soil acidification. The displaced calcium (Ca++) ions combine with the bicarbonate ions to form calcium bicarbonate, which, being soluble, is leached from the soil. The net effect is increased soil acidity. Nitrogen levels affect soil pH. Nitrogen sources - fertilizers, manures, legumes - contain or form ammonium. This increases soil acidity unless the plant directly absorbs the ammonium ions. The greater the nitrogen fertilization rate, the greater the soil acidification. As ammonium is converted to nitrate in the soil (nitrification), H ions are released. For each pound of nitrogen as ammonium, it takes approximately 1.8 pounds of pure calcium carbonate to neutralize the residual acidity. Also, the nitrate that is provided or formed can combine with basic cations like calcium, magnesium and potassium and leach from the topsoil into the subsoil. As these bases are removed and replaced by H ions, soils become more acidic. Consequently, the aim of the current study was to investigate mineral uptake under different irrigated water pH levels and the extent of benefiting from its results to rationalize the use of fertilizers and the extent to which its results can be used to rationalize the use of fertilizers in the production of Valencia orange seedlings grafted on different stocks.

Materials and Methods

Experimental location

This experiment was carried out under green house at the Horticulture Research Institute (HRI) garden - Giza- Egypt, during three successive seasons (2017, 2018&2019) respect.

Experimental materials preparing

Sour orange (*C. aurantum*) " SO" and Volkamer lemon (*C. volkamariana*) "VL" citrus rootstocks seedlings were uniformity selected as possible in growth and free from any apparent infection. Its grown in black plastic bags (4–5 L) in the size, filled with a mixture of sand and compost ((animal manures plus straw 1:1 and analyzed before using Table (a)) and mixed at 4:1 (v/v) ratio]. Both growing media or irrigated water source were analyzed Table (b & c). Stock seedlings were grafted by Valencia orange scions at May under plastic house.

Experimental design

After one month from grafting at May 2017and May 2018, 240 successful seedlings were moved to net house and divided to main groups A equally (A1: Valencia orange scion on Sour orange stock) & (A2: Valencia orange scion on Volkamer lemon stock) (120 seedlings / stock type), then every group was distributed to 3 sub-main groups [fertilizer levels (B): B1,B2 and B3 (40 seedlings/fertilizer rate)] . Every sub-main group divided to 4 sub-sub main groups (C): [C1, C2, C3 & C4 (pH levels) include 10 seedlings / pH level] which then divided to 5 replicates (2 seedlings / replicate).

Seedlings for both group routinely subjected to the same nursery practices managements for about 8 months. In this case, water-soluble fertilizers are applied during irrigation, either during each irrigation or weekly. Constant fertilization should provide rates of 75 to 100 ppm total nitrogen, whereas weekly fertilization of 200 to 400 ppm nitrogen is acceptable and good pest control is essential to the production of high quality nursery trees (Julian 2002).Experimental treatments were applied at the 1st week of May for the studied seasons.

Experimental technique was employed as follows:

Citrus rootstocks (Sour orange and Volkamer lemon)

Fertilizer rates:

(B1) 50% of the recommended dose

(B2) 75% of recommended dose

(B3) 100% the control (100% of the recommended dose) that was:

Soil application

1Kg super phosphate 15.5% p_2o_5 mixed with a soil for 100 /transplanting at preparing stage.

3g NPK19": 19:19 / seedling, 2.5 g NH_2NO_3 33% N / seedling, 5g NH_4SO_4 20 .6 % /N / seedling, Those 3 sources of N which applied / week and 5g K_2SO_4 50% /K_2O / seedling / month.

Foliar application

Spraying foliar feed 1g /L /month

Irrigation water pH levels as follows*

(C1)Irrigation water at "pH7.4" without adjusting (as control). Optimal irrigation should be provided to container nurseries to maintain adequate soil moisture without water logging

(C2) Irrigation water at pH_5.

(C3) Irrigation water at pH_7.

C4) Irrigation water at pH_9.

*Irrigated water thoroughly using $pH_{5,\ 7}$ and $_9$ which adjusted by using (KCl –NaOH) buffer solutions. Tap water was used as the control Daqiu Zhao et al. (2013).

TABLE (a): Compost mineral contents.

Element	Concentration
N	0.84 %
P_2O_5	0.61 ,,
K_20	0.78 ,,
Fe	45.0 mg /kg soil
Mn	80.0 ,, / ,, ,,
Zn	85.0 ,, / ,, ,,
Cu	10.50 ,, / ,, ,,
Mg	56.0 ,, / ,, ,,

TABLE (b): Chemical analysis of the experimental media.

Cations meq./l				Anions meq. /l				SP	EC mmohs	pH
K^+	Na^+	Mg^{++}	Ca^{++}	SO_4^{--}	Cl^-	HCO_3^-	CO_3			
1.11	23.87	2.57	5.23	7.66	24.11	1.01	…..	22	0.93	7.85

TABLE (c): Irrigated water analysis.

Cations meq/l				Anions meq/l				EC PPM	pH
K^+	Na^+	Mg^{++}	Ca^{++}	SO_4^{--}	Cl^-	HCO_3^-	Co_3^-		
0.31	5.24	2	2.51	2.60	3.61	3.85	…..	320	7.40

Measurements

Morphological parameters: After 6 months for tested seedlings: it's were carefully taken out from the pots as: seedling height (cm) ; stem diameter (cm); leaf area (cm^2); root length (cm) and width (cm). Then, tested seedlings washed with tap water several times, and separated to different organs (leaves, shoots and roots) to complete other measurements.

Physiological parameters

Leaf Chlorophylls a and b content

Leaf samples, representing each treatment of fresh leaves (0.5 g) were homogenized with acetone (85% v/v) in the presence of the little amounts of Na_2CO_3 and silica quartz, then filtration "Bokhner funnel G4". The residue was washed several times with acetone until being free from pigments. Each filtrate was made up to 250ml and measured colorimetric at wave length 662 and 644 nm to determine both chlorophylls a and b, respect., according to Saric et al. (1967) and Calculated as:

Chl.a =12.70 A663 – 2.79 A647= x1

Chl.b = 20.76 A647 – 4.62 A663=x2

Leaf total carbohydrates

Leaf total carbohydrates content were determined by 3,5-dinitrosalicylic acid according to Miller (1959).

Leaf and root elements content

Twenty mature leaves from the middle portion of shoots and roots for each replicate were taken and washed several times with tap water followed by distilled water to remove any residues that might affect the results and then dried at 70° for dry matter estimation. 0.5g of dried samples was digested using the H_2SO_4 and H_2O_2 as described by Cottenie (1980). The extracted samples were used to determine N% , P% and K% in leaves and roots as follows:

Nitrogen (N %)

Leaf and root N content was determined in the digested solution by the modified micro-kjeldahl method as described by Plummer (1971).

Phosphorus (P %)

Leaf and root P content was measured calorimetrically, using the molybdenum blue method by using Beckman Du 7400 spectrophotometer according to Murphy and Riley (1962).

Potassium (K%)

Leaf and root potassium contents (g/100g D.W.) were determined against a standard using flame-photometer (JENWAY – pfp7 Flame Photometer) according to Piper, (1950).

Statistical analysis

All data were statistically analyzed according to the technique of analysis of variance (ANOVA) as published by Gomez and Gomez (1984). Means of the treatment were compared by the least significant difference (LSD) at 5% level of significance which developed by Waller & Duncan (1979).

Results and Discussion

Vegetative growth

Seedling height (cm)

Data presented in Table (1) revealed that VL stock type significantly gave highest Valencia orange seedlings height values for both season .Also, fertilizer dose B2 (75% of the control treatment) significantly gave the highest seedlings height values. for both SO &VL stocks ; while B3 dose (the control) was the lowest during the two studied seasons .In addition ,both water irrigation pH_7 (C3) in the 1st season and pH_5 (C2) significantly increased the studied Valencia orange seedlings height grafted on both rootstocks (SO or VL), while, water irrigation pH_9 (C4) significantly gave the lowest seedlings height values respect for the two seasons.

Concerning the rootstock type and fertilizer dose interaction, data tabulated in Table (1) indicated that both the two rootstocks (SO & VL) significantly gave highest Valencia orange seedlings height under fertilizer dose 75 % .In the contrary, both rootstocks type was the lowest at 50% fertilizer dose in compared to the fertilizer dose 100 % (the control) for both seasons. Regard to the stock type and water irrigation pHs level interaction, data showed that both rootstocks (SO or VL) significantly gave the highest Valencia orange seedlings height for SO stock and for VOL stock respect. When irrigated with water at pH_7. While, Wi pH_9 was the lowest. As for the stock type ; fertilizer dose and Wi PHs, data illustrated that VL stock plus B2 nutrient application rate under Wi pH_7 significantly gave the highest seedlings height . Whereas, SO stock with B3 nutrient application rate plus Wi pH_7 was the lowest for both seasons.

Seedling stem diameter (cm)

Regarding the Valencia orange seedling stem diameter on two citrus rootstocks under study in response to the specific effect of genotype resource, Table (2) showed that both VL or SO stock had insignificant differences with this respect during the two seasons .In this concern data presented that fertilizer doses (B1) and (B2) significantly gave the highest seedlings diameter values for both SO& VL stocks; while B3 dose (the control) was the lowest during the two studied seasons . In addition , Wi pHs (C1"control");(C2" pH_5") and (C3"pH_7") significantly increased the studied stocks (SO or VL) seedlings diameter. and Wi pH_9 gave the lowest seedlings diameter. for both seasons.

Referring the interaction effect of different combinations between three studied factors, Table (2) showed that Valencia orange seedlings budded on SO or VL stocks. Significantly increased stem diameter under B2 (nutrient level) effect in the 1st season While, in the 2nd season SO stock stem diameter had the same trend in the 1st season. In contrary, data presented indicated that VL stock dia. had insignificant effect under all fertilizer doses. With regard to the stock type and Wi pH levels interaction, data cleared that Valencia orange seedlings grafted on both SO or VL stocks significantly gave the highest seedlings stem diameter, when irrigated with Wi pH_7 whereas, Wi pH_9 was the lowest during the two studied seasons .As for the interaction effect between SO and VL stocks , nutrient dose level and Wi pH levels , data showed that, Valencia orange seedlings that had been fed with B1 or B2 nutrient % dose and irrigated with Wi pH_7 significantly increased seedlings stem diameter. Moreover, B1 nutrient % dose was insignificant higher than B2 nutrient % dose when compared with the other studied treatments for both seasons.

Leaf area (cm^2)

Concerning the specific effect of the two citrus rootstocks under this study on Valencia orange seedling leaf area during transplanting stage. Data presented in Table (3) cleared that both VL and SO rootstocks did not show any significant differences during the two seasons. In this concern data presented that fertilizer dose (B1) or (B2) significantly gave a high values when compared to B3 dose (the control) treatment during the two studied seasons .In addition, Wi pH_7 (C2) treatment significantly increased the studied Valencia orange seedlings budded on rootstocks (SO or VL) seedlings leaf area in the 1st season and Wi, pH_5 or pH_7 significantly increased

TABLE 1. Effect of stock type and fertilizer rates under different irrigation water pH levels on seedling height (cm) of Valencia orange during (2017 &2018)

		Season I								Season II					
		C1	C2	C3	C4	Means (Ax B)	Means (A)			C1	C2	C3	C4	Means (Ax B)	Means (A)
A1	B1	66.73 j	73.83 h	97.40 b	51.93lm	72.47 B		A1	B1	66.47 k	77.20 i	102.57 c	51.10o	74.34 B	
	B2	67.92 ij	91.22 cd	97.30 b	52.18lm	77.16 A	71.31 B		B2	67.16 k	92.96 e	104.82 c	53.24 no	79.55 A	73.56 B
	B3	80.87 g	64.50jk	49.22m	62.63k	64.31 C			B3	82.07 h	60.96 l	48.82 o	59.23 lm	66.79 C	
Means (AxC)		71.84 C	76.51 B	81.31 A	55.58 D			Means (AxC)		71.90 C	77.04 B	85.40 A	54.52 D		
A2	B1	70.77hi	88.96de	104.97a	55.09 l	79.95 C		A2	B1	69.93 k	87.93 f	97.62 d	55.92 mn	77.60 C	
	B2	83.95fg	93.11cd	104.12a	62.23k	85.85 A	73.65 A		B2	84.33 gh	116.67 a	112.50 b	57.03 m	92.63 A	77.36 A
	B3	87.39ef	86.63ef	-	72.59h	82.20 B			B3	87.67 fg	86.23 fg	-	73.52 j	82.47B	
Means (AxC)		80.70 C	89.57 B	104.54A	63.30 D			Means (AxC)		80.64 C	95.61 B	105.06 A	62.16 D		

	C1	C2	C3	C4	Means (B)		C1	C2	C3	C4	Means (B)
B1	67.75e	80.40cd	101.19a	53.51f	75.71 B	B1	68.20 e	82.57 c	100.10 b	53.51 f	76.10 B
B2	75.94d	92.17b	100.71a	57.21f	81.51 A	B2	75,75 d	104.82 ab	108.66 a	55.14 f	86.09 A
B3	84.13c	75.57d	49.22g	67.61e	69.13 C	B3	84.87 c	73.60 d	48.82g	66.38 e	68.42 C
Means (C)	75.94 B	82.71 A	83.71 A	59.44 C		Means (C)	76.27 B	87.00 A	85.86 B	58.34 C	

Means having the same letter (s) in a column or line are not significantly different at 5% level.

A : A1 = Sour orange (SO) . A2 = Volkamer lemon (VL)

B : B1 = 50% of control Fertilizer dose , B2= 75 % of control Fertilizer dose and B3 = 100% (the control).

C: C1 = irrigation water pH control, C2 = irrigation water pH_5 , C3 = irrigation water pH_7 and C4 = irrigation water pH_9

TABLE 2. Effect of stock type and fertilizer rates under different irrigation water pH levels on seedling diameter (cm) **of Valencia orange during (2017 &2018) seasons.**

		Season l								Season ll					
		C1	**C2**	**C3**	**C4**	**Means (Ax B)**	**Means (A)**			**C1**	**C2**	**C3**	**C4**	**Means (Ax B)**	
A1	B1	0.91d-f	0.98cd	1.12ab	0.63h	0.91 A		A1	B1	0.88 de	0.95 b-e	1.03b	0.62 h	0.87 B	
	B2	0.92de	1.03 bc	1.13ab	0.75g	0.96 A	0.89 A		B2	0.90 c-e	1.02 b	1.12ab	0.73 g	0.94 A	0 87 A
	B3	0.98cd	0.84e-g	0.54h	0.83e-g	0.80 B			B3	0.97 b-d	0.87d-f	0.54 h	0.86 ef	0.81 C	
Means (AxC)		0.94 A	0.95 A	0.93 A	0.74 B			Means (AxC)		0.92 A	0.95 A	0.90 A	0.73 B		
A2	B1	0.93de	1.02cd	1.21a	0.77g	0.98 B		A2	B1	0.91c-e	1.02bc	1.20a	0.74 g	0.97 A	
	B2	1.00 cd	1.05bc	1.18a	0.81gh	1.01 A	0.91 A		B2	0.97b-d	1.01 bc	1.14a	0.77 fg	0.97 A	0.89 A
	B3	1.01cd	1.01cd	-	0.95cd	0.99 B			B3	1.00 bc	0.99 bc	-	0.92b-e	0. 97 A	
Means (AxC)		0.98 B	1.03 B	1.20 A	0.84 C			Means (AxC)		0.96 B	1.01 B	1.17 A	0.81 C		

	C1	**C2**	**C3**	**C4**	**Means (B)**		**C1**	**C2**	**C3**	**C4**	**Means (B)**
B1	0.92 cd	1.00 bc	1.16 a	0.70 e	0.95 A	B1	0.90 c	0.99 bc	1.12 a	0.68 d	0.92 A
B2	0.96 cd	1.04 b	1.15 a	0.78 e	0.98 A	B2	0.94 bc	1.02 ab	1.13 a	0.75 d	0.96 A
B3	1.00 bc	0.93 cd	0.54f	0.89 d	0.84 B	B3	0.99 bc	0.93 bc	0.54 e	0.89 c	0.84B
Means (C)	0.96 A	0.99 A	0.95 A	0.79 B		Means (C)	0.94 A	0.98 A	0.93 A	0.77 B	

Means having the same letter (s) in a column or line are not significantly different at 5% level.

A : A1 = Sour orange (SO) . A2 = Volkamer lemon ((VL)

B : B1 = 50% of control Fertilizer dose , B2= 75 % of control Fertilizer dose and B3 = 100% (the control).

C: C1 = irrigation water pH control, C2 = irrigation water pH_5 , C3 = irrigation water pH_7 and C4 = irrigation water pH_9

seedlings leaf area in the 2nd season . While, Wi pH_9 (C4) treatment statistically reduced seedling leaf area during the two seasons.

With regard to the interactions effect: from the Table (3) in spite of, both SO or VL stocks significantly gave the highest leaf area values under nutrient doses 50% (B1) or 75% (B2) in the 1st season in compared to the nutrient dose 100%(B3) But in the 2nd season, SO stock only significantly gave the best results under the same nutrient doses B1or B2 . While VL stock had in-significant effect under the 3 nutrient doses. In this concern, data cleared that SO stock seedlings irrigated with Wi pH_7 (C3) significantly had the highest leaf area in the 1st season. While, VL stock which irrigated with water at pH_5 significantly had a high leaf area in the 1st season and with Wi pH_7 in the 2nd season. In addition, stock type; fertilizer doses and irrigated water pHs in Table (3) showed that valencia orange seedlings budded on VL stock significantly gave the highest leaf area values when treated with fertilizer dose 50% (B1) and irrigated with Wi pH_5 in the 1st season and in 2nd season under nutrient dose 50% and Wi PH_7.

Seedling root distribution

Root length

Regarding Valencia orange seedling root length both the tow citrus stocks under study in response to the specific effect of genotype resource. Data showed that VL stock statistically gave a high values. With this respect in compared to SO stock. During the two seasons. With regard the specific effect of the nutrient doses under this study, data cleared that nutrient doses 50% (B1) or 75% (B2) of Fertilizer doses significantly increased root length, when compared to the control treatment 100% (B3) for both studied seasons. Concern the specific effect of Wi pHs levels ; data in Table (4) revealed that both Wi pH_5 (C2) or pH_7 (C3) significantly increased Valencia seedlings root length, whereas, Wi pH_9 (C4) was the lowest for the two seasons.

It is quite clear as show that, Valencia orange on SO stock plus both nutrient dose 50 % (B1) or 75% (B2) significantly increased root length, whereas, which budded on VL stock all the three nutrient doses under study had insignificant differences on root length for both seasons . With regard to the stock type and Wi pHs levels interaction, data illustrated that both Wi pH_5 or pH_7 significantly gave the highest SO stock root length , While, Wi pH_7 statistically the best for VL stock root length ; in contrary , Wi pH_9 was the lowest for both stocks during the two studied seasons. As for rootstock type, nutrient doses and Wi pHs levels interaction effect , data tabulated in Table (4) revealed that both rootstocks when fertilized with 50% or 75% of the nursery dose (the control) and irrigated with Wi pH_7 significantly gave the highest root length . Also, data cleared that Wi pH levels consider the main factor which control of both stocks root length not nutrient dose during the two seasons.

Root width

Concerning the specific effect of both the two citrus stocks type under this study seedling root width during the transplanting stage, data presented in Table (5) showed that VL stock significantly had higher root width values than SO stock for both season .Also, fertilizers doses B1(50%) and B2 (75%) significantly increased both VL or SO stocks root width during the two seasons . In addition, both Wi pH_5 (C2) and pH_7 (C3) significantly increased the studied stocks (SO or VL) seedling root width . On the other hand, Wi pH_9 (C4) gave the lowest values for the two seasons.

Referring the interaction effect of different combinations between three studied factors. Data presented in the Table (5) showed that Valencia orange seedlings on VL stock significantly had the highest values of root width under fertilizer dose 100% (B3) in the 1st season and not significant effect in the 2nd season. Regard to the stock type and Wi pHs levels interaction. Data showed that both Wi pH_5 or pH_7 significantly increased SO stock root width during the two seasons. Also, Wi pH_7 significantly gave the highest VL root width values for both seasons .With this respect,, the stock type; fertilizer dose and Wi pH levels interaction: data illustrated that Valencia orange budded on both SO or VL citrus stocks, fertilized with B1 (50%) or B2 (75%) from the control applications and irrigated with Wi pH_7 significantly gave the highest root width (cm) and the fertilizer dose B1 (50%) plus Wi pH_9 was the lowest during the two studied seasons. Generally,VL root width (cm) was higher than SO under the same conditions of this study.

TABLE 3. Effect of stock type and fertilizer rates under different irrigation water pH levels on leaf area (cm²) of Valencia orange during (2017 &2018) seasons.

		Season l								Season ll					
		C1	C2	C3	C4	Means (Ax B)	Means (A)			C1	C2	C3	C4	Means (Ax B)	Means (A)
A1	B1	16.14h	17.57f-h	21.73c	13.02i	17.12 A		A1	B1	19.11 hi	21.74 g	25.63 bc	16.84 j	20.83 A	
	B2	16.18h	20.02 cd	24.08b	14.02i	18.58 A	17.00 A		B2	19.31 hi	24.00 de	25.90 bc	17.00 j	21.55 A	20.33 A
	B3	18.29e-g	16.06h	12.63i	14.24i	15.31 B			B3	22.53 eg	18.73 hi	15.00 k	18.22 ij	18.62 B	
Means (AxC)		16.87 B	17.88 B	19.48 A	13.76 C			Means (AxC)		20.32 B	21.49AB	22.18 A	17.35 C		
A2	B1	16.29h	26.98a	20.44cd	14.05 i	19.44 A		A2	B1	19.82 h	23.66 de	28.41 a	17.32 j	22.30 A	
	B2	18.84ef	24.19b	19.85de	14.23i	19.28 A	17.50 A		B2	22.83 e-g	24.71 cd	26.82 ab	17.44 j	22.95 A	20.31 A
	B3	19.21de	19.01d-f	-	17.06gh	18.43 B			B3	23.11 e-g	23.16 eg	-	20.00 h	22.09 A	
Means (AxC)		18.11 C	23.39 A	20.15 B	15.11 D			Means (AxC)		21.92 C	23.84 B	27.62 A	18.25 D		

	C1	C2	C3	C4	Means (B)		C1	C2	C3	C4	Means (B)
B1	16.22 c	22.28 a	21.09 a	13.54 e	18.28A	B1	19.47 d	22.70 bc	27.02 a	17.08 e	21.57 A
B2	17.51 bc	22.11 a	21.97 a	14.13 e	18.93A	B2	21.07 cd	24.36 b	26.36 a	17.22 e	22.25 A
B3	18.75 b	17.54 bc	12.63 f	15.65 de	16.14B	B3	22.82 bc	20.95 cd	15.00 f	19.11 d	19.47 B
Means (C)	17.49 B	20.64 A	18.56 B	14.44 C		Means (C)	21.12 AB	22.67 A	22.79 A	17.80 C	

Means having the same letter (s) in a column or line are not significantly different at 5% level.
A : A1 = Sour orange (SO) . A2 = Volkamer lemon ((VL)
B : B1 = 50% of control Fertilizer dose , B2= 75 % of control Fertilizer dose and B3 = 100% (the control).
C: C1 = irrigation water pH control, C2 = irrigation water pH_5 , C3 = irrigation water pH_7 and C4 = irrigation water pH_9

TABLE 4. Effect of stock type and fertilizer rates under different irrigation water pH levels on root length (cm) of Valencia orange during (2017 &2018) seasons.

		Season I								Season II					
		C1	**C2**	**C3**	**C4**	**Means (Ax B)**	**Means (A)**			**C1**	**C2**	**C3**	**C4**	**Means (Ax B)**	**Means (A)**
A1	B1	38.1 e	44.6 cd	52.2 ab	33.2 g	42.0 A		A1	B1	37.3 fg	43.5 de	51.3 ab	33.0 h	41.2 A	
	B2	38.1 e	47.6 cd	52.6 a	34.0 fg	43.1 A	40.6 B		B2	38.3 fg	46.9 cd	51.4 ab	33.4 h	42.5 A	39.8 B
	B3	45.1 cd	37.8 ef	28.1 h	36.1 e-g	36.8 B			B3	44.7 de	36.7gh	26.8 i	36.0 gh	36.0 B	
Means (AxC)		40.4 B	43.4 A	44.3 A	34.4 C			Means (AxC)		40.1 B	42.4 A	43.2 A	34.1 C		
A2	B1	44.1 d	47.1 cd	54.7 a	34.0 fg	45.0 A		A2	B1	41.7 ef	46.5 cd	55.0 a	33.4 h	44.2 A	
	B2	46.5 cd	48.9 bc	54.3 a	34.3 e-g	46.0 A	41.8 A		B2	45.0c-e	48.9 bc	53.0 ab	33.4 h	45.2 A	41.0 A
	B3	47.0 cd	46.5 cd	-	44.5 d	46.0 A			B3	46.0 cd	45.2c-e	-	42.7 de	44.6A	
Means (AxC)		45.9 C	47.5 B	54.5 A	37.6 D			Means (AxC)		44.2 C	46.9 B	54.0 A	36.5 D		

	C1	**C2**	**C3**	**C4**	**Means (B)**		**C1**	**C2**	**C3**	**C4**	**Means (B)**
B1	41.1 cd	45.9 c	53.5 a	33.6 e	43.5 A	B1	39.5 e	45.0 cd	53.2 a	33.2 f	42.7 A
B2	42.3 cd	48.3 b	53.5 a	34.2 e	44.6 A	B2	41.7 de	47.9 bc	52.2 ab	33.4 f	43.8 A
B3	46.1 bc	42.2cd	28.1 f	40.3 d	39.2 B	B3	45.4 cd	41.0 de	26.8 g	39.4 e	38.2 B
Means (C)	43.2 B	45.5 A	45.0 A	36.0 C		Means (C)	42.2 B	44.6 A	44.1 A	35.3 C	

Means having the same letter (s) in a column or line are not significantly different at 5% level.
A : A1 = Sour orange (SO) . A2 = Volkamer lemon ((VL)
B : B1 = 50% of control Fertilizer dose , B2= 75 % of control Fertilizer dose and B3 = 100% (the control).
C: C1 = irrigation water pH control, C2 = irrigation water pH_5, C3 = irrigation water pH_7 and C4 = irrigation water pH_9

TABLE 5. Effect of stock type and fertilizer rates under different irrigation water pH levels on width of root (cm) of Valencia orange during (2017 &2018) seasons.

		Season l								Season ll					
		C1	**C2**	**C3**	**C4**	**Means (Ax B)**	**Means (A)**			**C1**	**C2**	**C3**	**C4**	**Means (Ax B)**	**Means (A)**
A1	B1	37.35 i	46.88 ef	60.91ab	23.04 k	42.05 B		A1	B1	38.00gh	51.00 d	58.87 bc	22.00 k	42.47 B	
	B2	40.64gi	53.93cd	57.94bc	26.07 jk	44.65 A	40.61 B		B2	41.00 g	53.43d	61.44 b	26.10 jk	45.49 A	41.15 B
	B3	46.97ef	35.88 i	22.12 k	35.51 i	35.12 C			B3	47.71 ef	36.37gh	22.17 k	35.68 hi	35.48 C	
Means (AxC)		41.65 B	45.56 A	46.99 A	28.21 C			Means (AxC)		42.24 B	46.93 A	47.49 A	27.93 C		
A2	B1	44.72 fg	53.94 cd	65.63a	27.08 jk	47.84 B	44.54 A	A2	B1	45.08 f	54. 79cd	66.13a	27.38 j	48.35 A	
	B2	47.16 ef	53.62cd	61.47ab	30.79 j	48.26 B			B2	47.94 ef	53.03d	62.00 b	31.27 ij	48.56 A	44.72 A
	B3	52.61d	50.65de	-	46.82ef	50.03 A			B3	51.55de	50.65de	-	46.81ef	49.67 A	
Means (AxC)		48.16 C	52.75 B	63.55 A	34.90D			Means (AxC)		48.19 C	52.82B	64.07 A	35.15 D		

	C1	**C2**	**C3**	**C4**	**Means (B)**		**C1**	**C2**	**C3**	**C4**	**Means (B)**
B1	41.04 e	50.41 cd	63.27 a	25.06 g	44.95 A	B1	41.54 e	52.90 bc	62.50 a	24.69 g	45.41 A
B2	43.90 e	53.78 c	59.71 b	28.43 f	46.46 A	B2	44.47 d	53.23 b	61.72 a	28.69 f	47.03 A
B3	49.79 d	43.27 e	22.12 h	41.17e	39.09 B	B3	49.63 c	43.51 de	22.17 h	41.25 e	39.14 B
Means (C)	44.91 B	49.15 A	48.37A	31.55 C		Means (C)	45.21 B	49.88 A	48.80 A	31.54 C	

Means having the same letter (s) in a column or line are not significantly different at 5% level.
A : A1 = Sour orange (SO) . A2 = Volkamer lemon ((VL)
B : B1 = 50% of control Fertilizer dose , B2= 75 % of control Fertilizer dose and B3 = 100% (the control).
C: C1 = irrigation water pH control, C2 = irrigation water pH_5, C3 = irrigation water pH_7 and C4 = irrigation water pH_9

These results are in line with those obtained by Gerloff-Elias et al. (2005), Ruan et al. (2007) and Anugoolprasert et al. (2012) whome mentioned to Irrigated water pH value is an important feature of water. Predecessors have reported the effects of different pH treatments on plant growth. Clark & Burge (2002), Ruan et al. (2007) and Kang et al. (2011) , in additions , Plants irrigated with different pH levels will produces change of rhizosphere pH levels, which reflected on plant growth performance as morphology, photosynthesis, nutrient absorption.

Physiological Parameters

Leaf chlorophyll a content

Regarding the specific effect of citrus stock type under study, Table (6) displays cleared that, leaves of Valencia orange seedlings budded on VL stock were statistically richest in Chl.a content in compared to those on SO ones during both seasons .Also, fertilizer dose B2 (75% of the control treatment) significantly gave the highest values of Chl.a content for both SO & VL stocks ; while B3 dose (the control) was the lowest during the two studied seasons .In addition , Wi pH_5 (C2) in the 1st season and both Wi pH_5 (C2) and pH_7 (C3) in the 2nd season significantly gave the highest values of Chl. a .While, Wi pH_9 (C4) gave with significant differences the lowest values for the two seasons.

Concerning the rootstock type and fertilizer doses interaction, data indicated that Valencia orange seedlings budded on both SO or VL stocks significantly had the highest Chl.a values under fertilizer dose B1 (50%) or B2 (75%) of the control treatment in the 1st season; while, in the 2ndseason fertilizer dose B2 was the highest of Chl.a. In the contrary, both rootstocks type was the lowest effect under 100% fertilizer dose for the 1st seasons. While, in the 2nd season fertilizer dose B3 (100 % of the control treatment) significantly gave the lowest values of Chl.a content with SO and (B1) and (B2) were the lowest values with VL stock. Regard to the stock type and Wi pHs levels interaction, data showed that Valencia orange seedlings on both SO or VL citrus stocks irrigated with Wi pH_7 (C3) statistically gave the highest Chl.a content and Wi pH_9 (C4) was the lowest for both seasons. As for the stock type; fertilizer doses and Wi pHs interactions, data illustrated that SO stock significantly gave the highest Chl.a content with B1 nutrient dose under Wi pH_7 (C3) during the two seasons. Moreover, VL stock plus fertilizer doses B1(50%) or B2(75 %) with pH_7. On the other hand, fertilizer dose 100% plus Wi pH_7 significantly gave the lowest Chl.a content during the two experimental seasons.

Leaf chlorophyll b content

With regard to the specific effect of the rootstock type under study on Valencia orange seedling leaves Chl. b content. Data tabulated in Table (7) showed that VL stock had significantly higher Chl. b content than SO in both seasons. With this respect, data disclosed cleared that both B1 (50%) or B2(75%) fertilizer doses significantly gave the highest leaf Chl. b values, while B3(100%) fertilizer dose was the lowest for both stocks during in the two seasons. .In addition , all water irrigation treatments except pH_9(C4) had insignificant effect on Valencia orange leaf Chl. b content. While, Wi pH_9 (C4) significantly reduced leaf Chl. b content in compared to the control for the two seasons.

With regard to the interaction effect, it could clearly noticed that Valencia orange seedling budded on SO stock significantly had a high leaf Chl. b content , when fertilized with (B1) or (B2) in both studied seasons Table (7). In this concern, data presented revealed that VL stock seedlings did not show any significant differences of leaf Chl. b content under all fertilizers doses during the two seasons. As for the stock type and Wi pHs levels interaction. Data showed that Valencia orange seedling budded on SO stock had insignificant effect of leaves Chl. b content when irrigated with Wi pH_5 (C2) or pH_7 (C3) in compared to the control (C1). In contrary, Wi pH_9 (C4) significantly reduced leaf chl. b when compared to the control (C1) treatment for both seasons. It was quite clear that the pronounced response to interaction effect of each investigated factors (rootstock type, fertilizers doses and irrigated water pHs levels) were reflected obviously on their combinations. Hence, the greatest leaf Chl.b content in Valencia orange seedlings leaves was significantly in concomitant to both SO or VL stocks fertilized with (B1) or (B2) and irrigated with Wi pH_7. Whereas, which treated with B3 doses (100%) and Wi pH_9 (C4) was the lowest Chl. b content when compared to the control treatment during the tow experimental seasons.

Leaf carbohydrate

Referring the specific effect of both SO and VL stocks types on Valencia orange seedling leaves carbohydrates content. Table (8) displays cleared that VL stock significantly gave high

TABLE 6. Effect of stock type and fertilizer rates under different irrigation water pH levels on leaf chlorophyll "a" (mg100/ gm F.W) of Valencia orange during (2017 &2018) seasons

		Season l								Season ll					
		C1	C2	C3	C4	Means (Ax B)	Means (A)			C1	C2	C3	C4	Means (Ax B)	Means (A)
A1	B1	0.739 de	0.750 de	0.917 ab	0.611fg	0.754 A		A1	B1	0.674 gh	0.665 gh	0.940a-c	0.587 hi	0.716 B	
	B2	0.710 ef	0.838b- d	0.865a-c	0.635fg	0.762 A	0.724 B		B2	0.777 ef	0.876c-e	0.929b-d	0.600 hi	0.795 A	0.723 B
	B3	0.709 ef	0.692ef	0.553 g	0.688ef	0.661 B			B3	0.790 ef	0.654 gh	0.501i	0.648 gh	0.658 C	
Means (AxC)		0.719 B	0.760 B	0.882 A	0.645 C			Means (AxC)		0.747AB	0.732 B	0.803 A	0.612 C		
A2	B1	0.759 de	0.830b- d	0.954 a	0.664 ef	0.802 A		A2	B1	0.728 fg	0.853c-e	1.090 a	0.607 hi	0.761 B	
	B2	0.765 cd	0.863a-c	0.934 a	0.682 ef	0.811 A	0.801A		B2	0.796 ef	0.917b- d	1.010 ab	0.615 hi	0.835 A	0.798 A
	B3	0.818b-d	0.812cd	-	0.741de	0.790 B			B3	0.838 de	0.834 de	-	0.731 fg	0.798 B	
Means (AxC)		0.781 B	0.835 B	0.944A	0.696 C			Means (AxC)		0.787 C	0.868 B	1.050 A	0.650 D		

	C1	C2	C3	C4	Means (B)		C1	C2	C3	C4	Means (B)
B1	0.659 d	0.790 bc	0.936 a	0.638 d	0.756 A	B1	0.701 de	0.759 cd	0.993 a	0.597 cd	0.763 B
B2	0.738 cd	0.851 ab	0.900 a	0.659 d	0.787 A	B2	0.787 cd	0.897 ab	0.970 a	0.608 ef	0.816 A
B3	0.764 bc	0.752 bc	0. 553 e	0.715 cd	0.696 B	B3	0.814 bc	0.744 cd	0.501 g	0.690 de	0.630 C
Means (C)	0.690 C	0.978 A	0.796 B	0.671 C		Means (C)	0.767 B	0.800 A	0.821 A	0.632 C	

Means having the same letter (s) in a column or line are not significantly different at 5% level.

A : A1 = Sour orange (SO) . A2 = Volkamer lemon ((VL)

B : B1 = 50% of control Fertilizer dose , B2= 75 % of control Fertilizer dose and B3 = 100% (the control).

C: C: C1 = irrigation water pH control, C2 = irrigation water pH_5, C3 = irrigation water pH_7 and C4 = irrigation water pH_9

TABLE 7. Effect of stock type and fertilizer rates under different irrigation water pH levels on leaf chlorophyll “b” (mg100/ gm F.W)of Valencia orange during (2017 &2018) seasons.

Season l							
		C1	C2	C3	C4	Means (Ax B)	Means (A)
A1	B1	0.479 ef	0.509c-e	0.615 ab	0.314 h	0.479 A	
	B2	0.484 de	0.582a-c	0.607 ab	0.345 gh	0.505 A	0.471 B
	B3	0.519c-e	0.458 ef	0.286 h	0.452 ef	0.429 B	
Means (AxC)		0.494 A	0.516 A	0.503 A	0.370 B		
A2	B1	0.491 de	0.550b-d	0.658 a	0.364 gh	0.516 A	
	B2	0.528c-e	0.587a-c	0.644 a	0.408 fg	0.542 A	0.527A
	B3	0.539b-d	0.536b-d	-	0.495 de	0.523A	
Means (AxC)		0.519 B	0.559 B	0.651 A	0.422 C		

Season ll							
		C1	C2	C3	C4	Means (Ax B)	Means (A)
A1	B1	0.467 ef	0.496d-f	0.565a-d	0.324 g	0.463 A	
	B2	0.478 ef	0.556a-d	0.596a-c	0.338 g	0.484 A	0.454 B
	B3	0.501d-f	0.461 f	0.246 h	0.452 f	0.415 B	
Means (AxC)		0.485 A	0.504 A	0.469 A	0.371 B		
A2	B1	0.480 ef	0.550b-d	0.635 a	0.449 f	0.529 A	
	B2	0.516c-f	0.557a-d	0.614 ab	0.451 f	0.535 A	0.528 A
	B3	0.545b-e	0.525c-f	-	0.491d-f	0.520 A	
Means (AxC)		0.514 B	0.544 B	0.625 A	0.464 C		

	C1	C2	C3	C4	Means (B)		C1	C2	C3	C4	Means (B)
B1	0.485 cd	0.530 c	0.637 a	0.339 e	0.498 A	B1	0.474 c	0.523 bc	0.600 a	0.387 d	0.499 A
B2	0.506 cd	0.585 b	0.623 ab	0.377 e	0.523 A	B2	0.497 c	0.557 ab	0.605 a	0.394 d	0.513 A
B3	0.529 c	0.497 cd	0. 286 f	0.473 d	0.446 B	B3	0.527 b	0.493 c	0. 246 e	0.471 c	0.434 B
Means (C)	0.507 A	0.537 A	0.515 A	0.397 B		Means (C)	0.499 A	0.524 A	0.484 A	0.417 B	

Means having the same letter (s) in a column or line are not significantly different at 5% level.

A : A1 = Sour orange (SO) . A2 = Volkamer lemon ((VL)

B : B1 = 50% of control Fertilizer dose , B2= 75 % of control Fertilizer dose and B3 = 100% (the control).

C: C1 = irrigation water pH control, C2 = irrigation water pH_5, C3 = irrigation water pH_7 and C4 = irrigation water pH_9

values with this respect in compared to SO stock for both seasons. As for the specific effect of fertilizers doses on Valencia orange seedling leaf carbohydrates content. The present results could be explained that fertilizer dose B1 (50 %) or B2 (75%) of the control treatment significantly gave the highest leaf Carbohydrate. While, fertilizer dose B3 (100 %) significantly was the lowest carbohydrate content in both seasons. Concern the specific effect of Wi pHs level, data revealed that Wi pH_7(C3) gave the highest carbohydrate leaf content in the 1st season and Wi pH_5(C2) or pH_7(C3). Whereas, (C4) Wi pH_9(C4) was the lowest in compared to the control treatment for the two seasons.

It was quite clear as show from Table (8) that, Valencia orange seedlings budded on SO stock fertilized with B2 (75 %) dose gave the highest carbohydrates content in the two seasons. In this concern data presented that VL stock did not show any significant differences of carbohydrate % between (B1) or (B2) in the 1st season and gave the highest carbohydrate % plus B2 in the 2nd season when compared with the control treatment. Regard to the citrus stock type and Wi pHs levels , Valencia orange seedlings budded on SO stock and irrigated with Wi pH_5 (C2) or Ph_7 (C3) significantly gave a high values of leaf carbohydrates content in compared to the control treatment (C1) Table (8). Also, seedlings on VL stock , Wi pH_7 (C3) was a suitable treatment for increasing with significant differences leaf carbohydrate contents during the two seasons . As for three factors under study interaction effect, data illustrated that both SO or VL stocks; fertilized with B1(50%) or B2(75%) of the control and irrigated with Wi pH_7 significantly gave the highest leaf carbohydrates when compared to both citrus stocks fertilized with B3(100%) and irrigated with Wi pH_9 was the lowest for both seasons.

These results are harmony with those obtained by Kidd & Proctor (2001), Clark & Burge (2002), Santos et al. (2011) and Anugoolprasert et al. (2012). Whom reported that plants irrigated with different pH levels will be reflected on plant growth performance as morphology, photosynthesis, nutrient absorption: N, P, K, Ca, and Mg, and their concentration uptake in roots, leaflets, petioles and whole plant, were not altered over the range of pH 3.6 to 5.7 for 4.5 months; this possibly explains the normal growth of sago palm seedlings at pH 3.6. have suggested that the direct toxicity of H+ was the primary cause the poor growth in H+-intolerant plants growing under very acidic soils conditions.

Seedling leaf N,P,K concentration
Nitrogen (%)

N% was estimated at the end of experiment and recorded in Table (9) clearly showed that Valencia orange seedlings budded on VL stock leaves significantly had N% higher than SO stock in the 1st season, while both of them did not show any significant differences in the 2nd season . Also, data presented revealed that both fertilizer doses B1(50%) or B2 (75 %) significantly increased seedling leaf N% for both SO or VL stocks ; while B3 (100%) treatment (the control) was the lowest N % during the two studied seasons .In addition , Wi pH of the control(C1) ; pH_5 (C2) and pH_7(C3) significantly increased leaves nitrogen content in compared to Wi pH_9 (C4) was the lowest percentage for both seasons.

The specific effect of investigated factors was reflected on interaction effect of their combinations. Herein, Valencia orange seedlings budded on SO stock and fertilized with B1 (50%) or B2 (75%) of nursery nutrients applications significantly gave the highest N% values during the two studied seasons Table (9). Whereas, seedlings which budded on VL stock and fertilized with B1 or B2 gave the same effect in the 1st season and with B2 (2.08%) in the 2nd season . In the contrary, both of the two stocks plus B3(100%) was the lowest in both seasons. Also, with this respect data illustrated that seedling leaves on VL stock had higher leaf N% than SO stock under the same fertilizer conditions. Regard to the stock type plus Wi pHs levels interaction effect. Data showed that Valencia orange seedlings budded on SO stock had with significant differences high leaf N % content when irrigated with Wi pH_5 or pH_7 N% during the two seasons. On the other hand, seedlings on VL stock plus Wi pH_7 significantly gave the highest N% leaf content for both seasons. Moreover seedlings on both stocks were the lowest leaf N% under Wi pH_9 conditions. As for the stock type; fertilizer doses and Wi pHs levels. Data illustrated that both citrus stocks (SO or VL); when fertilized with B1 or B2 doses and irrigated with Wi pH_7 significantly increased leaf N% content in both studied seasons. In additions, seedlings on both stocks; irrigated with Wi pH_7 but fertilized with B3 (100% of nutrient requirements) showed the lowest leaf N% during the two seasons.

TABLE 8. Effect of stock type and fertilizer rates under different irrigation water pH levels on leaf carbohydrate (%) of Valencia orange during (2017 &2018) seasons.

Season l

		C1	**C2**	**C3**	**C4**	**Means (Ax B)**	**Means (A)**
A1	B1	24.63 g-i	26.93 f-h	32.27b-d	17.73 kl	25.39 B	
	B2	25.93 f-i	31.56c-e	34.37a-c	20.82 jk	28.17 A	25.41 B
	B3	27.81e-g	24.42 g-i	15.11 l	23.26 h-j	22.65 C	
Means (AxC)		26.12 B	27.64 A	27.25AB	20.60 C		
A2	B1	26.42f-h	30.43c-e	37.45 a	21.97 ij	29.07 A	
	B2	28.11e-g	31.73c-e	36.00 ab	22.18 ij	29.51 A	28.97 A
	B3	29.41d-f	28.74 d-f	-	26.84 f-h	28.33 B	
Means (AxC)		27.98 C	30.30 B	36.73 A	23.66 D		

Season ll

		C1	**C2**	**C3**	**C4**	**Means (Ax B)**	**Means (A)**
A1	B1	25.35 g-i	26.42f-h	35.62 bc	17.31 k	26.18 B	
	B2	25.74f-h	32.82 cd	37.91 ab	20.00 jk	29.12 A	26.20 B
	B3	28.21d-f	25.11 g-i	16.61 k	23.24 h-j	23.29 C	
Means (AxC)		26.44 B	28.17A	30.05 A	20.18 C		
A2	B1	25.88f-h	31.73c-e	40.53 a	20.30 jk	29.61 B	
	B2	29.87d-f	33.75 cd	38.44 ab	21.77 ij	30.96 A	30.00 A
	B3	31.40 de	30.60 de	-	26.31f-h	29.44 B	
Means (AxC)		29.05 C	32.03 B	39.49 A	22.8 D		

	C1	**C2**	**C3**	**C4**	**Means (B)**		**C1**	**C2**	**C3**	**C4**	**Means (B)**
B1	25.52 d	28.68 cd	34.86 b	19.85 e	29.48 A	B1	25.62 de	29.08 cd	38.08 a	18.81 f	27.90 A
B2	27.02 d	31.65 bc	39.69 a	21.50 e	29.97 A	B2	27.51 c-e	33.29 b	38.18 a	20.89 f	29.97 A
B3	28.61 cd	26.60 d	15.11 f	25.05 d	23.84 B	B3	29.81 bc	27.86 c-e	16.61 g	24.78 e	24.77 B
Means (C)	27.06 C	28.98 B	29.89 A	22.13 D		Means (C)	27.65 B	30.07 A	30.96 A	21.49 C	

Means having the same letter (s) in a column or line are not significantly different at 5% level.
A : A1 = Sour orange (SO) . A2 = Volkamer lemon ((VL)
B : B1 = 50% of control Fertilizer dose , B2= 75 % of control Fertilizer dose and B3 = 100% (the control).
C: C1 = irrigation water pH control, C2 = irrigation water pH_5, C3 = irrigation water pH_7 and C4 = irrigation water pH_9

TABLES 9. Effect of stock type and fertilizer rates under different irrigation water pH levels on leaf nitrogen concentration (%) of Valencia orange during (2017 &2018) seasons.

		Season l								Season ll					
		C1	C2	C3	C4	Means (Ax B)	Means (A)			C1	C2	C3	C4	Means (Ax B)	Means (A)
A1	B1	1.88 e-g	2.03 c-e	2.29 ab	1.77 g	1.99 A		A1	B1	1.81 fg	2.01 c-f	2.20 b-d	1.63 hi	1.91 A	
	B2	1.94 d-f	2.11 b-d	2.21a-c	1.83 fg	2.02 A	1.94 B		B2	1.83 fg	2.13 cd	2.25 a-c	1.64 g-i	1.96 A	1.87 A
	B3	2.04 c-e	1.87 e-g	1. 42 h	1.87 e-g	1.80 B			B3	2.05 c-e	1.74 gh	1.51 i	1.71 gh	1.75 B	
Means (AxC)		1.95 B	2.00 A	1.97 AB	1.82 C			Means (AxC)		1.90 B	2.02 A	1.99 A	1.66 C		
A2	B1	2.02 c-f	2.11 b-d	2.36 a	1.84 fg	2.08 A		A2	B1	1.84 fg	2.13 cd	2.36 ab	1.70 g-i	2.01 B	
	B2	2.06 c-e	2.12 b-d	2.32 a	1.85 fg	2.09 A	2.07 A		B2	2.05 c-e	2.14 cd	2.43 a	1.70 g-i	2.08 A	1.84 A
	B3	2.07c-e	2.06 c-e	-	2.03 c-e	2.05 B			B3	2.10 c-e	2.06 c-e	-	1.92 d-f	2.03 B	
Means (AxC)		2.05 B	2.10 B	2.34A	1.91 C			Means (AxC)		2.00 C	2.11 B	2.40A	1.77 D		

	C1	C2	C3	C4	Means (B)		C1	C2	C3	C4	Means (B)
B1	1.95 cd	2.07 bc	2.33 a	1.81 d	2.04 A	B1	1.83 de	2.07 bc	2.28 a	1.67 e	1.96 A
B2	2.00 cd	2.12 a-c	2.27 ab	1.84 d	2.06 A	B2	1.94 cd	2.14 ab	2.34 a	1.67 e	2.03 A
B3	2.06 bc	1.97 cd	1.42 e	1.95 cd	1.85 B	B3	2.08 bc	1.90 cd	1.51 f	1.82 de	1.75 B
Means (C)	2.00 A	2.05 A	2.01 A	1.26 B		Means (C)	1.95 A	2.04 A	2.04 A	1.72 B	

Means having the same letter (s) in a column or line are not significantly different at 5% level.
A : A1 = Sour orange (SO) . A2 = Volkamer lemon ((VL)
B : B1 = 50% of control Fertilizer dose , B2= 75 % of control Fertilizer dose and B3 = 100% (the control) .
C: C1 = irrigation water pH control, C2 = irrigation water pH_5, C3 = irrigation water pH_7 and C4 = irrigation water pH_9

Phosphorus %

Concerning the specific effect of the two citrus rootstocks type under this study on leaf P %, data presented in Table (10) showed that VL stock statistically gave a high values with this respect in compared to SO stock in the two seasons. Regarding the effect of the treatments with this respect , data tabulated disclosed cleared that 50% or 75% of fertilizer doses significantly gave the highest leaf P %, while the 100% of fertilizer dose was the lowest for both seasons. As for the specific effect of water irrigation pH levels, data revealed that Wi pH_5 (C2) or pH_7 (C3) gave the highest P%, whereas, Wi pH_9 (C4) recorded the lowest values during the two seasons.

With regard to the interaction effect , it could noticed clearly that from the Table (10) SO rootstock did not show any significant differences of leaf P % between (B1) or (B2) for both seasons. In this concern data presented that VL stocks did not show any significant differences of P% between all treatments for both seasons. With regard to the stock type and Wi pHs levels interaction, pH_7 treatment significant had a high value of P% in the 1st season, while, pH_5 significant had a large value of P % with SO stock but pH_9 was the lowest during the two seasons. Whereas, VL stock when irrigated with Wi pH_7 gave significantly highest P % .While, Wi pH_9 was the lowest values for both them during the two seasons. Generally , the stock types , fertilizer doses plus irrigated water pHs levels showed that, fertilizer doses 50% or 75 % with pH_7 gave the greatest number of leaf P% ,while, fertilizer doses 100% with Wi pH_7 gave with significant effect the lowest P% during the two experimental seasons.

Potassium %

With regard to specific effect of both VL or SO stock type on leaf K % . Data tabulated in Table (11) revealed that VL stock significantly gave the higher K% than SO stock for both seasons . Also, fertilizer dose B2 (75%) significantly increased leaf K % for both citrus stocks under study ; while B3(100%) dose reduced K % content during the two studied seasons .In addition ,both Wi pH_5 (C2) or pH_7 (C3) significantly increased both studied stocks (SO or VL) leaf K % in the 1st season, while, Wi pH5 (C2) significantly increased K% in the 2nd season. On the other hand Wi pH_9 (C4) gave the lowest significant effect on K % for both seasons.

Referring the interaction effect of different combinations studied factors, Table (11) shows that Valencia orange seedlings budded on SO stock and treated with fertilizer dose 75 % (B2) significantly gave the highest K% value for the two seasons. Whereas, VL stock did not show any significant differences of leaf K % among all the fertilizer doses under study for both seasons. Regard to the stock type and Wi pHs levels interaction , data showed that VL stock gave with significant differences in leaf K% plus Wi pH_7 for both seasons , while, SO stock under PH_5 or $_7$ significant had a large leaf K % in the 1st season , so, pH_7 in the 2nd season. Moreover, both VL or SO stock plus Wi pH_9 were the lowest leaf K % during the two seasons. Generally, both citrus stocks in this study when fertilized with fertilizer doses 50% (B1) or 75% (B2) and irrigated with Wi pH_5 or $_7$ gave the highest K % values during studied seasons.

Seedling root N,P,K concentration

Nitrogen %

N % estimated at the end of experiment and recorded in Table (12) clearly showed that VL stock roots had significantly higher N% than SO stock for the two seasons. Also, data presented revealed that both fertilizer doses B1(50%) or B2 (75 %) significantly increased seedling root N % for both SO or VL stocks in the 1st season, while B2 (75 %) dose significantly increased seedling root N % in the 2nd season, while B3 (100%) dose (the control) was the lowest content during the two studied seasons. In addition, Wi pH_5 (C2) or PH_7(C3) significantly increased roots N % content in compared to Wi pH_9 (C4) was the lowest for both seasons.

As for the interaction effect of factors under this study, data tabulated in Table (12) cleared that Valencia orange seedlings on SO stock and fertilized with B2 (75%) dose significantly gave the highest N% values during the 1st season, while, in the 2nd season both B1 or B2 dose had insignificant difference between them. Whereas, seedlings on VL stock when fertilized with B1 or B2 or B3 had no significant effect during the two studied seasons. In the contrary, both stocks plus B3 (100%) was the lowest. Moreover, seedling on VL stock was a higher N% contents than SO stock under the same fertilizer conditions. Regard to the stock type plus Wi pHs levels. Data showed that SO stock had with significant differences a high root N% when irrigated with Wi pH_5 or pH_7 during both seasons. Also, seedlings on VL stock plus Wi pH_7 significantly gave the highest N% root. Whereas, seedlings on both stocks were the

TABLE 10. Effect of stock type and fertilizer rates under different irrigation water pH levels on leaf phosphorus (%) of Valencia orange during (2017 &2018) seasons.

		Season l								Season ll					
		C1	C2	C3	C4	Means (Ax B)	Means (A)			C1	C2	C3	C4	Means (Ax B)	Means (A)
A1	B1	0.21 fg	0.26 ef	0.39 ab	0.13 h	0.25 A		A1	B1	0.24 ef	0.27 de	0.36 ab	0.16 g	0.26 A	
	B2	0.22 f	0.35 bc	0.39 ab	0.14 hi	0.28 A	0.24 B		B2	0.24 ef	0.33 bc	0.36 ab	0.16 g	0.27 A	0.24 B
	B3	0.29 de	0.17 gh	0.11 i	0.17 gh	0.19 B			B3	0.27 de	0.23 Ef	0.10 h	0.23 ef	0.21 B	
Means (AxC)		0.24 B	0.26 B	0.30 A	0.15 C			Means (AxC)		0.25 B	0.28 A	0.27AB	0.18 C		
A2	B1	0.22f	0.35 bc	0.43 a	0.14 hi	0.29 A		A2	B1	0.25 e	0.32 bc	0.40 a	0.19 fg	0.29 A	
	B2	0.30 c-e	0.38 ab	0.41 a	0.16 gh	0.31 A	0.30 A		B2	0.29 cd	0.34 bc	0.40 a	0.20 fg	0.31 A	0.30 A
	B3	0.33 cd	0.32 cd	-	0.23 f	0.29 A			B3	0.32 bc	0.31 cd	-	0.26 de	0.29 A	
Means (AxC)		0.28 C	0.35 B	0.42A	0.18 D			Means (AxC)		0.29 C	0.32 B	0.40 A	0.22 D		

	C1	C2	C3	C4	Means (B)		C1	C2	C3	C4	Means (B)
B1	0.22 cd	0.31 b	0.41 a	0.14 e	0.27 A	B1	0.25 c	0.30 bc	0.38 a	0.18 d	0.28 A
B2	0.26 bc	0.37 a	0.40 a	0.15 e	0.30 A	B2	0.27 c	0.34 ab	0.38 a	0.18 d	0.29 A
B3	0.31 b	0.26 bc	0.11 f	0.20 d	0.22 B	B3	0.30 bc	0.27 c	0.10 e	0.26 c	0.23 B
Means (C)	0.26 B	0.31 A	0.31 A	0.16 C		Means (C)	0.27 B	0.30 A	0.29 A	0.21 C	

Means having the same letter (s) in a column or line are not significantly different at 5% level.
A : A1 = Sour orange (SO) . A2 = Volkamer lemon ((VL)
B : B1 = 50% of control Fertilizer dose , B2= 75 % of control Fertilizer dose and B3 = 100% (the control) .
C: C1 = irrigation water pH control, C2 = irrigation water pH_5, C3 = irrigation water pH_7 and C4 = irrigation water pH_9

TABLE 11. Effect of stock type and fertilizer rates under different irrigation water pH levels on leaf potassium concentration (%) of Valencia orange during (2017 &2018) seasons.

		Season l								Season ll					
		C1	C2	C3	C4	Means (Ax B)	Means (A)			C1	C2	C3	C4	Means (Ax B)	Means (A)
A1	B1	1.43 e-g	1.52 ef	1.93 ab	1.20 hi	1.52 B		A1	B1	1.62 d-f	1.78 b-d	1.91 a-c	1.26 hi	1.64 B	
	B2	1.47 ef	1.87 bc	2.01 ab	1.20 hi	1.64 A	1.51 B		B2	1.65 d-f	1.94 ab	1.94 ab	1.42 gh	1.74 A	1.64 B
	B3	1.54 d-f	1.40 f-h	1.13 i	1.36 f-h	1.36 C			B3	1.82 b-d	1.62 d-f	1.12 i	1.61 e-g	1.54 B	
Means (AxC)		1.48 B	1.60 A	1.70 A	1.25 C			Means (AxC)		1.70 B	1.78 A	1.66 B	1.43 C		
A2	B1	1.50 ef	1.85 bc	2.04 ab	1.21 hi	1.65 A		A2	B1	1.71 c-e	1.91 a-c	2.04 a	1.52 eg	1.80 A	
	B2	1.62 de	1.91 a-c	2.11 a	1.27 g-i	1.73 A	1.68 A		B2	1.82 b-d	1.93 a-c	1.98 ab	1.57 e-g	1.83 A	1.82 A
	B3	1.73 cd	1.71 cd	-	1.51 ef	1.65 A			B3	1.90 a-c	1.87 a-c	-	1.74 c-e	1.83 A	
Means (AxC)		1.62 C	1.82 B	2.08 A	1.33 D			Means (AxC)		1.81C	1.90 B	2.01 A	1.61 D		

	C1	C2	C3	C4	Means (B)		C1	C2	C3	C4	Means (B)
B1	1.47 ef	1.69 c	1.99 a	1.21 g	1.59 B	B1	1.67 d	1.85 bc	1.98 a	1.39 f	1.72 B
B2	1.55 de	1.89 b	2.06 a	1.24 g	1.69 A	B2	1.74 cd	1.94 ab	1.96 a	1.50 e	1.79 A
B3	1.64 cd	1.56 de	1.13 h	1.44 f	1.44 C	B3	1.86 b	1.75 cd	1.12g	1.68 d	1.60 C
Means (C)	1.55 B	1.71 A	1.73 A	1.30 C		Means (C)	1.76 B	1.85 A	1.69 C	1.52 D	

Means having the same letter (s) in a column or line are not significantly different at 5% level.

A : A1 = Sour orange (SO) . A2 = Volkamer lemon ((VL)

B : B1 = 50% of control Fertilizer dose , B2= 75 % of control Fertilizer dose and B3 = 100% (the control).

C: C1 = irrigation water pH control, C2 = irrigation water pH_5, C3 = irrigation water pH_7 and C4 = irrigation water pH_9

lowest under Wi pH_9 conditions. whene , seedling fertilized with B1 or B2 doses and irrigated with Wi pH7 significantly increased root N% content for SO or VL in both studied seasons. In additions, seedlings on both stocks; irrigated with Wi pH_7 but fertilized with B3 (100% nutrient requirements) was the lowest.

Phosphorus %

Concerning the specific effect of the two citrus stocks type under this study on P % , data presented in Table (13) showed that seedling on VL stock statistically gave a higher values with this respect in compared to SO stock in the two seasons . With this respect , data also disclosed cleared that B2 (75%) fertilizer dose gave the highest significant effect on root P%, while B3 (100%) was the lowest . As for the specific Wi pH effect, data revealed that C1 (the control) ; C2 (pH_5) or C3 (pH_7) significantly increased seedling roots P%. In contrary, C4 (pH_9) was the lowest in the two seasons.

With respect, it could noticed clearly that from the Table (13) seedling on SO stock when fertilized with B2 (75% of nursery nutrient applications) gave the highest significant P% values in the 1st season and with B1or B2in the 2nd season gave similarly effect. In this concern data presented that seedling on VL stock did not show any significant differences of P % for under all fertilizer doses in the two seasons. With regard to stock type and Wi pHs levels interaction, it can be noticed that, Wi pH_7 significantly gave the highest P % in VL roots , whereas, pH_9 for both VL or SO stocks was the lowest during the two seasons. Finally, both citrus stock type; fertilizer dose and Wi pHs, data showed that, fertilizer doses B1 (50%) or B2 (75 %) plus pH_7 gave the greatest root P % values when compared with B3(100%) plus Wi pH_7 was the lowest during the two experimental studies.

potassium %

As for the specific effect of both citrus stocks under this study on Valencia orange seedlings roots K% during transplanting stage . Data presented in Table (14) cleared that both VL and SO stocks did not show any significant differences in root K% during the two seasons. Regard to the specific effect of fertilizer doses , data indicated that both (B1) or (B2) dose significantly increased seedling root K % for both SO or VL stocks ; while B3 dose (the control) was the lowest during the two studied seasons . In addition , Wi pH control (C1) and pH5 (C2) significantly increased SO or VL root K% in the 1st season and pH_5 (C2) and pH_7 (C3) significantly increased K % for the two stocks in the 2nd season. In contrary, pH_9 (C4) significantly reduced root K % for both stocks during the two seasons.

With regard to the interaction effect, from the Table (14) it can be clearly noticed that SO stock when fertilized with B1 (50%) or B2 (75%) significantly increased seedling root K % during the two seasons. Whereas, seedlings which budded on VL stock did not show any significant differences in K% under all fertilizer doses for the two seasons. In this concern data presented that SO stock irrigated with Wi pH control (C1) or pH_5 (C2) or pH_7 (C3) gave a high root K% values in the 1st season while, in the 2nd season pH_7 (C3) was the highest. Whereas, Valencia orange seedlings which budded on VL stock plus Wi pH_7 (C3) gave the highest root K% values for the two seasons. With respect, stock type; fertilizer dose and irrigated water pH_s levels interaction data showed that Valencia orange seedlings on both studied citrus stocks gave a high root K% values when fertilized with 50% dose and irrigated with Wi pH_7 in the 1st season and 50% or 75% plus Wi pH_7 in the 2nd season when compared to the control (B3) plus Wi pH_7which gave significantly the lowest values during the two experimental seasons.

We must understand that seedlings growth rate and it's quality are not increased by adding more and more chemical macro nutrient fertilizers. It is important to realize that less is more when availability of nutrients is timed with actual requirements. We need to completely change our thinking and understanding of nursery management. Small nursery holdings; expensive inputs of nutrient applications or the lack of an integrated strategy for serving seedlings will returns have combined bad results. Moreover, irrigated water pH level will play an important role for nutrient elements Availability in root area and mineral uptake. These results agreement with Maust & Williamson (1994) who mentioned that N is the most important element in the most fertilization programs applications. and is especially critical in the nursery where high plant densities exist and rapid. Thus, N fertilization levels lower than those normally applied in commercial citrus nurseries may be adequate for optimal growth of container-grown nursery plants.

TABLE 12. Effect of stock type and fertilizer rates under different irrigation water PH levels on root nitrogen concentration (%) of Valencia orange during (2017 &2018) seasons.

		Season l								Season ll					
		C1	C2	C3	C4	Means (Ax B)	Means (A)			C1	C2	C3	C4	Means (Ax B)	Means (A)
A1	B1	1.21 fg	1.27 ef	1.53 b	0.94 i	1.24 B		A1	B1	1.05 hi	1.20 fg	1.46 bc	0.91 j	1.16 A	
	B2	1.21 fg	1.44 bc	1.47 b	1.07 h	1.30 A	1.22 B		B2	1.05 hi	1.40 cd	1.41b-d	0.95 ij	1.20 A	1.12 B
	B3	1.32 de	1.18 fg	0.81 j	1.17 fg	1.12 C			B3	1.20 fg	1.02 hi	0.79 k	1.02 hi	1.00 B	
Means (AxC)		1.25 B	1.30 A	1.27AB	1.06 C			Means (AxC)		1.10 B	1.21 A	1.22 A	0.96 C		
A2	B1	1.21 fg	1.45 bc	1.71 a	1.12 gh	1.37 A		A2	B1	1.12 gh	1.35 d	1.51 b	1.00 ij	1.25 B	
	B2	1.33 de	1.42 cd	1.54 b	1.15 gh	1.36 A	1.36 A		B2	1.24 ef	1.40 cd	1.63 a	1.00 ij	1.32 A	1.27 A
	B3	1.37 cd	1.35 de	-	1.26 ef	1.23 B			B3	1.33 de	1.30 de	-	1.14 fg	1.26 B	
Means (AxC)		1.30 C	1.41 B	1.63 A	1.18 D			Means (AxC)		1.23 C	1.35 B	1.57 A	1.05 D		

	C1	C2	C3	C4	Means (B)		C1	C2	C3	C4	Means (B)
B1	1.21 d	1.36 c	1.62 a	1.03 e	1.31 A	B1	1.09 d	1.28 c	1.49 ab	.96 e	1.21 B
B2	1.27 d	1.43 bc	1.51 b	1.11 de	1.33 A	B2	1.15 d	1.40 b	1.52 a	.98 e	1.26 A
B3	1.36 c	1.27 d	0.81 f	1.22 d	1.17 B	B3	1.27 c	1.16 d	0.79 f	1.08 d	1.08 C
Means (C)	1.28 B	1.35 A	1.31 A	1.12 C		Means (C)	1.17 B	1.28 A	1.26 A	1.01 C	

Means having the same letter (s) in a column or line are not significantly different at 5% level.

A : A1 = Sour orange (SO) . A2 = Volkamer lemon ((VL)

B : B1 = 50% of control Fertilizer dose , B2= 75 % of control Fertilizer dose and B3 = 100% (the control).

C: C1 = irrigation water pH control, C2 = irrigation water pH_5, C3 = irrigation water pH_7 and C4 = irrigation water pH_9

TABLE 13. Effect of stock type and fertilizer rates under different irrigation water pH levels on root phosphorus concentration (%) of Valencia orange during (2017 &2018) seasons.

		Season l								Season ll					
		C1	C2	C3	C4	Means (Ax B)	Means (A)			C1	C2	C3	C4	Means (Ax B)	Means (A)
A1	B1	0.07 de	0.10 cd	0.13 bc	0.05 f	0.09AB		A1	B1	0.11de	0.12 cd	0.16 ab	0.06 f	0.11 A	
	B2	0.09 de	0.15 ab	0.16 a	0.05f	0.11 A	0.09 B		B2	0.11 de	0.15 bc	0.16 ab	0.08 f	0.13 A	0.11 B
	B3	0.10 cd	0.07 de	0.05 f	0.07 de	0.07 B			B3	0.14 cd	0.11 de	0.05 f	0.11 de	0.10 A	
Means (AxC)		0.09AB	0.11 A	0.11 A	0.06 B			Means (AxC)		0.12 A	0.13A	0.12 A	0.08 B		
A2	B1	0.10 cd	0.13 bc	0.17 a	0.06 ef	0.12 A		A2	B1	0.11 cd	0.14 bc	0.19 a	0.09 ef	0.13 A	
	B2	0.11 cd	0.14 ab	0.17 a	0.06 ef	0.12 A	0.12 A		B2	0.14 cd	0.16 ab	0.18 a	0.10 ef	0.15 A	0.14 A
	B3	0.13 bc	0.12 bc	-	0.10 cd	0.11 A			B3	0.14 bc	0.14 bc	-	0.12 cd	0.13 A	
Means (AxC)		0.11 B	0.13 B	0.17 A	0.07 C			Means (AxC)		0.13B	0.15 B	0.19A	0.10 C		

	C1	C2	C3	C4	Means (B)		C1	C2	C3	C4	Means (B)
B1	0.09 cd	0.12 bc	0.15 ab	0.06 de	0.11 AB	B1	0.11 cd	0.13 bc	0.18 a	0.08 d	0.13 AB
B2	0.10 c	0.15 ab	0.17 a	0.06 de	0.12 A	B2	0.13 bc	0.16 ab	0.17 a	0.09 d	0.14 A
B3	0.12 b	0.10 c	0.05 e	0.09 cd	0.09 B	B3	0.14 bc	0.13 bc	0.05e	0.12 c	0.11 B
Means (C)	0.10 A	0.12 A	0.12 A	0.07 B		Means (C)	0.13 A	0.14 A	0.13 A	0.10 B	

Means having the same letter (s) in a column or line are not significantly different at 5% level.
A : A1 = Sour orange (SO) . A2 = Volkamer lemon ((VL)
B : B1 = 50% of control Fertilizer dose , B2= 75 % o control f Fertilizer dose and B3 = 100% (the control).
C: C1 = irrigation water pH control, C2 = irrigation water pH_5, C3 = irrigation water pH_7 and C4 = irrigation water pH_9

TABLES 14. Effect of stock type and fertilizer rates under different irrigation water pH levels on root potassium concentration (%) of Valencia orange during (2017 &2018) seasons.

		Season I								Season II					
		C1	C2	C3	C4	Means (Ax B)	Means (A)			C1	C2	C3	C4	Means (Ax B)	Means (A)
A1	B1	0.41 fg	0.46 de	0.55 a-c	0.31 h	0.43A		A1	B1	0.39 fg	0.44 ef	0.57 b	0.31 h	0.42A	
	B2	0.43 ef	0.52 bc	0.55 a-c	0.32 h	0.46 A	0.42 A		B2	0.40 fg	0.53 bc	0.58 ab	0.31 h	0.45 A	0.41 A
	B3	0.48 de	0.40 fg	0.20 i	0.40 fg	0.37 B			B3	0.46 de	0.37 g	0.24 i	0.37 g	0.36 B	
Means (AxC)		0.44 A	0.46 A	0.43 A	0.34 B			Means (AxC)		0.42 B	0.45AB	0.47 A	0.33 C		
A2	B1	0.46 de	0.53 a-c	0.59 a	0.36 gh	0.49 A		A2	B1	0.40 fg	0.51 cd	0.63 a	0.32 h	0.47 A	
	B2	0.50 cd	0.52 bc	0.57 ab	0.38 fg	0.49 A	0.49 A		B2	0.46 de	0.53 bc	0.62 a	0.32 h	0.48 A	0.47 A
	B3	0.51 cd	0.50 cd	-	0.46 de	0.49 A			B3	0.50 cd	0.47 de	-	0.41 fg	0.46 A	
Means (AxC)		0.49 B	0.52 B	0.58 A	0.40 C			Means (AxC)		0.45 B	0.50 B	0.63 A	0.35 C		

	C1	C2	C3	C4	Means (B)		C1	C2	C3	C4	Means (B)
B1	0.44 c	0.50 bc	0.57 a	0.34 d	0.46 A	B1	0.40 c	0.48 b	0.60 a	0.32 d	0.45 A
B2	0.47 bc	0.52 ab	0.56 a	0.35 d	0.48 A	B2	0.43 c	0.53 a	0.60 a	0.32 d	0.47 A
B3	0.50 bc	0.45 c	0.20 e	0.43 c	0.39 B	B3	0.48 b	0.42 c	0.24e	0.39 c	0.38 B
Means (C)	0.47 A	0.49 A	0.44 B	0.37 C		Means (C)	0.44 B	0.48 A	0.48A	0.34 C	

Means having the same letter (s) in a column or line are not significantly different at 5% level.

A : A1 = Sour orange (SO) . A2 = Volkamer lemon (VL)

B : B1 = 50% of control Fertilizer dose , B2= 75 % of control Fertilizer dose and B3 = 100% (the control).

C: C1 = irrigation water pH control, C2 = irrigation water pH_5, C3 = irrigation water pH_7 and C4 = irrigation water pH_9

Conclusion

Valencia orange (Citrus sinensis) seedlings grafted on Sour orange (Citrus aurantum) gave the best vegetative growth ,root length & width ,leaf chl. A & b, leaf carbohydrates content and NPK uptake when fertilized with 50 % dose of the control treatments and irrigated with water pH_7 . Also, seedlings grafted on Volkamer lemon (*Citrus Volkamariana*) citrus stocks gave the same trend when fertilized with 50 % or 75% dose of the control treatments and irrigated with water PH7. In contrary, seedlings on both Sour orange and Volkamer lemon stocks fertilized with 100 % of nursery recommendations and irrigated with water pH_9 was the lowest.

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Conflicts of interest

The author declares that there are no conflicts of interest related to the publication of this study.

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تأثير الري بمستويات مختلفة في الاس الهيدروجيني " الـ pH " وجرعات مختلفة من التسميد علي نمو شتلات الموالح.

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شتلات برتقال صيفي مطعومة علي اصلي النارنج او الفولكاماريانا تم اضافة اسمدة بمستويات مختلفة ٥٠٪,٧٥٪ , ١٠٠٪ من الاسمدة الموصي بها في المشتل وتم اضافة مياه الري عند مستويات مختلفة الاس الهيدروجيني " ال pH"٥ او ٧ او ٩ والمقرنة (مياه الري). وجاءت النتائج كما يلي : شتلات البرتقال الصيفي المطعومة علي اصل النارنج او الفولكا ماريانا اعطت افضل نتائج فيما يتعلق ب (طول الشتلة , سمك الساق , مساحة الورقة وانتشار الجذور) كذلك محتوي الاوراق من الصبغات والكربوهيدرات الكلية وعناصر النتروجين والفوسفور والبوتاسيوم عند مستوي معنوية ٥٪ عندما تم اضافة ٥٠٪ من الاسمدة الموصي بها (المقارنة) وتم ريها بماء ري ذات pH_7 شتلات البرتقال الصيفي المطعومة علي اصل الفولكاماريانا اخذت نفس الاتجاه ولكن عند مستوي تسميد ٥٠٪ او ٧٥٪ من المقارنة ومياه ري ذات pH_7 شتلات البرتقال الصيفي المطعومة علي اصل النارنج او الفولكاماريانا وتحت ظروف تسميد ١٠٠٪ من توصيات المشتل (المقارنة) ومياه ري ذات pH_7 (المقارنة) او pH_9 كانت الاقل وبدرجة معنوية .