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EFFECT OF SPRAYING WITH NANO SEAWEED EXTRACT AND QUALITY OF IRRIGATION WATER ON GROWTH OF VOLKAMER LEMON ROOTSTOCK SAPLINGS

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Abstract

This experiment was carried out in the Karbala nursery for certified citrus production belongs to the Iraqi Ministry of Agriculture during the 2019 growing season, using three-month-old Volkamer lemon saplings. The treatments included irrigation with three types of irrigation water of different salinity, and three concentrations (0.5, 1.0 and 1.5 ml. Liters^{-1}) of Nano-seaweed extract, in addition to the control treatment. The experiment aimed to investigate the effect of spraying Nano commercial seaweed extract on saplings tolerance to irrigation water salinity. The results showed that the higher level of salinity in irrigation water, the lower values of seedlings growth parameters including leaf area, shoot and root dry weight and higher leaf content rate of proline and catalase activity. The results showed that spraying rootstock saplings with Nano-seaweed extract resulted not only in saplings growth improvement in most traits under study, but also reduced the effect of stress due to the salinity of irrigation water giving normal growth plants that do not differ from the seedlings irrigated with low salinity water or river water.

***Keywords*:** SWE, lemon, rootstock, citrus, salinity

Introduction

Citrus volkameriana (volkamer lemon) is one of the citrus rootstock that is widely used in important citrus growing regions in the world. This rootstock is characterized by high specifications that have a positive effect on the growing grafts and it is compatible with most types of citrus fruits as well as its resistance to the disease of rapid deterioration and flicking of wood and the disease of peeling of phloem bark (Kacar, 2011 and 2011, Schinor). And that this stoke is a hybrid from pollination (*Citrus medica* * *Citrus aurantifolia*). It is well-matched for grafting with lemon, most oranges and mandarin varieties (Lacey *et al*., 2006).

Khan and others (2009) have generally described seaweed extract as organic sources that supplement fertilizers in agricultural production, and more than 31 million tons are used in agricultural production annually in the world. Seaweed extract stimulates the growth of the plant when added in a few concentrations and does not leave any residues that have a negative effect on the plant or on the soil, due to its non-toxic biological nature. Marine algae contain many nutrients and some growth regulators such as oxins, gibberellins and amino acids that lead to improved vegetative and root growth in the plant Craigie (2011), in addition to treating plants with marine algae extracts to improve the ability of the plant to absorb nutrients thus to Increased plant resistance to diseases (Chouliaras *et al*., 2009).

Salinity is one of the important environmental stresses that affect plant growth and productivity. Increased salinity is considered one of the main problems that reduce the areas of land designated for agricultural production in most parts of the world, especially in dry and semi-dry areas that are characterized by being limited in rain, with high temperatures and increased evaporation. All of these conditions have combined to exacerbate the problem of salinity and its negative impact on agricultural production (Eraslan *et al*., 2008). This study, therefore, aimed to improve the growth of volkamer lemon rootstock saplings by increasing their tolerance to the salinity of irrigation water and reducing the time required to prepare them for vaccination using spraying seedlings with seaweed extract in different concentrations.

Materials and Methods

The experiment was carried out in the Karbala nursery to produce certified citrus seedlings belonging to the Iraqi Ministry of Agriculture during the agricultural season 2019, using three-month-old folkamri seedlings. The seedlings were transferred to 10 kg plastic pots filled with sandy mixture soil (Table 1). The main treatments included three types of irrigation water of different salinity are river water, well water or puncture water with salinity levels of 1.2, 2.4 and 4.5 decimeters M-1, respectively. While the secondary treatments included spraying the seedlings with Nano Seaweed Extract with three concentrations of 0.5, 1.0 and 1.5 ml. Liter^{-1}) in addition to the control treatment. The extract was sprayed on fulgamryana seedlings seven times, at the rate of one spray every 30 days during the experiment period that started on 1/5/2019, with irrigation with water quality being tried one time a week.

At the end of the experiment, data were collected, for the growth indicators under study that included the total area of the leaf (cm^2)/plant by relying on a sample of 10 full-size leaves from different parts of each experimental unit using the Image J computer program to extract the average three times, the dry weight of the shoot and root system (g), leaf content of proline acid (mg.g^{-1})

Using Spectrophotometer along a wavelength of 520 nanometers (Bates *et al*., 1973) and estimating the efficacy of Catalase (CAT) at a wavelength of 240 nanometers (1984 Aebi).

Data were analyzed using GenStat 2012 computing program. Analysis of variance ANOVA was performed for each measured parameter. Means were compared ($P \leq 0.05$) among treatments under study using Duncan's multiple range tests.

Results and Discussion

The results showed (Table 2) that the average values of all growth indicators under study differed according to the type of irrigation water and the concentration of seaweed extract used. Generally the highest rates for leafy area (3075 cm^2), dry weight of the shoot system (15.633g) and root system (10.590g), the lowest values of leaf content from proline (0.129mg.g^{-1}) and the effectiveness of the catalase enzyme (16.1) were when sprayed with seaweed extract at a concentration of 1.0 ml.L^{-1} in the treatment of watering with river water and a significant difference from The values recorded in the plants of the same irrigation method sprayed with distilled water. Whereas, the lowest rates for foliar area (668cm^2) the dry weight of the vegetative system (2.220g) and the root group (1.053g) and the highest values for the leaf content of proline (1.425mg.g^{-1}) and the effectiveness of the catalase enzyme (152.5) were in the treatment of watering with regular water in the absence of seaweed extract.

The growth of each part of the plant is affected by the physiological and biochemical processes that occur in the vegetative part of the plant. Therefore, vegetative growth is an important indication of the vitality and activity of the plant. The results indicated that spraying with seaweed extract, regardless of the concentrations, led to an increase in the

The decrease in the total foliar area of the plant due to the effect of increasing the salinity of irrigation water is due to the dampening of the photosynthesis process due to the osmotic effect resulting from the reduced amount of water entering the plant and thus reducing the transport of nutrients and growth hormones from the roots to the rest of the plant (Tuteja, 2005). Or reduce the swelling pressure of the leaf cells, which leads to less.

Table 1 : Effect of spraying with Nano-manufactured seaweed extract and the type of irrigation water on different growth indicators of lemon saplings

Treatments		Total leaf area/plant cm	Shoot dry weight g	Root dry weight g	Leaf content of Proline	Catalase activity
SWE concentrations	Irrigation water type					
0	River	916 hi	5.903 Fg	2.243 F	0.232 f	23.1 Ef
	Well	738 hi	4.773 I	1.977 F	0.358 cd	50.0 Cd
	Drainage	668 i	2.220 J	1.053 G	1.425 a	152.5 A
0.5	River	1650 de	6.270 ef	3.833 D	0.295 e	26.3 Ef
	Well	1562 def	6.713 e	2.943 E	0.338 de	34.6 De
	Drainage	1028 gh	5.250 hi	2.870 E	0.721 b	92.2 B
1.0	River	3075 a	15.633 a	10.590 A	0.129 g	16.1 F
	Well	2336 b	11.053 b	4.410 C	0.222 f	16.4 F
	Drainage	1395 ef	7.380 d	4.043 Cd	0.389 cd	58.5 C
1.5	River	2041 bc	6.443 ef	3.923 D	0.226 f	16.7 F
	Well	1759 cd	8.553 c	4.783 B	0.299 e	31.2 Ef
	Drainage	1287 fg	5.543 gh	2.734 E	0.412 c	86.4 B

Values are means of 3 replications. Means followed by the same letter(s) within a column are not significantly different accodring Duncan's multiple range tests ($P \leq 0.05$) elongation and thus less paper area (Shahwani, 2006). The reduction in the dry weight of indications of micro-growth. The results of the study agreed with what Ismail and Ghazai (2012) found when using seaweed extract that led to an increase in the plant content of major and minor nutrients and plant hormones, especially cytokines, which have a large and effective role in increasing lateral branching. Al-Hawezy (2014) showed that spraying commercial Kelpak extract resulted in a significant increase in stem diameter, leaf area and percentage of chlorophyll in Loquat *Eriobotrya japonica* plant.

The vegetative group was also linked to a lack of water, followed by a decrease in nucleic acids, chlorophyll content, an increase in ABA acid, and inhibition of GA3 activity (Idris, 2004). The decrease in the value of the water potential leads to poor water absorption by the roots (Taiza and Zeiger, 2006). The gathering of salts impedes the absorption of water and thus an imbalance in the ionic and nutritional balance and consequently low efficiency of photosynthesis as a result of the accumulation of sodium ions in the leaves, which leads to a decrease in their water content and a reduction in dry weight in general (Ashraf and Harris, 2004; Parida and Das, 2005).

On the other hand, high levels of salinity cause plant stunting and aging of plant tissues as a result of an increase in

abscisic acid and ethylene, and this results in a decrease in the number of leaves and the leaf area, which affects the efficiency of photosynthesis and thus a decrease in the materials stored in the vegetable total and dry weight loss (Mass, 1999). The results showed that the proportion of proline increased with increasing salinity of irrigation water, may be attributed to the rapid building of proline and its low consumption, which increases the speed of its accumulation in addition to inhibiting the activities of oxidizing enzymes for proline, and that the increase of proline accumulation may be due to increased protein breakdown and its conversion to amino acids, including proline. Ashraf and Foolad, 2007). Proline regulates the osmosis of plant tissue cells, reduces the ionic effect of salts and contributes to restricting the toxic elements absorbed by the plant under saline conditions. The level of proline accumulation in plant tissues depends on plant varieties growing under saline conditions (Munns, 2005 and Hong-Bo *et al*., 2006).

The results showed the effectiveness of catalase enzyme increased in plants by increasing the salinity of irrigation water, which is one of the plant strategies to reduce the effects of salinity and the resulting damage Reaction Oxygen Specie with harmful oxidative effect of proteins, enzymes and plant growth in general (Tester) and Munns, 2008). Therefore, the activity of catalase increased in the leaves of the seedlings irrigated with more salty puncture than by the other irrigation water used in the Ameri experiment (2014). While, spraying the saplings with the seaweed extract reduced catalase activity even in plants irrigated with high salinity water.

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