Plant Archives Vol. 20, Supplement 1, 2020 pp. 2827-2831 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

RESPONSE OF CITRUS SEEDLINGS *TROYER CITRANGE* & *CARRIZO CITRANGE* TO THE TREATMENT WITH TWO TYPES OF FOLIAR SPRAYING AND THEIR EFFECT ON SOME VEGETATIVE AND ROOT CHARACTERISTICS OF IT

Alaa Abbas Ali*, Harith Mahmoud Aziz Al-Tamimi, Susan Mohammed AlRubaei and Rana Hassan Shatti
Department of Horticulture and Landscape, College of Agriculture, Kerbala University, Iraq
*Corresponding author: alaa.ali@uokerbala.edu.iq

Abstract

A factorial experiment 3 x 3 carried out within the design of randomized completely block design. In the vegetable canopy of the Department of Horticulture and landscape, College of Agriculture, University of Karbala, for the season 2018 to study the effect of spraying three levels of fertilizer (Cultivar & karma) are 0, 1 and 2 g. L^{-1} For each of them and the interaction between them in improving some of the vegetative and root characteristics of the seedlings Troyer citrange & Carrizo citrange, the results of the statistical analysis showed: -

- Foliar fertilizer Cultivar at a concentration of 2 g.L^{-1} was superior to the other treatments in the average number of leaves, leaf area, vegetative and root dry weight.
- Fertilizer karma exceeded the concentration of 2 g.L^{-1} in the average number of leaves, chlorophyll and the leaf area compared to the other treatments.
- The concentration 1 g. L^{-1} of Cultivar fertilizer was the best from the other treatments by giving the highest plant height rate compared to the lowest rate recorded in the control treatment.
- The interaction between the treatments resulted in significant differences in most studied vegetative and root characteristics, the treatment Cultivar 1g.L^{-1}. karma 1 g.L^{-1} was recorded the most significant difference in plant height compared to other treatments, while treatment Cultivar 0 g.L^{-1}. karma 2 g. L^{-1} gave The highest rate in both the average number of leaves and the leaf area, compared to the other treatments, while the treatment Cultivar 1 g. L^{-1}. karma 2 g.L^{-1} showed significant difference in the chlorophyll rate compared to other treatments, treatment Cultivar 2 g. L^{-1}. karma 0 g.L^{-1} was the best of the other treatments significantly, by giving the highest rate in both stem diameter and dry weight of the root, The interaction between the treatments did not have any significant effect on the dry weight of the vegetative characteristic throughout the search period.

Keywords : Citrus, seedlings, foliar application

Introduction

Citrus belongs to the Rutaceae family, which includes many species, the most economically important of which is the Citrus, which most citrus belongs to it (Agha *et al.*, 1991 and Al-Hamidawi *et al.*, 2009), It's believed that the original habitat of it the tropics and subtropics between latitudes 40º north and south of the equator (Davies and Albrigo, 1994).

The economic, nutritional, medical and aesthetic importance of the citrus tree lies. In the fact that the fruits are a source of pectin that used in the food industry, the peel of fruits, as well as flowers and small leaves, used as a source for extracting essential oils, citrus fruits are the most important sources of vitamin C and P. It is also contain calcium, phosphorus, iron and potassium salts (Khalifa, 1980).

The most important citrus producing countries are Brazil, China, the United States of America, Mexico, India, Iran, Turkey, Spain and Syria.

As for Iraq, its cultivation is widespread in the central and southern regions; production can hardly meet the need for local consumption except for a short period. Despite the fact that citrus cultivation has passed for a long time due to poor management of land and water and the failure to choose the appropriate assets for the purpose of grafting and neglect of control and fertilization operations, where production reached about 101.86 tons Annually with 5879 fruit trees (A.O.A.D, 2017).

Citrus propagation with seeds, a method that is still used until now in some regions, especially tropical, due to the phenomenon of multiple embryos that characterize most of the citrus seeds. However, the method of propagation by grafting and the production of seedlings with desired varieties has begun to spread and has become a common method in most areas famous for growing citrus fruits, due to the good features of grafted seedlings. Where they bloom after 1-3 years of graft, while seedlings characterized by a relatively long period of juvenility. That may reach for more than 7 years, there is also difficulty in harvesting because, of the height of these trees and the presence of spins, in addition to some of these problems related to the soil. For example, the high percentage of lime, drought and nematodes, while others related to diseases (fungal and viral), insects and the environment (Khafji *et al.*, 1990 and Moreno *et al.*, 1996).

Hybridization between similar plants genetically, within the same family considered one of the methods used to produce assets have spices of a genetic characteristic. That can be used for the purpose of grafting desired varieties cultivated which do not those spices have it as characterized by the characteristics of genetic certain bear different environmental conditions. From these hybrids is Carrizo Citrange & Troyer Citrange, it is stick result of hybrid between sweet oranges & trifoliate oranges. Which characterized by its compatibility with most of the recognized citrus fruits. In which the grafted species are distinguished by the abundance of the load of fruits and the quality of the resulting fruits, in addition to resisting inappropriate conditions such as cold and tolerating infection with some diseases and pests such as rapid viral deterioration and nematodes (Hassan, 2005).

Treatment with foliar application is one of the fast and useful ways to fertilize plants, with mineral elements, whether macro or micro, due to the speed of these elements reaching the plant inside through the stomata on the surface of the leaves and to compensate for the lack of elements quickly and effectively in the event of a shortage of these elements and to avoid any problems Plant (Al-Taha *et al.*, 2014, Al-Tememe *et al.*, 2017).

The aim of this study to know the best concentration and the best foliar application used within this study and its effect in getting these seedlings to the appropriate stage of growth as soon as possible for the purpose of using them in the processes of propagation of citrus fruits by different vegetative methods.

Materials and Methods

A factorial experiment 3 x 3 carried out within the design of (RCBD). In the vegetable canopy of the Department of Horticulture and landscape, College of Agriculture, University of Karbala, Husayniyah district. For the period from 15\3 to 15\7\2018, to study the effect of spraying three levels of foliar application It is (0, 1 and 2) g. L^{-1} of both karma and its fertilizer formula (NPK) 21:21: 21 and Cultivar with fertilizer formula (NPK) 20: 20: 20 and their interaction in improving the vegetative and root growth of citrus stick hybrid Carrizo Citrange & Troyer Citrange, (27 seedlings) were selected as homogeneous as possible to grow, as they were obtained from the horticultural and forestry plant, Al-hindiah district planted in polyethylene bags (1.25 kg), transferred on 1/3/2018 to bags of 5 kg filled with sandy mixture soil in a ratio of 1: 3, where the seedlings were divided into 3 replicates, each replicate contains 9 seedlings, the seedlings were sprayed with study coefficients from 15/3/2018 to 15 / 7/2018 early morning for karma, in the evening of the same day, the Cultivar was sprayed, between one spray and another one month using a 2-liter manual sprinkler after adding 1 cm^3 of the diffuser (brightly) to each concentration for the purpose of reducing the surface tension of the leaves until complete wetness, control treatment was sprayed with distilled water only, and the irrigation process for seedlings was carried out one day before the spraying process in order to increase the efficiency of the seedlings in absorbing the foliar application (Salim & Joudi, 2015).

Irrigation was done regularly based on the need for seedlings, and at the end of the experiment, the data were subjected to statistical analysis using Genstate. The least significant difference tested at 0.05 probability level and the following characteristics measured:

Studied Traits

Plant Height (cm): The height of the growing seedlings for each plant was measured by a metric tape measure and the rate was taken for each treatment.

Number of leaves: number of leaves calculated for each plant and the rate was taken for each treatment.

Stem diameter (mm): The diameter measured for three seedlings per replicate and the rate taken for each treatment using vernia.

$$\text{Leaf area} = \frac{\text{Leaf dry weight (g) X average of harvested area (cm}^2\text{)}}{\text{Average dry weight of the harvested part (g)}}$$

Leaf area: calculated by taking 3 leaves from different parts of each seedling and weighing after separating the leaves from the petioles, taking tablets with an area of 1 cm^2 of the cut leaves, the leaves and leaves tablets of the area were placed in an oven at a temperature of 70º C until the weight has been proven, after the leaf area average calculated according to the following formula (Dvorinc, 1965):

After that, the leafy area of the plant extracted by multiplying the area of one leaf by the number of leaves per seedling and extracting the average for each treatment.

Chlorophyll leaf content: The chlorophyll content in the leaves was estimated by the Chlorophyll meter of the type SPAD - 502 by taking a reading of 3 leaves per (seedlings) and then taking the rate for each treatment and measured in units SPAD UNIT (Minnott *et al.*, 1994).

Shoot dry weight : The shoot separated and washed with water, to remove dust and impurities. The samples placed in paper bags separately and then dried in an oven at 70 ° C for 48 hours and weighed by a sensitive balance (Al-Sahaf, 1989).

Root dry weight : The whole root separated from the vegetative part and washed with water to remove the dust and impurities. The samples placed in paper bags separately and dried in an oven at 70° C for 48 hours, then weighed by a sensitive balance (Al-Sahaf, 1989).

Results and Discussion

Plant Height

The results of Table (1) show a significant effect of cultivar treatment on the height of the plant where the concentration exceeded 1 g. L^{-1} by giving it the highest rate of 145.8 cm compared to the lowest rate of 135.0 cm in the control treatment. The karma treatment did not have any significant effect on this trait for the duration of the study. Whereas, the interaction between these two substances had a significant effect, as the treatment 1 g. L^{-1} cultivar and 1 g. L^{-1} karma outperformed the other treatments by giving them the highest average plant high of 150.7 cm compared to the other treatments. The increase in plant height at concentration 1 g. L^{-1} and both foliar application may be due to the effect of their content of the three macro elements NPK within this limit, which led to stimulation of cell elongation and consequently an increase in plant height compared to the other treatments or the reason may be due to the sufficiency of stem cell response at These two foliar application interaction at this level although not the largest level (Al-Rubaie *et al.*, 2018).

Number of Leaves

It is note from Table (2) that the treatment with cultivar gave significant differences in its effect on the characteristic of the number of leaves, as the concentration exceeded 2 g.L^{-1} over the other treatments by giving it the highest rate of 217.3. As for the treatment with karma, it also led to a significant effect on the rate of this trait, which reached a maximum at a concentration of 2 g.L^{-1} as it reached 224.2 compared to the lowest rate recorded in the control treatment, which amounted to 192.0.

It is clear from the same table that the interaction between these two substances had a significant effect, as the transactions differed between them, and the treatment excelled 0 g. L^{-1} cultivar and 2 g. L^{-1} karma over the rest of the transactions with the highest average rate of 248.7 compared to the lowest rate which was in the control treatment as it reached 142.7.

The reason for the increase in the number of leaves when increasing the concentration and for both foliar application may be due to the role of macro mineral elements in compensating the plant's need for mineral elements necessary for photosynthesis, respiration and various metabolic processes in sufficient quantities in the process of cell division and elongation and activation of many enzymes necessary in the production of important hormones Such as oxins, gibberellins, and cytokines, which positively affect the cell division process, which leads to encouraging growth, increasing the formation of leaf buds, and thus increasing the number of leaves (Al-Tamimi, 2010).

Stem Diameter

By noting the results presented in Table (3), it was found that there were no significant differences for the treatment with karma and cultivar materials and for all concentrations in their effect on the characteristic of the stem diameter rate throughout the duration of the study.

As for the interaction between these two articles, it was observed that a significant effect of treatment with these two foliar application reached a maximum at treatment 2 g. L^{-1} cultivar and 0 g. L^{-1} karma, which scored 10.68 mm, compared to the lowest rate recorded in the control treatment, which was 8.51 mm.

The increase in the stem diameter in this treatment may be due to the influence of the macro elements N.P.K on cell division and expansion and consequently the increase in the stem diameter (Al-Temimi *et al.*, 2019).

Leaf Area

From Table (4) It is noted that a significant effect was achieved with respect to the cultivar treatment in the rate of leafy area, as the concentration was recorded at 2 g. L^{-1} the highest rate was 704.0 cm^2 compared to the lowest rate recorded in the control treatment, which reached 523.0 cm^2. The same applies to karma, as it achieved a concentration of 2 g. L^{-1}, the highest rate was 736.0 cm^2 compared to the lowest rate recorded in the control treatment, which reached 550.0 cm^2. also from the same table the interaction between the different factors had a significant effect on the rate of this trait, reaching its highest level in the treatment 0 g. L^{-1} cultivar and 2 g. L^{-1} karma which gave 874.0 cm^2 compared to the lowest record level in the control treatment which was 331.0 cm^2.

Leaf content of Chlorophyll

The results of Table (4) confirmed the occurrence of a significant effect in relation to the treatment with cultivar as the treatment in the two concentrations 1 and 2 g. L^{-1} did not differ from each other significantly as they recorded 61.44 SPAD and 60.99 SPAD respectively, while the difference was significant with the control treatment, which gave the lowest rate of 44.89 SPAD.

The treatment with karma resulted in a concentration exceeding 2 g. L^{-1} over the rest of the transactions, with the highest rate of 61.55 SPAD compared to the lowest rate recorded in the control treatment, reaching 51.66 SPAD.

The interaction between the transactions resulted in a significant difference between them, as the treatment gave 1 g. L^{-1} cultivar and 2 g. L^{-1} karma had the highest chlorophyll rate of 66.43 SPAD compared to the control treatment, which gave the lowest rate of 34.02 SPAD. The increase in the rate of chlorophyll for both foliar application may be due to the role of the important and direct nitrogen component in the formation of the chlorophyll by its participation in the synthesis of Prophyrins units included in its synthesis (Singh, 2003; Al-Tamimi *et al.*, 2017 and Al-Rubaie *et al.*, 2018).

Shoot dry weight

The results shown in Table (6) had a significant effect of the cultivar treatment on the dry weight characteristic of the shoot, where the concentration exceeded 2 g. L^{-1} over the rest of the treatments and gave the highest rate of 35.23 g compared to the rest of the treatments. The treatment with karma did not have any significant effect in this trait throughout the study period, as was the case with regard to the interaction between the treatments, which did not significantly affect the rate of this trait.

Root dry Weight

The results of Table (7) showed the effect of plants on different concentrations of cultivar in the root dry weight characteristic, where the concentration exceeded 2 g. L^{-1} over the rest of the treatments and gave the highest rate of 14.96 g compared to 12.20 g which was recorded in the control treatment. The treatment with karma did not have any significant effect on this trait on all concentrations used in this study for the duration of the study. While the interaction between the different concentrations of these two articles resulted in significant differences between the treatments, they were evident at the concentration of 2 g. L^{-1} cultivar and 0 g. L^{-1} karma it recorded the highest rate of 18.63 g. Compared to other treatments.

The increase in the average root dry weight may be due to the increase in the leafy area exposed to sunlight (Table 4), which increases the biochemical processes, activates the carbon representation and increases the nutrients manufactured inside the leaves, thus increasing the dry weight of the root (Table 6) and the dry weight of the root (Al-Sahaf, 1989).

Table 1 : Effect of foliar application and interaction on Plant high (cm)

Cultivar g.L^{-1} / Karma g.L^{-1}	0	1	2	Average
0	132.0	137.2	149.2	139.4
1	143.5	150.7	128.0	140.7
2	129.5	149.5	141.3	140.1
Average	135.0	145.8	139.5	
L.S.D. 0.05	Cultivar 7.26	Karma n.s	Interaction 12.58	

Table 2 : Effect of foliar application and interaction on Leaves number

Karma g.L^{-1} \ Cultivar g.L^{-1}	0	1	2	Average
0	142.7	227.7	205.7	192.0
1	228.0	159.0	215.3	200.8
2	248.7	193.0	231.0	224.2
Average	206.4	193.2	217.3	
L.S.D. 0.05	Cultivar 19.34	Karma 19.34	Interaction 33.49	

Table 3 : Effect of foliar application and interaction on Stem diameter (mm)

Karma g.L^{-1} \ Cultivar g.L^{-1}	0	1	2	Average
0	8.51	10.20	10.68	9.80
1	9.98	9.72	9.04	9.58
2	9.46	9.51	8.97	9.31
Average	9.32	9.81	9.56	
L.S.D. 0.05	Cultivar n.s	Karma n.s	Interaction 1.675	

Table 4 : Effect of foliar application and interaction on leaf area (cm^2)

Karma g.L^{-1} \ Cultivar g.L^{-1}	0	1	2	Average
0	331.0	623.0	698.0	550.0
1	365.0	653.0	725.0	581.0
2	874.0	632.0	701.0	736.0
Average	523.0	636.0	704.0	
L.S.D. 0.05	Cultivar 166.5	Karma 166.5	Interaction 288.4	

Table 5 : Effect of foliar application and interaction on leaf content of chlorophyll (SPAD)

Karma g.L^{-1} \ Cultivar g.L^{-1}	0	1	2	Average
0	34.02	59.02	61.93	51.66
1	42.07	58.87	61.42	54.12
2	58.58	66.43	59.63	61.55
Average	44.89	61.44	60.99	
L.S.D. 0.05	Cultivar 4.026	Karma 4.026	Interaction 6.973	

Table 6 : Effect of foliar application and interaction on Shoot dry weight (g)

Karma g.L^{-1} \ Cultivar g.L^{-1}	0	1	2	Average
0	34.07	27.37	36.50	32.64
1	32.00	35.97	34.93	34.30
2	30.07	26.40	34.27	30.24
Average	32.04	29.91	35.23	
L.S.D. 0.05	Cultivar 4.476	Karma n.s	Interaction n.s	

Table 7 : Effect of foliar application and interaction on Root dry weigh (g)

Karma g.L^{-1} \ Cultivar g.L^{-1}	0	1	2	Average
0	14.00	11.40	18.63	14.68
1	11.60	13.60	12.80	12.67
2	11.00	14.57	13.43	13.00
Average	12.20	13.19	14.96	
L.S.D. 0.05	Cultivar 2.601	Karma n.s	Interaction 4.505	

References

A.O.A.D (2017). Arab Agricultural Statistics Yearbook – vol. No. (37)

Agha, J.T. and Dawood, A.D. (1991). Produce of evergreen fruits. University of Mosul. Ministry of Higher Education and Scientific Research. Iraq.

Al-Hmedawi, A.M.S., Al-Asedy, A.A. and Al-Sagheer, S.H.H. (2009) Effect of spraying with GA_3, NAA, Fe and Zn on seedling growth sour Orange (*Citrus aurantium* L.). Euphrates Journal of agriculture science, 1(2): 38-43.

Al-Khafaji, M.A.; Suhail, A.A. and Abdul-Razzaq, A.M. (1990). Evergreen Fruit production. Ministry of Higher Education and Scientific Research. Baghdad University, Iraq.

Al-Rubaie, S.A.F.; Alaa, A.A.; Aziz, H.M. and Manar, A. (2018). The effect of foliar spraying with NPK on the growth of Olive transplants *Olea europea* L. variety Khudhery.

Al-Sahaf, F.H. (1989). Applied Plant Nutrition. Ministry of Higher Education and Scientific Research. Baghdad University, Iraq.

Al-Taha, A.H.M. and. Noor Ra'ad Abdulkareem Al Mubarak (2014). The effect of spraying with herbal extract Kelpak and Compound Fertilizer N.P.K. In concentrations of nitrogen, phosphorous and potassium And the total protein in the leaves and fruits of date palm. Basra Research Journal (Operations) 40(1): 65-84.

Al-Tamimi, H.M.A. (2010). Effect of IAA concentration and foliar application on growth of budding apple seedlings. Master Thesis Musayyib Technical College. Middle Euphrates University.

Al-Tamimi, H.M.A.; Alaa, A.A. and Zena, M.M. (2019). Effect of humic acid and seaweed extract (ALGA) on growth characteristics and nutrient content of local apricot seedlings *Prunus armeniaca* L. IOP Conference Series: Earth and Environmental Science 388. 012071

Al-Tememe, Z.A.M.; Alaa, A.A.; Muna, H.S. and Abeer, Q.K. (2017). The physiological study of the effect of foliar spray of humic acid and compound fertilizers N.P.K on some chemical characteristics of date palm cultivar Maktoom in the city of Kerbala. Journal of Kerbala for Agricultural Sciences, 4(1):1-13.

Davies, F.S. and Albrigo, L.G. (1994). Citrus Crop production Science in Horticulture .USA, UK, CAB International. Printed by Red Wood Books. Wiltshire. UK.

Dvorinc, V. (1965). Lucraripactic de ampelographic E. Didacticta spedagogica Bucureseti R.S. Romania.

Hassan, A.A.M. (2005) Methods of plant breeding. Arab House for Publishing and Distribution. First edition. Egypt, 393.

Khalifa, T. (1980). Citrus trees in the Kingdom of Saudi Arabia. Agricultural Research Center Najran. Ministry of Agriculture and Water. Riyadh. Kingdom of Saudi Arabia.

Minnotti, P.L.; Halseth, D.E. and Sieczka, J.B. (1994). Chlorophyll measurement to assess the nitrogen status of potato varieties. Hort.Science., 29(12): 1497-1500.

Moreno, J.J.; Lucena J.J. and Carpena O. (1996). Effect of the Iron supply on the nutrition of different Citrus variety /rootstock combinations using DRIS. Journal of Plant Nutrition. 19(5): 689-704.

Salim, Q.T.S. and Judy, A.T. (2015). Effect of liquid organic fertilizer and spraying with gibberellic acid and anti-transpiration (Stress Relief) in some vegetative growth characteristics of apple seedlings (Anna variety). Journal of Iraqi Agricultural Sciences, 46(5): 784-792.

Singh, A. (2003). Fruit physiology and production .5th ed. Kalyani publishers. New Delhi, 11002.