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RELATIONSHIP OF THE GROWTH AND FRUITING OF 'BALADY 'MANDARIN TREES BY SPRAYING SALICYLIC ACID AND CITRIC ACID

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ABSTRACT

During 2020 & 2021 seasons, 10 years old 'Balady' mandarin trees (*Citrus reticulata*, Blanco) growing in sandy soil, at private orchard located at Al-Kassara watercourse, El-Salhia El-Gadida, Sharkia Governorate, Egypt were subjected to five gradual concentrations (100, 200, 300, 400 and 500 ppm) of salicylic acid (SA) or/and citric acid (CA). The study aimed to examine the effect of SA and CA each one alone or in combination on vegetative growth, yield and fruit quality of the 'Balady' mandarin. Using SA or/and CA was very effective in stimulating vegetative growth, leaves main pigments, yield and its components as well as fruit quality, relative to the control. Furthermore, concerning the two vegetative growth parameters, yield and fruit quality parameters spraying SA present superior effect rather than spraying CA. However, the combined application of SA and CA was significantly higher than using any one alone. Furthermore, non-significant differences were observed between the two highest concentrations (400 and 500 ppm). It could be concluded that treating Balady mandarin grown under sandy soil with SA and CA each one at 400 ppm seems necessary for improving growth, productivity and fruit quality of 'Balady' mandarin.

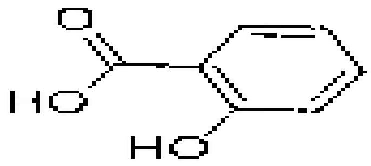
keywords*:* Citrus; *Citrus reticulata;* mandarin; salicylic acid; citric acid; productivity; fruit quality

INTRODUCTION

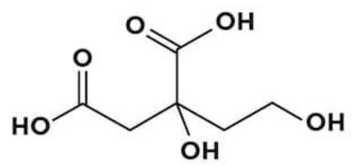
Citrus is the most famous genus of family Rutaceae. Citrus fruits are suggested to be the most cash crops all over the world, it occupies the third position between fruit crops in the world after grapes and apples. The total production of the citrus in the world reached 138 million-ton fruits (**FAO, 2018**). In Egypt, the cultivated acreage of total citrus reached 456082 feddan. or in terms of production, which amounted to 4247000 tons (**Statistics - Ministry of Agriculture, 2020**). However, of total citrus, 'Balady' mandarin (*Citrus reticulata*, Blanco) is the highest second rank after oranges cultivated and produced in Egypt. During last years, mandarin cultivated area reported 97622 feddans; producing 861 thousand tons. Under Egyptian conditions, it contributes 20.27% of total citrus production. Currently, most of 'Balady' mandarin orchard suffer from biotic and abiotic stress as an example, climate change, soil composition, nutrition, irrigation management, cultivar and rootstock etc. All of these factors may cause vegetative growth weakness, resulting in reduced flowering and, as a result, lower yield and quality in 'Balady' mandarin fruit. To mitigate the negative effects of these factors on 'Balady' mandarin tree growth and productivity, the trees were treated with substances such as salicylic acid and citric acid.

Salicylic acid (SA) from Latin salix willow tree in widely used in organic synthesis and function as a plant hormone. It is derived from the metabolism of salicin. It is phenolic phytohormone found in plants with role in plant growth, development, photosynthesis, transpiration as well as uptake and transport nutrients (**Aly, 2015**). SA at concentrations from 200 to 400 mg/l enhanced leaf area, fruit yield and physicochemical quality when applied on Navel orange (**Ali** & **El Zayat, 2019).**

Citric acid (CA) is a natural and organic antioxidant compound has as auxinic action, it provided disease control, cell division and promotion of lipase, synergistic effect on rooting and improving growth, flowering, yield and fruit quality of fruit trees (**Elad,1992; Ahmed *et al.*, 2003; Abo El-Komsan *et al.*, 2003 and Abdelmoniem *et al.*, 2019).** Because of its low pH content, accessibility, and low cost, Citric acid is an excellent choice for use in such treatments. The application of citric acid to the leaves promotes the formation of green colour in peach, *Actinidia chinensis* and helianthus leaves (**Tagliavini *et al.*, 2000; Kosegarten *et al.*, 2001**).



Structure of salicylic acid molecule ($C_7H_6O_3$), molecular weight =138.12



Structure of Citric acid molecule ($C_6H_8O_7$)

Therefore, a comprehensive study was carried out to assess the effect of spraying salicylic acid (SA) and Citric acid (CA) separately or in combination on the vegetative growth, yield and fruit quality of Balady mandarin.

Materials and Methods:

The present study was carried out during 2020 and 2021 seasons on one hundred eight uniforms in vigor Balady mandarin, grown in private orchard located at Al-Kassara watercourse, El-Salhia El-Gadida, Sharkia Governorate, Egypt. Where, the soil texture is sandy, since water table depth is not less than one and half meters. The chosen 'Balady' mandarin trees are ten-year-old buddied on *Citrus aurantium* and planted at 3*4 meters apart. Drip irrigation system was adapted in the orchard using water of underground well.

Soil analysis: A composite sample of experimental orchard soil was collected and subjected to Physical and chemical analysis according to **Walsh & Beaton (1986)**. The obtained data are shown in Table (1).

Experimental work: The present study included two factors and the treatments were arranged in split plot design. Factor A including salicylic acid (SA) treatments (0.0, 100, 200 300, 400 and 500 ppm) occupy the main plot, however factor B including citric acid (CA) treatments (0.0, 100, 200, 300, 400 and 500 ppm) take place at the spilt plot. The two materials were sprayed three times yearly; (at the beginning of February, beginning of March and the third spraying at beginning of May). Each treatment was replicated three times, one tree per each. Triton B at 0.05 ml/liter (wetting agent) was added to all spraying solutions.

Different measurement and determinations: Sixteen shoots from spring growth cycle were chosen on four labeled branches. The following parameters were determined:

Vegetative growth characters: At the second week of June during both seasons, twelve mature leaves located at the middle part of one-year-old shoots were picked from each replicate according to **Ibrahim (2010)**, leaf area (cm^2) was estimated utilizing an area meter (The Cl, 202 Portable Laser Leaf Area Meter). The average main shoot length (cm) was recorded as a result of measuring the length of eight shoots/tree, from the four main geographic directions of the tree, two shoots per each direction.

Measurements of leaf pigments: Samples of six mature and fresh leaves, from those located at the middle part of shoots, were taken at the second week of June. The leaves cut into small pieces then 0.5 g weight from each sample was taken and extracted by 25% acetone in the presence of little amounts of Na_2CO_3 then filtered. The extract was completed to a known volume (20 ml) with acetone 85%. A portion of this extract was taken for the determination of chlorophylls a & b and total chlorophyll calorimetrically (as mg/100 g F.W) at wave length 662 and 644 nm for chlorophylls a and b, respectively. Concentration of each pigment was calculated by using the following equations according to **Walsh & Beaton (1986)**.

$$\text{Chlorophyll a} = (9.784\ X\ E\ 662) - (0.99\ X\ E\ 644) = \text{mg/100g FW}$$

$$\text{Chlorophyll b} = (21.426\ X\ E\ 644) - (4.65\ X\ E\ 662) = \text{mg/100 g FW}$$

Total carotenoids = (4.965 x E440) – 0.268 (Chlorophyll a + b) = mg/100 g FW

Total chlorophyll = 20.2 (E 644) + 8.02 (E 662) (mg/100 g FW)

Where: E= Optical density at a given wavelength.

Measurement of yield as well as physical properties of fruit: The fruit were harvested when the TSS/acid ratio in the juice of the check treatment reached to 8.0 in the two experimental seasons. The number of fruits per tree was recorded at harvest time and the average fruit weight (g) was determined. Then the yield per tree (kg) was mathematically calculated as a sum of multiply fruit weight × fruit number. From the yield of each tree, eight fruits were randomly taken; the following physical and chemical characteristics were studied: Fruit weight (g), Fruit peel (g) and pulp weight (g), peel thickness, Percentage of total soluble solids (TSS%) were determined in juice according to **Ranganna (1977)**. Percentage of titratable acidity (TA) as grams of citric acid per

100 grams of fruit juice using titration against with 0.1 N NaOH, According to **A.O.A.C, (2000)**, Percentage of reducing and total sugars in fruit juice by using Lane and Eynon volumetric method, according to **Ranganna (1977)**.

Statistical analysis of data: All obtained data were tabulated and subjected for the proper statistical analysis; by analysis of variance (ANOVA) using the statistical package MSTATC Program. Comparisons between means of different treatments on 'Balady' mandarin were made by using LSD at $p \leq 0.05$ (**Snedecor & Cochran, 1990**).

Results and discussion:

1- Vegetative growth:

Data concerning the effect of salicylic and citric acid at different concentration on vegetative growth characters namely; shoot length (cm) and leaf area (cm^2), during 2020 and 2021 years are given in Table (2). It is clear from the obtained data that regardless the concentration used to spray the two compounds at different concentrations (100 ppm to 500 ppm) was capable to improved 'Balady' mandarin shoot length and leaf area (cm^2) rather than control treatment**.** Noteworthy that, gradual increasing SA or/and CA concentration from 100 to 500 ppm was parallel with gradual and significant in shoot length (cm) and leaf area (cm^2) of 'Balady' mandarin during the two experimental seasons. Furthermore, concerning the two vegetative growth parameters, spraying SA present superiority effect than spraying CA, however, the combined application of the two materials was significantly higher than using any one of them. These data were true during the two experimental seasons 2020 and 2021.

Regarding the interaction between spraying SA and CA for the two vegetative growth parameters (shoot length and leaf area) it was significantly in the two experimental seasons as illustrated in Table (2). It is clear that spraying 'Balady' mandarin with salicylic acid accompanied with spraying citric acid together at 500 ppm recorded the higher shoot length and leaf area rather than control or other treatments. On the other hand, the lowest values of shoot length and leaf area were recorded on the untreated trees in the two experimental seasons, respectively.

The promoting effect of SA on the shoot length, number of leaves and leaf area was attributed to its important roles on activating cell division and the biosynthesis. In addition, **Raskin (1992 a & b) and Samara *et al.* (2012)** mentioned that enhancing effect of salicylic acid on the availability and movement of nutrients could result in stimulating different nutrients in the leaves. Furthermore, foliar application of salicylic acid remarkably enhanced the leaf area of other fruit trees (**Samara *et al.*, 2012; Khalil, 2014; Ahmed *et al.*, 2015; Barakat *et al.*, 2015**; **Abdel-Salam, 2016; Ali** & **El Zayat, 2019** and **Farag, 2019).**

The positive effect of CA on vegetative growth characters of 'Balady' mandarin might be attributed to their vital role in protecting the plant cell from senescence, preventing the free radicals from oxidation of lipids as well as their effect in enhancing cell division and building of organic acids and promotes the formation of green colour to the leaves and the biosynthesis of organic foods. (**Elade, 1992; Rao *et al.*, 2000; Tagliavini *et al*., 2000; Kosegarten *et al*., 2001 and Abdelmoniem *et al.*, 2019**). Citric acid is responsible for enhancing peroxidase and catalase activity that catalyze the oxidation of H_2O_2, which is toxic to cell and impairs the resistance of plants against various diseases (**Rao *et al.*, 2000**). Moreover, the citric acid is essential in regulation of metabolism and are responsible for physiological processes such as cytokinins and gibberellins (**Samiullah *et al.*, 2000 and Abdelmoniem *et al.*, 2019**).

2- Effect of leaves pigments:

Obtained data in Tables (3 and 4) showed that the leaves chlorophylls and total (in terms of chlorophyll a, chlorophyll b and total chlorophyll) and carotenoids contents of 'Balady' mandarin were remarkable increased due to spraying SA or CA and their combinations during the two experimental seasons, in comparison with those of untreated trees. It's clear from this Table that, treating Balady mandarin with SA or/and CA significantly was very effective in enhancing chlorophylls a, b and total chlorophyll in leaves over the check treatments. There was a gradual promotion on these pigments with increasing SA and CA concentrations from 100 to 500 ppm, without significant promotion occurred among the least two concentrations namely 100 ppm neither for salicylic nor for citric acid. These results were true for chlorophyll a, b and total chlorophyll, during the two experimental seasons. The highest chlorophyll a (7.99 & 8.49 mg/100g FW), chlorophyll b (4.19 & 4.39 mg/100g FW) and total chlorophyll (12.18 &12.66 mg/100g FW) was obtained when the Balady mandarin trees received the two acids in combination at highest concentrations (500 ppm). However, non-significant differences were observed between the two highest concentrations 400 ppm and 500 ppm, neither individual application nor for combined application. On the opposite side, the untreated trees present the lowest chlorophylls contents (6.23 & 6.28 mg/100g FW for chlorophyll a; 2.81 & 2.79 mg/100g FW for chlorophyll b and 9.04 & 9.07 mg/100g FW for total chlorophyll). It is worth to mention that leaves total carotenoids contents tack the same line as chlorophylls contents, the data tack similar trend during the two successive seasons. Furthermore, concerning the interaction between the two examined compounds (salicylic and citric acids), it was significant in the 2020 and 2021 seasons.

Similar results concerning the positive effect of salicylic and citric acids on leaves pigments were observed by certain authors in citrus trees or other fruit trees, such as **Elade, 1992; Rao *et al.*, 2000; Samiullah *et al.*, 2000; Samara *et al.*, 2012; Khalil 2014; Ahmed *et al.*, 2015; Barakat *et al.*, 2015; Abdel-Salam, 2016 and Farag (2019).**

3- Yield and its components:

Data presented in Tables (5 and 6) shows the effect of spraying SA or/and CA each one at 100 to 500 ppm, alone or in combinations, on the yield (kg/tree), number of fruits/tree and average fruit weight (g) of Balady mandarin trees, during 2020 and 2021 seasons. This Table showed that the two examined compounds in single or combined application were capable to significantly increased yield and fruit weight during the two experimental seasons.

During the second season, the data showed that increasing the two compounds concentrations of SA and CA from 100 to 500 ppm was parallel to significant increment in yield (kg/tree), fruit numbers/tree and fruit weight (g). However, during the first experimental season (2020) only the higher concentrations 400 and 500 ppm success to increase the yield, fruit number and average fruit weight. Contrary the lowers concentrations (100, 200 and 300 ppm) failed to increase the number of fruits per tree. However, spraying the two compounds has a significant effect on the yield/tree at the same season, this increment can be explained by the important role of salicylic and citric acids in enhancing fruit weight (g).

The same Table showed that, all treatments included the two compounds was superior than spraying each one alone. However, the interactions between SA and CA was significant. The trees received the combined application of the two compounds at higher concentration (500 ppm) present the highest yield/tree (35.6 & 37.1 kg/tree), fruit weight (149.0 & 152 g), the highest fruit number/tree (239.1 & 242.7). On the opposite side, untreated trees present the lowest yield (21.9 & 22.2 kg/tree), fruit weight (116.2 & 115.9 g) and fruit number/tree (190.7 & 190.2), during both seasons, respectively.

3-1-Effect on fruit physical properties:

Data concerning the effect of salicylic and citric acids on 'Balady' mandarin fruit physical properties during 2020 and 2021 seasons are illustrated in Tables (6 and 7). Data of the both experimental seasons revealed that, spraying 'Balady' mandarin trees with SA or/and CA significantly enhanced fruit weight and pulp weight (g) rather than control treatment. Increasing the concentration of SA or/and CA from 100 ppm to 500 ppm was remarkable and gradually increased the fruit weight and pulp weight (g). However, the trees treated with highest SA and CA concentrations (500 ppm) present the highest promotion on fruit physical characteristics (fruit weight, pulp and peel weight and peel thickness). Furthermore, non-significant differences were observed between the two highest concentrations, neither for SA nor for CA and their combinations, during the two experimental seasons. contrary, untreated trees present the lowest fruit weight, pulp weight, peel weight, during the two experimental seasons.

The interactions between the two examined compounds had significant promote effect on fruit weight, pulp weight and peel weight. However, the trees sprayed with the higher levels of the two compounds (SA at 500 ppm complained with CA at 500 ppm) produced the highest pulp weight (116.9 & 119.6 g) and peel weight (32.4 & 33.2 g), during 2020 and 2021 seasons, respectively. On the opposite side, untreated trees produced the lowest pulp weight (89.1 & 88.5 g) and peel weight (27.1 & 27.3 g) during the two experimental seasons, respectively. During the two experimental seasons, all salicylic or/and citric acids failed to varied significantly the shape index of Balady mandarin fruits. These findings can be explained by the similar effects of these two compounds on fruit length and fruit diameter during the two experimental seasons.

The beneficial effect of SA and CA on fruit physical properties of Balady mandarin can be explained as follows: The effect of salicylic acid on fruit dimensions, pulp and peel weights (g) may be due to the various functions of salicylic acid in fruit growth and fruit quality (such as activates some important enzymes, proteins, water turgor, photosynthesis and photosynthesis pigments and stimulate mineral uptake such as potassium and boron **(Tagliavini *et al.*, 2000; Kosegarten *et al*., 2001; Hayat and Ahmed, 2007 and Hayat *et al.*, 2012 & 2013)**. Also, salicylic acid is responsible for improving water consumption and leaf water content that can be lead to improve fruit growth (**Rajasekaran and Blum,**

1999; Masoud and El-Sahrawy, 2012; and **Supapvanich *et al.* 2017 a&b)**. Furthermore, SA also reported to promote growth by increasing photosynthetic activity (**Ngullie *et al.* 2014; Ali** & **El Zayat, 2019)** leading to proper supply of carbohydrates to the fruits. Similar finding was also observed by **Singh *et al*. (2001); Zhang *et al.* (2003); Wang *et al.* (2010); and Ngullie *et al.* (2014).** Furthermore, the positive effect of citric acid on fruit physical properties of 'Balady' mandarin and other fruit trees were previously reported by: **Maksoud *et al* (2009)** on Chemlali olive fruits **Abdelmoniem *et al.* (2019)** on Washington navel orange trees and **Mohamed *et al.* (2015)** on grapevines**.** The important role of CA on enhancing mineral elements uptick and stimulating some important biological functions in plant cells was able to explain its favorable effect on fruit physical properties, which found in this work. Furthermore, it can provide disease control, cell division and promotion of lipase, synergistic effect on and improving yield and fruit physical properties quality of Balady mandarin and other fruit trees (**Elad,1992; Ahmed *et al.*, 2003; Abo El-Komsan *et al.*, 2003 and Khiamy, 1999**).

3-2-Fruit chemical properties:

Data concerning the single or companied effects of SA or/and CA at different concentrations, on Balady mandarin fruit juice total soluble solids, reducing sugars and total sugars during 2020 and 2021 seasons are illustrated in Tables (8 and 9). Tables (8 and 9) shows that spraying SA or/and CA were capable to causing significant promotion in TSS % and sugars contents (reducing and total sugars %) in fruit juice of Balady mandarin rather than the control trees during the two experimental seasons. This promotion was gradual and parallel with increasing SA and CA. However, SA concentrations showed superior effect rather than CA treatments. Furthermore, the trees received the two materials in combination present higher and significant TSS%, reducing and total sugars % than those received each one alone. The date takes the similar trend during the two seasons. It is clear from these Tables that non-significant differences were observed between the higher concentrations (400 and 500 ppm) during the two experimental seasons.

The interactions between the two examined compounds (SA and CA) on TSS%, reducing sugars% and total sugars% were significant. The trees received the highest SA and CA concentrations produced the higher and significant concentrations of TSS (12.2 & 12.6%), reducing sugars (4.5 & 4.8%) and total sugars (8.75 & 8.92%). On the opposite side, un treated trees present the lowest concentrations of TSS (10.2 & 10.1 %), reducing sugars (3.1 & 3.2%) and total sugars (7.21 & 7.02%), during the two experimental seasons, respectively. On the other hand, data illustrated in Table (9) shows that all SA and CA treatments failed to significantly varied the titratable acidity of Balady mandarin fruits juice, except those treated with SA and CA in combination each at 400 ppm or 500 ppm during the second season, whereas the juice titratable acidity decreased significantly comparison to untreated trees.

The promotion effect of SA and CA on fruit chemical properties of 'Balady' mandarin that showed in the present study was also noticed by some local and foreign authors on citrus or other fruit trees such as **Khiamy (1999); Abo El-Komsan *et al*. (2003); Ahmed *et al.* (2003); Ahmed & Seleem (2008); Hayat *et al.* (2013); Abd El-Megeed (2015); Barakat *et al.* (2015);**

Ibrahim *et al.* (2017); Mohamed (2017); Ali & **El Zayat (2019); Farag (2019).**

This important roles of SA concerning increasing total soluble solid and sugars in Balady mandarin fruit can be explained by its effect on enzyme activation, cellular membrane transport processes and translocation of assimilates, anion neutralization, which is essential in maintenance of membrane potential and osmotic potential regulation, which is one of the important mechanisms in the control of plant water relations (**Sadeghipour & Aghaei, 2012; Hayat *et al.*, 2013; Abd El-Megeed, 2015; Barakat *et al.*, 2015; Ibrahim *et al*., 2017; Mohamed, 2017 & 2019; Kheder, 2018 and Farag, 2019).** Furthermore, CA as antioxidant can plays an important role in fruit trees metabolism including many physiological aspects such as building and translocation of carbohydrates, photosynthesis, membrane function, water uptake and tolerance to biotic and abiotic stress.

These roles can explain TSS and sugar contents in fruit juice (**Khiamy, 1999; Ahmed *et al.* 2003; Abo El-Komsan *et al*. 2003; Ahmed & Seleem, 2008 and Abdelmoniem *et al.*, 2019**).

Conclusion: It is clear from the obtained data that, under sandy soil conditions in Sharkia Governorate, spraying salicylic acid (SA) and citric acid (CA) can play a beneficial role in enhancing 'Balady' mandarin trees growth and productivity as well as fruit physical and chemical properties. The obtained data also revealed that increasing SA or/and CA concentrations were associated with improvement of physicochemical quality of Balady mandarin fruits. Non-significant differences were observed between the two highest concentrations (400 and 500 ppm). In order to improve the growth and productivity of Balady mandarin trees, it is recommended to spray Balady mandarin trees grown under sandy soil conditions with SA and CA at 400 ppm three times yearly.

Table (1): Physical and chemical analysis of experiment orchard soil.

Physical properties				**Chemical properties**		
Texture	**Sand (%)**	**Silt (%)**	**Clay (%)**	**N (%)**	**Na^+ (meq/l)**	**$CaCO_3$ %**
Sandy	91.0	6.00	3.00	0.08	9.0	4.0
OM (%)	**pH** (1:2.5 extract)	**EC** (1:2.5 extract) (dsm^{-1}) 1cm/ 25°C		K^+ (meq/l)	P (Olsen, meq/l)	Ca++ (meq/l)
0.432	8.1	1.35		0.5	0.22	3.8

Table (2): Effect of spraying salicylic acid (SA)and citric acid (CA) on shoot length (cm) and leaf area (cm2) of Balady mandarin, during 2020 and 2021 seasons

Treatments	Shoot length (cm)						
	Season, 2020						
	SA 0.0 ppm	**SA 100 ppm**	**SA 200 ppm**	**SA 300 ppm**	**SA 400 ppm**	**SA 500 ppm**	**Mean B**
CA 0.0 ppm	12.2	14.1	16.9	18.3	20.1	21.9	17.3
CA 100 ppm	13.3	15.2	17.7	18.9	21.2	22.2	17.9
CA 200 ppm	14.2	16.2	18.4	19.8	21.9	23.0	18.9
CA 300 ppm	14.9	17.0	18.9	20.1	22.4	23.8	19.5
CA 400 ppm	15.5	17.5	19.7	21.6	23.5	24.1	20.3
CA 500 ppm	15.6	17.7	19.9	21.9	23.9	24.3	20.6
Mean A	**14.3**	**16.3**	**18.6**	**20.1**	**22.2**	**23.2**	
New LSD $_{5\%}$	**A= 1.1 ; B=1.2 ; AB= 1.8**						
	Season, 2021						
CA 0.0 ppm	11.9	15.3	17.2	19.4	21.3	22.0	17.9
CA 100 ppm	12.9	16.5	17.9	20.7	22.3	23.9	19.0
CA 200 ppm	13.8	17.2	18.7	21.5	23.6	25.4	20.0
CA 300 ppm	14.4	17.9	19.4	21.9	24.1	26.7	20.7
CA 400 ppm	15.9	18.0	19.9	22.6	25.2	27.2	21.5
CA 500 ppm	16.1	18.2	20.1	22.7	25.9	27.2	21.7
Mean A	14.2	17.2	18.9	21.5	23.7	25.4	
New LSD $_{5\%}$	**A= 0.9 ; B= 1.4 ; AB= 2.1**						
	Leaf area (cm^2)						
	Season, 2020						
CA 0.0 ppm	30.1	32.2	34.6	39.8	42.1	44.4	**37.2**
CA 100 ppm	32.2	33.3	36.9	41.2	44.9	45.7	**39.0**
CA 200 ppm	33.4	34.9	37.7	42.9	45.7	46.9	**40.3**
CA 300 ppm	34. 9	36.7	38.9	43.8	47.2	47.7	**41.5**
CA 400 ppm	35.7	39.0	39.2	43.9	48.7	48.3	**42.8**
CA 500 ppm	36.6	39.8	40.9	44.1	49.2	49.2	**43.3**
Mean A	**33.8**	**36.0**	**38.0**	**42.6**	**46.3**	**47.0**	
New LSD $_{5\%}$	**A= 1.9 ; B= 1.7 ; AB= 2.5**						
	Season, 2021						
CA 0.0 ppm	30.7	33.2	39.7	40.9	46.9	47.7	**39.9**
CA 100 ppm	32.9	36.8	41.1	41.2	48.9	48.8	**41.7**
CA 200 ppm	34.1	38.9	42.0	44.4	49.8	49.7	**43.2**
CA 300 ppm	35.7	39.7	43.0	45.9	50.3	50.9	**44.3**
CA 400 ppm	37.3	40.7	44.2	46.9	51.9	51.9	**45.5**
CA 500 ppm	38.2	41.2	44.3	47.8	51.9	52.1	**45.9**
Mean A	**34.8**	**38.4**	**42.4**	**44.5**	**49.9**	**50.2**	
New LSD $_{5\%}$	**A= 2.0 ; B= 2.4 ; AB= 3.5**						

Table (3): Effect of spraying salicylic acid (SA) and citric acid (CA) on chlorophyll a and chlorophyll b (in mg/100g FW) of Balady mandarin, during 2020 and 2021 seasons.

Treatments	Chlorophyll a (mg/100g FW)						
	Season, 2020						
	SA 0.0 ppm	SA 100 ppm	SA 200 ppm	SA 300 ppm	SA 400 ppm	SA 500 ppm	Mean B
CA 0.0 ppm	6.23	6.48	6.87	7.29	7.39	7.41	**6.95**
CA 100 ppm	6.39	6.59	6.99	7.41	7.52	7.66	**7.09**
CA 200 ppm	6.44	6.77	7.11	7.53	7.69	7.83	**7.22**
CA 300 ppm	6.67	6.88	7.24	7.64	7.78	7.92	**7.36**
CA 400 ppm	6.79	6.95	7.31	7.71	7.82	7.98	**7.43**
CA 500 ppm	6.80	6.97	7.34	7.75	7.89	7.99	**7.46**
Mean A	**6.55**	**6.77**	**7.14**	**7.56**	**7.68**	**7.80**	
New LSD $_{5\%}$	**A= 0.19 ; B= 0.21 ; AB= 0.31**						
	Season, 2021						
CA 0.0 ppm	6.28	6.42	6.59	6.99	7.77	7.89	**6.99**
CA 100 ppm	6.45	6.59	6.93	7.21	7.89	8.08	**7.19**
CA 200 ppm	6.53	6.89	7.21	7.44	7.99	8.21	**7.38**
CA 300 ppm	6.69	6.95	7.49	7.56	8.21	8.39	**7.55**
CA 400 ppm	6.82	7.16	7.50	7.99	8.33	8.41	**7.71**
CA 500 ppm	6.89	7.21	7.55	8.19	8.39	8.49	**7.79**
Mean A	**6.61**	**6.87**	**7.22**	**7.56**	**8.11**	**8.25**	
New LSD $_{5\%}$	**A= 0.15 ; B= 0.21 ; AB= 0.32**						
	Chlorophyll b (mg/100g FW)						
	Season, 2020						
CA 0.0 ppm	2.81	3.18	3.30	3.56	3.79	3.89	**3.41**
CA 100 ppm	2.97	3.21	3.39	3.69	3.89	3.99	**3.52**
CA 200 ppm	3.07	3.27	3.45	3.72	3.97	4.07	**3.59**
CA 300 ppm	3.10	3.29	3.49	3.77	4.03	4.11	**3.63**
CA 400 ppm	3.15	3.29	3.49	3.80	4.11	4.18	**3.67**
CA 500 ppm	3.17	3.30	3.51	3.81	4.12	4.19	**3.68**
Mean A	**3.05**	**3.26**	**3.44**	**3.73**	**3.96**	**4.07**	
New LSD $_{5\%}$	**A= 0.09 ; B= 0.11 ; AB= 0.16**						
	Season, 2021						
CA 0.0 ppm	2.79	3.29	3.45	3.77	3.89	3.98	**3.53**
CA 100 ppm	2.99	3.49	3.69	3.91	4.02	4.18	**3.71**
CA 200 ppm	3.11	3.66	3.78	4.01	4.19	4.31	**3.84**
CA 300 ppm	3.23	3.79	3.91	4.11	4.30	4.33	**3.95**
CA 400 ppm	3.66	3.89	3.99	4.20	4.35	4.38	**4.08**
CA 500 ppm	3.79	4.07	4.02	4.22	4.37	4.39	**4.14**
Mean A	**3.26**	**3.70**	**3.81**	**4.04**	**4.19**	**4.26**	
New LSD $_{5\%}$	**A= 0.11 ; B= 0.16 ; AB= 0.23**						

Table (4): Effect of spraying salicylic acid (SA) and citric acid (CA) on total chlorophyll and total carotenoids (in mg/100g FW) of Balady mandarin, during 2020 and 2021 seasons.

Treatments	Total chlorophylls (mg/100g FW)						
	Season, 2020						
	SA 0.0 ppm	SA 100 ppm	SA 200 ppm	SA 300 ppm	SA 400 ppm	SA 500 ppm	Mean B
CA 0.0 ppm	9.04	9.66	10.17	10.85	11.18	11.03	**10.32**
CA 100 ppm	9.33	9.08	10.38	11.01	11.41	11.65	**10.48**
CA 200 ppm	9.51	10.04	10.56	11.25	11.66	11.09	**10.69**
CA 300 ppm	9.77	10.17	10.73	11.41	11.81	12.03	**10.99**
CA 400 ppm	9.94	9.88	10.80	11.52	11.93	12.16	**11.04**
CA 500 ppm	9.97	10.27	10.85	11.56	12.01	12.18	**11.14**
Mean A	**9.59**	**9.85**	**10.58**	**11.27**	**11.33**	**11.69**	
New LSD $_{5\%}$	**A= 0.82 ; B= 0.64 ; AB= 0.95**						
	Season, 2021						
CA 0.0 ppm	9.07	9.71	10.04	10.76	11.66	11.87	**10.52**
CA 100 ppm	9.44	10.08	10.62	11.12	11.91	12.26	**10.91**
CA 200 ppm	9.64	10.55	10.99	11.45	12.18	12.52	**11.27**
CA 300 ppm	9.92	10.74	11.04	11.62	12.51	12.72	**11.43**
CA 400 ppm	10.48	11.05	11.49	12.19	12.66	12.79	**11.78**
CA 500 ppm	10.68	11.28	11.57	12.41	12.76	12.66	**11.89**
Mean A	**9.87**	**10.57**	**10.96**	**11.59**	**12.28**	**12.47**	
New LSD $_{5\%}$	**A= 0.71 ; B= 0.69 ; AB= 1.01**						
	Total carotenoids (mg/100g FW)						
	Season, 2020						
CA 0.0 ppm	1.82	2.10	2.24	2.51	2.62	2.66	**2.33**
CA 100 ppm	1.89	2.19	2.30	2.55	2.67	2.69	**2.38**
CA 200 ppm	1.92	2.20	2.35	2.56	2.72	2.71	**2.41**
CA 300 ppm	1.97	2.21	2.37	2.58	2.73	2.73	**2.43**
CA 400 ppm	1.99	2.22	2.40	2.60	2.73	2.75	**2.45**
CA 500 ppm	1.99	2.24	2.39	2.61	2.74	2.76	**2.46**
Mean A	**1.93**	**2.19**	**2.34**	**2.57**	**2.70**	**2.71**	
New LSD $_{5\%}$	**A=0.18 ; B= 0.17 ; AB= 0.25**						
	Season, 2021						
CA 0.0 ppm	1.79	2.11	2.32	2.56	2.77	2.83	**2.40**
CA 100 ppm	1.82	2.14	2.40	2.66	2.79	2.84	**2.44**
CA 200 ppm	1.84	2.22	2.42	2.69	2.81	2.87	**2.48**
CA 300 ppm	1.85	2.24	2.44	2.72	2.86	2.89	**2.50**
CA 400 ppm	1.88	2.26	2.45	2.75	2.88	2.90	**2.52**
CA 500 ppm	1.88	2.26	2.46	2.77	2.88	2.91	**2.53**
Mean A	**1.84**	**2.21**	**2.42**	**2.69**	**2.83**	**2.87**	
New LSD $_{5\%}$	**A= 0.16 ; B= 0.12 ; AB= 0.18**						

Table (5): Effect of spraying salicylic acid (SA) and citric acid (CA) on fruit weight (g) and fruit numbers/tree, during 2020 and 2021 seasons.

Treatments	SA 0.0 ppm	SA 100 ppm	SA 200 ppm	SA 300 ppm	SA 400 ppm	SA 500 ppm	Mean B
Fruit weight (g)							
season 2020							
CA 0.0 ppm	116.2	122.3	130.2	137.2	143.3	146.7	**132.6**
CA 100 ppm	119.9	125.5	133.1	139.4	144.4	146.9	**134.9**
CA 200 ppm	120.3	126.3	134.3	140.9	145.5	147.1	**135.7**
CA 300 ppm	121.9	129.9	137.1	143.3	145.9	148.3	**137.7**
CA 400 ppm	124.3	131.3	138.7	144.0	147.1	148.9	**139.1**
CA 500 ppm	124.2	132.7	139.7	144.1	148.5	149.0	**139.7**
Mean A	**121.1**	**128.0**	**135.5**	**141.5**	**145.8**	**147.1**	
New LSD $_{5\%}$	**A= 2.7 ; B= 2.9 ; AB= 4.2**						
season 2021							
CA 0.0 ppm	115.8	121.4	129.3	135.8	139.9	141.3	**130.6**
CA 100 ppm	119.2	124.1	131.3	136.7	144.1	146.6	**133.7**
CA 200 ppm	121.1	126.3	134.4	139.9	147.7	147.9	**136.2**
CA 300 ppm	122.2	127.7	134.5	140.1	148.9	149.1	**137.1**
CA 400 ppm	123.3	128.9	136.1	142.2	149.9	151.9	**138.7**
CA 500 ppm	123.9	129.7	137.9	142.4	150.7	152.8	**148.3**
Mean A	**120.9**	**126.4**	**133.9**	**139.5**	**146.8**	**148.3**	
New LSD $_{5\%}$	**A= 2.5 ; B= 2.8 ; AB= 4.1**						
Fruit numbers / tree							
season 2020							
CA 0.0 ppm	190.7	200.3	210.3	221.1	229.3	230.3	**213.7**
CA 100 ppm	199.3	205.5	213.3	223.3	231.9	231.9	**217.5**
CA 200 ppm	204.3	209.1	217.3	225.6	233.5	233.3	**220.5**
CA 300 ppm	208.3	211.3	218.8	227.1	235.5	235.1	**222.7**
CA 400 ppm	210.4	213.3	220.1	228.9	237.0	238.1	**224.6**
CA 500 ppm	211.1	215.7	220.9	229.1	237.7	239.1	**225.6**
Mean A	**204.1**	**209.2**	**216.8**	**225.9**	**234.2**	**234.6**	
New LSD $_{5\%}$	**A= 3.2 ; B= 3.9 ; AB= 5.7**						
season 2021							
CA 0.0 ppm	190.2	205.3	215.5	221.3	228.9	230.2	**215.2**
CA 100 ppm	194.4	209.3	219.7	225.5	231.1	233.9	**218.9**
CA 200 ppm	197.7	211.1	221.3	228.9	237.9	237.7	**222.4**
CA 300 ppm	199.3	214.4	225.3	233.1	239.1	239.9	**225.2**
CA 400 ppm	200.3	216.9	227.9	236.3	240.3	241.1	**227.1**
CA 500 ppm	201.9	217.7	229.9	237.7	241.3	242.7	**228.5**
Mean A	**197.3**	**212.5**	**223.3**	**230.5**	**236.4**	**237.6**	
New LSD $_{5\%}$	**A= 4.1 ; B= 4.4 ; AB= 6.4**						

Table (6): Effect of spraying salicylic acid (SA) and citric acid (CA) on yield (kg/tree) and peel weight (g) of Balady mandarin, during 2020 and 2021 seasons.

Treatments	SA 0.0 ppm	SA 100 ppm	SA 200 ppm	SA 300 ppm	SA 400 ppm	SA 500 ppm	Mean B
Yield (kg/tree)							
season 2020							
CA 0.0 ppm	22.1	24.5	27.4	30.3	32.9	33.8	**28.5**
CA 100 ppm	23.9	25.8	28.4	31.1	33.5	34.1	**29.5**
CA 200 ppm	24.5	26.4	29.2	31.8	33.9	34.3	**30.1**
CA 300 ppm	25.4	27.4	30.0	32.5	34.4	34.9	**30.8**
CA 400 ppm	26.1	28.0	30.5	32.9	34.9	35.5	**31.3**
CA 500 ppm	26.2	28.6	30.8	33.1	35.3	35.6	**31.6**
Mean A	**24.7**	**26.8**	**29.4**	**32.0**	**34.5**	**34.7**	
New LSD $_{5\%}$	**A= 1.4 ; B= 1.2 ; AB= 1.8**						
season 2021							
CA 0.0 ppm	21.9	24.9	27.9	30.1	32.0	32.5	**28.3**
CA 100 ppm	23.2	25.9	28.8	30.8	33.3	34.3	**30.9**
CA 200 ppm	23.9	26.7	29.7	32.0	35.1	35.2	**30.4**
CA 300 ppm	24.4	27.4	30.3	32.7	35.6	35.8	**31.0**
CA 400 ppm	24.7	27.9	31.0	33.6	36.0	36.6	**31.6**
CA 500 ppm	25.0	28.3	31.7	33.8	36.4	37.1	**32.1**
Mean A	**23.9**	**26.9**	**29.9**	**32.2**	**34.7**	**35.3**	
New LSD $_{5\%}$	**A= 1.3 ; B= 1.2 ; AB= 1.8**						
Peel weight (g)							
season 2020							
CA 0.0 ppm	27.1	27.9	28.1	28.3	29.2	30.1	**28.5**
CA 100 ppm	27.5	28.1	28.7	28.9	29.7	30.5	**28.9**
CA 200 ppm	27.9	28.3	29.0	29.6	30.2	30.9	**29.3**
CA 300 ppm	28.5	28.9	29.4	30.0	30.9	31.7	**29.9**
CA 400 ppm	29.1	29.4	30.0	30.5	31.3	32.0	**30.4**
CA 500 ppm	29.2	29.6	30.2	30.8	31.7	32.4	**30.7**
Mean A	**28.2**	**28.7**	**29.2**	**29.7**	**30.5**	**31.3**	
New LSD $_{5\%}$	**A= 0.5 ; B= 0.4 ; AB= 0.6**						
season 2021							
CA 0.0 ppm	27.3	28.1	28.7	29.4	29.9	31.1	**29.1**
CA 100 ppm	27.9	28.5	29.4	29.9	30.5	31.8	**29.7**
CA 200 ppm	28.7	29.3	29.9	30.2	30.9	32.2	**30.2**
CA 300 ppm	29.1	29.5	30.1	30.7	31.7	32.7	**30.6**
CA 400 ppm	29.5	29.7	30.6	30.9	31.9	33.0	**30.9**
CA 500 ppm	29.5	29.9	30.7	31.1	32.0	33.2	**31.1**
Mean A	**28.7**	**29.2**	**29.9**	**30.4**	**31.2**	**32.3**	
New LSD $_{5\%}$	**A= 0.4 ; B= 0.5 ; AB= 0.7**						

Table (7): Effect of spraying salicylic acid (SA) and citric acid (CA) on peel thickness and pulp weight (g) and fruit peel thickness (mm) of Balady mandarin, during 2020 and 2021 seasons.

Treatments	SA 0.0 ppm	SA 100 ppm	SA 200 ppm	SA 300 ppm	SA 400 ppm	SA 500 ppm	Mean B
Peel thickness (mm)							
season 2020							
CA 0.0 ppm	3.1	3.2	3.1	3.0	3.1	3.1	**3.1**
CA 100 ppm	3.2	3.1	3.2	3.1	3.2	3.2	**3.2**
CA 200 ppm	3.2	3.1	3.0	3.1	3.2	3.2	**3.1**
CA 300 ppm	3.2	3.2	3.1	3.1	3.1	3.2	**3.1**
CA 400 ppm	3.2	3.2	3.1	3.2	3.2	3.0	**3.2**
CA 500 ppm	3.2	3.2	3.1	3.1	3.2	3.1	**3.1**
Mean A	3.2	3.2	3.1	3.1	3.2	3.1	
New LSD $_{5\%}$	**A= NS ; B= NS ; AB= NS**						
season 2021							
CA 0.0 ppm	3.0	3.0	3.1	3.1	3.0	3.1	**3.1**
CA 100 ppm	3.1	3.0	3.1	3.2	3.1	3.0	**3.1**
CA 200 ppm	3.1	3.1	3.1	3.2	3.0	3.0	**3.1**
CA 300 ppm	3.0	3.1	3.1	3.1	3.0	3.1	**3.1**
CA 400 ppm	3.1	3.0	3.0	3.1	3.4	3.4	**3.2**
CA 500 ppm	3.2	3.1	3.2	3.2	3.4	3.5	**3.3**
Mean A	**3.1**	**3.1**	**3.1**	**3.2**	**3.2**	**3.2**	
New LSD $_{5\%}$	**A= NS ; B= NS ; AB= 0.8**						
Pulp weight (g)							
season 2020							
CA 0.0 ppm	89.1	94.4	102.1	108.9	114.1	110.0	**104.5**
CA 100 ppm	92.4	97.4	104.4	110.5	114.7	116.4	**106.0**
CA 200 ppm	92.4	98.0	105.3	111.3	115.3	116.2	**106.5**
CA 300 ppm	93.4	101.0	107.7	113.3	115.0	116.2	**107.8**
CA 400 ppm	95.2	101.9	108.7	113.5	115.8	116.9	**108.7**
CA 500 ppm	95.0	105.8	109.6	113.3	116.8	116.9	**109.6**
Mean A	**92.9**	**99.8**	**106.3**	**111.8**	**115.3**	**115.4**	
New LSD $_{5\%}$	**A= 3.1 ; B= 2.2 ; AB= 3.2**						
season 2021							
CA 0.0 ppm	88.5	93.3	100.6	106.4	110.0	109.9	**101.5**
CA 100 ppm	91.3	95.6	101.9	106.8	113.6	114.2	**103.9**
CA 200 ppm	92.4	97.0	104.5	109.7	116.8	115.7	**106.0**
CA 300 ppm	93.1	98.2	104.4	109.4	117.2	116.4	**106.3**
CA 400 ppm	93.8	99.2	105.5	111.3	118.0	118.9	**107.8**
CA 500 ppm	94.4	99.8	107.2	111.4	118.7	119.6	**108.5**
Mean A	**92.3**	**97.2**	**104.0**	**109.2**	**115.7**	**115.8**	
New LSD $_{5\%}$	**A= 3.8 ; B= 2.4 ; AB= 3.6**						

Table (8): Effect of spraying salicylic acid (SA)and citric acid (CA) on total soluble solids % and reducing sugars % of Balady mandarin, during 2020 and 2021 seasons.

Treatments	SA 0.0 ppm	SA 100 ppm	SA 200 ppm	SA 300 ppm	SA 400 ppm	SA 500 ppm	Mean B
TSS (%)							
	season 2020						
CA 0.0 ppm	10.2	10.7	10.9	11.1	11.4	11.8	11.0
CA 100 ppm	10.4	10.8	11.1	11.3	11.6	11.9	11.2
CA 200 ppm	10.7	10.8	11.5	11.6	11.7	12.1	11.4
CA 300 ppm	10.6	11.1	11.5	11.7	11.9	12.1	11.5
CA 400 ppm	10.8	11.2	11.6	11.8	12.0	12.2	11.6
CA 500 ppm	10.8	11.2	11.6	11.9	12.1	12.2	11.6
Mean A	10.6	11.0	11.4	11.7	11.8	12.1	
New LSD 5%	A= 0.4 ; B= 0.3 ; AB= 0.4						
season 2021							
CA 0.0 ppm	10.1	10.4	10.6	10.9	11.3	11.3	10.8
CA 100 ppm	10.3	10.6	10.8	11.2	11.6	11.7	11.0
CA 200 ppm	10.3	10.8	11.1	11.4	11.9	11.9	11.2
CA 300 ppm	10.5	11.1	11.5	11.7	12.2	12.3	11.6
CA 400 ppm	10.6	11.3	11.7	12.0	12.3	12.5	11.7
CA 500 ppm	10.6	11.4	11.9	12.1	12.4	12.6	11.8
Mean A	10.4	10.9	11.3	11.6	12.0	12.1	
New LSD 5%	A= 0.4 ; B= 0.5 ; AB= 0.73						
Reducing sugars (%)							
season 2020							
CA 0.0 ppm	3.1	3.4	3.7	3.8	4.0	4.1	3.7
CA 100 ppm	3.2	3.5	3.7	3.9	4.0	4.3	3.8
CA 200 ppm	3.3	3.5	3.8	4.0	4.2	4.3	3.9
CA 300 ppm	3.3	3.7	3.7	4.0	4.2	4.3	3.9
CA 400 ppm	3.4	3.7	3.9	4.0	4.3	4.4	4.0
CA 500 ppm	3.4	3.8	3.9	4.2	4.4	4.5	4.1
Mean A	3.3	3.6	3.8	4.0	4,2	4.3	
New LSD 5%	A= 0.1 ; B= 0.2 ; AB= 0.3						
season 2021							
CA 0.0 ppm	3.2	3.6	3.9	4.1	4.2	4.3	3.9
CA 100 ppm	3.3	3.5	3.9	4.2	4.3	4.4	3.9
CA 200 ppm	3.4	3.7	4.0	4.2	4.3	4.5	4.0
CA 300 ppm	3.6	3.7	4.2	4.2	4.5	4.6	4.2
CA 400 ppm	3.6	3.8	4.1	4.3	4.6	4.7	4.2
CA 500 ppm	3.6	3.8	4.1	4.3	4.6	4.8	4.2
Mean A	3.5	3.7	4.0	4.2	4.4	4.5	
New LSD 5%	A= 0.2 ; B= 0.2 ; AB= 0.3						

Table (9): Effect of spraying salicylic acid (SA)and citric acid (CA) on total sugars (%) and titratable acidity % of Balady mandarin, during 2020 and 2021 seasons.

Treatments	SA 0.0 ppm	SA 100 ppm	SA 200 ppm	SA 300 ppm	SA 400 ppm	SA 500 ppm	Mean B
Total sugars (%)							
season 2020							
CA 0.0 ppm	7.21	7.62	8.02	8.20	8.31	8.49	**7.97**
CA 100 ppm	7.44	7.73	8.09	8.29	8.39	8.53	**8.08**
CA 200 ppm	7.62	7.80	8.16	8.31	8.40	8.59	**8.14**
CA 300 ppm	7.69	7.88	8.24	8.36	8.41	8.66	**8.23**
CA 400 ppm	7.70	7.92	8.28	8.40	8.47	8.71	**8.25**
CA 500 ppm	7.78	7.99	8.29	8.42	8.49	8.75	**8.29**
Mean A	**7.57**	**7.82**	**8.18**	**8.33**	**8.41**	**8.622**	
New LSD $_{5\%}$	A= 0.51 ; B= 0.49 ; AB= 0.72						
season 2021							
CA 0.0 ppm	7.02	7.22	7.39	7. 97	8.66	8.79	**7.84**
CA 100 ppm	7.11	7.31	7.44	8.12	8.73	8.81	**7.92**
CA 200 ppm	7.17	7.33	7.50	8.23	8.76	8.88	**7.98**
CA 300 ppm	7.19	7.39	7.52	8.39	8.81	8.90	**8.03**
CA 400 ppm	7.22	7.41	7,60	8.41	8.86	8.91	**8.07**
CA 500 ppm	7.23	7.43	7.66	8.53	8.87	8.92	**8.11**
Mean A	**7.16**	**7.35**	**7.52**	**8.28**	**8.78**	**8.87**	
New LSD $_{5\%}$	A= 0.33 ; B= 0.41 ; AB= 0.60						
Titratable acidity (%)							
season 2020							
CA 0.0 ppm	1.125	1.125	1.128	1.111	1.120	1.119	**1.121**
CA 100 ppm	1.120	1.119	1.123	1.119	1.122	1.123	**1.121**
CA 200 ppm	1.128	1.121	1.119	1.121	1.124	1.131	**1.124**
CA 300 ppm	1.119	1.123	1.121	1.124	1.121	1.122	**1.130**
CA 400 ppm	1.126	1.133	1.120	1.129	1.119	1.132	**1.127**
CA 500 ppm	1.120	1.121	1.119	1.123	1.117	1.121	**1.120**
Mean A	**1.123**	**1.124**	**1.122**	**1.121**	**1.121**	**1.125**	
New LSD $_{5\%}$	A= NS ; B= NS ; AB= NS						
season 2021							
CA 0.0 ppm	1.134	1.133	1.133	1.129	1.129	1.129	**1.131**
CA 100 ppm	1.122	1.119	1.121	1.131	1.130	1.122	**1.124**
CA 200 ppm	1.130	1.121	1.129	1.129	1.099	1.132	**1.123**
CA 300 ppm	1.131	1.125	1.130	1.130	1.110	1.088	**1.119**
CA 400 ppm	1.134	1.122	1.127	1.122	0.945	0.922	**1.062**
CA 500 ppm	1.132	1.122	1.129	1.123	0.932	0.912	**1.058**
Mean A	**1.131**	**1.124**	**1.128**	**1.127**	**1.058**	**1.051**	
New LSD $_{5\%}$	A=NS ; B= NS ; AB= 0.245						

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الملخص العربي

علاقة نمو وإثمارأشجار اليوسفي البلدي برش حامض السلسليك وحامض الستريك

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خلال موسمي ٢٠٢٠ و ٢٠٢١ ، خضعت أشجار اليوسفي البلدي وعمرها ١٠ سنوات والتي تنمو في التربة الرملية، في بستان خاص يقع في منطقة ترعة الكسارة، الصالحية الجديدة، محافظة الشرقية، مصر، لخمسة تركيزات تدريجية (١٠٠، ٢٠٠، ٣٠٠، ٤٠٠، ٥٠٠ جزء في المليون) من حمض الساليسيليك وحمض الستريك. هدفت الدراسة إلى فحص تأثير حمض الساليسيليك وحمض الستريك كلا على حدة أو مشتركة على النمو الخضري والمحصول وجودة ثمار اليوسفي البلدي. كان استخدام حمض الساليسيليك وحمض الستريك فعالاً للغاية في تحفيز النمو الخضري، وصبغات الأوراق الرئيسية، والمحصول وكذلك جودة الثمار، مقارنةً بمعاملة الكنترول. علاوة على ذلك، فيما يتعلق بمعاملتي النمو الخضري، فإن معاملات المحصول وجودة الثمار التي تم رشها باستخدام حمض الساليسيليك اعطت تأثيرًا متفوقًا على رش حمض الستريك. ومع ذلك، كان التطبيق المشترك لـ حمض الساليسيليك و حمض الستريك أعلى بكثير من استخدام أي منهما بمفرداً. علاوة على ذلك، لوحظت فروق غير معنوية بين أعلى تركيزين (٤٠٠ و ٥٠٠ جزء في المليون). يمكن الاستنتاج أن معاملة أشجار اليوسفي البلدي المزروعة في التربة الرملية باستخدام حمض الساليسيليك و حمض الستريك كلا على حده بمعدل ٤٠٠ جزء في المليون تبدو ضرورية لتحسين النمو والإنتاجية وجودة ثمار اليوسفي البلدي.