

The effect of spraying nutrient solution (Growmore) and benzyl adenine on some vegetative traits of sour orange seedling

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ABSTRACT

The experiment was carried out in the lath house of the College of Agriculture, Al-Qasim Green University, during the growing season 2022-2023, to study the effect of foliar spraying with the nutrient solution (Grow more) and the growth regulator benzoyl adenine (BA) on the vegetative growth of 6-month-old sour orange seedlings. The experiment included spraying with Grow more nutrient solution in three concentrations (0, 1 and 2) gm. l⁻¹ and benzyl adenine in three concentrations (0, 50 and 100) mg.l⁻¹. The study was carried out as a factorial experiment with two factors according to the randomized complete block design (RCBD) with three replications for each treatment. The results can be summarized as follows: The study factors affected all the studied traits, as it gave the highest values for average plant height, stem diameter, number of leaves, chlorophyll content in the leaf and number of branches, when the two factors overlapped with Grow more nutrient solution and benzyl adenine (BA) at a concentration of 2 g. l⁻¹ and 100 mg.l⁻¹ for both agents, respectively, it recorded 73.14 cm, 0.75 cm, 77.14 leaf. plant⁻¹, 70.63 spad and 5.37 branch. plant⁻¹, respectively.

Keywords: sour orange, citrus, nutrient solution, benzyl adenine, vegetative traits

INTRODUCTION

The sour orange (*Citrus aurantium* L.) belongs to the genus of citrus fruits belonging to the Rutaceae family, which grows in the tropics and subtropics between latitudes 40° north and south of the equator. The original home of orange trees is India (6). Citrus is one of the important fruit trees for local consumption in Iraq, as the number of produced trees is about (13156000) trees, the cultivated area is (37900) dunum, and the production rate per tree is 27.3 kg (10).

It also extracts from it materials that enter the industry, and from it produces the best types of oils and some flavors (2) , (1). And the seedlings of sour orange are

considered one of the assets that are fed to it, but it has a high compatibility with other citrus varieties (7). The growth of sour orange seedlings is slow in order to reach the required level for selling or grafting on it, therefore the experiment was conducted.

Benzyl adenine affects the increase in cell division. It also affects the activation of RNA, thus increasing the vital reactions in the cell. It also affects the activation of enzymes necessary for vital reactions, and increases the building of chlorophyll and proteins, thus delaying the aging of leaves and increasing the transfer of nutrients to active tissues (9)

The aim of the search

The use of a Benzyl adenine regulator (BA) and spraying with a nutrient solution in improving vegetative growth and accelerating the growth of sour orange seedlings, reaching the appropriate size for grafting or the stage suitable for sale in a short period of time, and determining the best concentration of the two actions

MATERIALS AND METHODES

The experiment was carried out in the Lathhouse of the College of Agriculture, Al-Qasim Green University, during the growing season 2022- 2023. sour Orange seedlings were prepared from the citrus propagation nursery certified by the Ministry of Agriculture and located in the Hindiya district / Holy Karbala. 81 sour orange seedlings were selected from the seed of a local variety, 6 months old, with Almost homogeneous growth and planted in 2 kg plastic bags. The seedlings were placed in the Lathhouse of the Department of Horticulture and Landscaping / Al-Qasim Green University. All service operations (irrigation, weeding, fertilization) were performed on the seedlings in a

Table (1) Grow more fertilizer contents of mineral elements %

Mo	Zn	B	S	Mn	Cu	Mg	Ca	Fe	K	P	N
0.21	0.90	0.97	0.20	0.21	0.75	0.10	0.05	0.154	20	20	20

The seedlings were sprayed early in the morning until they were completely wet. A distance of half a meter was left between one treatment and another. Barriers were used to avoid the effect of spray between treatments.

Studied traits

Measurements were taken one month after the last spray and included:

1- Average plant height (cm): The height of the plant was measured with a metric tape from the top of the crown (above soil surface) to the end of the main stem ending with the

homogeneous manner throughout the duration of the experiment.

The experiment was carried out following a randomized complete block design (**R.C.B.D**), The levels of the nutrient solution were (0, 1 and 2 gm. l⁻¹) and the level of Benzyl adenine was low (0, 50 and 100 mg . l⁻¹), as the experiment included (9) treatments with three replicates for each treatment, each experimental unit containing 3 seedlings, and one replicate containing 27 seedlings. The nutrient solution Grow more is a balanced foliar fertilizer (20 - 20 - 20) (N-P- K) produced by the American company Grow and More. It contains most of the macro and micro nutrients. The results of the experiment were analyzed using the statistical program (Genstat), and the averages were compared using the least significant difference test (L.S.D), at a probability level of 0.05 (5).

The treatments were carried out in a rate of three sprays (the first spray on 20/20/2022, the second spray on 20/11/2022 and the third spray on 1/3/2023) both factors.

highest leaf of the plant for all treatments, and then the average was extracted.

2- Main stem diameter (cm): The diameter of the main stem of the seedlings was measured at a height of 5 cm from the soil surface of the bag by Vernier calipers for each transaction and extract the rate.

3- Average number of leaves (leaf.seedling⁻¹): The number of leaves for each seedling was calculated and the average number of leaves for each treatment was extracted.

4- The content of chlorophyll in the leaf (SPAD): The total chlorophyll content of the leaves was measured using the Spad device, where a group of leaves chosen about the fifth leaf under shoot tip was chosen randomly and the average was extracted.

5- Average number of branches (branch.seedling⁻¹): The number of lateral branches on the main stem of each seedling was calculated and then the average was extracted.

Table 2. Effect of spraying with nutrient solution (Grow more) and Benzyl adenine and the interaction between them on the average of plant height (cm).

Benzyl adenine (mg. l ⁻¹) (BA)	Nutrient Solution (g . l ⁻¹) (GM.)			Averag (BA)
	0	1	2	
0	52.14	55.05	58.22	55.14
50	60.28	62.33	62.76	61.79
100	72.45	73.11	73.14	72.90
Averag (GM.)	61.62	63.49	64.70	
L.S.D. (P ≤ 0.05)	BA 2.33	GM. 2.33	(BA) * (GM.) 3.76	

From the same table, it is clear that spraying Benzyl adenine had a significant effect on the rate of plant growth when using a concentration of 100 mg. l⁻¹, and the highest rate was (72.90 cm) compared to the lowest height (55.14 cm) in the comparison treatment. Additionally the interaction between the nutrient solution (Grow more) and Benzyl adenine had a significant effect on this plant height, as it reached the highest rate of plant height when using 2 g . l⁻¹ of the nutrient solution and 100 mg . l⁻¹ of Benzyl adenine (73.14 cm), significantly superior to the control treatment that it gave the lowest height (52.14 cm).

2- Average stem diameter (cm)

Through the data in Table (3), we see that spraying the nutrient solution (Grow

RESULTS

1- Average plant height (cm)

From the results of Table (2), spraying the nutrient solution (Grow more) with a concentration of 2 gm. l⁻¹ gave a significant increase in relation to the height of the plant, as it reached the highest rate (64.70 cm) compared to the lowest height (61.62 cm) for the comparison treatment.

more) has a significant effect on the rate of stem diameter when using a concentration of 2 g. l⁻¹ the highest rate of stem diameter was (0.71 cm) compared to the lowest rate (0.63 cm) when treated with For comparison, spraying Benzyl adenine at a concentration of 100 mg gave the highest average of the diameter of the stem, which reached (0.73 cm) significantly superior to the lowest average of the diameter of the stem (0.59 cm) in the comparison treatment.

The bilateral interaction between the two experimental procedures had a significant effect on the average stem diameter, as the largest diameter of the stem (0.75 cm) was recorded at the highest concentrations, which were significantly superior to the lowest average (0.51 cm) in the comparison treatment.

Table 3. Effect of spraying with nutrient solution (Grow more) and Benzyl adenine and the interaction between them on the average stem diameter (cm)

Benzyl adenine (mg. l ⁻¹) (BA)	Nutrient Solution (g . l ⁻¹) (GM.)			Averag (BA)
	0	1	2	
0	0.51	0.60	0.66	0.59
50	0.68	0.70	0.72	0.70
100	0.69	0.74	0.75	0.73
Averag (GM.)	0.63	0.68	0.71	
L.S.D. (P _≤ 0.05)	BA 0.06	GM. 0.07	(BA) * (GM.) 0.11	

3- Average number of leaves (leaf.plant⁻¹):

The results presented in Table (4) show that spraying the nutrient solution (Grow more) at a concentration of 2 g . l⁻¹ gave the highest mean number of leaves (60.02 leaf.plant⁻¹), which was significantly superior to the treatment of concentrations (1 and 0) g. l⁻¹. For those who differed between them significantly, they recorded the averages (54.60) and (48.95) leaf. plant⁻¹ in order.

It is noted from the same table that spraying Benzyl adenine at a concentration of

100 mg. l⁻¹ it gave the highest mean for the number of leaves, which reached 75.86 leaf. plant⁻¹, significantly superior to the lowest mean for the number of leaves, 35.84 leaf. plant⁻¹ when compared.

It is clear that the two-way interaction of the experimental factors had a significant effect on the average number of leaves, so the highest average number of leaves was 77.14 leaf.plant⁻¹ at the highest concentrations of the two factors, which were significantly superior to the lowest average number of leaves (32.18 leaf. plant⁻¹) in the comparison treatment.

Table (4) Effect of spraying with nutrient solution (Grow more) and Benzyl adenine and the interaction between them on the average number of leaves (leaf.plant⁻¹)

Benzyl adenine (mg. l ⁻¹) (BA)	Nutrient Solution (g . l ⁻¹) (GM.)			Averag (BA)
	0	1	2	
0	32.18	35.15	40.20	35.84
50	40.24	52.63	62.72	51.86
100	74.42	76.01	77.14	75.86
Averag (GM.)	48.95	54.60	60.02	
L.S.D. (P _≤ 0.05)	BA 2.02	GM. 2.09	(BA) * (GM.) 3.11	

4- The content of chlorophyll in the leaf (spad):

From the results presented in Table (5), it is clear that increasing the concentration of the nutrient solution (Grow more) increased the amount of chlorophyll in sour orange

leaves, reaching the highest value of 61.20 SPAD at a concentration of 2 g. l⁻¹, which was significantly superior to the other two concentrations, which recorded 58.53 SPAD and 53.29 SPAD at 1 g. l⁻¹ and 0 g. l⁻¹ respectively.

Table 5. Effect of spraying with the nutrient solution (Grow more) and Benzyl adenine and the interaction between them on the average content of leaves of chlorophyll SPAD

Benzyl adenine (mg. l ⁻¹) (BA)	Nutrient Solution (g . l ⁻¹) (GM.)			Averag (BA)
	0	1	2	
0	32.16	45.15	50.22	42.51
50	61.27	62.33	62.76	62.12
100	66.44	68.11	70.63	68.39
Averag (GM.)	53.29	58.53	61.20	
L.S.D. (P≤ 0.05)	BA 2.62	GM. 2.91	(BA) * (GM.) 4.61	

Increasing the concentration of benzyl adenine had significantly increased the average chlorophyll content in plant leaves, and recorded the highest value of 63.39 SPAD at the concentration of 100 mg.l⁻¹, which was superior to the content of treatments 0 mg.l⁻¹ and 50 mg.l⁻¹, which recorded 42.51 SPAD and 62.12 SPAD, respectively.

While the interaction between the two factors had a significant effect on the chlorophyll content of the leaves in addition to an increase in the concentration of the two factors led to a direct increase in the amount of chlorophyll, so the lowest value was 32.16 SPAD when the comparison treatment of the two concentrations overlapped as well it

increased until it gave an average of 70.63 SPAD at the two concentrations of 2 mg.l⁻¹ Nutrient solution and 100 mg.l⁻¹ Benzyl adenine. Significantly outperformed most of the interactions.

5- Number of branches (branch.plant⁻¹):

Through the results presented in Table (5), we find that spraying the nutrient solution (Grow more) had a significant effect on increasing the number of branches in sour orange plants as it recorded the highest rate of 5.37 branch. plant⁻¹ when the treatment was 2 g.l⁻¹, which was significantly superior to the comparison treatment, which recorded an average of 3.77 branch. plant⁻¹.

Table (5) Effect of spraying with nutrient solution (Grow more) and Benzyl adenine and the interaction between them on the average number of branches (branch.plant⁻¹)

Benzyl adenine (mg. l ⁻¹) (BA)	Nutrient Solution (g . l ⁻¹) (GM.)			Averag (BA)
	0	1	2	
0	3.33	4.00	5.12	4.15
50	3.66	4.66	5.33	4.55
100	4.33	4.77	5.66	4.92
Averag (N. S.)	3.77	4.48	5.37	
L.S.D. (P _≤ 0.05)	BA 0.08	GM. 0.09	(BA) * (GM.) 0.12	

While the increase in Benzyl adenine concentration had the same effect on the direct increase in the number of branches, and the highest rate was recorded, 4.92 branch. plant⁻¹, which were significantly superior to the comparison treatment.

In the same way, the effect of the two-way interference of the two factors was recorded, The highest rate of the number of branches was 5.37 branch. plant⁻¹ when the concentrations of 2 g. l⁻¹ and 100 mg. l⁻¹ each of Nutrient Solution overlapped with Benzyl adenine, respectively, control treatments showed the lowest rate of the number of branches 3.33 branch.

DISCUSSION

The increase in the studied traits as a result of spraying the nutrient solution may be attributed to the overlapping effects between the nutrients it contains in the formation of total chlorophyll and cytochromes and the entry of some of them into the process of photosynthesis and energy production and help in building nucleic acids(8), Encouraging the roots to absorb nutrients and activate the

vital processes in the plant, which is reflected in the nutritional status of the plant and the increase in the number of vegetative branches (3).

The reason for the increase in all the studied traits when increasing the concentrations of spraying with Benzyl adenine may also be due to the fact that spraying with this regulator increases the leafy area of the plant and the photosynthesis process, which affected the increase in the manufactured materials, so it reflected positively in improving plant growth, in addition to that it stimulates the growth of axillary buds and thus increasing the number of Branches (4).

Benzyl adenine affects the increase in cell division and elongation. It also affects the activation of RNA, thus increasing the vital reactions in the cell. It also affects the activation of enzymes necessary for vital reactions, and increases the building of chlorophyll and proteins, thus delaying the aging of leaves and increasing the transfer of nutrients to active tissues and their representation(9).

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