



# Response of bitter orange seedlings to effect of adding Ferti Mar and GROWX AMINO MIX on some vegetative traits

Mohammed Ghani Mohsen<sup>1</sup>, Mahmoud S. Abdel-Wahed<sup>2</sup>

<sup>1,2</sup>Horticulture And garden engineering, College of Agriculture and Marshlands, University of Dhi-Qar, 64001 ,Iraq.

[mohammedgheni91@gmail.com](mailto:mohammedgheni91@gmail.com), [Mahmoodalbraheme@gmail.com](mailto:Mahmoodalbraheme@gmail.com)

## Abstract

The experiment was carried out in the Saran-covered nursery of the Department of Horticulture and Landscaping, College of Agriculture and Marshes, at Dhi-Qar University during the growing season (2021-2022). One-year-old bitter orange seedlings were obtained as homogeneous in growth as possible from one of the Baghdad governorate nurseries on February 20, 2022. The seedlings were transferred to plastic pots with a capacity of 10 kg (26 cm diameter) filled with an agricultural medium consisting of mixed soil and moss in a ratio of 1:3. The process of servicing the plants was carried out similarly, such as pruning, hoeing, fertilizing and irrigation throughout the study period, the study was carried out as a two-factor experiment using Randomized Complete Block Design (R.C.B.D). The first factor represented the spraying by Ferti Mar compound at four concentrations (0, 0.5, 1, 1.5) ml l<sup>-1</sup>, and the second factor spraying by GROWX AMINO MIX compound at four concentrations (0, 1, 2, 3) g l<sup>-1</sup>. It was sprayed at a rate of three sprays between one spray and another two weeks. The study results can be summarized as follows: Ferti mar spraying treatments positively affected most indicators of citrus seedlings' vegetative growth. The spraying treatment with a concentration of 1.5 ml l<sup>-1</sup> significantly outperformed by registering the highest rate for seedling height, stem diameter, number of branches, number of leaves and leaf area was 95.33 cm, 8.98 mm, 16.04 branch seedling<sup>-1</sup>, 44.23 leaves seedling<sup>-1</sup>, and 16.42 cm<sup>2</sup>, respectively. Spraying treatments by Growx amino mix showed a positive effect on most of the vegetative growth indicators of citrus seedlings. The spraying treatment with a concentration of 3 g l<sup>-1</sup> was superior by recording the highest rate for seedling height, seedling diameter, number of branches, number of leaves, and leaf area, which amounted to 91.4 cm, 8.36 mm, 15.30 branch seedling<sup>-1</sup>, 42.49 leaf seedling<sup>-1</sup>, and 15.47 cm<sup>2</sup> sequentially. The interaction treatments between the two factors of the study had a significant positive effect on most of the studied traits, and the interaction treatment between the concentration of 1.5 ml l<sup>-1</sup> of Fertimar and 3 g l<sup>-1</sup> Growx amino mix recorded the best results significantly for growth indicators.

8870

**Keywords:** orange , seedling , Ferti , vegetative, traits.

**DOI Number:** 10.14704/nq.2022.20.10.NQ55870

**NeuroQuantology 2022; 20(10): 8870-8876**

## 1. Introduction

Bitter orange (*Citrus aurantium* L.) belongs to the genus Citrus family Rutaceae, which grows in tropical and subtropical areas between latitudes 40 north and south of the equator. India is the original home of *Citrus aurantium* (Al-Khafaji et al., 1990). In Iraq, most types of citrus are spread in the central regions due to their suitability to the prevailing

environmental conditions. The number of fruitful citrus trees is about 7,768,290 million, producing 176,117 tons. Orange occupies the first place in production with 142,717 tons, then oranges with 22,143 tons, sour lemons with 5375 tons, tangerines with 4494 tons and lemons Sweet with 1388 tons (Central Statistics Organization, 2020).



Citrus is of great importance among other fruit trees due to its nutritional, environmental, economic and medical importance, as its fruits are a rich source of vitamins, especially vitamin C and reasonable quantities of vitamins A, B2, B1 and B2, as well as being rich in the mineral elements necessary to build the human body such as potassium, calcium and magnesium as well as About small amounts of other elements such as iron, phosphorous, sodium and other elements (Ahmed and Daoud, 2020). The method of absorbing nutrients through the roots is the natural way plants absorb their needs from the soil, so fertilizers are widely added to the soil. Although the plant is adequately equipped with nutrients and elements added in this way, there are excessive losses in the number of fertilizers added, especially when added to large agricultural areas, which prompted researchers to search for other ways to add fertilizers (Dang et al., 2005). The foliar fertilization method is efficient and effective in feeding plants by the vegetative parts and providing the plant with nutrients in a homogeneous manner (Brian, 1999).

Seaweed extracts are from the organic sources used in agricultural production, as more than 15 million tons of them are used annually in the agricultural field. It contains macro and microelements, auxins, cytokinins, vitamins, amino and organic acids and multiple sugars. It also acts as a regulator of osmosis in high concentrations and increases plant tolerance to salinity, drought and harsh environmental conditions (Jensen, 2004). It also increases the efficiency of nutrient absorption, reduces the phenomenon of load exchange, and encourages the process of photosynthesis and respiration. It is an antioxidant because it contains alpha-tocopherol, beta-carotene, niacin, thymine and ascorbic acid,

which increase enzyme activity. Amino acids are compounds naturally produced by the plant that works to increase the balanced growth of the plant, increase the response to fertilization, resist diseases, increase the protein inside the cells, provide the plant's need for nitrogen, as well as prevent poisoning resulting from high ammonia inside the plant cells (Abdul Hafez, 2006). Amino acids from the effectiveness of various physiological processes within the plant directly or indirectly, as well as being the main component for building proteins and many co-enzymes. Cell membrane permeability (Hassan et al., 2010).

Due to the absence of previous studies on the effect of spraying with Ferti Mar and Growx Amino Mix on citrus seedlings in Dhi-Qar Governorate, this study was conducted to know the impact of spraying with Ferti Mar and Growx Amino Mix individually or overlapping in improving the vegetative growth characteristics of citrus seedlings to obtain On strong-growing seedlings suitable for grafting. As well as reducing the environmental and economic impact resulting from the use of traditional fertilizers.

## 1. Materials and methods

### 1. Study site

The experiment was carried out in the Saran-covered nursery of the Department of Horticulture and Landscape Engineering, College of Agriculture and Marshes, University of Dhi-Qar, during the growing season 2021-2022, where a number of one-year-old citrus seedlings were selected to conduct this study. At a ratio of 1:3, a random sample was taken from the river mixture and analyzed in the laboratories of the Directorate of Agriculture in Dhi-Qar to identify some of the chemical and physical properties of soil (Table 1).

**Table (1) the chemical and physical properties of soil properties**

Characteristic	Measuring unit	Value
pH		7.5
EC	ds.m <sup>-1</sup>	2.51
Texture	Silty loam	loamy sand
Sand	mg l <sup>-1</sup>	70.24
Silt		14.44
Clay		15.42
N		25.89
P		7.55
K		116.78

### 2. Preparing and serving seedlings

Citrus seedlings were obtained from one of the nurseries of Baghdad governorate on 20.02.2022 and were approximately one year old, homogeneous in growth, and planted in plastic bags made of

polyethylene. The seedlings were transferred to plastic pots of 10 kg (26 cm diameter). The process of servicing the plants was carried out. They were symmetrically pruning, hoeing, fertilizing and irrigating throughout the study period.



### 3. Study parameters

#### The first factor:

The shoots were sprayed with Ferti Mar at four concentrations:

- 1- Without spraying the compound Ferti Mar (spraying with distilled water).
- 2- Spray the Ferti Mar compound with a (0.5 ml l<sup>-1</sup>) concentration.
- 3- Spray the Ferti Mar compound with a concentration of (1 ml l<sup>-1</sup>).
- 4- Spray the Ferti Mar compound with a (1.5 ml l<sup>-1</sup>) concentration.

#### The second factor:

It included spraying the shoots of the seedlings with the compound Growx amino mix in four concentrations:

- 1- Without spraying the Growx amino mix (spraying with distilled water).
- 2- Spray the compound Growx amino mix at a concentration of (1 g l<sup>-1</sup>).
- 3- Spray the compound Growx amino mix at a concentration of (2 g l<sup>-1</sup>).
- 4- Spray the compound Growx amino mix at a concentration of (3 g l<sup>-1</sup>).

### 4. Studied traits

#### Indicators of vegetative growth:

Vegetative growth measurements were carried out from each experimental unit and included the following:

##### 1- Seedling height (cm)

Measure the height of the plant from the area of contact of the stem with the planting medium to the growing tip with a metric ruler

##### 2- Stem diameter (mm)

The diameter of the seedling was measured at the height of 5 cm from the soil level by a vernier foot.

##### 3- Branches number (branch seedling<sup>-1</sup>)

Calculate the number of side branches per plant by counting the number of branches on the main stem and then extract the rate of each treatment.

##### 4- Leaves number of (leaf seedling<sup>-1</sup>)

The number of leaves per plant was calculated by calculating the number of leaves on the main stem and lateral branches for each seedling and each duplicate and then extracting the average for each treatment.

##### 5- Leaf area (cm<sup>2</sup>)

The area of one leaf for seedlings was measured at the end of the experiment according to the method (Sadik et al., 2011). The average leaf area was calculated by taking 5 sheets of full width from each treatment using the computer image program. The process was repeated three times, taking the average and extracting the average leaf area for a seedling.

## 2. Results and Discussion

### 1. Seedling height (cm)

The results of Table (2) indicate that the study factors and their interactions significantly increased the height of the citrus seedlings. Spraying the seedlings with Ferti mar significantly increased the seedlings' height with an increase in the spraying concentration. The spraying treatment with a concentration of 1.5 ml l<sup>-1</sup> was significantly superior to registering the highest height of the seedlings. It was 95.33 cm compared to the comparison treatment, which recorded the lowest seedlings height, 74.50 cm.

As for spraying with Growx amino mix, the same table results indicate a significant effect of spraying treatments on increasing the height of seedlings. The concentration of 3 g l<sup>-1</sup> recorded the highest seedling height of 91.4 cm compared to the comparison treatment, which gave the lowest height of 77.28 cm.

As for the interaction coefficients between Ferti mar and Growx amino mix, the same table results indicate a significant and apparent increase in the height of the citrus seedlings. Spraying treatment with Ferti mar concentration 1.5 ml l<sup>-1</sup> and Growx amino mix at a concentration of 3 g l<sup>-1</sup> recorded the highest seedlings height of 101.78. It did not differ significantly from the treatment of spraying with Ferti mar at a concentration of 1.5 ml l<sup>-1</sup> and Growx amino mix at a concentration of 2 g l<sup>-1</sup>, which recorded a height of 98.26 cm for seedlings.

Table (2) Effect of **Ferti mar** and **Growx amino mix** and the interaction between them on height of citrus seedlings (cm)

levels Ferti mar ml l <sup>-1</sup>	levels Growx amino mix g <sup>-1</sup>				average effect Ferti mar
	0	1	2	3	
0	62.89	70.47	81.95	82.68	74.50
0.5	75.93	80.70	89.33	87.81	83.47
1	81.21	90.01	95.7	93.86	90.20
1.5	89.10	92.21	98.26	101.78	95.33
average effect	77.28	83.34	91.34	91.4	



Growx amino mix					
LSD 0.05					
Ferti mar = 1.819		Growx amino mix = 1.819		Interaction= 3.637	

## 2. Stem Diameter (mm)

The results of Table (3) show that spraying with Ferti mar significantly increased the stem diameter of the treated plants, and this increase was continuous with the increase in the spraying concentration. The plants treated with a concentration of 1.5 ml l<sup>-1</sup> gave the highest average stem diameter of 8.98 mm, while the non-sprayed plants recorded less Average stem diameter was 6.14 mm.

It is clear from the same Table that there are significant differences between the concentrations of the Growx amino mix in its effect on the stem

diameter of the treated plants. The plants with a concentration of 3 g l<sup>-1</sup> recorded the highest average stem diameter of 8.36 mm for seedlings compared to the control treatment, which recorded the lowest seedling diameter of 7.31 mm.

As for the interaction between Ferti mar and Growx amino mix, the same table results indicate its significant effect on the stem diameter of seedlings. Spraying treatment with Ferti mar at a concentration of 1.5 ml l<sup>-1</sup> and with Growx amino mix at a concentration of 3 ml<sup>-1</sup> recorded the highest stem diameter rate, reaching 9.23 mm.

**Table (3) Effect of Ferti mar and Growx amino mix and the interaction between them on Stem diameter (mm)**

levels Ferti mar ml l <sup>-1</sup>	levels Growx amino mix g <sup>-1</sup>				average effect Ferti mar
	0	1	2	3	
0	5.41	5.86	6.23	7.07	6.14
0.5	7.09	7.44	7.65	8.32	7.62
1	8.25	8.62	8.70	8.93	8.62
1.5	8.49	9.06	9.14	9.23	8.98
average effect Growx amino mix	7.31	7.74	7.95	8.36	
LSD 0.05					
Ferti mar = 0.145		Growx amino mix = 0.145		Interaction= 0.291	

8873

## 3. Branches number (branch seedling<sup>-1</sup>)

The results in Table (4) indicate that Ferti mar spraying on citrus seedlings significantly increased the average number of branches for seedlings with an increase in the spraying concentration. The spraying treatment with a concentration of 1.5 ml l<sup>-1</sup> recorded the highest average number of branches per seedlings which was 16.04 branch seedlings<sup>-1</sup>, while the comparison treatment recorded the lowest average number of branches for seedlings, which amounted to 11.67, branch seedlings<sup>-1</sup>.

As for the effect of spraying with Growx amino mix, the results of the same Table show the significant impact of spraying treatments compared to the comparison treatment, which gave the lowest average number of branches, which amounted to 12.76

branches seedling<sup>-1</sup>, and the increase was proportional to the increase in spraying concentration, as the treatment recorded at a concentration of 3 g l<sup>-1</sup> the highest rate of branches reached 15.30, branches seedling<sup>-1</sup>.

The results also show the significant effect of the interaction treatments between Ferti mar and Growx amino mix, as the results of the same Table indicate a significant increase in most of the interaction treatments compared to the comparison treatment, which gave the lowest average number of branches reached 10.41 branches seedling<sup>-1</sup>. In contrast, the spray treatment was recorded with a concentration of 1.5 ml Ferti mar and 3 g l<sup>-1</sup> Growx amino mix; the highest number of branches reached 17.42 seedling<sup>-1</sup>.

**Table (4) Effect of Ferti mar and Growx amino mix and the interaction between them on branches number (branch seedling<sup>-1</sup>)**

levels Ferti mar ml l <sup>-1</sup>	levels Growx amino mix g <sup>-1</sup>				average effect Ferti mar
	0	1	2	3	



0	10.41	10.92	12.61	12.74	11.67
0.5	12.66	13.23	13.55	14.08	13.38
1	13.46	15.38	16.41	16.96	15.55
1.5	14.53	14.96	17.26	17.42	16.04
average effect Growx amino mix	12.76	13.62	14.95	15.30	
LSD 0.05					
Ferti mar = 1.010		Growx amino mix = 0.505		Interaction=0.505	

#### 4. Leaves number (leaf seedling<sup>-1</sup>)

Table (5) results indicate a significant effect of spraying with Ferti mar on the average number of leaves for seedlings<sup>-1</sup>. This increase was related to the increase in the concentration of spraying with Ferti mar, as the treatment with a concentration of 1.5 ml l<sup>-1</sup> gave the highest average number of leaves per plant, which amounted to 44.23 leaves. Seedling<sup>-1</sup> was significantly superior to Ferti mar treatment with a concentration of 1 ml l<sup>-1</sup>, while the control treatment recorded the lowest rate of 32.12 leaves for seedling<sup>-1</sup>. The results of the same Table also showed that spraying with Growx amino mix had an apparent effect on the number of leaves for each seedling, as the spraying treatment with a concentration of 3 g l<sup>-1</sup>

<sup>1</sup>recorded the highest rate of the number of leaves per seedling, which amounted to 42.49 leaf seedlings<sup>-1</sup>.

The interaction between Ferti mar and Growx amino mix clearly affects the number of leaves for seedlings. The treatment of spraying with Ferti mar at a concentration of 1.5 ml l<sup>-1</sup> and Growx amino mix at a concentration of 3 g for l<sup>-1</sup> was superior by recording the highest rate of the number of leaves per seedling was 48.15 leaves for seedling<sup>-1</sup>, which did not make Significantly different from the interaction treatment between Ferti mar and Growx amino mix at a concentration of 1.5 ml l<sup>-1</sup> and 2 g l<sup>-1</sup>, which gave 46.93 leaves of seedlings<sup>-1</sup>, compared to the control treatment, which gave 26.36 leaves of seedlings<sup>-1</sup>.

8874

**Table (5) Effect of Ferti mar and Growx amino mix and the interaction between them on leaves number (leaf seedling<sup>-1</sup>)**

levels Ferti mar ml l <sup>-1</sup>	levels Growx amino mix g <sup>-1</sup>				average effect Ferti mar
	0	1	2	3	
0	26.36	32.97	33.75	35.41	32.12
0.5	32.43	38.89	40.20	41.83	38.34
1	33.99	41.30	42.15	44.58	40.50
1.5	38.26	43.90	46.93	48.15	44.23
average effect Growx amino mix	32.76	39.26	40.75	42.49	
LSD 0.05					
Ferti mar = 2.458		Growx amino mix = 1.229		Interaction=1.229	

#### 5. Leaf area (cm<sup>2</sup>)

It is clear from the results of Table (6) that there are significant differences between the treatments in the area of one leaf, as the results showed that the level exceeded 1.5 ml l<sup>-1</sup>Ferti mar at a rate of 16.42 cm<sup>2</sup>. In comparison, the lowest rate of area of one leaf was achieved when the treatment of 0 ml l<sup>-1</sup> amounted to 11.58 cm<sup>2</sup>.

As for the effect of spraying with Growx amino mix, the results of the same Table show that there are significant differences compared to the comparison treatment, as the treatment of spraying with 3 g l<sup>-1</sup>

<sup>1</sup>gave the highest average per leaf area, which amounted to 15.47 cm<sup>2</sup> and did not differ significantly with the treatment of 2 g l<sup>-1</sup>. The area of one leaf was 14.94 cm<sup>2</sup>, while the treatment 0 g l<sup>-1</sup> gave the lowest average area of one leaf, which was 12.24 cm<sup>2</sup>.

As for the effect of the interaction between the treatments, the results showed that the interaction was significant, as the treatment outperformed 1.5 ml l<sup>-1</sup>Fertimar and 3 g l<sup>-1</sup>Growx amino mix, as the area of one leaf in it was 17.71 cm<sup>2</sup> compared to the control treatment, which amounted to 10.16 cm<sup>2</sup>.

**Table (6) Effect of Ferti mar and Growx amino mix and the interaction between them on leaf area (cm<sup>2</sup>)**



levels Ferti mar ml l <sup>-1</sup>	levels Growx amino mix g <sup>-1</sup>				average effect Ferti mar
	0	1	2	3	
0	10.16	11.04	12.64	12.48	11.58
0.5	11.20	13.29	13.01	14.79	13.07
1	13.21	14.52	16.76	16.75	15.31
1.5	14.36	16.23	17.38	17.71	16.42
average effect Growx amino mix	12.24	13.77	14.94	15.47	
LSD 0.05					
Ferti mar = 0.678		Growx amino mix = 0.339		Interaction=0.339	

### 3. Discussion

#### Effect of spraying Ferti mar and Growx amino mix on the vegetative characteristics of citrus seedlings

The results of tables (2, 3, 4, 5 and 6) show that seedling height, stem diameter, number of branches, number of leaves and leaf area were significantly affected by spraying citrus seedlings with Ferti mar, as it had a clear effect on the characteristics of vegetative growth because it contained algae extracts and some elements. Basic nutrients and growth regulators, which include auxins and cytokinins, as well as its content of vitamins, which are involved in vital activities, which leads to increased absorption and is positively reflected in the characteristics of vegetative growth in plants, as the area of one leaf and leaf area increases (Osman et al., 2010). Ferti mar spraying led to a noticeable increase in some vegetative characteristics of the plant, such as height, number of branches and leaf area, due to its content of growth regulators such as auxins and cytokinins (Khan, 2009). Increasing the efficiency of photosynthesis is positively reflected in most of the vegetative growth characteristics, to which Spann and Little (2011) agree on orange trees.

The tables (2, 3, 4, 5 and 6) show a significant increase in vegetative growth characteristics such as seedling height, stem diameter, number of branches, number of leaves and leaf area when spraying the seedlings with Growx amino mix. The increase is because the Growx amino mix is a source of acids. The amino acid, which can be quickly implemented inside the plant, plays a role in protein formation and its entry into the formation of vitamins. The Growx amino mix stimulates photosynthesis and builds carbohydrates. It also works to build and encourage the work of some enzymes and enzymatic companions (Bender, 2012). This is a clear indication of the role of amino acids in increasing the tissue content of protein and preventing water stress for the merging of amino acids and the formation of proteins. The Growx amino mix contains a group of

organic nutrients that are characterized by their rapid absorption and representation in the plant and work to balance the vital processes within the plant, which is positively reflected in improving the vegetative growth indicators of the plant.

#### References

- Bender, D. A. (2012). Amino acid. Metabolism, 3rd end (New York: Wiley-Blackwell).
- Brayan, C. (1999). Foliar Fertilization. Secrets of success. Prosym" Bond foliar application ". Adelaide Australia. Publ. Adelaide Univ :30-36 p.
- Dang, S.; L. Cheng; C.F. Scagel and Fuchigami (2005). Timing of urea application affect leaf and root N. uptake in young fuji/mq apple trees .J. Hortic Sci. Biotech. 80:116-120.
- Hassan, H. S. A., S. M. A. Sarrwy, and E. A. M Mostafa (2010). Effect of foliar spraying with liquid organic fertilizer, some micronutrients, and gibberellins on leaf mineral content, fruit set, yield, and quality of "Hollywood" plum trees. Agriculture and Biology Journal of North America, 1(4): 638-643.
- Jensen, E. (2004). Seaweed Fact or fanc from the organic broadcaster. Published by Moses, the midwest organic and sustainable education. From the broadcaster, 12(3):164-170.
- Khan, W. U. P .Rayirath, S. Subramanian, M. N. Jithesh, P. Rayorath, D. M. Hodges, and B. Prithviraj (2009). Seaweed extracts as biostimulants of plant growth and development. Journal of Plant Growth Regulation. 28(4):386-399.
- Osman, S. M., M. A Khamis and A. M Thorya (2010). Effect of mineral and Bio-NPK Soil application on vegetative growth, flowering, fruiting and leaf chemical composition of young olive trees. Research Journal of Agriculture and Biological Sciences. 6(1): 54-63.
- Spann, T. M. and H. A Little (2011). Applications of a commercial extract of the



- brown seaweed *Ascophyllum nodosum* increase drought tolerance in container-grown 'Hamlin' sweet orange nursery trees. *HortScience*. 46(4): 577-582.
9. Ahmed, F. A., and Daoud, H. D. (2020). Citrus production technologies. General Administration of Agricultural Extension and Technology Transfer. Ministry of Agriculture and Natural Resources. Republic of Sudan 30 p.
  10. Central Statistical Organization (2020). Citrus tree production. Ministry of Planning and Development Cooperation. The Republic of Iraq. p. 2-4.
  11. Al-Khafaji, M. A., Suhail, A. A., and Alaa, A. M. (1990). Perennial green fruit. Baghdad University. Ministry of Higher Education and Scientific Research. Iraq.
  12. Al-Douri, I. F. S. (2007). Effect of sulfur, nitrogen and ascorbic acid spraying on vegetative growth and mineral content of young apple trees, cultivar Anna Vistabella. Master's thesis, College of Agriculture and Forestry. University of Al Mosul.
  13. Abdel-Hafez, A. A. (2006). The use of amino acids and vitamins in improving the performance, growth and quality of horticultural crops under Egyptian conditions. *Agricultural Bulletin*. Scientific Office of the United Company for Agricultural Development, Cairo, Egypt.

