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Article

# Influence of Foliar Spray with Urea and GA3 on Some Vegetative Growth Characteristics of Mandarin Saplings cv.Clementine.

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**ABSTRACT**
The experiment was conducted in the lath house affiliated with the College of Agriculture / University of Anbar to investigate the effect of foliar spray of urea and GA3 on some vegetative growth traits of mandarin saplings cv. Clementine, during the period from April 2021 to December 2021, spraying urea(46% N) included 0(spray with distilled water as control), 4, 8 and 12 $g.l^{-1}$; on the other hand, spraying GA3 included 0(spray distilled water as control), 30 and 60 $mg.l^{-1}$. The results showed that urea spray significantly increased all vegetative traits, especially 12 $g.l^{-1}$, compared to the control. In the same context, GA3 at 60 $mg.l^{-1}$ spray increased all vegetative growth characteristics, like plant height, leaves number increment, leaves area, shoot number, shoot length and rootstock diameter increment, compared to the lowest value in control.
**Keywords**: Foliar Spray, Urea, Nitrogen, GA3, Vegetative Growth, Mandarin.

## INTRODUCTION

Mandarin (Citrus reticulata Blanco) belongs to the family Rutaceae. It is one of the evergreen fruit trees and can be considered the lowest species of Citrus in height and size. This is due to the abundance and thinness of the branches produced by the plant, which gives it a drooping shape. Clementine is one of the common and successful species in Iraqi orchards; the growth of these trees is medium to relatively large, the small leaves are elongated and pointed, devoid of thorns and atria, it has a deep reddish-orange color, and both the rind and segments exhibit slightly more adherence than most mandarins [1]. Citrus is one of the important fruit trees for local consumption in Iraq. The number of fruit trees for mandarin reached 241,549 trees. The average productivity of one tree was estimated at 18.6 kg, while the total production was estimated at 4,494 tons. Baghdad governorate occupied the first place in terms of production, which was estimated at 1,380 tons with a percentage of (30.7%), followed by Diyala governorate, whose production amounted to 1199 tons,( 26.7%), while Salah al-Din governorate occupied the third place in terms of production, whose production was estimated at 1159 tons of the total production of Iraq [6]. Taking care of seedlings from the beginning of their life and carrying out various

fertilization operations, whether by adding to the soil or foliar spraying or treating them with some growth regulators, will give the seedlings a good growth force and speed up their arrival to the production stages earlier [2]. Plants need nutrients for their growth and development to form one or more important compounds in the plant's metabolic processes. These elements are available in the soil, but the availability may not correspond to the plant's need because of their lack of movement, lack of readiness, leaching or volatilization, which leads to the failure of the roots to absorb some of these elements from the soil, foliar uptake of mineral nutrients is ranged from 8 to 20 times more efficient than soil application [14]. The nitrogen fertilization process is one of the important agricultural operations carried out in nurseries to encourage the growth of seedlings and obtain good seedlings capable of growing consistently in terms of the vegetative and root system [10]. Urea is considered one of the most suitable nitrogen fertilizers for foliar application because of its rapid absorption, transmission, non-polarity and high solubility, as well as its high nitrogen content [5]. Nitrogen is one of the most important major nutrients necessary for growth, and its ratio in high-end plants is 2-5% of the dry weight; its importance lies in its entry into the synthesis of amino acids, proteins, enzymes and cytochromes, which is important in the process of photosynthesis, respiration and some hormones, as it forms an essential part in the formation of chlorophyll pigment [11]. As the nutritional factor has an effective effect on growth and production, many researchers have indicated the vital role of growth regulators in many important physiological activities in regulating plant growth, and among these substances is gibberellic acid (GA3), which plays a significant and important role in encouraging cell division and elongation, as Stimulates elongation in the internodes in addition to stimulating plants to flower [13], [9]. This study was conducted to study the effect of spraying with urea as a source of nitrogen and GA3 and the combination between them in building a strong structure for mandarin saplings by improving the vegetative growth characteristics

## MATERIALS AND METHODS

This trial was conducted in the Lath house affiliated with the Department of Horticulture and Landscape Gardening / College of Agriculture / Anbar University from April 2021 to December 2021 to study the response of mandarin saplings cv. clementine to foliar spray with urea and GA3 on 2- years old mandarin (Citrus reticulata Blanco) grafted on sour orange rootstock (Citrus aurantium L.), uniform saplings were selected and transplanted into a black container, potting medium was a mixture of organic matter(cattle manure) and soil (1:2), saplings were subjected to the same cultural practices during growing season and were routinely irrigated wherever it is needed, soil and organic matter was analyzed as shown in Table (1,2)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Texture Grade | | | Available nutri-ents mg. kg $^{-1}$ soil | | |
| | | | | | | | Clay Loam | | | | | |
| pH | EC(1:1) ds.m$^{-1}$ | CEC C.mol.l$^{-1}$ | OM g.kg$^{-1}$ soil | Sand g.kg$^{-1}$ soil | Loam g.kg$^{-1}$ soil | Clay g.kg$^{-1}$ soil | N | P | K | Total CaCO3 g.kg$^{-1}$ soil | Fe | Zn |
| | | | | | | | | | | | g.kg$^{-1}$ soil | |
| 7.9 | 5.19 | 25.47 | 13 | 42.90 | 27.80 | 29.17 | 62.95 | 13.7 | 216.7 | 269 | 2.22 | 1.56 |

**Table 1. Some physio-chemical characteristics of the experimental soil**

| | | g.kg$^{-1}$ | | | | |
|---|---|---|---|---|---|---|
| pH | Ec(1:1) ds.m$^{-1}$ | Organic carbon | N | P | K | C/N |
| 6.7 | 1.7 | 316 | 23 | 9.8 | 25.3 | 13.73 |

**Table 2. Physical - Chemical analysis of organic matter.**

One hundred eight saplings were selected uniformly as much as possible. The experiment involved 12 treatments. The experiment was laid out in a randomized complete block design with 3 replications. Each replicate consisted of 3 experimental units. urea(46% N) was applied at 0(spray water as control), 4,8 and 12 g.l$^{-1}$, three levels of GA3(Gibberellic acid) viz. 0(spray water as control), 30 and 60mg.l$^{-1}$, all saplings received spraying solution, which was done early in the morning with tween 20 (1ml.l$^{-1}$) till run off at the second week of April, May and June, the results were subjected to analysis of variance (ANOVA), and differences between treatments were made by F-test and the least significant differences at P= 5%. The following characteristics were measured:

*Plant height increment (cm):*

It was measured at the beginning of the experiment (April of 2021) and at the end of the experiment (December of 2021). As a result of the difference between the two readings, height increment was calculated.

*Leaves number increment (leaf. sapling $^{-1}$):*

It was calculated (April 2021), and at the end of the experiment (December 2021), the result of the difference between the two readings was calculated as increment.

*Leave area (dm$^2$):*

10 fully expanded leaves were taken at the fifth - eighth node from the top of the branches to measure leaf area, which was measured according to the following equation: [7]

$$\text{Leaf area} = \frac{2}{3} \times \text{length} \times \text{width}$$

*Shoot number increment (shoot. sapling $^{-1}$):*

Main shoots on the main stem were calculated (April 2021), and at the end of the experiment (December 2021), the result of the difference between the two readings increment of main branches was calculated.

*Shoot length (cm):*

Branche lengths were measured on the sapling main stem using a measuring tape at the end of the experiment (December 2021).

*Rootstock diameter increment (mm):*

Recorded at the beginning (April 2021) and the end of the experiment (December), increments were determined by calculating the difference between them

## RESULTS

*Plant height increment (cm):*

It is evident from the results shown in Table (3) that there is a significant increase in the plant height as a result of urea spray, the highest value (23.36cm) at N3(12 g.l$^{-1}$) compared to the lowest value (14.86 cm) at N0(spray water only), on the same context, GA3 spray showed a significant effect especially G2(60 mg.l$^{-1}$) which gave 20.69 cm compared with G0(spray water only) which gave 16.90 cm. The results also showed that plant height was significantly affected by the interaction; N3G1 achieved the highest value (25.67cm) Compared with N0G0, which gave the lowest value (13.73 cm).

*Leaves number increment (leaf. sapling $^{-1}$):*

It is clear from the results shown in Table (3) that the spray treatments with urea had a significant effect on leaf number increment, which increased with the increase in concentration; N3 achieved the highest value (130.67 leaves. sapling $^{-1}$) compared to the N0 which gave 95.03 leaves. sapling $^{-1}$, concerning GA3 spray, G2 achieved the highest value(129.78 leaf. sapling $^{-1}$) compared to the lowest value at G0(100.30 leaf. sapling $^{-1}$). The interaction showed a significant effect; N3G2 registered the highest value (138.78 leaves. sapling$^{-1}$) compared to the lowest value when compared to N0G0, which was (54.11 leaf. sapling $^{-1}$)

*leave area (dm$^2$):*

From the results shown in Table (3), it is clear that urea spray has a significant effect on leaves area. This effect increased with the increase in the concentration. N2 achieved the highest value(38.03 dm$^2$) compared to N0, which gave the lowest value (22.81 dm$^2$). GA3 spray showed a significant effect on these traits. G1 achieved the highest value (34.76 dm$^2$) compared to the lowest value (27.54 dm$^2$) at G0. On the other hand, the interaction between spraying with urea and GA3 showed a significant effect on this characteristic. N3G1 achieved the highest value (41.93 dm$^2$), while the lowest value (17.44 dm$^2$) at N0G0

| Gibberellin (G) | Urea (N) | | | | Mean |
|---|---|---|---|---|---|
| | N0 = control | N1 = 4 g.l$^{-1}$ | N2 = 8 g.l$^{-1}$ | N3 =12 g.l$^{-1}$ | |
| **plant height increment (cm)** | | | | | |
| G0= control | 13.73 | 16.87 | 16.93 | 20.07 | **16.90** |
| G1= 30 mg.l$^{-1}$ | 14.50 | 17.47 | 20.00 | 25.67 | **19.41** |
| G2 = 60 mg.l$^{-1}$ | 16.33 | 19.00 | 23.10 | 24.33 | **20.69** |
| Mean | 14.86 | 17.78 | 20.01 | 23.36 | |
| LSD 0.05 | N | G | N × G | | |
| | 1.11 | 0.96 | 1.92 | | |
| **leaves number increment(leaf. sapling $^{-1}$)** | | | | | |
| G0= control | 54.11 | 105.55 | 116.00 | 125.55 | **100.30** |
| G1= 30 mg.l$^{-1}$ | 109.89 | 121.67 | 120.44 | 127.67 | **119.92** |
| G2 = 60 mg.l$^{-1}$ | 121.11 | 125.89 | 133.33 | 138.78 | **129.78** |
| Mean | 95.03 | 117.70 | 123.26 | 130.67 | |
| LSD 0.05 | N | G | N × G | | |
| | 3.03 | 2.63 | 5.26 | | |
| **leaves are (dm$^2$)** | | | | | |
| G0= control | 17.44 | 28.03 | 32.74 | 31.96 | **27.54** |
| G1= 30 mg.l$^{-1}$ | 25.02 | 31.18 | 40.91 | 41.93 | **34.76** |
| G2 = 60 mg.l$^{-1}$ | 25.97 | 32.96 | 40.43 | 36.49 | **33.96** |
| Mean | 22.81 | 30.72 | 38.03 | 36.79 | |
| LSD 0.05 | N | G | N × G | | |
| | 1.15 | 1.00 | 2.00 | | |

**Table 3 Effect of foliar application with urea, GA3 and their combination on plant height increment, leaves number increment and leaves area..LSD = Least significant difference at 5% probability**

*Shoot number increment (shoot. sapling$^{-1}$):*

Spray with urea had a significant effect on new shoots. N3 achieved the highest value (5.11 shoot. sapling$^{-1}$) without significant difference from N2 compared to N0, which gave the lowest value (3.33 shoot.sapling$^{-1}$). Foliar application with GA3 showed a significant effect in this characteristic. G2, without significant difference with G1, gave the highest value (5.08 and 4.42 shoot.sapling$^{-1}$), respectively, compared to G0. Regarding the interaction between the studied factors, N3G2 achieved the highest value (6.33 shoot. sapling $^{-1}$) Compared to the lowest value (2.89 shoot. sapling $^{-1}$) at N0G0 (Table 4).

*Shoot length (cm):*

From the results shown in Table (4), it is clear that urea spray had a significant effect on shoot length, especially N2, which gave (41.32cm). On the other hand, G2 achieved the highest value (36.54 cm) compared to G0, which registered the lowest value (29.87 cm); on the other hand, the interaction between the studied

factors, N2G2, achieved the highest value (45.40 cm) in comparison with N0G0 which gave the lowest value (22.86 cm)

*Rootstock diameter increment (mm):*

As shown in Table (4), the results revealed a significant increase in the rootstock diameter. As it sprayed with urea, N3 achieved the maximum value (11.28 mm) compared with N0, which gave the minimum value (9.00 mm). Application GA3 increased rootstock diameter, especially G2, which recorded the maximum value (10.84mm), while G0 gave the minimum value (8.03mm). On the other hand, the interaction between the studied factors showed that N3G2 recorded the maximum diameter (13.03mm) in comparison with the minimum value(6.96mm) in N0G0

| **Gibberellin (G)** | **Urea (N)** | | | | Mean |
|---|---|---|---|---|---|
| | N0 = control | N1 = 4 g.l$^{-1}$ | N2 = 8 g.l$^{-1}$ | N3 =12 g.l$^{-1}$ | |
| **shoot number increment(shoot.sapling $^{-1}$)** | | | | | |
| G0= control | 2.89 | 3.44 | 3.67 | 4.33 | **3.58** |
| G1= 30 mg.l$^{-1}$ | 3.11 | 4.55 | 5.33 | 4.67 | **4.42** |
| G2 = 60 mg.l$^{-1}$ | 4.00 | 5.00 | 5.00 | 6.33 | **5.08** |
| Mean | 3.33 | 4.33 | 4.67 | 5.11 | |
| | N | G | N × G | | |
| LSD 0.05 | 0.71 | 0.62 | 1.23 | | |
| **Shoot length (cm)** | | | | | |
| G0= control | 22.86 | 23.83 | 36.97 | 35.83 | **29.87** |
| G1= 30 mg.l$^{-1}$ | 24.72 | 31.30 | 41.60 | 36.40 | **33.50** |
| G2 = 60 mg.l$^{-1}$ | 25.00 | 32.30 | 45.40 | 43.47 | **36.54** |
| Mean | 24.19 | 29.14 | 41.32 | 38.57 | |
| | N | G | N × G | | |
| LSD 0.05 | 1.74 | 1.51 | 3.02 | | |
| **rootstock diameter increment(mm)** | | | | | |
| G0= control | 6.96 | 7.60 | 8.56 | 9.00 | **8.03** |
| G1= 30 mg.l$^{-1}$ | 7.90 | 9.06 | 11.36 | 11.83 | **10.04** |
| G2 = 60 mg.l$^{-1}$ | 8.43 | 9.80 | 12.10 | 13.03 | **10.84** |
| Mean | 7.76 | 8.82 | 10.67 | 11.28 | |
| | N | G | N × G | | |
| LSD 0.05 | 0.37 | 0.32 | 0.64 | | |

**Table 4 Effect of foliar application with urea, GA3 and their combination on shoot number increment, shoot length and rootstock diameter increment.LSD = Least significant difference at 5% probability**

## DISCUSSION

It is observed from the results mentioned above in Table (3&4) that a significant increase occurred in vegetative characteristics by foliar application of urea, which may be attributed to the role of nitrogen, which occupied (46%) of urea

composition that serves as a constituent of many plant cell components, including amino acids, amides, proteins, nucleic acids and coenzymes. Furthermore, there is a strong positive correlation between photosynthesis and leaf nitrogen content [15], In addition to the role of nitrogen, which contributes directly or indirectly to the biological construction of some hormones, such as auxin and cytokinin, which play an important role in cell expansion, moreover to the role of cytokinin in stimulating cell division, which leads to an increase in the height of saplings and an increase in the number and length of vegetative shoots. These findings are in agreement with [12] and [8]. The effect of gibberellic acid in improving vegetative growth may be due to its role in increasing cell size through its contribution to increasing the flexibility of cell walls or to the role of auxin-induced by gibberellin in cell growth and its importance in stimulating genetic reproduction and then the process of translation and building of RNA and protein on the other hand, auxins induced by gibberellins stimulate the plasticity of cell walls by breaking cell wall bonds and re-arranging them in new sites under the influence of turgor pressure, which contributes to an increase in cell size, These results are in agreement with [3] and [4].

## CONCLUSION

From these results, it can be concluded that urea as a source of nitrogen and GA3 (12 $g.l^{-1}$ +60 $mg.l^{-1}$) can be sprayed to get good growth of saplings so that early marketable size saplings can be produced and by reducing the cost of production

## References


1 Agha, J. T and D. A.Daoud. Production of Evergreen Fruits -Part Two-Ministry of Higher Education and Scientific Research. Iraq. **1991**.

2 Al-Araji ,J., M, RI. Al-Hamdani and M. H.Sharif . Effect of foliar spraying with urea on the growth and seedlings of three olive cultivars (Olea *europeae* L.) *Rafidain Journal of Agriculture.* **2005**; *33 (4)*: 40 - 41.

3 Al-Falahy, T. H. R . Response of kumquat (*Fortunella margarita*) saplings to foliar spray with Bio-stimulator and GA3 . IOP Conference Series: Earth and Environmental Science. **2021**;761: 1-8.

4 Al-Rawi, T. K. Response of traditional lemon seedling to foliar fertilizer NPK, seaweed extract and gibberellin .Plant Archives. 21 (supplement 1): **2021**; 114 -117.

5 Bondada, B.R., J.P.Syvertsen & L.G. Albrigo. Urea nitrogen uptake by citrus leaves.*Hort.Sci.* **2001**; *36 (6):*1061-1065.

6 Central Statistical Organization. Production Report. Annual Statistical Group. Ministry of Planning, Agricultural Statistics Directorate, Publication and Public Relations Department, Baghdad. **2020**.

7 Chou, G.J. Anew method of measuring the leaf area of Citrus. *Acta Hort sci.* **1966**; *5*, 7- 20.

8 Harsha, H.R., V. Rao., K. J. Dayamani and M. Shivanna. Pummelo (*Citrus maxima* Merill) seedlings growth as influenced by plant growth regulators and macronutrients. Int. J. Curr. Microbiol. *App. Sci.* **2017**; *6 (12)*:1750- 1754.

9 Hussein, M.J. and T.H.R.Al-Falahy (2021). Influence of potassium and GA3 on yield and some fruit quality of date palm cv. Barhee. *Int. J. Agricult. Stat. Sci.* Vol. 17, Supplement 1, pp. 1173-1178.

10 Jacob, N. A. (**2013**). Effect of foliar spraying with urea and gibberellin acid GA3 on some vegetative growth characteristics of *Citrus aurantium* L. seedlings. Al-Furat Journal of Agricultural Sciences.5 (4): 1 - 6.

11 Leghari,S.J.; NA.Wahocho;.M.Laghari ; A.H. Laghari ; G.M.Bhabhan; K.H. Talpur ; T.A.Bhutto; S.A.Wahocho & A.A.Lashari. (**2016**). Role of nitrogen for plant growth and development. Areview. Advances in Environmental Biology. 10(9):209-218.

12 Patil, S.R., D.P.Waskar & A.M. Sonkamble. (**2013**).Effect of gibberellic acid, urea and neem cake on growth of Rangpur lime (*Citrus limonia*, Osbeck) seedlings.The Asian Journal of Horticulture. 8(1):285- 287.

13 Russell, L.J & P.B. Kaufman. (**2008**). The role of gibberellins in plant cell elongation .Critical Reviews in Plant Science. 1(1):23-47.
14 Smoleń S. (**2012**). Foliar Nutrition: Current State of Knowledge and Opportunities. In: A. K. Srivastava (Ed.), *Advances in Citrus Nutrition*. pp. 41 – 58.
15 Taiz, L. & E. Zeiger. (**2010**). Plant Physiolog .5th ed .Publisher Sunderland, Masschusetts. USA

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