International Journal of Advanced Biochemistry Research 2025; 9(4): 787-791

International Journal of Advanced Biochemistry Research

ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating: 5.29
IJABR 2025; 9(4): 787-791
www.biochemjournal.com
Received: 14-02-2025
Accepted: 19-03-2025

Ruqaya Rasool Jawad
Department of Horticulture and Landscape, College of Agriculture, Al-Qasim Green University, Babylon, Iraq

Hadi Kadhim Al-Jubouri
Department of Horticulture and Landscape, College of Agriculture, Al-Qasim Green University, Babylon, Iraq

Sad Shker Mahmood
Department of Horticulture and Landscape, College of Agriculture, Al-Qasim Green University, Babylon, Iraq

Corresponding Author:
Ruqaya Rasool Jawad
Department of Horticulture and Landscape, College of Agriculture, Al-Qasim Green University, Babylon, Iraq

The effect of humic acid, calcium, and plant growth regulators on chemical and fruit traits of black diyala fig trees (*Ficus carica* L.)

Ruqaya Rasool Jawad, Hadi Kadhim Al-Jubouri and Sad Shker Mahmood

DOI: https://www.doi.org/10.33545/26174693.2025.v9.i4i.4193

Abstract
This study investigated the effect of humic acid, calcium oxide, and certain plant growth regulators on fig trees of the "Black Diyala" cultivar. The experiment was conducted during the 2024 growing season in a private orchard in the Al-Mahaweel district, Babylon Governorate. Four levels of humic acid and calcium oxide were added to the soil at concentrations: (0, humic acid at 10 mL/L, calcium oxide at 5 mL.L-1, humic acid 10 mL/L + calcium oxide 5 mL/L). In addition, foliar sprays of the growth regulators NAA and GA_3 were applied at concentrations (0, 75 mg.L-1 Naphthalene Acetic Acid, 100 mg.L-1 Gibberellic Acid). The treatments and their interactions were evaluated for their influence on various vegetative and fruit characteristics of the fig trees. The factorial experiment was executed in a randomized complete block design (RCBD) (4×3) with three replicates. The results revealed that both the individual and combined applications of the treatments led to significant increases in nitrogen, phosphorus, potassium content, chlorophyll index, vitamin C, total soluble solids (TSS), fruit moisture, and dry matter percentage. The treatment A4B3 recorded the highest values for nitrogen (3.27%), phosphorus (0.435%), potassium (1.903%), chlorophyll content (70.17 Spad), vitamin C (7.269 mg/100g juice), and TSS (18.96%). Meanwhile, the treatment A2B3 yielded the highest fruit moisture content (78.54%) and dry matter percentage in fruits (21.46%).

Keywords: Humic acid, calcium, growth regulators (GA3, NAA), *Ficus carica*. L

Introduction

The fig tree (*Ficus carica* L.) is a deciduous fruit species belonging to the genus Ficus, which is part of the family Moraceae. This genus comprises approximately 100 species and 700 cultivars. It is believed that the fig originated in the Arabian Peninsula, and its cultivation was spread by Muslims to North Africa and the Mediterranean countries (Herre *et al.*, 2008) [21]. Currently, Turkey ranks first in global fig production, followed by Egypt and Algeria. The global fig production is estimated at approximately 1,051,795 tons (F.A.O, 2021). Iraq's annual production is estimated at 9,681 tons, with an average yield of 23.45 kg per tree, according to the (Central Statistical Organization 2021).

Fig fruits are consumed both fresh and dried and are also used in various industries due to their high content of minerals, vitamins, dietary fiber, and phenolic compounds (Oskouei *et al.*, 2015) [18]. Moreover, the fig tree is considered a medicinally important plant due to the utility of its different parts,such as fruits, leaves, buds, bark, and seeds. For instance, its phenolic compounds play a vital role in antioxidant activity, which positively impacts human health (Joseph & Raj, 2011) [17]. Humic acid is an organic humic substance that enhances soil fertility, improves plant growth and yield, and reduces the adverse effects of soil salinity. It promotes the availability of essential nutrients in the soil by converting them into absorbable forms for the plant and stimulates microbial activity. Furthermore, it contributes to improved vegetative growth, enhanced qualitative and quantitative yield, and supports sustainable agricultural production (Ennab *et al.*, 2023) [15]. Humic acid also improves soil properties and activates soil microorganisms, in addition to stimulating plant development and increasing total yield (Perminova *et al.*, 2019) [8]. According to Ferrara and Brunetti (2010) [16], applying humic acid to grapevine soil improved both the quantitative and qualitative characteristics of the fruit.

Calcium positively affects the growth of plant organs and tissues by stimulating root development and facilitating the incorporation of substances into cell walls. It increases the thickness and permeability of cell walls and protects them from enzymatic degradation (Zhi *et al.*, 2017) [20]. Calcium is relatively immobile within the plant and thus tends to accumulate more in older leaves. Deficiency symptoms commonly appear first on young leaves and are widespread in fruit trees (Prado, 2021) [14]. Thakur and Chawla (2019) [19] found that treating apple trees with three calcium concentrations (0.25, 0.50, and 0.75 g/L) enhanced vegetative growth indicators such as leaf area and plant height, and improved fruit growth and quality parameters such as fruit length, diameter, volume, weight, firmness, and total yield.

Plant growth regulators (PGRs) are non-nutritional organic compounds naturally synthesized in plants. They regulate and activate growth and physiological processes at low concentrations (Radi, 2021) [3]. The use of PGRs has become a crucial aspect of agricultural practices, especially for fruit crops, as these compounds enhance both physical and chemical fruit traits. Following the discovery of auxins, NAA was found to be effective in addressing two major problems in fruit production: alternate bearing and premature fruit drop. Similarly, the application of gibberellins and cytokinins has improved fruit quality, reduced defects, and extended postharvest life, thereby increasing the marketable period for high-quality fruits (Bisht *et al.*, 2018) [13]. In an experiment conducted by (Al-Rawi 1999) [4] on Black Diyala fig trees, the effects of NAA and GA_3 on vegetative, chemical, and yield traits were examined, resulting in significant differences across most studied traits. Maseer (2020) [5] also reported that spraying Black Diyala fig trees with gibberellic acid had a significant impact on improving physical and chemical fruit traits, total yield, and vegetative growth indicators.

Materials and Methods

The experiment was conducted during the 2024 growing season in a private orchard in Al-Mahaweel district, Babylon Governorate, south of Baghdad. The study aimed to evaluate the effects of humic acid, calcium oxide, and selected plant growth regulators on fig trees (*Ficus carica* L.), specifically the 'Black Diyala' cultivar. The experiment was conducted as a factorial experiment (4×3) according to the randomized complete block design (RCBD), and the treatments were randomly distributed with a total of 36 trees, 12 treatments with three replicates, each experimental unit consisting of one tree. Where each experimental unit consisted of a single tree. The experimental design included three levels of humic acid and calcium oxide, and four levels of plant growth regulators with the following treatment concentrations: first factor is (0- humic acid 10 ml/L - calcium oxide 5 ml/L - humic acid 10 ml/L + calcium oxide 5 ml/L) and symbolized by (A1, A2, A3, A4) added to the soil and the second factor is growth regulators at concentrations (0, naphthalene 75 gibberellin 100 mg/L) for (B1, B2, B3) Treatments of factor A (humic acid and calcium oxide) were applied three times. In contrast, factor B (growth regulators) was applied twice, with a one-month interval between each application. The trees used in the experiment were 8 years old, as uniform as possible in terms of size and vigor, and planted at a spacing of 5 × 5 meters. Standard horticultural practices were implemented, including irrigation, weed control, pest and disease management, and pruning. Data were statistically analyzed using GenStat software (Version 12). Treatment means were compared using the Least Significant Difference (LSD) test at a 0.05 probability level (Rawi, 2000) [12].

The treatments were as follows

1. The comparison was sprayed with distilled water.
2. Humic acid 10 ml/L.
3. Calcium oxide 5ml/L.
4. Humic Acid 10ml/L + Calcium Oxide 5ml/L.
5. Naphthalene 75mg/L.
6. Gibberellin 100mg/L.
7. Humic Acid 10ml/L + Naphthalene 75mg/L.
8. Calcium Oxide 5ml/L + Naphthalene 75mg/L.
9. Humic Acid 10ml/L + Calcium Oxide 5ml/L + Naphthalene 75mg/L.
10. Humic Acid 10ml/L + Gibberellin 100mg/L.
11. Calcium Oxide 5ml/L + Gibberellin 100mg/L.
12. Humic Acid 10ml/L + Calcium Oxide 5ml/L + Gibberellin 100mg/L.

Measured Traits

Total Nitrogen Percentage (%)

The percentage of total nitrogen was calculated using the Kjeldahl device (Keeney *et al.*, 1982) [10].

Phosphorus Percentage (%)

The percentage of total phosphorus was estimated using the method of ammonium fundate - ammonium mollipids (Al-Sahaf, 1989) [9].

Potassium Percentage (%)

The percentage of potassium in the plant was estimated according to the method mentioned (Al-Sahaf, 1989) [9].

Total Chlorophyll Content in Leaves (SPAD)

Five leaves were randomly selected from the lower, middle, and upper parts of each tree. Chlorophyll content was measured using a German-made SPAD meter, and the average value per tree was calculated for each experimental unit.

Fruit Vitamin C Content

Vitamin C content in fruit juice was determined according to the method described (Al-Ani *et al.* 2007) [11].

Total Soluble Solids (T.S.S) in Fruits (%)

Total soluble solids in fruit juice were measured using a Japanese-made hand refractometer. A drop of juice was placed on the device, and readings were taken for several samples, from which the average value was calculated for each experimental unit.

Fruit Moisture Content (%)

A weighed fruit sample was subjected to air-drying until constant weight was achieved. Moisture percentage was then calculated using the following formula:

$$\text{Fruit Moisture Percentage\%} = \frac{\text{Soft sample weight} - \text{Dry sample weight}}{\text{Sample soft weight}} \times 100$$

Fruit Dry Matter Content (%)
This percentage was calculated based on the fresh and dry weight of the fruit samples as follows:

$$Percentage\ of\ dry\ matter\% = \frac{Fruit\ dry\ weight}{Fruit\ soft\ weight} \times 100$$

Results and Discussion
Nitrogen Percentage (%)
The results presented in Table (1) indicate a significant effect of humic acid and calcium oxide on leaf nitrogen content. Treatment A4 recorded the highest nitrogen percentage (2.861%) compared to the lowest value (2.081%) observed in treatment A1. As for the plant growth regulators, the same table shows a significant effect as well, where treatment B3 recorded the highest nitrogen percentage (2.714%), while treatment B2 resulted in the lowest value (2.232%).
The interaction between the studied factors had a significant effect on nitrogen percentage. The combined treatment A4B3 resulted in the highest nitrogen percentage (3.279%), compared to the lowest value of (1.841%) recorded in treatment A1B1.

Table 1: The effect of humic acid, calcium oxide, and plant growth regulators, and their interaction, on nitrogen percentage

Factor B	Factor A				average
	A1	A2	A3	A4	
B1	1.841	2.509	1.934	2.790	2.268
B2	2.013	2.435	1.968	2.514	2.232
B3	2.390	2.830	2.358	3.279	2.714
average	2.081	2.591	2.086	2.861	
L.S.D$_{(0.05)}$	A 0.418		B 0.322		Interaction 0.745

Phosphorus Percentage (%)
Table (2) shows that the application of humic acid and calcium oxide had a significant effect on phosphorus concentration in fig leaves. Treatment A4 recorded the highest mean value (0.265%) compared to the lowest value (0.152%) in treatment A1. Regarding plant growth regulators, the results in the same table indicate a significant effect, with treatment B3 recording the highest phosphorus percentage (0.245%), while treatment B1 showed the lowest (0.150%).
Furthermore, the interaction between the studied factors also had a significant effect. The combined treatment A4B3 resulted in the highest phosphorus percentage (0.435%) compared to the lowest (0.130%) in treatment A1B1.

Table 2: Effect of humic acid, calcium oxide, plant growth regulators, and their interaction on phosphorus percentage (%)

factor B	factor A				average
	A1	A2	A3	A4	
B1	0.130	0.150	0.147	0.173	0.150
B2	0.158	0.153	0.143	0.187	0.160
B3	0.170	0.193	0.183	0.435	0.245
average	0.152	0.165	0.157	0.265	
L.S.D$_{(0.05)}$	A 0.034		B 0.023		Interaction 0.061

Potassium Percentage %
According to the results in Table (3), the application of humic acid and calcium oxide had a significant effect on potassium content in fig leaves. Treatment A4 recorded the highest mean value (1.742%) compared to the lowest value (1.301%) observed in treatment A1.
Regarding plant growth regulators, the data also indicated a significant effect, with treatment B3 achieving the highest mean potassium content (1.754%), while the lowest value (1.336%) was recorded in treatment B1.
The interaction between the experimental factors significantly influenced potassium levels. The combined treatment A4B3 gave the highest value (1.903%), whereas the lowest value (1.147%) was recorded under treatment A1B1.

Table 3: Effect of humic acid, calcium oxide, plant growth regulators, and their interaction on potassium percentage (%)

Factor B	Factor A				Average
	A1	A2	A3	A4	
B1	1.147	1.454	1.212	1.532	1.336
B2	1.255	1.695	1.476	1.793	1.554
B3	1.503	1.856	1.755	1.903	1.754
average	1.301	1.668	1.481	1.742	
L.S.D(0.05)	A 0.334		B 0.276		Interaction 0.552

Total Leaf Chlorophyll Content (SPAD)
Table (4) illustrates that the application of humic acid and calcium oxide had a significant effect on total chlorophyll content in fig leaves. The highest mean value (68.90 SPAD) was recorded under treatment A4, compared to the lowest value (64.79 SPAD) observed in the control (A1).
Similarly, plant growth regulators had a significant effect on this trait, with treatment B3 yielding the highest mean chlorophyll content (68.71 SPAD), while the lowest value (63.75 SPAD) was recorded under B1.
The interaction between the two factors also had a significant influence, where treatment A4B3 recorded the highest chlorophyll content (70.17 SPAD), compared to the lowest value (59.27 SPAD) in treatment A1B1.

Table 4: Effect of humic acid, calcium oxide, plant growth regulators, and their interaction on total chlorophyll content in leaves (SPAD)

Factor B	Factor A				Average
	A1	A2	A3	A4	
B1	59.27	65.10	63.90	66.73	63.75
B2	67.47	68.03	67.67	69.80	68.24
B3	67.63	68.17	68.90	70.17	68.71
average	64.79	67.10	66.82	68.90	
L.S.D$_{(0.05)}$	A 1.482		B 1.711		Interaction 2.964

Vitamin C Content in Fruits (mg/100 g Juice)
The results presented in Table (5) indicate that the application of humic acid and calcium oxide did not have a statistically significant effect on the average vitamin C content in fig fruits.
However, the application of plant growth regulators had a significant impact on this trait. The highest mean vitamin C content (7.01 mg/100 g juice) was recorded in treatment B3, while the lowest content (6.46 mg/100 g juice) was observed under B1.
Furthermore, the interaction between factors showed a significant effect. The combination treatment A4B3 yielded the highest vitamin C content (7.26 mg/100 g juice), whereas the lowest value (6.16 mg/100 g juice) was recorded in A1B1.

Table 5: Effect of humic acid, calcium oxide, plant growth regulators, and their interaction on vitamin C content in fig fruits (mg/100 g juice)

Factor B	Factor A				Average
	A1	A2	A3	A4	
B1	6.16	6.45	6.35	6.89	6.46
B2	6.21	6.44	6.22	6.44	6.33
B3	6.58	7.16	7.03	7.26	7.01
average	6.32	6.69	6.53	6.87	
L.S.D$_{(0.05)}$	A 0.562		B 0.486		Interaction 0.973

Total Soluble Solids (T.S.S %)

The results in Table (6) indicate that the application of humic acid and calcium oxide significantly affected the total soluble solids (T.S.S) content in fig fruits. Treatment A4 recorded the highest mean value (18.03%) compared to the lowest (16.34%) in treatment A1.

Similarly, plant growth regulators showed a significant effect on T.S.S levels. The highest mean (17.89%) was observed in treatment B3, while the lowest (16.61%) was recorded under B1.

A significant interaction effect was also observed between the two factors. The combination treatment A4B3 recorded the highest T.S.S value (18.96%), whereas the lowest (15.48%) was observed in A1B1.

Table 6: Effect of humic acid, calcium oxide, plant growth regulators, and their interaction on total soluble solids in fig fruits (T.S.S %)

Factor B	Factor A				Average
	A1	A2	A3	A4	
B1	15.48	16.18	17.35	17.45	16.61
B2	16.17	16.48	17.27	17.67	16.90
B3	17.37	17.73	17.49	18.96	17.89
average	16.34	16.79	17.37	18.03	
L.S.D$_{(0.05)}$	A 0.552		B 0.478		Interaction 0.957

Fruit Moisture Content (%)

Table (7) shows that the application of humic acid and calcium oxide had a significant effect on the moisture content of fig fruits. The highest mean value (78.18%) was recorded under treatment A4, while the lowest (77.43%) was observed in A1.

Plant growth regulators also had a significant impact on this trait. Treatment B3 recorded the highest moisture percentage (78.06%), compared to the lowest value (77.27%) in B1.

Furthermore, the interaction between the factors was significant. The combination treatment A2B3 resulted in the highest moisture content (78.54%), while the lowest value (76.83%) was observed under A1B1.

Table 7: Effect of humic acid, calcium oxide, plant growth regulators, and their interaction on fruit moisture content (%)

B	factor A				Average
	A1	A2	A3	A4	
B1	76.83	77.04	77.60	77.62	77.27
B2	77.28	78.00	78.07	78.52	77.96
B3	78.19	78.54	77.11	78.42	78.06
average	77.43	77.86	77.59	78.18	
L.S.D$_{(0.05)}$	A 0.699		B 0.570		Interaction 1.140

Fruit Dry Matter Content (%)

The results in Table (8) reveal that the application of humic acid and calcium oxide had a significant effect on the dry matter percentage in fig fruits. The lowest mean value (21.80%) was recorded under treatment A4, while the highest (22.55%) was observed in A1.

Plant growth regulators also had a significant influence on this trait. Treatment B3 resulted in the lowest dry matter percentage (21.92%), whereas treatment B1 recorded the highest value (22.71%).

Moreover, the interaction between the factors significantly affected the dry matter percentage. The lowest value (21.46%) was recorded in treatment A2B3, while the highest value (23.15%) was observed in treatment A1B1.

Table 8: Effect of humic acid, calcium oxide, plant growth regulators, and their interaction on fruit dry matter content (%)

Factor B	factor A				Average
	A1	A2	A3	A4	
B1	23.15	22.94	22.38	22.37	22.71
B2	22.71	21.99	21.90	21.47	22.01
B3	21.79	21.46	22.88	21.56	21.92
average	22.55	22.13	22.38	21.80	
L.S.D$_{(0.05)}$	A 0.630		B 0.492		Interaction 1.383

The observed increase in total chlorophyll content following humic acid treatment can be attributed to its role in enhancing vegetative growth, thereby improving the plant's ability to absorb essential nutrients. Humic acid facilitates the conversion of nutrients, especially N, P, and K, from unavailable to plant-absorbable forms. The availability of these nutrients stimulates the photosynthetic process, resulting in increased total chlorophyll content in the leaves (Al-Hamdani, 2012) [1].

The increase in chlorophyll content due to foliar application of plant growth regulators is likely a result of enhanced root activity, which improves nutrient uptake, particularly those involved in chlorophyll biosynthesis. Consequently, chlorophyll content increases compared to the untreated control. This process also enhances food synthesis, stimulates plant growth, and activates enzymatic systems, leading to elevated levels of growth-promoting hormones (Devlin & Witham, 2003) [2].

The rise in fruit moisture content associated with humic acid treatment may be due to its stimulatory effect on plant growth and development. This enhancement expands the leaf surface area exposed to light, promoting the synthesis of photosynthates and their translocation to other plant parts. As a result, total soluble solids increase while dry matter content tends to decrease (Perminova *et al.*, 2019) [8].

Plant growth regulators contribute to increased leaf area and delayed leaf senescence, which enhances the synthesis and transport of assimilates to the fruits. This also accelerates biochemical transformations within fruit tissues, increasing their accumulation of total soluble solids and vitamin C (Radi, 2021) [3], consistent with findings by Al-Anebi (2008) [6].

The increased fruit moisture content resulting from growth regulator application is also related to their physiological role in promoting cell division, elongation, and enlargement, as well as increasing cell wall permeability. This facilitates greater water absorption, leading to higher fruit moisture content and a corresponding reduction in dry matter content (Jundia, 2003) [7].

Conclusions

1. The application of growth regulators, calcium, and humic acid boosted the fig trees' vegetative development and improved the fruits' quality and quantity.
2. The best concentrations used for the first factor are 10 ml humic acid and 5 ml calcium oxide.
3. Regarding the second factor (growth regulators), the best results were achieved when using naphthalene acetate 75 mg/liter combined with gibberellic acid 100 mg/liter.

References

1. Al-Hamdani HM. Plant Physiology of Fruit Trees. Cairo, Egypt: Arab Publishing and Distribution House; 2012.
2. Devlin RM, Witham FH. Plant Physiology. Shouki M. Mahmoud, translator. Cairo, Egypt: Arab Publishing and Distribution House; 2003.
3. Radi MM. Plant Growth Regulators. Fayoum, Egypt: Ministry of Higher Education and Scientific Research, Fayoum University; 2021.
4. Al-Rawi AZDN. The effect of NAA and GA_3 application on fruit drop and fruit quality traits of Black Diyala fig (*Ficus carica* L.) [M.Sc. thesis]. Baghdad, Iraq: College of Agriculture, University of Baghdad; 1999.
5. Maseer SAA. Effect of spraying with NPK nano-fertilizer and GA_3 on the physical, chemical, and physiological traits and yield of Black Diyala fig trees [M.Sc. thesis]. Dhi Qar, Iraq: College of Agriculture, University of Dhi Qar; 2020.
6. Al-Anebi RMM. Effect of NAA and calcium chloride foliar spray on vegetative and fruit traits of Black Diyala fig trees [M.Sc. thesis]. Kufa, Iraq: College of Agriculture, University of Kufa; 2008.
7. Jundia HM. Physiology of Fruit Trees. Cairo, Egypt: Arab Publishing and Distribution House; 2003.
8. Perminova IV, García-Mina JM, Knicker H, Miano T. Humic substances and nature-like technologies: understanding humic substances structures and interactions for the development of environmentally friendly technologies. Journal of Soils and Sediments. 2019;19:2663-2664.
9. Al-Sahaf FH. Applied Plant Nutrition. Baghdad, Iraq: Ministry of Higher Education and Scientific Research, University of Baghdad, House of Wisdom for Publishing, Translation and Distribution; 1989. p. 259.
10. Keeney DR, Nelson DW. Nitrogen-inorganic forms. In: Page AL, editor. Methods of Soil Analysis: Part 2. Chemical and Microbiological Properties. 2nd ed. Madison, WI: American Society of Agronomy; 1982. p. 643-698.
11. Al-Ani M, Opara LU, Al-Bahri D, Al-Rahbi N. Spectrophotometric quantification of ascorbic acid contents of fruit and vegetables using the 2,4-dinitrophenylhydrazine method. Journal of Food Agriculture and Environment. 2007;5(3/4):165.
12. Al-Rawi KM, Khalaf Allah AM. Design and Analysis of Agricultural Experiments. Baghdad, Iraq: Ministry of Higher Education and Scientific Research, University of Baghdad; 2000. p. 561.
13. Bisht TS, Rawat L, Chakraborty B, Yadav V. A recent advances in use of plant growth regulators (PGRs) in fruit crops - A review. International Journal of Current Microbiology and Applied Sciences. 2018;7(5):1307-1336.
14. De Mello Prado R. Mineral Nutrition of Tropical Plants. Vol. 1. Cham, Switzerland: Springer; 2021.
15. Ennab HA, Mohamed AH, El-Hoseiny HM, Omar AA, Hassan IF, Gaballah MS, *et al.*, Humic acid improves the resilience to salinity stress of drip-irrigated Mexican lime trees in saline clay soils. Agronomy. 2023;13(7):1680.
16. Ferrara G, Brunetti G. Effects of the times of application of a soil humic acid on berry quality of table grape (*Vitis vinifera* L.) cv Italia. Spanish Journal of Agricultural Research. 2010;8(3):817-822.
17. Joseph B, Raj SJ. A comparative study on various properties of five medicinally important plants. International Journal of Pharmacology. 2011;7(2):206-211.
18. Oskouei TE, Allahyari SA, Atashkhosrow AA, Delazar A, Pashaii M, Gan SH, Najafi M. Methanolic extract of *Ficus carica* Linn. leaves exerts antiangiogenetic effects based on the rat air pouch model of inflammation. Evidence-Based Complementary and Alternative Medicine. 2015;2015:Article ID 760405.
19. Thakur BS, Chawla W. Effect of calcium chloride on growth, fruit quality and production of apple. Journal of Pharmacognosy and Phytochemistry. 2019;8(1S):588-593.
20. Zhi HH, Liu QQ, Dong Y, Liu MP, Zong W. Effect of calcium dissolved in slightly acidic electrolyzed water on antioxidant system, calcium distribution, and cell wall metabolism of peach in relation to fruit browning. The Journal of Horticultural Science and Biotechnology. 2017;92(6):621-629.
21. Herre EA, K. eler, Machado C. Evolutionary ecology of fig leaves extra. Recent progress and outstanding puzzle. Ecology. 2008;37:438-456.