Effect of Paisen, Populuseuphratica Bud Extract and Copper Sulfate on Some Traits of Vegetative Growth and Yield of Aswad Diyala Cultivars

Hadi Kadhim Hussein Al-Jubouri

College of Agriculture, Al-Qasim Green University, Iraq.

Email: Hadi.kahdim@agre.uoqasim.edu.iq

Abstract

This study was conducted in a private orchard in Al-Kifl District / Babylon province for the season 2020, 54 fig trees of the Aswad Diyala cultivar, aged 8 years, were selected, homogeneous in size and growing strength as much as possible and planted on dimensions (5 x 5 m). Trees are irrigated as a tourist and fertilized with nitrogen and compound fertilizers in two batches in the third and fifth months annually at an average of 1 kg/tree\(^1\). The randomized complete block design (R.C.B.D) -Research design: The experiment is implemented by following the Randomized Complete Block Design (R.C.B.D) as a factorial experiment (3 x 3 x 2) of Paisen were (0, 100, 200) mg/L\(^1\) (Paisen is a natural cytokinin extracted from the roots of grape vines) and Populus euphratica bud extract (0, 20, 30) g/L\(^1\) and copper sulfate (0, 2.5) g/L\(^1\) spraying on the vegetative growth in three periods. And the highest results obtained were for) Paisen 200 mg/L\(^1\) + extract 30 g/L\(^1\) + copper sulfate 2.5 g/L\(^1\) (yield quantity - fruit weight - fruit size - chlorophyll content of leaves and leaf area) and were recorded (27.12 kg – 38.05 g – 33.97 cm\(^3\) – 115.93 mg / kg fresh weight – 174.19 cm\(^2\) ) respectively when using the highest concentrations of each of the study factors combined compared to the lowest results when the control treatment and reached (21.03 kg – 30.68 g – 25.07 cm\(^3\) – 111.77 mg / kg fresh weight – 152.26 cm\(^2\) ) respectively.

Keywords: Paisen, Vegetative, Aswad, Copper.

1. Introduction

The fig, (Ficus carica L.) belongs to Moraceae family, The name Carica is due to a region in Anatolia famous for the cultivation and manufacture of figs, while the English Fig evolved from the Indian name Feg. It is believed that the original home of figs is the Arabian Peninsula. Where there are now many wild forests from it, and after the Islamic conquest, Muslims spread its cultivation in North Africa and Mediterranean countries such as Spain, Portugal, southern France, Italy and Greece [1]. California occupies third place for fig production after Turkey and Greece [2]. In most cultivars, fig-trees produce three crops, but one of them is the main crop. Many local fig cultivars are spread in Iraq, but the most important of them is in the central region, the black Diyala cultivar [3]. (The total production in Iraq is estimated at about 9322 tons, and the average tree production was about 22.85 kg [4]. Fresh or dried fig fruits, juices, and wines are used, and latex is used in the manufacture of cheese. Most of the active substances in figs have antiseptic and laxative properties, and it is considered one of the aiding factors in digestion and in the treatment of some intestinal diseases and chronic constipation [5]. Fig leaves contain the compound Methoxsalen, which is used to treat vitiligo, psoriasis and skin cancer diseases caused by exposure to ultraviolet rays [6]. [7], mentioned that the Euphrates poplar plant contains a high percentage of salicin, which has an important role in stimulating the growth of plants and inhibiting the growth of bacteria and fungi that infect them, and that the newly opened buds of it contain three times of phenolic compounds, especially isosalipirside and Naringerin acid, which Each of them is characterized by inhibiting the growth of microorganisms and [8], indicated that the salicincompound works to protect plants from some biological diseases caused by fungi and bacteria and improve their growth. [9], confirmed that western bark contains salicin glycoside and populin glycoside, and it may be known as Benzoyl salicin or Hypopulin, and the percentage of these compounds is high in the buds during flowering. [10], showed the cytokinins lead to the release of the lateral buds in the figs from the dominance of the terminal buds without the need to cut the terminal buds, which is reflected in the increase in the production of trees. It also encourages the expansion and division of cells, which increases growth. 

Content from this work may be used under the terms of the Creative Commons Attribution 3.0 licence. Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI. Published under licence by IOP Publishing Ltd.
Copper sulfate reduces the infestation of fruits, as it was used to combat some insects, as well as being nutrients that the plant needs to conducted vital processes.

2. Materials and Methods

The study included 18 treatments, each treatment was repeated three times (each tree was considered an experimental unit). The experiment was implemented as a factorial experiment and the Randomized Complete Block Design (RCBD) was chosen with three factors and three replicates (3 x 3 x 2). The replicate is a single tree.

Where the levels of Paisen (0, 100, 200) mg/L and Populuseuphratica bud extract (0, 20, 30) g/L and copper sulfate (0, 2.5) g/L spraying on Vegetative total in three periods.

Then the results were analyzed according to the analysis of variance table and the averages were compared using the L.S.D test at a 5% probability level [11].

The experiment was conducted in three sprayings, the first on 3/24/ and the second on 04/24/ and the third on 5/24/2020, as the trees were sprayed until completely wetness, and cleaning fluid was added as a diffuse.

The following traits were measured:

- Fruit yield, where the amount of yield during the season was calculated and the average was extracted for each treatment.
- The fruit weight, it was calculated by taking a group of fruits in each harvest and calculated their average weight, and then calculated the final average for each treatment.
- Fruit size was calculated according to the displaced water method and the average was calculated as in the previous description.
- Total chlorophyll content of leaves: Total chlorophyll was measured using a Spectrophotometer UV-Visible device according to [12] method.
- Average leaf area:

The 15 completed leaves have been taken after the fifth leaves from several branches and extracted the total area of it and then divided by the total number of leaves and extracted the average.

The treatments were as follows:-

- spraying with distilled water
  - Paisen 0 + extract 0 + copper sulfate 2.5 g . L⁻¹
  - Paisen 0 + extract 20 g . L⁻¹ + copper sulfate 0
  - Paisen 0 + extract 20 g . L⁻¹ + copper sulfate 2.5 g . L⁻¹
  - Paisen 0 + extract 30 g . L⁻¹ + copper sulfate 0
  - Paisen 0 + extract 30 g . L⁻¹ + copper sulfate 2.5 g . L⁻¹
  - Paisen 100 mg. L⁻¹ + extract 0 + copper sulfate 0
  - Paisen 100 mg. L⁻¹ + extract 0 + copper sulfate 2.5 g . L⁻¹
  - Paisen 100 mg. L⁻¹ + extract 20 g . L⁻¹ + copper sulfate 0
  - Paisen 100 mg. L⁻¹ + extract 20 g . L⁻¹ + copper sulfate 2.5 g . L⁻¹
  - Paisen 100 mg. L⁻¹ + extract 30 g . L⁻¹ + copper sulfate 0
  - Paisen 100 mg. L⁻¹ + extract 30 g . L⁻¹ + copper sulfate 2.5 g . L⁻¹
  - Paisen 200 mg. L⁻¹ + extract 0 + copper sulfate
  - Paisen 200 mg. L⁻¹ + extract 0 + copper sulfate 2.5 g . L⁻¹
  - Paisen 200 mg. L⁻¹ + extract 20 g . L⁻¹ + copper sulfate 0
  - Paisen 200 mg. L⁻¹ + extract 20 g . L⁻¹ + copper sulfate 2.5 g . L⁻¹
  - Paisen 200 mg. L⁻¹ + extract 30 g . L⁻¹ + copper sulfate 0
  - Paisen 200 mg. L⁻¹ + extract 30 g . L⁻¹ + copper sulfate 2.5 g . L⁻¹

3. Results and Discussion

3.1. Fruits yield

Table (1) showed that the amount of yield increased significantly when using Paisen, and the highest results were when using the concentration of 200 mg / L, and the amount of alkaline was 25.903kg compared to the lowest results when the control treatment amounted to 22.354, as kg well as the effect of spraying the extract significantly in increasing the amount of yield. The highest result recorded at the concentration was 30 g / L, and it was recorded as 24.806 kg compared with the lowest results when compared, and it was 23.442 kg and also the effect of using copper sulfate on the amount of yield, where the highest average of production when using the concentration 2.5 g / L⁻¹ and gave 24.34 kg, while the comparison gave
24.03 kg. With regard to the bi-interaction between the factors of the study, the interaction between the two factors (A, B) was the highest results in the treatment (A3, B3) and amounted to 26.47 kg, while the interaction of the two factors (A, C) was significant and the best results were obtained in the treatment (A3, C2) and recorded 26.20 kg as the interaction between the two factors (B, C) we notice there is a significant increase and the highest results were when the treatment (B3, C2) gave 25.07 kg. The interaction was also significant, and the highest yield was recorded when using 200 mg/L of Paisen and 30 g/L of Populus eufraica bud extract, and copper sulfate concentration of 2.5 g/L−1, and the amount of yield was 27.12 kg compared to the control treatment, which was recorded 21.03 kg.

Table 1. Effect of spraying Paisen, Populus eufraica bud extract and copper sulfate on the average fruit yield k.g/ tree.

| A*B   | A   | C   | Treatment     |
|-------|-----|-----|---------------|
| A1    | B1  | C1  | 21.03         |
| A2    | B2  | C2  | 21.87         |
| A3    | B3  | C3  | 21.45         |

3.2. Fruit weight

Through the results in Table (2), we noted that the paisen spraying was significant in the average fruit weight and the highest result was at the concentration of 200 mg / L, and then the highest average was 36.49 g compared to the control treatment, which recorded the lowest average of fruit weight, which is 32.98 g m. Also, treating fig trees of Diyala black cultivar with different concentrations of western bud extract had a significant effect on increasing the weight of the fruit, and the highest result was obtained when using the concentration 30 g/L−1, and the highest rate was 35.74 g m, while the lowest average was 34.01 g m when compared.

It is also showed from the table data that spraying copper sulfate has a significant effect on increasing the weight of the fruit, where we notice the highest result when using the 2.5 g/L−1 concentration and it was 35.13 g m, while the lowest rates when the control treatment amounted to 34.53 g m. With regard to the interaction between the factors of the study, the interaction between the two factors (A, B) was the highest results in the treatment (A3, B3) and amounted to 37.50 gm, while the interaction of the two factors (A, C) was significant and the best results were obtained in the treatment (A3, C2) and recorded
36.50 gm, as the interaction between the two factors (B, C) we notice there is a significant increase and the highest results were when the treatment (B3, c2) and amounted to 36.15 gm.

The interaction between the three study factors was significant, and the highest results were recorded at the levels of 200 mg/L, Paisen, the concentration of the extract was 30 g/L, and the concentration of 2.5 mg/L copper sulfate, and the highest weight of the fruits were recorded at 38.05 gm and the lowest was when the control treatment amounted to 30.68 gm.

Table 2. Effect of spraying Populus euphratica bud extract, Paisen and copper sulfate on the rate of the average weight of the fruit is gram.

| Treatments | A*B | C | C1 | B | A |
|------------|-----|---|---|---|---|
| 31.36      | 32.04 | 30.68 | B1 |
| 33.05      | 33.08 | 33.02 | B2 | A1 |
| 34.52      | 34.88 | 34.17 | B3 |
| 34.77      | 35.41 | 34.14 | B1 |
| 34.88      | 35.58 | 34.19 | B2 | A2 |
| 35.21      | 35.53 | 34.89 | B3 |
| 35.68      | 35.86 | 35.51 | B1 |
| 36.28      | 36.44 | 36.12 | B2 | A3 |
| 37.50      | 38.05 | 36.95 | B3 |
| 1.268      | 1.793 |   |   |   |   |
| Effect A   | 35.13 | 34.53 | C | Effect |
| 0.598      | 1.035 |   |   | LSD |
| 32.98      | 33.31 | 32.64 | A1 |
| 35.02      | 35.51 | 34.54 | A2 | interaction |
| 36.49      | 36.56 | 36.42 | A3 |
| 0.732      | 1.035 |   |   | LSD |

3.3. The fruit size at maturity.

The results in Table (3) showed that the Paisen treatments with their three concentrations caused an increase in the fruit size compared to the control treatment, and the highest average was when using the concentration 200 mg/L by giving it the largest average of the fruit size and it reached (32.96 cm³), while the minimum average of the fruit size was in the control treatment was (27.99 cm³). We also see that spraying western buds extract significantly affected the fruit size, and the best fruit size was recorded at the concentration of 30 g/L and it was (31.27 cm³) and the lowest size, when control treatment, was (28.53 cm³). Copper sulfate was significantly affected when used at a concentration of 2.5 g/L, which gave the highest average fruit size, which is (31.02 cm³) compared to the lowest average when control treatment, which amounted to (29.06 cm³). The interaction between the two factors (A, B) was the highest results in the treatment (A3, B2) and gave 33.45 cm³ and the interaction of the two factors (A, C) was significant and the best results were obtained in the treatment (A3, C2) and recorded 33.54 cm³ as the interaction between the two factors (B, C) we notice there is a significant increase and the highest results were when the treatment (B3, c2) and amounted to 31.81 cm³.
The interaction between the study factors was also significant, and the highest average of this trait was recorded when using the concentration (200 mg/L\(^1\)of Paisen, 30 g/L\(^1\)of Populus euphratica bud extract, and the used concentration of copper sulfate 2.5 g/L\(^1\)). The highest average of fruit size was recorded, (33.27 cm\(^3\)) and the lowest rate when control treatment with (25.07 cm\(^3\)).

**Table 3.** Effect of spraying Paisen, Populus euphratica bud extract and copper sulfate on the average fruit size cm\(^3\).

| Treatments | C   | C\(_1\) | B   | A   |
|------------|-----|---------|-----|-----|
| A*B        |     |         |     |     |
| 26.25      | 27.43 | 25.07   | B\(_1\) |     |
| 28.60      | 29.31 | 27.90   | B\(_2\) | A\(_1\) |
| 28.10      | 28.23 | 27.97   | B\(_3\) |     |
| 29.41      | 29.52 | 29.30   | B\(_1\) |     |
| 31.26      | 31.83 | 30.70   | B\(_2\) | A\(_2\) |
| 31.27      | 32.24 | 31.28   | B\(_3\) |     |
| 31.93      | 31.46 | 32.39   | B\(_1\) |     |
| 33.45      | 33.88 | 33.02   | B\(_2\) | A\(_3\) |
| 32.86      | 33.97 | 31.76   | B\(_3\) |     |
| 4.053      | 5.732 |         |     | LSD |

Effect A

- 31.02
- 29.06
- 1.911
- LSD

Effect B

- 27.99
- 28.32
- 27.65
- A\(_1\)

- 30.81
- 31.20
- 30.43
- A\(_2\)

- 32.96
- 33.54
- 32.39
- A\(_3\)

- 2.340
- 3.309
- LSD

**3.4. Chlorophyll content**

Treating trees with different concentrations of Paisen led to an increase in the content of chlorophyll in leaves, and the highest average were obtained when using the highest concentration (114.45 mg / kg fresh weight) and the lowest average when compared to (112.71 mg / kg fresh weight) and spraying different concentrations of Populus euphratica bud extract showed a significant increase in the total chlorophyll content of leaves, and the highest total chlorophyll content was when using a concentration of 30 g/L\(^1\), which gave (113.90 mg/kg fresh weight). Compared with the lowest content of chlorophyll when the control treatment was (112.99 mg / kg fresh weight), and copper sulfate had a significant effect on the content of chlorophyll in leaves, and the highest average of this trait was recorded when spraying a concentration of 2.5 g/L\(^1\), which recorded (117.61 mg / kg fresh weight). Compared with the lowest content (112.09 mg / kg fresh weight) when control treatment. Also, the interaction between the factors of the study, the interaction between the two factors (A, B) was the highest results in the treatment (A3. B3) and amounted to 115.81 mg L kg fresh weight and the interaction of the two factors (A, C) was significant and the best results were obtained in the treatment (A3.C2) and recorded 114.72 mg / kg fresh weight as the interaction between the two factors (B, C) we notice there is a significant increase and the highest results were when the treatment (B3.C2) gave 114.03 mg / kg fresh weight.
The triple interaction was significant in the total chlorophyll content of the leaves, which reached the highest chlorophyll content when spraying the concentration (200 mg/L of Paisen, a concentration of 30 g/L of the extract and 2.5 g/L of copper sulfate), so the chlorophyll content of the leaves was reached. Total (115.93 mg/kg fresh weight) compared to the lowest chlorophyll content when the control treatment was (111.77 mg/kg fresh weight).

### Table 4. Effect of spraying Paisen, *Populuseuphratica* bud extract and copper sulfate on the chlorophyll content of leaves mg/kg fresh weight.

| Treatments | Interaction | A*B | A*C | B | A |
|------------|-------------|-----|-----|---|---|
|            | C1          | C2  |     |   |   |
| 112.15     | 112.53      | 111.77 | B1 |   | A1|
| 112.95     | 113.00      | 112.91 | B2 |   | A1|
| 113.02     | 113.07      | 112.97 | B3 |   |     |
| 113.26     | 113.54      | 112.99 | B1 |   | A2|
| 113.79     | 113.95      | 113.63 | B2 |   |     |
| 113.49     | 113.90      | 113.07 | B3 |   |     |
| 113.55     | 113.72      | 113.37 | B1 |   | A3|
| 114.61     | 114.72      | 114.51 | B2 |   |     |
| 115.18     | 115.93      | 114.44 | B3 |   |     |
| 1.396      | 1.974       |      |     |   | LSD|

**Effect A**

| B           | LSD |
|-------------|-----|
| 112.71      | 112.87 112.55 | A1 |
| 113.51      | 113.52 113.51 | A2 | interaction A*C
| 114.45      | 114.72 114.17 | A3 |
| 0.806       | 1.140 | LSD |

**Effect B**

| B           | LSD |
|-------------|-----|
| 112.99      | 113.26 112.71 | B1 | interaction B*C
| 113.79      | 113.82 113.75 | B2 |
| 113.90      | 114.03 113.77 | B3 |
| 0.806       | 1.140 | LSD |

### 3.5. Average Leaf area

Through the data in Table (5), we find that treating trees with different concentrations of Paisen led to a significant increase in the average leaf area. The highest average when using the concentration was 200 mg/L⁻¹, and it was recorded (171.52 cm²), while the lowest average of leaf area was recorded when compared. It was (155.28 cm²) and the effect of spraying *Populuseuphratica* bud extract in increasing the average leaf area, the highest average at the concentration was 30 g/L⁻¹, which gave (165.92 cm²) and the lowest rate obtained when the control treatment recorded (160.73 cm²). We also show from the table data that spraying copper sulfate has a significant effect on increasing the weight of the fruit, where we notice the highest result when using the 2.5 g/L⁻¹ concentration and it was 164.16 cm², while the lowest rates when the control treatment amounted to 162.92 cm². The interaction between the two factors (A, B) was the highest results in the treatment (A3, B3) and amounted to 173.38 cm², while the interaction of the two factors (A, C) was significant and the best results were obtained in the treatment (A3, C2) 172.11 cm² as the interaction between the two factors (B, C) we notice there is a significant increase and the highest results were when the treatment (B3, C2) and recorded 166.22 cm².
With regard to the triple interaction, also significantly superior and the highest results were at the highest concentrations of all study factors, which were recorded (174.19 cm²) and the lowest when the control treatment recorded (152.26 cm²).

**Table 5.** Effect of spraying *Populus euphratica* bud extract, Paisen and copper sulfate on average leaf area cm².

| Treatment | C | B | A |
|-----------|---|---|---|
| A × B × C | 153.51 | 154.76 | 152.26 | B₁ |
|           | 155.64 | 156.10 | 155.19 | B₂ | A₁ |
|           | 156.67 | 157.30 | 156.05 | B₃ |
|           | 158.96 | 159.25 | 158.67 | B₁ |
|           | 164.76 | 166.49 | 163.03 | B₂ | A₂ |
|           | 167.71 | 168.18 | 167.24 | B₃ |
|           | 169.73 | 170.50 | 168.97 | B₁ |
|           | 171.46 | 171.63 | 171.29 | B₂ | A₃ |
|           | 173.38 | 174.19 | 172.56 | B₃ |
| LSD       | 1.235 | 1.746 |      |

Effect A

| A | 0.582 | LSD |
|---|---|---|
| 155.28 | 156.05 | 154.50 | A₁ |
| 163.81 | 164.31 | 163.31 | A₂ |
| 171.52 | 172.11 | 170.94 | A₃ |
| 0.713 | 1.008 | LSD |

Effect B

| B | 159.96 | 161.50 | 161.50 | B₁ |
|---|---|---|---|---|
| 160.73 | 161.50 | 159.96 | B₁ |
| 163.95 | 164.74 | 163.17 | B₂ |
| 165.92 | 166.22 | 165.62 | B₁ |
| 0.713 | 1.008 | LSD |

The reason for the increase in the studied traits of yield, weight and size of fruits, leaf area and chlorophyll content of leaves as a result of using the study factors is due to the many effects that return to the positive results of growth. As the cytokines have important physiological effects, including cell division and widening, delaying leaf senescence, as well as increasing branching in trees and activating the building of nucleic acids [13]. This in turn, increases plant growth and increases manufactured materials, which is reflected in an increase in the quantity and quality of yield, as well as an increase in photosynthesis and an increase in chlorophyll. The extract also contains many compounds, the most important of which is salicylic acid, which has an active role in the decomposition of sugar and the construction of chlorophyll. It also has a role in protecting the plant and closing the stomata [14]. Copper is also necessary for the photosynthesis process for its effective role in transferring electrons from water and converting light energy into chemical energy that is used in the vital activities of the plant, and that the copper element is involved in the regulation of several biochemical processes in the plant and in the processes of metabolism in the roots. It also has an effective role in representing the proteins necessary for plant growth and raising its ability to increase the formation of nucleic acids RNA, DNA and nitrate reduction and in the redox processes [15]. In addition to the role of sulfur in building proteins and in the process of photosynthesis and increasing processed food, which is reflected in increased growth [15].
References

[1] Annual Statistical Collection (2020) . central Statistical organization and information Technology. Ministry of Planning and Development cooperation . Iraq .
[2] Abu Zaid, Al-Shahat Nasr. (2000). plant hormones. Agricultural applications, home Arabic for Distribution and Publishing, second edition. National Research Center . Cairo . Egypt .
[3] Abu Zaid, Al-Shahat Nasr (1988). Medicinal plants and herbs. Dar Al Bahar Publications. Beirut.
[4] Abu Salah, Muhammad Omar Abdullah (1998). Plant growth regulators and photosynthesis. King Saud University . Kingdom Saudi Arabia .
[5] Al-Douri, Ali Hussein Abdullah and Adel Khudair Saad Al-Rawi. (2000). Fruit production. Ministry of Higher Education and Scientific Research. University of Al Mosul . Iraq .
[6] Aldgwi, Ali. (2004) . Encyclopedia of cultivation and production of ornamental plants, landscaping and flowers. Al Hilal Library House. Madhouny Library, Cairo . Republic of Egypt.
[7] Al Rayes, Abdul Hadi Jawad.( 1987) . Plant nutrition. part One . aspects of nutrition vegetable . Ministry of Higher Education and Scientific Research - University of Baghdad - Iraq.
[8] Al-Rawi, khashie Mahmoud and Abdul Aziz Muhammad Khalaf Allah (2000). Design and analysis of agricultural experiments. Dar Al-Kutub Foundation for Printing and Publishing. University of Mosul, Iraq.
[9] Darjazi, B.B. (2011).Morphological and pomological characteristics of fig (FicuscaricaL.) cultivars from Varamin, Iran. African Journal of Biotechnology 10(82): 19096-19105
[10] Flaishman, M.A., Rover, V. & Stover, E. (2008). The fig: botany, horticulture, and breeding. Hort. Rev. 34, 113-197.
[11] Food and Agriculture Organization. (2017). Data archives. FAOSTAT. 24 Nov, 2017.
[12] Gerber, H.J. ( 2010 ) . Tree Training and Managing Complexity and Yield in Fig (FicuscaricaL.) . Thesis . Dep. Hort. Agric. . Univ. of Stellenbosch . Florida USA .
[13] Goodwin, T. W., . (1976) .Chemistry and Biochemistry of Plant Pigments . 2nd ed. Academic Press , USA , 373 p.
[14] Muthulakshimi , S. and Lingakunar (2017) Role of salicylic acid ( SA ) in plants A review International . Journal of applied Research .
[15] Zekri, Mongi, and T. A. Obreza . 2003. Microenutrient deficiencies in citrus : Boron , Copper and Molybdenum .Institute of Food and Agricultural Sciences . University of Florida .