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# Efficiency of Fig Tree (Aswad Diyala) for Peeling and Spraying with Gibberellin and Iron on the Content of the Branches of Nutrients

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**Abstract.** The experiment was conducted on fig trees, Diyala black variety, at the age of (13) years, in one of the orchards affiliated to the General Directorate of Vocational Education / Vocational Section in Diwaniyah Mixed Agricultural Preparatory School / Qadisiyah Governorate for the season 2022, 81 black Diyala fig trees, homogeneous in size, height, and growth strength as much as possible, were selected, planted at dimensions (4 x 4) meters, and irrigated by a plate method, in order to study the response of fig trees to pruning (0, 25, and 50%) and spraying with gibberellin (0, 30, and 60 mg.$L^{-1}$) and chelated iron (0, 1, and 2 g.$l^{-1}$) in the nutrients content of fig leaves of Black Diyala variety, the experiment was designed as a factorial according to the randomized block design (RCBD), the experiment included 27 treatments with three replications and were distributed randomly in three sectors, tree branches were pruned last season on 1/1/2022 and trees were sprayed with gibberellin and chelated iron in the early morning, starting on 3/15/2022, the spraying was repeated every 15 days three times. Chelated iron three days after spraying gibberellin. The results showed that the levels of pruning and the concentrations of spraying gibberellin and chelated iron on the trees were positive in increasing the content of the branches of the nutrients under study compared to the comparison treatments, whether single or combined. % for nitrogen, 0.198, 0.166, and 0.152% for phosphorus, 0.887, 0.782, and 0.755% for potassium, 0.541, 0.506, and 0.493% for calcium, and 0.541, 0.506, and 0.493 mg $kg^{-1}$ dry matter, respectively, while recorded The overlap coefficients $P_2G_2$, $P_2F_2$, and $G_2F_2$ recorded 1.49, 1.43, 1.30% nitrogen, 0.237, 0.212, 0.179% phosphorus, 0.935, 0.905, 0.794% potassium, 0.569, 0.549, 0.513% calcium, and 57.89%. And 54.78 and 47.47 mg $kg^{-1}$ dry material for the element iron, respectively. As for the triple interaction between the factors, the treatment $P_2G_2F_2$ recorded the best results in these characteristics, amounting to 1.55% nitrogen, 0.267% phosphorus, 0.944% potassium, 0.577%, and 59.19 mg $kg^{-1}$ dry matter for the iron element.

**Keyword.** Fig, Pruning, Gibberellin, Chelated iron, Chemical content of nutrients.

## 1. Introduction

The cultivation of fruit trees occupies an important economic position due to its nutritional and economic value to humans. Among the fruit trees are fig trees, *Ficus carica* L., which belongs to the Moraceae family [1], and the genus Ficus contains 800 species, the largest part of which is classified as ornamental plants, most of which are It is evergreen and has limited numbers of these trees whose fruits are edible. It is believed that its original habitat is the south of the Arabian Peninsula, as well as the spread of its cultivation in the subtropical regions [2-4].

The estimated production of figs in Iraq, according to the report of the production of summer fruit trees for the year 2021 of the Ministry of Planning / Central Bureau of Statistics / Directorate of Agricultural Statistics, is (9322) tons, and the average productivity per tree is (22.58) kg. $Tree^{-1}$, and the highest productivity per tree reached (33.00) kg. $Tree^{-1}$ The cultivated area in Iraq is 459 hectares and the total production is 3271 tons [5]. Each 100 grams of fresh figs contains 78% water, 1.3% protein, 0.3% fat, 17% carbohydrates, 2% fiber, 48 mg of carotene, 50 mg of vitamin B, 9 mg of vitamin C, 54 mg of calcium, 22 mg of phosphorus. 250 mg potassium, 4 mg zinc and 6 mg [6] and [7].

Pruning is one of the important agricultural operations that are carried out on fruit trees, and it may include removing the terminal bud, and that the tree responds in different ways than if the entire branch was removed, and that different species and even different varieties of one species respond in different ways to the same pruning, pruning fig trees in the first years of pregnancy is limited to removing crowding or transverse branches that are located in the middle of the tree to ensure exposure to light. It is also recommended to cut its upper branches to a quarter or a third, and its purpose is to play a role in increasing the leafy area of fig trees and the number and length of its branches, increasing the total chlorophyll content of the leaves, stimulating the roots to absorb nutrients and then transferring them to the leaves, and encouraging enzyme systems in food-making processes and hormones that encourage growth, which is reflected in increasing the yield and improving its quality.

It affects the transfer of photosynthetic products to fruits and roots, and regulates the formation of flower buds. In general, it can be said that pruning affects the physiological state of the tree for several years [8,9].

Gibberellins have biological effectiveness in stimulating cell division, elongation, or both, as well as genetic dwarfism, the flowering process, the formation of virgin fruits, and the removal of the dormancy phase in seeds and buds. And protein as well as increasing the moisture content of cells and controlling the permeability of cell walls [10,11].

The modern way to add nutrients, especially small ones, to plants is in the form of chelates, which are organic materials that contain the nutrient such as iron, which has an essential and necessary role in the system of many enzymes involved in the respiration process, including Catalase, Peroxidase, and Cytochrome oxidase. Iron in these compounds is of particular importance in oxidation reactions, where its importance lies in the transfer of electrons in oxidation-reduction reactions, and it is one of the important roles in the nutritional metabolism of the cell. It helps to build chlorophyll, although it does not enter into its composition and enters into the construction of cytochromes, which are of great importance in the processes of photosynthesis and respiration [12].

The farmers' lack of optimal management of orchards and their lack of knowledge of modern technologies in the use of fertilizers, irrigation methods and control, prompted a number of researchers to use some technologies to reduce these problems, including the method of pruning and spraying plant growth regulators and microelements on trees individually or in combination, and based on what we mentioned above The aim of the study is to study the response of fig trees (Black Diyala variety) to the leaf content of nutrients through the effect of removing part of the branch length and spraying with gibberellic acid and chelated iron, and the interaction between these factors.

## 2. Major Format Guidelines

A field experiment was conducted in one of the orchards affiliated to the General Directorate of Vocational Education / Vocational Section in Diwaniyah Mixed Agricultural Preparatory School / Al-Qadisiyah Governorate for the season 2022. 81 fig trees, Diyala black variety, were selected, homogeneous in size, height, and growth potential as much as possible, with an age of 13 years,


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planted on dimensions of (4 x 4) meters, and irrigated with water by the method of panels. The soil was analyzed before starting the implementation of the research, on 12/28/2021, by taking a sample of the orchard soil in different places from five locations represented by the four sides of the orchard and the middle to be a representative sample of the orchard soil after air drying and at depths of (0-30) and (30-60) cm. Then, the samples were ground and sifted with a sieve with a diameter of (2 mm) and some physical and chemical properties were estimated according to the methods presented in [13] as in Table 1.

**Table 1.** Some chemical and physical properties of the orchard soil.

| Character | Value | Character | Value |
|---|---|---|---|
| Soil reactivity, Ph | 7.2 | Nitrogen | %0.3 |
| Electrical conductivity EC(1:1) | Decismens.m$^{-1}$ 1.3 | Phosphorous | ppm2.8 |
| Soil Organic Matter SOM | %6 | Potassium | ppm16.5 |
| Sand | %18 | CaSo4 | Meq/1 (1) |
| Silt | %28 | Fe | mg.kg$^{-1}$ 871.793 |
| Clay | %54 | Sodium | ppm3.9 |

The experiment included three factors, each with three levels. The first factor included three levels of shortening pruning (the first level 0 without any pruning of the branch length, code $P_0$), and (25% level, where pruning was done by removing 25% of the branch length, code $P_1$) and ( Level 50%, where pruning was carried out by removing 50% of the length of the branch ($P_2$) in a row, and the pruning process was carried out on 1/1/2022. The pruning also included the removal of cankers, infected and intertwined branches, and high branches that are difficult to reach. In the second factor, three concentrations of gibberellic acid (GA3) were included (the first concentration is 0 without spraying gibberellin, symbol $G_0$), (the second concentration 30 mg.L$^{-1}$, symbol $G_1$), and (the third concentration 60 mg.L$^{-1}$, symbol $G_2$) respectively. Gibberellic acid (GA3) was sprayed with three sprays, the first on March 15, the second on March 30, and the third on April 15. The third factor included three concentrations of (Ethylene diaminetetra acetic acid (EDTA) iron chelate 13%), including (the first concentration 0 without Spraying of chelated iron ($F_0$) and (the second concentration 1 gm.l$^{-1}$, symbol $F_1$) and (the third concentration 2 gm .l$^{-1}$, symbol $F_2$), respectively, according to the recommendation for this chelated iron compound, three days after each spray of gibberellin. The solutions were sprayed on the vegetative growth until the degree of complete wetness of the tree, and the dispersant material Tween-20 was used at a concentration of 0.01% [14] and the spraying was carried out in the early morning, while the (comparison) treatment was sprayed with distilled water only, and before spraying the trees are washed with water to clean the leaves from Dust on it. This is done a day before spraying the treatments. During spraying, a plastic cover is used to isolate the trees from each other during spraying.

*2.1. The Studied Traits Included the Nutrients Content of the Leaves*

In the first week of June, ten full-grown leaves were collected from each experimental unit, from the fourth to the sixth leaf from the apex of the young growth, i.e. from the fully expanded, newly mature and physiologically active leaves. The digestion process for the air-dried and ground leaves was carried out according to the method of [15] by taking 0.25 gm of the dry weight of the leaves (per experimental unit) and placing it in glass digestion tubes with a capacity of 100 ml and following the method of Di-acid digestion in a ratio of (9: 4) i.e. adding Concentrated sulfuric (H2SO4) to the beaker and then concentrated perchloric acid (HClO4) at the specified ratio, after that the tubes are placed in a sand bath equipped with a heat source until the color of the solution becomes clear, then it is cooled and the volume is completed to 100 ml with distilled water, so the solution becomes ready for the determination of the following elements:

*2.1.1. The Percentage of Nitrogen in the Shoots (%)*

According to the method [15], the nitrogen concentration was estimated in the nitrogen distillation apparatus (Macrokjeldhal of German origin).


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*2.1.2. Percentage of Phosphorus in Branches (%)*

According to the Spectrophotometric Vanadium Phosphomolybdate Method mentioned in [15], the phosphorus concentration was estimated by a spectrophotometer (type Bichrom-Libra S22-UK 2005) at a wavelength of 410 nm.

*2.1.3. Percentage of Potassium in Branches (%)*

According to the [15] method, the concentration of the elements was estimated directly based on the standard potassium solution by means of an atomic absorption spectrophotometer (Perkin Elmer, 5000, USA, USA).

*2.2. Measurement of Iron (mg.kg dry matter$^{-1}$) and Calcium (%)*

- Atomic Absorption Spectro photometer.
- Iron: using the spectrometer and according to the method reported by [16] Page.

## 3. Results

*3.1. The Percentage of Nitrogen*

We note from Table 2 that pruning has an effect on the percentage of nitrogen in the branches of fig trees. The pruning treatment $P_2$ (50%) was significantly superior and gave the highest percentage of the nitrogen element, amounting to 1.40%, which differed from the comparison treatment, which recorded the lowest percentage of nitrogen in it, amounting to 0.82%. It is noted Also from the results of the table, the treatment of spraying with gibberellin $G_2$ at a concentration of 60 mg $L^{-1}$ had a significant effect on the percentage of nitrogen in the branches of fig trees, as it gave the highest percentage of 1.25% compared to the control treatment $G_0$ without spraying, which recorded the lowest rate of 1.05%. The same table showed that the treatment of spraying with chelated iron F2 at a concentration of 2 g $L^{-1}$ led to a significant increase in the percentage of nitrogen amounted to 1.18% compared to the control treatment $F_0$ without spraying, which recorded 1.11%. As for the bilateral overlap between pruning and gibberellin levels, it had a significant effect on increasing the percentage of nitrogen, especially the treatment $P_2G_2$, which represents pruning 50% overlapping with gibberellin at a concentration of 60 mg.$L^{-1}$, as the ratio reached 1.49%, while the comparison treatment with both pruning and gibberellin $P_0G_0$ showed the lowest percentage and was 0.67 %. The results of the bilateral interaction between the concentrations of pruning 50% and chelated iron 2g.$l^{-1}$ showed a significant increase in the percentage of the nitrogen element, as the treatment $P_2F_2$ gave the highest value of 1.43%, while the percentage decreased to 0.76% in the treatment $P_0F_0$, as well as the interaction between the concentrations of gibberellin 60 mg. $L^{-1}$ and chelated iron 2 gm. $L^{-1}$ also differed significantly in the nitrogen content of the leaves, as it recorded the highest rate of 1.30% compared to the control treatment, which recorded 1.02%. The results of the triple overlap of the study factors showed a significant effect on the percentage of nitrogen, as it appeared with its highest value when treatment $P_2G_2F_2$ reached 1.55%, which made it significantly superior to treatment $P_0G_0F_0$, which gave the lowest percentage of nitrogen and was 0.64%.

**Table 2.** Efficiency of fig trees (Aswad Diyala variety) for pruning and spraying with gibberellin and iron in the content of the aqar of the nitrogen element %.

| (P)Pruning | (G)Gibberellic acid | (F) Chelated iron | | | G*F | P*F | P*G | Average P |
|---|---|---|---|---|---|---|---|---|
| | | $F_0$ | $F_1$ | $F_2$ | | | | |
| $P_O$ | $G_0$ | 0.64 | 0.68 | 0.70 | 1.02 | 0.76 | 0.67 | 0.82 |
| | $G_1$ | 0.73 | 0.79 | 0.86 | 1.05 | 0.82 | 0.79 | |
| | $G_2$ | 0.92 | 0.99 | 1.05 | 1.07 | 0.87 | 0.99 | |
| $P_1$ | $G_0$ | 1.11 | 1.14 | 1.17 | 1.09 | 1.18 | 1.14 | 1.21 |
| | $G_1$ | 1.19 | 1.21 | 1.23 | 1.13 | 1.21 | 1.21 | |
| | $G_2$ | 1.25 | 1.27 | 1.30 | 1.17 | 1.24 | 1.28 | |
| | $G_0$ | 1.32 | 1.33 | 1.34 | 1.21 | 1.38 | 1.33 | |

| (P)Pruning | (G)Gibberellic acid | | | (F) Chelated iron | | | G*F | P*F | P*G | Average P |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $F_0$ | $F_1$ | $F_2$ | | | | |
| $P_2$ | | $G_1$ | | 1.36 | 1.39 | 1.41 | 1.25 | 1.40 | 1.39 | 1.40 |
| | | $G_2$ | | 1.45 | 1.47 | 1.55 | 1.30 | 1.43 | 1.49 | |
| | L.S.D | | | | 0.018 | | 0.010 | 0.010 | 0.010 | 0.006 |
| | $G_0$ | $G_1$ | $G_2$ | 1.11 | 1.14 | 1.18 | Average F | | | |
| Average G | 1.05 | 1.13 | 1.25 | | F = 0.006 | | | G = 0.006 | | L.S.D |

*3.2. Phosphorus Percentage*

The results in Table 3 show the percentage of phosphorous for fig tree branches that was significantly affected by the use of pruning and spraying each of gibberellin and chelated iron, and it appeared in all study factors, where the pruning treatment recorded 50%, the highest percentage was 0.198%, compared to the measurement treatment, which recorded the lowest percentage of 0.093%, as well as gibberellin spraying treatments, where the treatment of 60 $mg.l^{-1}$ gave the highest rate of 0.166%, compared to the measurement treatment, which recorded the lowest percentage of phosphorus, amounting to 0.124%, as well as spraying treatments with chelated iron $2gm.l^{-1}$, which recorded the highest rate, which was 0.152%. Compared to the measurement treatment, which recorded the lowest rate of 0.135%. The interaction of pruning and gibberellin showed a significant effect on this trait. Treatment $P_2G_2$ gave the highest percentage of phosphorus, amounting to 0.237%, unlike treatment $P_0G_0$, in which the percentage decreased to 0.078%. Likewise, the interaction of pruning and chelated iron $P_2F_2$ showed a significant effect in the percentage of phosphorus, which amounted to 0.212% when treated. Which made it significantly superior to the treatment $P_0F_0$, which gave the lowest percentage and was 0.087%, and the results of the bilateral overlap between the levels of gibberellin and chelated iron also indicated a significant effect on the proportion of phosphorus, as it recorded 0.179%, compared to the measurement treatment, which recorded the lowest percentage of 0.118%. The triple overlap reached a significant degree as a result of the large variation in the percentage of phosphorous, as it appeared with the highest value of 0.267% in the treatment $P_2G_2F_2$, superior to the treatment $P_0G_0F_0$ that gave the lowest percentage and was 0.072%.

**Table 3.** Efficiency of fig trees (Aswad Diyala) for pruning and spraying with gibberellin and iron in the content of the branches of the element phosphorus (%).

| (P)Pruning | (G)Gibberellic acid | | | (F) Chelated iron | | | G*F | P*F | P*G | Average P |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $F_0$ | $F_1$ | $F_2$ | | | | |
| $P_O$ | | $G_0$ | | 0.072 | 0.078 | 0.084 | 0.118 | 0.087 | 0.078 | 0.093 |
| | | $G_1$ | | 0.088 | 0.091 | 0.097 | 0.124 | 0.092 | 0.092 | |
| | | $G_2$ | | 0.102 | 0.109 | 0.116 | 0.130 | 0.099 | 0.109 | |
| $P_1$ | | $G_0$ | | 0.122 | 0.127 | 0.132 | 0.137 | 0.136 | 0.127 | 0.140 |
| | | $G_1$ | | 0.136 | 0.140 | 0.144 | 0.141 | 0.139 | 0.140 | |
| | | $G_2$ | | 0.148 | 0.151 | 0.155 | 0.145 | 0.144 | 0.151 | |
| $P_2$ | | $G_0$ | | 0.159 | 0.168 | 0.175 | 0.151 | 0.183 | 0.168 | 0.198 |
| | | $G_1$ | | 0.186 | 0.191 | 0.195 | 0.167 | 0.200 | 0.191 | |
| | | $G_2$ | | 0.203 | 0.240 | 0.267 | 0.179 | 0.212 | 0.237 | |
| | L.S.D | | | | 0.006 | | 0.004 | 0.004 | 0.004 | 0.0021 |
| | $G_0$ | $G_1$ | $G_2$ | 0.135 | 0.144 | 0.152 | Average F | | | |
| Average G | 0.124 | 0.141 | 0.166 | | F = 0.0021 | | | G = 0.0021 | | L.S.D |

*3.3. The Percentage of Potassium*

The results show in Table 4 that the percentage of potassium in the branches of fig trees was significantly affected by the levels of pruning, as the treatment $P_2$ excelled by giving it the highest percentage of 0.887%, while the percentage decreased significantly to 0.61% in the treatment $P_0$, and spraying with gibberellin $G_2$ significantly increased the percentage of potassium, as it reached 0.782% in the branches of fig trees compared to treatment $G_0$, which gave 0.695%, as well as the effect of spraying with chelated iron significantly in increasing the content of the branches of the element

potassium, as treatment $F_2$ recorded the highest percentage of potassium, which amounted to 0.755%, compared to treatment $F_0$, which recorded the lowest percentage of potassium, which is 0.725 %. The results of the interaction between pruning and gibberellin showed a significant effect on the percentage of potassium in the branches, as it increased to 0.935% in the treatment $P_2G_2$, while it decreased significantly to 0.566% in the treatment $P_0G_0$. $P_2F_2$, which gave the highest percentage of 0.905%, while treatment $P_0F_0$ gave the lowest percentage, which was 0.595%. As a result of the interaction of gibberellin and chelated iron, treatment $G_2F_2$ gave the highest percentage of potassium amounted to 0.794%, which made it significantly superior to treatment $G_0F_0$, which gave the lowest percentage, which was 0.675%. The interaction of the three factors led to significant differences in the percentage of potassium in the branches of fig trees, especially the treatment $P_2G_2F_2$, which was characterized by the highest percentage of potassium amounted to 0.944%, while the percentage decreased to 0.547% in the treatment $P_0G_0F_0$.

**Table 4.** Efficiency of fig trees (Aswad Diyala) for pruning and spraying with gibberellin and iron in the branches' potassium content (%).

| (P)Pruning | (G)Gibberellic acid | (F) Chelated iron | | | G*F | P*F | P*G | Average P |
|---|---|---|---|---|---|---|---|---|
| | | $F_0$ | $F_1$ | $F_2$ | | | | |
| $P_O$ | $G_0$ | 0.547 | 0.566 | 0.586 | 0.675 | 0.595 | 0.566 | 0.611 |
| | $G_1$ | 0.594 | 0.606 | 0.617 | 0.695 | 0.611 | 0.606 | |
| | $G_2$ | 0.644 | 0.662 | 0.673 | 0.716 | 0.625 | 0.660 | |
| $P_1$ | $G_0$ | 0.683 | 0.693 | 0.706 | 0.732 | 0.713 | 0.694 | 0.723 |
| | $G_1$ | 0.716 | 0.725 | 0.733 | 0.745 | 0.722 | 0.725 | |
| | $G_2$ | 0.740 | 0.747 | 0.765 | 0.755 | 0.735 | 0.751 | |
| $P_2$ | $G_0$ | 0.795 | 0.825 | 0.855 | 0.770 | 0.869 | 0.825 | 0.887 |
| | $G_1$ | 0.885 | 0.906 | 0.915 | 0.782 | 0.889 | 0.902 | |
| | $G_2$ | 0.926 | 0.937 | 0.944 | 0.794 | 0.905 | 0.935 | |
| L.S.D | | | 0.0044 | | 0.0025 | 0.0025 | 0.0025 | 0.0015 |
| | $G_0$ | $G_1$ | $G_2$ | 0.725 | 0.741 | 0.755 | Average F | |
| Average G | 0.695 | 0.744 | 0.782 | F = 0.0015 | | | G =0.0015 | L.S.D |

*3.4. Calcium Percentage*

The results in Table 5 show that pruning caused a significant increase in the percentage of calcium in the branches of fig trees, as it reached 0.541% in treatment $P_2$, while the percentage decreased significantly to 0.434% in treatment $P_0$. Also, spraying gibberellin increased the percentage of calcium in the branches, as treatment $G_2$ gave higher The percentage of calcium reached 0.506%, and this treatment was superior to treatment $G_0$, which showed the lowest percentage and was 0.468%. Also, spraying chelated iron increased the calcium percentage of fig tree branches to 0.493% in treatment $F_2$, which made it significantly superior to treatment $F_0$, which gave 0.480%. The two-way interactions of pruning with gibberellin and pruning with chelated iron and gibberellin with chelated iron showed a significant effect on the percentage of calcium, as the treatments $P_2G_2$, $P_2F_2$, and $G_2F_2$ excelled by giving them the highest percentage of calcium, which reached (0.569, 0.549, and 0.513%), respectively, unlike the treatments. $P_0G_0$, $P_0F_0$, and $G_0F_0$, which gave the lowest percentages in tree branches, were (0.418, 0.428, and 0.462%), respectively. The triple interaction showed its significant effect in increasing the percentage of calcium, especially treatment $P_2G_2F_2$, which gave the highest concentration of 0.577%, achieving a significant increase compared to treatment $P_0G_0F_0$, which gave the lowest percentage of calcium in fig tree branches, 0.412%.


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**Table 5.** Efficiency of fig trees (Aswad Diyala) for pruning and spraying with gibberellin and iron in the branches' content of calcium (%).

| (P)Pruning | (G)Gibberellic acid | (F) Chelated iron | | | G*F | P*F | P*G | Average P |
|---|---|---|---|---|---|---|---|---|
| | | $F_0$ | $F_1$ | $F_2$ | | | | |
| $P_O$ | $G_0$ | 0.412 | 0.419 | 0.423 | 0.462 | 0.428 | 0.418 | 0.434 |
| | $G_1$ | 0.428 | 0.431 | 0.436 | 0.469 | 0.434 | 0.432 | |
| | $G_2$ | 0.444 | 0.451 | 0.459 | 0.474 | 0.439 | 0.451 | |
| $P_1$ | $G_0$ | 0.466 | 0.474 | 0.477 | 0.479 | 0.479 | 0.472 | 0.485 |
| | $G_1$ | 0.480 | 0.484 | 0.487 | 0.486 | 0.485 | 0.484 | |
| | $G_2$ | 0.490 | 0.498 | 0.504 | 0.491 | 0.489 | 0.498 | |
| $P_2$ | $G_0$ | 0.507 | 0.515 | 0.520 | 0.498 | 0.532 | 0.514 | 0.541 |
| | $G_1$ | 0.529 | 0.542 | 0.551 | 0.506 | 0.542 | 0.541 | |
| | $G_2$ | 0.560 | 0.569 | 0.577 | 0.513 | 0.549 | 0.569 | |
| L.S.D | | | 0.0015 | | 0.0009 | 0.0009 | 0.0009 | 0.0005 |
| | $G_0$ | $G_1$ | $G_2$ | | Average F | | | |
| Average G | 0.468 | 0.485 | 0.506 | | F = 0.0005 | | G = 0.0005 | L.S.D |

*3.5. Iron Concentration*

The results in Table 6 show that pruning had a significant effect on the concentration of iron in fig tree branches, as treatment $P_2$ was significantly superior to treatments P1 and $P_0$ in the amount of iron, which amounted to 53.55 mg $kg^{-1}$, while the concentration of iron was significantly decreased in pruning treatments $p_0$ and $p_1$. Which amounted to (32.10 and 41.90 mg $kg^{-1}$) in the branches of fig trees, respectively, as the table shows that spraying with gibberellin also had a significant effect on the content of the branches of the iron element, and treatment $G_2$ gave the highest rate of iron concentration amounted to 46.36 mg $kg^{-1}$, while Treatments $G_0$ and $G_1$ gave the lowest rate of iron concentration, as it recorded (38.66 and 42.54 mg $kg^{-1}$), respectively, as well as spraying with chelated iron also had a significant effect in treatment $F_2$, which recorded the highest concentration in the branch content of the iron element, which reached 43.77 mg $l^{-1}$, while the two treatments recorded $F_0$ and F1 had the lowest concentration (41.07 and 42.71 mg $kg^{-1}$), respectively. As for the interaction between pruning and gibberellin, it showed a significant increase in the concentration of iron, especially in treatment $P_2G_2$, which gave the highest concentration of 57.89 mg $kg^{-1}$, while treatment $P_0G_0$ showed the lowest concentration of iron, which was 28.18 mg $kg^{-1}$. By giving it the highest amount of iron amounted to 54.78 mg $kg^{-1}$, unlike the treatment $P_0F_0$ in which the iron concentration decreased to 30.59 mg $kg^{-1}$, and the results of the interaction between the levels of gibberellin and chelated iron showed the significant effect through the superiority of treatment $G_2F_2$ by giving it the highest concentration of iron amounted to 47.47 mg $kg^{-1}$ compared with treatment G0F0, which gave the lowest concentration of iron, which was 37.04 mg.$kg^{-1}$. The table also showed that the differences resulting from the influence of the triple overlap of the study factors reached the degree of significance. The treatment $P_2G_2F_2$ gave the highest concentration of iron in the branches of fig trees, which amounted to 59.19 mg $kg^{-1}$, outperforming the rest of the treatments, especially the treatment $P_0G_0F_0$, in which iron appeared in the lowest concentration and was 25.66 mg. $kg^{-1}$.

**Table 6.** Efficiency of fig trees (Black Diyala variety) for pruning and spraying with gibberellin and iron in the content of the branches of the iron element (mg.$kg^{-1}$ dry matter).

| (P)Pruning | (G)Gibberellic acid | (F) Chelated iron | | | G*F | P*F | P*G | Average P |
|---|---|---|---|---|---|---|---|---|
| | | $F_0$ | $F_1$ | $F_2$ | | | | |
| $P_0$ | $G_0$ | 25.66 | 29.00 | 29.88 | 37.04 | 30.59 | 28.18 | 32.10 |
| | $G_1$ | 31.28 | 32.24 | 33.78 | 39.05 | 32.37 | 32.43 | |
| | $G_2$ | 34.83 | 35.88 | 36.38 | 39.88 | 33.35 | 35.70 | |
| $P_1$ | $G_0$ | 37.55 | 38.36 | 39.52 | 41.12 | 40.79 | 38.48 | 41.90 |
| | $G_1$ | 40.45 | 41.63 | 43.18 | 42.55 | 41.73 | 41.76 | |
| | $G_2$ | 44.38 | 45.21 | 46.85 | 43.97 | 43.18 | 45.48 | |

| (P)Pruning | (G)Gibberellic acid | | | (F) Chelated iron | | | G*F | P*F | P*G | Average P |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $F_0$ | $F_1$ | $F_2$ | | | | |
| $P_2$ | | $G_0$ | | 47.90 | 49.80 | 50.23 | 45.07 | 51.84 | 49.31 | 53.55 |
| | | $G_1$ | | 51.62 | 53.78 | 54.93 | 46.52 | 54.02 | 53.44 | |
| | | $G_2$ | | 55.99 | 58.48 | 59.19 | 47.47 | 54.78 | 57.89 | |
| | L.S.D | | | | 0.45 | | 0.26 | 0.26 | 0.26 | 0.15 |
| | $G_0$ | $G_1$ | $G_2$ | 41.07 | 42.71 | 43.77 | Average F | | | |
| Average G | 38.66 | 42.54 | 46.36 | | F = 0.15 | | | G = 0.15 | | L.S.D |

## 4. Discussion

Based on the foregoing, it turns out that there is a significant effect. Pruning is one of the important operations for the success of growing fruit trees. The main objectives of pruning are to maintain well-lit leaf surfaces, and to create the right balance between vegetative growth and fruiting functions, which allows air circulation by obtaining a proper harvest. Good, and when interpreting these results in all the search tables on tree pruning, we find that in the case of our research this is on large fruit trees, it helps the transmission of photosynthetic products and increases the activity of vegetative growth, which increases the activity of trees in the absorption of water and nutrients such as nitrogen, phosphorus and potassium Iron and calcium, which in turn led to the efficiency of photosynthesis and vital processes, which increases the activity of the roots and made them more efficient in absorbing elements from the soil and then increasing their levels in the plant. As well as the role of pruning in increasing the share of food storage at the start of growth with activity in food and hormonal processing during the growing season, and this is consistent with what was indicated by [17-19].

As for the levels of gibberellins in fig tree content of elements, as treatment G2 at a concentration of 60 mg.L-1 was significantly superior to the rest of the treatments in the percentage of nitrogen (Table 1), the percentage of phosphorus (Table 2), and the percentage of potassium (Table 3), it may be attributed to the role of Gibberellin ((GA3) in improving the characteristics of vegetative growth and increasing the absorption of nutrients by the roots and its role in increasing the vital processes within the plant of carbon metabolism, respiration and cell division, especially in the principles of leaf emergence and its effect on the distribution system of hemicellulosic fibers of the cell walls, thus reducing its hardness and increasing its flexibility and ductility, making it easier From the process of expanding and elongating the cells, and this worked to increase the leafy area and delay their aging and stimulate the roots of fig trees to withdraw the largest amount of water and increase the content of the branches of elements. To him [10,11,20].

As for the effect of iron on chemical properties, iron enters the composition of plant cytochromes responsible for the transfer of electrons and the synthesis of ferodoxin and participates in the process of oxidation and reduction in the process of respiration and photosynthesis and enters the composition of chloroplasts that contain total iron in plants and participates in the formation of plant proteins and participates in the activation of many Of the enzymes such as Nitrogenase and others, it has an important role and a catalyst for activating the reactions of the formation of green pigments through a series of compounds that end with the formation of the chlorophyll molecule, so the percentage of nitrogen and magnesium increases by adding iron because they are included in the synthesis of chlorophyll, and iron has an important role in the formation of nucleic acids and enzyme accompaniments such as cytochrome and catalase of importance In the process of photosynthesis, their ability to absorb mineral elements such as potassium increases in the branches, and this is consistent with what they indicated [12,21,22,23].

## Conclusions

Winter pruning of fig tree branches showed significant superiority in improving chemical properties
Likewise, spraying with gibberellin led to a significant increase in the studied traits, especially at the higher levels. And spraying with chelated iron also gave an increase in the concentration of these elements to the branches of fig trees. As a result, the double and triple interaction between the factors of the study, pruning and spraying with gibberellin and chelated iron, resulted in a significant increase in all the studied traits.


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**Recommendations**

- Carrying out winter pruning, especially the removal of 25% or 50%, which has a role in improving the shape and organization of trees and in improving ventilation and lighting for them.
- The use of higher concentrations of the foliar spray of fig trees with the growth regulator gibberellin.
- Pruning and foliar spraying should be done with the study factors according to the proven times in the method of working in figs, the Aswad Diyala variety
- Increasing the number of spraying appointments by more than three.
- Conducting studies on other varieties of fig trees with the same study factors

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