Effect of Foliar Spraying with Nano Iron and Ascorbic Acid on the Vegetative and Fruiting Growth of Lemon,

Zeana Hazbar Khazaal

College of Agriculture, University of Diyala, Iraq
zeanahazber@uodiyala.edu.iq

Abstract

The experiment was carried out on 6-year-old trees in one of the private orchards of the Khalis district, Diyala governorate. The experiment included a study of two factors, the first is of three levels of Nano-iron Fe (0,20,40) mg l-1, and the second factor is of three levels of Ascorbic Acid (0,200,400) mg l-1. The experiment was carried out according to a completely randomized block design (RCBD) as aexperiment with three replicates, and the results were analyzed using the statistical program SAS (2003) and the averages were compared according to Duncan's multiple range test at a probability level of 0.05.

The results of the study showed a clear significant superiority of the treatment with nano iron at a concentration of 40 mg L-1 in each of the characteristics of leaf area, total chlorophyll, and the level of carbohydrates in the leaves. It also surpassed the characteristics of the total number of fruits, weight of the fruit, and the total yield of the plant compared to the treatment by nano iron at a concentration of 20 mg L-1 and the comparison treatment. The results also showed that the treatment by ascorbic acid at a concentration of 400mg l-1 was significantly superior in all the studied vegetative and fruiting traits compared to the Ascorbic treatment at a concentration of 200 mg and comparison treatment.

Key words: **Ascorbic Acid, Nano Iron,**

Introduction

Citrus Lemon L. trees pertain to citrus, which belongs to the Rutaceae family. Northeastern regions of India and southwest of China are the original home of this type 3 The lemon is one of the types of citrus fruits cultivated in Iraq since a long time ago due to the availability of convenient conditions to grow and to its favorable qualities by consumers, for its fruits are distinguished by being rich in mineral salts necessary to build the human body such as potassium, calcium, iron, magnesium, sodium, sulfur, and phosphorus, and a source of vitamin C, A, B1 and B2. As between 4. Therefore, its fruits are used in the manufacture of fresh juice as well as flavorings of many foods and treating many diseases 11. The number of trees planted in Iraq is estimated according to the data of the Central Statistical 7 around 320611 trees. Iraq production of lemon is estimated at 2103 tons. One of the varieties of lemon is the local one, and it is very desirable in Iraq because it is of excellent quality, small in size, juicy, the skin is thin, and the acidity is lower than the other varieties, 3.

Foliar feeding has become one of the important agricultural operations in feeding plants and providing them with nutrients at the present time, and it includes spraying nutrients in the form of solutions on the vegetative parts of the plant in a way that facilitates their absorption by the leaves in a homogeneous manner, as the leaves are a major center for many metabolic activities and have the ability to absorb nutrients like the roots 21.

Iron is an essential element for plant growth, chlorophyll synthesis, respiration, and redox processes of tissues of the plant and it is also

involved in the synthesis of important cytokines in plants, in addition to the important cycle of photosynthesis 25. Foliar spraying with nanofertilizers is one of the modern agricultural processes used in the field of plant nutrition, where foliar fertilizers can achieve the fastest response to the plant, especially with problems in soils, high pH and inefficient growth of roots 29.

The use of ascorbic acid has increased nowadays as a spray on the vegetative system of fruit trees because it is an antioxidant 26. and its effect on plant growth is similar to that of growth regulators that encourage growth 12. as well as its role in reducing stress caused by temperature, toxins, stimulating respiration and cell division, entering in the electron transport system, and protecting chloroplasts from oxidation10. Ascorbic acid is also important in increasing the growth and activity of the various organs of plants, including the roots.

Due to the importance and benefit of trees, this research was conducted to determine the most appropriate levels of iron and ascorbic acid for the tree, and the extent of its reflection on the yield and production.

Materials and Methods

The experiment was carried out on 6-year-old trees in one of the private orchards of the Khalis district, Diyala governorate. The experiment is a study of two factors, the first is three levels of iron nanoparticles Fe (0,20,40) mg l -1 and denoted by (Fe1, Fe2, Fe3) respectively. The second factor has three levels of Ascorbic Acid (0,200,400) mg l $^{-1}$ and denoted by (C1, C2, C3) respectively. The experiment was carried out according to a completely randomized block design RCBD as a factorial experiment and three replicates and compared the averages according to Dunkin's test a probability level of 0.05 and the results were analyzed using the statistical program SAS (2003).

Studied traits:

1. **Leaf area (cm^2).**

Using a leaf area measuring device leaf area meter, type AREAMETER 202 - CL LASER and extract the average area of one leaf.

2. **Leaves content of total chlorophyll (mg.100 gm fresh weight^{-1})**

The chlorophyll content in the leaves was estimated by mashing 0.2 gm of the leaves by adding 20 ml of acetone, 80% concentration. The optical absorbance was estimated using a spectrophotometer at two wavelengths of 663 and 645 nm, and according to the chlorophyll content of the leaves according to the equation

Leaves content of total chlorophyll (mg gm-1) = solution volume x (20.2 A645 + 8.02 A663)/Sample weight x 1000.

13.

3. Determination of leaf content of total soluble carbohydrates (%)

Estimate your contentaRobohedraT in time according to method 16.

4. **Averagee fruit weight (gm)**

Estimate using a sensitive electronic scale.

5. **Fruit size (ml. fruit)**

The fruit size was measured according to the displacement water rule.

6. **Yield per tree (kg tree).**

The yield was estimated through the number of fruits per experimental unit at harvest and the average weight of the fruit and by applying the following equation:

Yield per plant (kg) =The average weight of one fruit (gm) × the number of fruits remaining on the plant/ 1000.

Results and discussion

The results of Table (1) and Table (2) show a significant superiority of spraying with iron nanoparticles at a concentration 40 on the treatment of spraying with nano iron 20 and the comparison treatment (spraying with distilled water), where the moral superiority

was in each of the following qualities: leave area (26,039), percentage of total chlorophyll (50.49), ratio of the carbohydrates in leaves (4,651) as well as the fruitful qualities: number of fruits (64.00), weight of one fruit (81.36) and the yield of a single plant (4,958) were compared with the comparison treatment that gave the lowest percentages of the mentioned traits, respectively. The reason is due to the important characteristics of nano-fertilizers, such as their small size, which enables the plant to absorb them easily, as well as their increased surface area, which increases the absorption surface, and the possibility of direct entry into plant cells. 27..

Nanoparticles or their aggregates whose diameter is less than the track size in the cell wall can easily enter through those walls and access plasma membrane 19.

Iron is an essential element in chlorophyll, as 29-3% of the total amount of iron is present in green leaves and has an important role in contributing to the building of enzymes and compounds that make up the chlorophyll molecule 6. The effect of nano-iron in increasing the aforementioned characteristics may be attributed to its important role in many vital processes in the plant that are related to increasing the characteristics of vegetative growth, as it has a role in the representation of nucleic acids and enzymes in plastids that encourage increased cell divisions and cell elongation, which It leads to an increase in the content of chlorophyll, and then an increase in the efficiency of photosynthesis and an increase in the characteristics of vegetative and fruiting growth

Nano iron has an important role in many vital processes that occur in the plant, including making food and encouraging the production of amino acids and enzymes that increase the activity of antioxidant enzymes and cell divisions 17. Nano iron has a role in increasing the growth of roots represented by its dry weight, which constitutes a site for the production of cytokinins and their export to the vegetative part. This is in line with 5. that the increase in the dry weight of the vegetative body of the plant by the effect of spraying with iron nanoparticles is due to an increase in the representation of CO2 and the absorption of nutrients present in the soil and an increase in the synthesis of carbohydrates 14. 23. The results of this study agree with what it has reached by 22 and 28. on plants.

The results of Table (1) and (2) also showed that spraying plants with ascorbic acid at a concentration of 400 mg liter 1 has significantly exceeded the vegetative qualities, which included each of the leaf area (25.49) cm and the percentage of total chlorophyll (48.37)mg/l and the percentage of carbohydrates in the leaves (4.412) % as well as the fruiting qualities where the percentage of the number of fruits (61.44) fruit/plant and the weight of one fruit (79.21)mg and the yield of one plant (4.517) compared with the comparison treatment (spraying with distilled water only), which gave the lowest percentages of the mentioned qualities respectively.

The increase in the previously mentioned vegetative and fruiting traits when treated with ascorbic acid is due to the role of the vital acid in stimulating the cell to divide and biosynthesize organic food within the plant, in addition to increasing the plant's ability to resist various stresses that occur to the plant.

These results are consistent with those obtained by 8. 24. and 2.on the effect of ascorbic acid, as well as (1)when treated with ascorbic acid. (9) Ascorbic acid also plays an important role in ridding the plant of reactive oxygen radicals that oxidize cells and is therefore considered an important antioxidant 20. It also works to build carbohydrates and thus increase the plant’s stock of organic matter that works to increase the plant’s stock of nutrients and thus is reflected in the vegetative and fruitful growth of the plant 18. This is consistent with 15 and 5.

The results of Table (1) and Table (2) also showed a significant superiority of the

interaction treatment between spraying with nano iron at a concentration of 40 mg L-1 and spraying by Ascorbic acid at a concentration of 400 mg L-1 for all traits measured in the study on all treatments.

Table (1): Effect of foliar spraying by nano iron and ascorbic acid on the vegetative and fruiting growth of local lemon

Treatments			Leaf area (cm)	Chlorophyll (mg.g-1)	Carbohydrates%
Nano iron (Fe)	**0**		23.82 C	45.84 C	4,017 C
	20		25.89 B	47.80 B	4,324 B
	40		26,039 A	50.49 A	4,651 A
Ascorbic Acid (C)	**0**		25.03 C	47.70 C	4,242 C
	200		25.23 B	48.06 B	4,338 B
	400		25.49 A	48.37 A	4,412 A
Nano iron (Fe) * Ascorbic Acid (C)	**Fe1**	**C1**	23.68 e	45.74 e	3,930 h
		C2	23.80 d	45.83 e	4,013 g
		C3	23.98 d	45.94 e	4,107 f
	Fe2	**C1**	25.69 c	47.63 d	4,243 e
		C2	25.89 b	47.84 d	4,360 d
		C3	26.09	47.94	4,370

			b	d	d
	Fe3	**C1**	25.73 c	49.72 c	4,553 c
		C2	26.00 b	50.52 b	4,640 b
		C3	26.39 a	51.22 a	4,760 a

Means with the same letter are not significantly different according to Duncan multiple ranges test at 5% level

Table (2): Effect of foliar spraying by nano iron and ascorbic acid on the vegetative and fruiting growth of local lemons

Treatments			Number of fruits	fruitweight (g)	Yield (kg)
Nano iron (Fe)	**0**		52.78 C	75.22 C	3,474 C
	20		59.89 B	78.85 B	4,403 B
	40		64.00 A	81.36 A	4,958 A
Ascorbic Acid (C)	**0**		57.89 B	77.57 B	4,150 B
	200		57.33 B	78.66 A	4,169 B
	400		61.44 A	79.21 A	4,517 A
Nano iron (Fe) * Ascorbic Acid (C)	**Fe1**	**C1**	52.33 e	73.33 e	3,343 e
		C2	48.67 f	75.67 d	3,183 e
		C3	57.33 d	76.67 d	3,897 d
	Fe2	**C1**	59.00 cd	78.16 c	4.29 c
		C2	59.33 cd	78.83 bc	4,356 c
		C3	61.33	79.58	4,560

			cb	bc	bc
	Fe3	**C1**	62.33 abc	81.22 a	4,813 ab
		C2	64.00 ab	81.38 a	4,967 a
		C3	65.67 a	81.48 a	5,093 a

Means with the same letter are not significantly different according to Duncan multiple ranges test at 5% level

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