Plant Archives Vol. 19, Supplement 2, 2019 pp. 680-684 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

EFFECT OF FOLIAR SPRAYING WITH AMINO AND ORGANIC NUTRIENTS ON THE GROWTH OF FIG (*FICUS CARICA*) SEEDLINGS (WAZERI CULTIVAR)

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Abstract

The experiment was conducted in the lath house belonging to the Technical Institute / Musaib during the growth season 2017 on the fig seedlings (Wazeri cultivar), which was one year age and included two factors: - The first factor: The effect of the foliar spraying with amino acid solution (Terra-Sorb) at levels of (0, 4, 8 mg.L^{-1}), the second factor is spraying with organic fertilizer (Manish Al-Zuhoor) at levels of (0, 6, 12, 18 mg.L^{-1}), with 4 batches every 20 days starting from April, it were conducted as a factorial experiment according to the Completely randomized design (CRD), with three replicates and five seedlings for the experimental unit. The averages were compared according to the test of the least significant difference below the probability level of 0.05. The most important results indicated the following: 1. Spraying with amino acid solution (Terra-Sorb) at concentration of (8 mg.L^{-1}) was significantly excelled in vegetative and root growth and the leaves content of nitrogen, phosphorus and potassium for fig seedlings. 2. Spraying with organic fertilizer (Manish Al-Zuhoor) at a concentration of (18 mg.L^{-1}) was significantly excelled in all growth Indicators. 3. As for the interaction between both experiment factors, The interaction treatment between spraying with amino acid solution (Terra-Sorb) at concentration of (8 mg.L^{-1}) and spraying with organic fertilizer (Manish Al-Zuhoor) at a concentration of (18 mg.L^{-1}) was excelled by giving it the highest results to the studied traits.

Keywords: foliar Spraying, Organic Nutrients, Fig\

Introduction

Fig tree (*Ficus carica* L.) is one of the Deciduous Fruit Trees belonging to the Moraceae family. It contains about 800 genus and 1,400 species of trees, which are subtropical trees. it does not bearing very low temperatures, so their need from cold hours are little to break the dormant phase. Its original homeland is the Arabian Peninsula, which is found as wild forests. After the Islamic conquests, its cultivation spread in North Africa and the Mediterranean countries such as Spain, Portugal, southern France, Italy and Greece (Al-Jumili, 1990). The world production of figs is about 11.117.452 tons per year with an area of 358.493 hectares. The most important producing countries are Turkey, followed by Egypt and Algeria (World Food Organization, 2013). In Iraq, the number of fruit trees amounted to 416135 trees and their total production is 9867 tons per year, where Saladin province comes in the first order followed by Nineveh and Wasit (Central Bureau of Statistics, 2013). The fruits of figs are used for fresh consumption, for drying or for the manufacture of jams, and their fruits are of high nutritional value. They contain a high percentage of sugars, 52.9%, protein 3.6%, fats 1.3%, iron, copper, calcium, vitamins A and C. There is also a white liquid in leaves, branches and roots that has a medical characteristic (Goziekci, 2010). Foliar nutrition is considered one of the most successful methods to treat the lack of nutrient elements important for plant growth because many nutrient elements added to the soil are not used by the plant only little because of their stabilization in the soil or the deposition it or washing it or lack of its availability, which is reflected negatively on the growth of the plant, It is an economic method that works to improve vegetative growth where the plant prepares part of its needs for nutrient elements, where the foliar spraying is not a substitute for soil fertilization, but is complementary to it (Abdoul and Musallah, 1988). Nutrition also plays an important role in increasing the growth and development of seedlings, especially in the early stages of life, through the arrival of the macro and micro-elements in a form that can be absorbed by the root hairs (Al-Nuaimi, 1999). The amino acids play an important role in the growth and development of the plant and increase its efficiency in the providing and absorption of nutrients, especially the element of nitrogen and activates the photosynthesis process, especially if sprayed on the plant in the form of nourishing solutions, so that the ions of amino acids are easily released to benefit the plant quickly, where it reaches cell Cytoplasm leading to increase the photosynthesis process because it enters the synthesis of certain enzymes necessary for this process (Koksal *et al*., 1999). Plants also need to organic fertilizers, which improve the growth and development of plants well (Tiaz, 2006), The use of organic fertilizer with highly soluble in water or soil solution and high effective and has no harmful effect on the plant, where that the adding it to the soil or spraying on the plant has led to increase nutrient absorption, thus led to improve the vegetative and root traits for plants (Al-Kader *et al*., 1990). The spraying with organic fertilizers has an important role in improving vegetative and root traits, the leaves content of nutrient elements, and obtaining on a good growth seedlings. This study aims to determine the best level for spraying with amino acid solution (Terra-Sorb) and organic fertilizer (Manish Al-Zuhoor) in improving the vegetative and root growth traits and the leaves content of nutrient elements in order to obtain viable seedlings for cultivation in a sustainable location.

Materials and Methods

The experiment was conducted in the lath house belonging to the Technical Institute / Musaib during the growth season 2017 according to the Completely randomized design (CRD) on the fig seedlings (Wazeri cultivar), which was one year age and included two factors: - The first factor: The effect of the foliar spraying with amino acid solution (Terra-Sorb) at levels of (0, 4, 8 mg.L^{-1}), the second factor is spraying with organic fertilizer (Manish Al-Zuhoor) at levels of (0, 6, 12, 18 mg.L^{-1}), The seedlings were supplied from

one of the local nurseries and their age were one year old, homogeneous in size approximately 35 cm in height, 5 mm in diameter and The seedlings were cultivated in 2 kg plastic bags, On 5/2/2017 they were converted into 5 kg bags filled with the reverine mixture + peat moss with ratio of 1: 3 (Al-Rawi, 1991) On 1/4/2017 fertilizers were added and according to the statistical plan, where the experimental unit included 5 seedlings, with three replicates. The seedlings were sprayed with Terra-Sorb, it is a fast-soluble water amino acid containing total amino acids, total nitrogen, potassium, boron, zinc and manganese with concentrations of (21%, 2.1%, 0.064%, 0.019%, 0.067%, 0.046%). The Monish Al-Zuhoor solution, it is a liquid organic fertilizer supported with humic acid containing the macro-elements of NPK, has been sprayed with concentrations of (20, 20, 20%), with 4 batches every 20 days starting from April, The treatment of spraying started in the morning until full wetness using a 2 liter hand sprayer with the addition of the dishwashing liquid at a concentration of 1 cm^3 with each spraying as a spreading material for the purpose of increasing surface tension and facilitating the absorption of plant tissues for foliar fertilizer (Al-Sahaf, 1989). The control treatment was also sprayed with distilled water only and the two foliar spraying treatments was repeated. The required measurements were taken on 1/11/2017.

Studied traits

(i) Average height of seedling (cm)

The average height of seedling at the end of the experiment using the metric tab and the height was measured from the surface of the soil to the Apical meristem.

(ii) Average diameter of stem (cm)

The diameter was measured by the Vernia at a height of 2 cm for each seedlings and the average was taken for each experimental unit.

(iii) Number of total leaves per seedlings (leaf.seedling^{-1})

The number of leaves per seedlings was calculated and the average was calculated for each experimental unit.

(iv) Leaf area (cm^2)

A digital planimeter was used to measure this trait in cm^2 units by taking four full-width leaves from the middle branch on the main stem of each seedling and each treatment where the plant leaf is printed on white paper. The machine lens is then passed around the border of the leaf, the process is repeated three times, the average is taken and the leaf area is extracted.

(v) Total dry weight of total vegetative (g):

The seedlings were rooted at the end of the experiment carefully after irrigation of the seedlings well before one day to maintain the largest possible total root, the roots were then uprooted from the soil and washed well with water, the total vegetative was separated from the root system and for each replicate, and the samples were placed in paper bags and dried in an oven at 70 °C until stabilize dry weight and it was measured with a sensitive electrical balance.

(vi) Total dry weight of the root system (g):

The same method of measuring the dry weight for the total vegetative.

(vii) The percentage for nutrient elements (N, P, K):

The samples were taken from each seedling and for each replicate, it was then washed with distilled water to get rid of the dust and impurities which were suspended and placed in the perforated paper bags and then dried in an electric oven at 70 °C for 48 hours and until stabilize the weight, The samples were milled, a 0.5 g of sample powder (dry leaves) was taken by the electric miller, the samples were digested by concentrated sulfuric acid and 1 ml of perchloric acid (Jones and Steyn, 1973). The following elements were estimated:

A) **Nitrogen (%):** it was measured by using a micro-Kjeldahl (Black, 1965).

B) **Phosphorus (%):** it was estimated using ammonium molybdenum and measured by a spectrophotometer along wavelength (880 mn) according to method of (Olsen and Page, 1980).

C) **Potassium (%):** it was estimated by using the Flame Photometer according to the method in (Hesse, 1971)

The results were statistically analyzed and the averages were compared by the test of least significant difference (LSD) at the probability level of 0.05 (Al-Rawi and Abdel Aziz, 1980) by applying the statistical program (SAS, 2000).

Results and Discussion

Table (1) showed the positive effect of the foliar spraying with amino acid solution (Terra-Sorb) in stimulating the growth of fig seedlings (Wazeri cultivar), where the treatment (8 mg.L^{-1}) was significantly excelled in all studied traits, where the height of seedling amounted (89.93 cm) compared to the control treatment which amounted to (71.18 cm). The diameter of the stem also gave (1.93 cm) while the control treatment gave (1.36 cm), The number of leaves was (22.96 leaves.seedling^{-1}) compared to the control treatment amounted to (16.21 leaves.seedling^{-1}), the leaf area was (163.46 cm^2) compared to the control treatment which amounted to (108.05 cm^2), The dry weight of the total vegetative was (22.48 g) compared to the control treatment which amounted to (18.15 g), It also gave the highest dry weight of the root system amounted to (13.90 g) while the control treatment gave (10.77 g), This treatment was also significantly excelled in the percentage of nitrogen, phosphorus and potassium in the leaves by giving it (2.57, 0.26, 1.36%), respectively. The control treatment gave (1.55, 0.12, 1.16%), respectively, As for the control treatment, which gave (1.55, 0.12, 1.16%), respectively, this significant superiority, which appeared in most studied traits may be due to the vital role of foliar nutrition in the increase of plant metabolism and growth due to the role played by all the nutrient elements found in the foliar fertilizer amino acid (Terra-Sorb), Which contributed to the construction of secondary main vehicles, which have an important role in the growth of the plant, thus obtain a growth of vegetables and roots with good traits, where the nitrogen enters in the formation of chlorophyll molecule and raise the level in the leaves, which leads to the photosynthesis process, nutrient production and its role in the activity of meristmatic and cell division and enter into the synthesis of amino acids, including Tryptophan which is initiator for the formation of Auxin, which promotes the increase of cell divisions and its expansion, which increases the growth of the plant in addition to its role in increasing the ability of the plant to

absorb nutrient elements and their accumulation (Al-Bayoumi et al., 2000) or this is due to the fact that increasing the amino acids leads to a decrease in the Osmotic pressure, which in turn reduces the water stress of the cell, increasing the cell's ability to withdraw water and dissolved nutrients in it, Causing an increase in vegetable growth for plant (Claussen, 2004). The reason may be due to the fact that increasing the concentration of spraying with nutritious fertilizer has led to increase the leaves content of nutrient elements, which has stimulated vegetative and root growth, thus increasing the ability of seedlings to absorb large quantities of phosphorus to meet their requirements. This component, which incorporates a number of organic compounds and power plants Which stimulates growth (Mohammad and Muayed, 1991). Or the containment of the nutrient (Terra-Sorb) on the amino acids and nitrogen, which increase the leaves content of nutrient elements and this promotes the growth of vegetative and root, thus increase the ability of the plant to absorb sufficient amounts of nitrogen is increasing its accumulation in the plant in the form of proteins and amino acids, Encouraging modern germination and increasing vegetative growth of the plant (Al-Yacoubi, 1985). The increase in the absorption of potassium by the plant has a significant effect in increasing the vegetative growth of the seedlings because of its important role in a number of bio-processes within the plant, such as increasing the efficiency of the leaf in the photosynthesis process, respiration and metabolism of carbohydrates and proteins through the activating the oxidation enzymes, energy enzymes and transaminase enzymes, It also has great importance in the formation of high molecular weight compounds such as proteins, as well as its work in regulating the movement, efficiency and providing of growth regulators (Yassin, 2001). The increase of phosphorus in leaves may be due to the containment of the amino solution on some nutrient elements that contributed to the absorption of this element directly or indirectly because of some physiological events that occur in leaves and other parts of the plant (Tucker, 1999). This results agree with (Yousef *et al*., 2011) who found that the spraying of olive seedlings (*Olea europaea* L.) Chemlali cultivar with nutrition solution (pepton) containing a total of 16% amino acids with a concentration of 0.5% caused a significant increase in the traits of vegetative growth, Hamoud et al., (2013) reported that the spraying of grape seedlings (*Vitis vinifera* L.) Kamali cultivar with the amino acid (Vejamino) containing total amino acids 20% with concentration of (50 $mg.L^{-1}$) gave a significant increase in the height of seedling, number of leaves, leaf area and the leaves content of nitrogen and phosphorus. Majid, (2014) showed that the spraying of peach seedlings *Prunus persica* (Crimson baby cultivar) with Majesto solution containing amino acids 7.98% with a concentration of (5 $mg.L^{-1}$) gave a significant increase in vegetative traits and the leaves content of nutrient elements. We also note from the same table that spraying the seedlings with organic solution (Monish Al-Zuhoor) had a positive effect on the growth of fig seedlings (wazeri cultivar), where the level of (18 $mg.L^{-1}$) showed a significant effect on other treatments, where the height of the seedlings amounted to (95.43 cm) compared to the control treatment which amounted of 66.23 cm, The stem diameter amounted to 2.07 cm while the control treatment gave 1.32 cm, this treatment gave leaves amounted their number to (24.30 $leaves.seedling^{-1}$), while the control treatment gave (15.76 $leaves.seedling^{-1}$), The leaf area also significantly excelled which amounted to (162.19 cm^2) while the control treatment gave (107.93 cm^2), The dry weight for the total vegetative for the seedlings amounted to 23.83 g while the control treatment amounted to 16.41 g, The dry weight of the root system was significantly excelled amounted to 16.6 g while the control treatment amounted to 8.31 g, The spraying treatment with (18 $mg.L^{-1}$) was excelled in the leaves content of nitrogen, phosphorus and potassium, where amounted to (2.46, 0.23, 1.34%), respectively, while non-treating amounted to (1.52, 0.16, 1.17%), respectively. This may be due to the fact that the spraying of organic fertilizer on the seedlings has led to encouraging growth effects that improve the physiological processes, thus the ability of the plant to absorb water, the micro and macronutrients, which in turn improves plant growth (Havlin *et al*., 2005). The reason may be due to the fact that this fertilizer contains some of the microelements, especially nitrogen, which was absorbed by the leaves that have an important role in the completion of important processes, including the activation of the photosynthesis process, thus stimulate the division and elongation of cells, the formation of membranes that increase the leaf area (Martin, 2002), The reason may be due to the common role for nutrient elements that the fertilizer contain it in the formation of bio-plant membranes, in the formation of energy-rich compounds and in the formation of chlorophyll, which activates photosynthesis, which in turn increases seedling growth and increase their length (Devlin and Francis, 1993), Or perhaps due to the effect of the nutrient solution in filling the need of the plant of the mineral elements necessary for photosynthesis, respiration and metabolic processes to what the solution contains from the primary nutrient elements (NPK), with balanced amounts contribute to support the division and expansion of cells and then increase the length of the main branch [Hartman, 2000]. These results agree with (Al-Moussawi, 2011) when spraying fig seedlings with nutrition solution (Agroleaf) at a concentration of (22.5 $g.L^{-1}$) led to an increase in plant height, the diameter of stem, leaf area and the leaves content of nitrogen and potassium, Zoein, (2013) showed significant superiority in seedling length, stem diameter, and leaf area when spraying fig seedlings (Aswod cultivar) with the solution foliar fertilizer (Grofalcs) at a concentration of (200 $mg.L^{-1}$) and the Grofalcs solution at a concentration of (3 $g.L^{-1}$). Al-Humaidawi *et al*. (2006) indicated that the spraying of the nutritious solution for some macronutrients caused a significant increase in some vegetative traits of fig trees (wazeri cultivar), Al-Khafaf, (2003) found when spraying fig trees (Aswod Diyala cultivar) with solution containing nitrogen, potassium, iron and zinc at a concentration of 0.3% for each them, has a significant increase in the average of seedling height, stem diameter and leaf area. Al-Aujani, (2011) confirmed that the spraying with Gibberelin at a concentration of (150 mg. L^{-1}) on Fig trees (Aswod Diyala cultivar) caused a significant increase in the studied vegetative traits, Al-Humaidawi et al., (2012) showed that the spraying of fig trees (Aswod diyala cultivar) with nitrogen, potassium and calcium at concentration of 0.3% for each of them led to a significant increase in the good chemical and physical traits for the fruits. The addition of nitrogen, phosphorus, potassium and organic fertilizer to Fig trees (Aswod Succary cultivar) that improved the studied traits (Mohammed and Hussein, 2016). We also noted from the table that the bi-interaction for the both experiment's

factors has a significant effect on fig (Wazeri cultivar), where significantly excelled the trait of the seedling height which amounted to (110.03 cm), the diameter of their stem amounted to (2.40 cm, 28.06 leaves), The length of untreated seedlings amounted to (58.53 cm), their diameter (1.12 cm), the number of their leaves (12.35 leaves.seedling^{-1}). The total area of the leaf amounted to (184.65 cm^2) compared to the control treatment (85.29 cm^2). Through increasing the growth of the mentioned traits for the seedlings, the dry weight of the total vegetative was significantly excelled, which amounted to (26.36 g), the dry weight for the root system, which amounted to (18.84 g) while the non-treatment was (14.53 g, 7.26 g), respectively, The percentage of nitrogen, phosphorus and potassium was significantly excelled and amounted to (3.00, 0.32, 1.48%), respectively, while the control treatment amounted to (1.08, 0.10, 1.11%), respectively.

Table 1: shows the effect of foliar spraying with the nutritious solution amino acid (Terra-Sorb) and organic fertilizer (Monish Al-Zuhoor) in some vegetative and root traits, the leaves content of nitrogen, phosphorus and potassium for fig seedlings (wazeri cultivar).

Terra-Sorb (mg.L^{-1})	Monish Al-Zuhoor (mg.L^{-1})	Plant height (cm)	Stem Diameter (cm)	Number of leaves per seedlings	Leaf area (cm^2)	Dry weight for total vegetative (g)	Dry weight for the root system (g)	Percentage of nitrogen (%)	Percentage of phosphorus (%)	Percentage of Potassium (%)
0	0	58.53	1.12	12.35	85.29	14.53	7.26	1.08	0.10	1.11
	6	68.28	1.26	15.63	96.75	17.29	9.57	1.42	0.11	1.14
	12	75.82	1.44	17.09	113.81	19.04	11.34	1.70	0.13	1.19
	18	82.10	1.63	19.80	131.37	21.76	14.92	2.02	0.15	1.23
4	0	66.63	1.32	16.30	110.52	16.11	8.53	1.41	0.16	1.16
	6	74.25	1.58	19.00	128.32	19.48	10.67	1.83	0.18	1.20
	12	86.09	1.85	22.47	154.04	20.02	12.00	2.11	0.21	1.26
	18	94.17	2.18	25.05	170.56	23.37	16.04	2.38	0.23	1.32
8	0	73.55	1.54	18.63	133.00	18.59	9.15	2.09	0.24	1.25
	6	81.36	1.72	21.17	158.07	21.18	12.56	2.41	0.26	1.34
	12	94.79	2.06	24.00	178.12	23.79	15.06	2.79	0.29	1.40
	18	110.03	2.40	28.06	184.65	26.36	18.84	3.00	0.32	1.48
LSD 0.05	6.43		0.11	1.80	11.03	0.92	0.73	0.13	0.02	0.10
Averages of Terra-Sorb (mg.L^{-1})	0	71.18	1.36	16.21	106.80	18.15	10.77	1.55	0.12	1.16
	4	80.28	1.73	20.70	140.86	19.74	11.81	1.93	0.19	1.23
	8	89.93	1.93	22.96	163.46	22.48	13.90	2.57	0.27	1.36
LSD 0.05	5.76		0.11	1.73	12.32	1.07	0.92	0.14	0.02	0.12
Averages of Monish Al-Zuhoor (mg.L^{-1})	0	66.23	1.32	15.76	109.60	16.41	8.31	1.52	0.16	1.17
	6	74.63	1.52	18.60	127.71	19.31	10.93	1.88	0.18	1.22
	12	85.56	1.78	21.18	148.65	20.95	12.80	2.20	0.21	1.28
	18	95.43	2.07	24.30	162.19	23.83	16.60	2.46	0.23	1.34
LSD 0.05	7.31		0.12	1.75	11.08	1.12	0.76	0.11	0.01	0.11

Through this study we can conclude that the foliar spraying with amino acid solution (Terra-Sorb) and Organic fertilizer solution (Monish Al-Zuhoor) for fig seedlings (wazeri cultivar), with one year age has led to improve all growth indicators.

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