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THE IMPACT OF NAPHTHALENE, ACETIC ACID AND ORGANIC FERTILIZER ON SEEDLINGS GROWTH OF POMEGRANATE (*PUNICA GRANATUM* L.) SALIMI CULTIVAR

Lauy M. Hamza*, Hade K. Hassan and Imad A. Aubeid

Department of Horticulture, College of Agriculture, University of Qasim Green, Iraq.

Abstract

The study was conducted at greenhouse belonging to College of Agriculture, Al-Qasim green University during the growth season of (2016 to 2017) on the pomegranate seedlings (Salimi cultivar). Seedlings were sprayed with naphthalene acetic acid at three concentrations of 0, 50, 100 ml/L, on two spraying and organic fertilizer with three concentrates of 0, 4, 8 g/seedling according to the randomized complete block design (RCBD), with three replicates and a factorial experiment to study the effect of improving vegetative traits for pomegranate seedlings. The results showed that the spraying treatment with naphthalene acetic acid at a concentration of100 ml/L was significantly excelled by giving it the highest average for the traits of stem length, number of leaves, stem diameter, number of branches and leaf area compared to control treatment. The treatment of organic fertilizer at a concentration of 8 g was significantly excelled on the rest of the treatments in the improving of all vegetative traits. The results also indicated that the interaction treatment between the spraying treatment with at concentration of 100 ml/L and the adding of 8 g organic fertilizer (100 ml /L + 8 g) had an effective in improving the vegetative traits for the pomegranate seedlings.

Key words : Pomegranate, naphthalene acetic acid, organic fertilizer, auxuin, salimi cultivar.

Introduction

The pomegranate has been widely cultivated in some countries of the world such as Spain, Italy, Cyprus, Saudi Arabia, Iraq, Syria, Lebanon, Egypt, Florida and some southern states of America. Pomegranate (*Punica granatum* L.) belongs to the Punicacae family (Al-Douri, 2000). The number of fruit trees in Iraq is about (11,977,000 trees), their production of fruits (304,000 tons per year) and the average production per tree (25.4 kg) (Annual Statistical Abstract, 2008). More than 23 cultivars are cultivated in Iraq. Salimi cultivar is most commonly cultivated and produced in the central region orchards (Al-Azzi, 1990). The economic importance for pomegranate cultivation comes from the beginning of its early fruits in the third year for cultivation and the late ripening of the fruits, which extends to the late summer until the beginning or mid-winter, where the decrease in the presence of fruits other than citrus. The pomegranate husks are used in leather Tannin to contain the substance of tannin, which is also used in the treating of diarrhea. Its fruits also contain some medicinal substances, most notably anthocyanins and phenolic substances, which have proven to be effective as antimicrobial agents and inhibitors for a number of pathogens, as well as high nutritional value for its fruits, vitamin (C) and some mineral elements (Ca, P, K) (Opara *et al.*, 2009; Gracious *et al*., 200). Plant growth hormone aregenerally involved in growth and development (Al-Taey, 2018). Auxins play an important role in a wide range of plant growth and development processes. At the cellular level, they divide, expand and reveal during the plant life cycle. At the plant level, they play an important role in the formation of roots, Apical dominance, phototropism, etc. (Haynes, 1980). Abdul (1987) also mentioned that Auxins affect the elongation and expansion of cells by affecting cell walls' ability to grow and play a major role in balancing Juvenile hormones and senescence hormones (Salman, 1988) cleared Auxin has a role in stimulating

Author for correspondence : E-mail :lauyhamza@yahoo.com

growth towards the longitudinal axis when it adds to the total vegetative for poor plants in their content of growth stimulators. An Al-Hmedawi *et al*. (2009) found when spraying the sour orange trees with NAA, there was an insignificant increase in the number of leaves and the leaf area in both concentrations compared to the control treatment. Atiand Al-Sahaf (2007) also noted that spraying sour orange seedlings (three months age) with NAA at concentration of 2000, 4000, 6000 mg/L, with a rate of two sprayings has significantly increased of seedling height, its diameter and fresh and dry weight of the total vegetative after four months of the second sprayings. The concentration (4000 mg/L) has excelled giving it the best results for the height of the seedling and its diameter, the fresh and dry weights, respectively, and the increase in the leaf area for the seedlings, the number of leaves, the length of the main root and the fresh and dry weights.This increase amounted the maximum at concentration of 4000 mg/L compared to the control treatment. Developed countries are turning to organic agriculture, although traditional agriculture leads to increased production, but organic agriculture has been more profitable than conventional agriculture because of price differentials (Gliessman *et al*, 1996). The protection of the environment from pollution has become a prerequisite for the continuation of the process of economic and social development (Hussein, 2004), (Al-Taey *et al*., 2018) mention to the utilization of mineral fertilizers in lettuce development is a typical agricultural practice that gets satisfactory outcomes terms of yield. Al-Khatib (1993) has showed that the chemical fertilization has led to a higher concentration of nitrates and other fertilizer components in land and in groundwater sources. Recent studies have tended to the use of plant extracts and byproducts of the food industry to stimulate growth and increase the production of minerals, growth regulators, vitamins and organic acids, as well as their ease of absorption by the plant and its cheap prices (Al-Obeidi, 2006; Moursi *et al*., 1981). The addition of organic waste to the soil plays a "major" role in increasing soil fertility and the provision of nutrient elements in them, as well as improving Chemical and Physical Soil Properties such as Ion Exchange, Water storability and the release of catalysts from amino acids (Dwayne and Hassan, 2003). The addition of organic matter from its various sources greatly affects the chemical and physical properties of the soil. Its decomposition products, especially organic acids and CO_2, increase the processing of many nutrient elements, as well as the conservation of nutrients from the movement down a way from the root region and the ability to adsorption of ions on its surface strongly for its large surface area per the unit weight of it within the mechanism of Physisorption as well as ionic attraction according to the mechanism of Chemisorption. Organic matter is considered an important source of microorganisms in the soil, which helps to increase its activity and thus make the elements more availability for growing plants (Al-Taey and Majid, 2018). The organic fertilization is the most important way to develop and raising the agricultural production value and reduce the environmental pollution resulting from the excessive use of mineral fertilizers (Burhan and AL-Taey, 2018). While, Atiand Al-Sahaf (2007) found that organic fertilization (20% poultry or 20% cattle with 20% of the Whey) gave an increase in the number of Aerial stems of the plant which amounted to (10.67, 9.33 stem / plant) for the two seasons (spring and autumn), respectively. This study aims to study the effect of organic fertilization and naphthalene acetic acid on the most important vegetative traits for pomegranate seedlings and determine the best used treatments, which lead to increase vegetative growth.

Materials and Methods

The experiment was conducted at greenhouse belonging to Department of Horticulture and Landscaper Gardening, College of Agriculture, Al-Qasim Green University during the growth season of 2016 to 2017. The study included two factors: the first: The effect of spraying with naphthalene at three concentrations of 0, 50, 100 ml/L. The second factor is the adding of organic fertilizer at three concentrates (0, 4, 8 g/seedlings) and the interaction between them in the growth of pomegranate seedlings (Salami cultivar). The seedlings were prepared from one of the private nurseries in Al-Rarnegia region belonging to Babylon province. A 108 pomegranate seedlings (Salimi cultivar) were selected, with 6 month age, with almost homogeneous growth and cultivated in 2 kg plastic pots. Seedlings were placed in the greenhouse belonging to Department of Horticulture, College of Agriculture on 01/26/2016. The seedlings were sprayed with naphthalene acetic acid in the early morning until full wetness, a sufficient distance has been left between the one treatment and another using the barriers to avoid the effect of the spray between the treatments and two droplets of Dish washing liquid were added to the spray solution as a spreading material. At the next day, the organic fertilizer was added to the seedlings and mixed with the soil, the seedlings were irrigated. The second spraying on 1/4/2017 with naphthalene at three concentrations of 0, 50, 100 ml/L. On the second day, the second batch of organic fertilizer, which was produced

by the American company (Caspian) was added. It contains most of the macro and micronutrients at concentrations of 0, 4, 8 g/seedling. All service operations were conducted for seedlings such as irrigation, Grubbing and pest control. A factorial experiment was conducted according to the Randomized Complete Block Design (RCBD), with three replicates and four seedlings per experimental unit. Thus, the number of seedlings was 108. Three seedlings were randomly selected from each treatment. The results of the experiment were analyzed using the statistical program Genstat and the averages were compared using a Least Significant Difference (LSD) test at a probability level of 0.05 (Al-Rawi and Khalaf Allah, 2000). The vegetative traits were measured after about one month from the second spraying and then the measurements were taken for the following studied traits:

1. The average height of seedling (cm)

It was measured by using a metric strip from the crown region to the highest of the main stem for the seedling.

2. The average diameter of stem (cm):

The diameter of main stem for seedlings was measured at a height of 2 cm from the soil surface of the plastic pot by Vernier calipers for each treatment and the average was calculated.

3. Average number of branches (branch/seedlings)

The number of lateral branches on the main stem of each seedling was calculated and then the average was calculated.

4. Average number of leaves (leaf/seedlings)

The number of leaves per seedling was calculated and the number of leaves per treatment was extracted.

5. Leaf area (cm^2/seedlings)

The leaf area was calculated based on the one leaf area and the number of leaves in the seedling where the average of one leaf area was calculated by taking 15 leaves of different parts of each treatment and weighed after the separation of the necks from it, and then took 5 squares with 1 cm of cut leaf and then calculated the average of one leaf area was calculated according to the following equation:

$$S = \frac{G \times s}{g}$$

Where,

S = leaf area (cm)

G = leaf weight (g)

s = the average area of the square (cm^2)

g = the average weight of the square (g)

The leaf area of the seedlings was calculated by multiplying the number of leaves for seedling by the average of one leaf area for it according to Spedagogica and Dvorinic (1965).

Table 1 : shows the organic fertilizer components (Caspian).

Elements	Percentage
Organic matter (O.M)	35 – 45
N	4
P_2O_5	3
K_2O	4
PH	6 -7
Manganese	500 – 1000 PPm
Zinc	500 – 1000 ppm
Iron	500 – 1000 ppm

Results and Discussion

The average height of seedling (cm)

Table 2 illustrates that the Fertilization of seedlings with organic fertilizers has led to an increase in the average height of seedling with increasing the used concentration, the highest average for seedling height amounted of 97.92 cm in seedling treatment with 8 g/ seedlings compared with the lowest height in the control treatment which amounted of 77.69 cm. The increase in the average height of seedling may be due to the effect of organic fertilizers in filling the plant's need for important mineral elements in the cell division process and elongation it, and bio-processes such as photosynthesis and respiration (Awad and Atawia, 1995). The seedlings spraying with naphthalene acetic acid had a positive effect on increasing the average height of seedling, which amounted the highest height (92.86 cm) in seedlings treated at concentration of 100 mg/L compared to the lowest average amounted of 82.45 cm in the control treatment.The increase in plant height was due to the role of Auxin (NAA) in building proteins and enzymes in the of cell division process and its expansion, which led to increase Osmotic pressure within it, then absorption of the amount of water and nutrients. This is positively reflected plant growth, including plant height (Abdul, 1987). As for the interaction between the concentrations of organic fertilizers and naphthalene acetic acid, it also showed a clear effect on the height of treated plants. The seedlings were treated with the highest concentration for each of them was excelled by giving it the highest average for stem height amounted of 101.90 cm compared to the lowest average (69.24 cm) in the control treatment.

The average diameter of stem (cm)

Table 3 shows that the treatment of organic fertilizer has an effect on the average diameter of stem where the maximum average for stem diameter at the treatment (8 g/seedling), which amounted of 1.72 cm compared to the control treatment, which amounted of 1.15 cm. The increase in the average diameter of stem may be due to the addition of the organic fertilizer dueto what organic fertilizer contain of important nutrients such as nitrogen, which are involved in many of the bio-processes that occur in the plant such as the formation of amino acids, proteins and enzymes that promote the increase of cellular divisions and elongation of cells. The tissue growth increases, leading to an increase in the activity of the Cambium layer, which, when dividing, lead to increases this increase in diameter (Al-Naimi, 1987). As well as the naphthalene significantly affected by giving the highest average amounted of 1.71 cm, when spraying at a concentration of 100 mg/L, while the lowest average was at the control treatment, which amounted of 1.16 cm. The reason for the increase due to naphthalene spraying may be due to the role of naphthalene in the expansion and division of plant cells, which in turn leads to increase the growth of stem diameter (Abdul, 1987). The interaction between organic fertilizer and naphthalene has a significant effect on the diameter of the stem. The increase in stem diameter may be due to the common positive action of both organic fertilizer and naphthalene in increasing the average diameter of stem for treated plants.

Average number of branches (branch/seedlings)

Table 4 shows that the addition of organic fertilizer had an effect on the average number of branches, where the treatment (8 g/seedling) has excelled by giving it the highest average amounted of 6.72 branch/plant, while the control treatment gave the lowest average amounted of 4.10 branches/seedlings. It may be due to what organic fertilizer contain of important nutrients that needed by the plant, including (N, P, K, Mn, Zn, etc.) and then improve growth and increase the photosynthesis process in the plant, which leads to the break of the apical dominance and increase the number of branches in the plant (Abouseeda, 1999). In addition, the naphthalene spraying had an effect on the average number of branches where the highest average was at the treatment (100 mg / L) which amounted of 6.14 branches/plants, while the control treatment gave the lowest average for this trait amounted of 3.66 branches/plant as previously explained by Abdul (1987). The interaction between the high concentrations of organic fertilizers (8 g/seedlings) and naphthalene acetic acid (100 mg/L) gave the highest average number of branches amounted of 7.44 branches/plants compared to the lowest average number which amounted of 3.33 branch/plant in the control treatment for the reasons mentioned above.

Table 2 : Effect of spraying with naphthalene and organic fertilizer and their interaction in average height of seedling (cm).

Naphthalene concentration (mg/L)	Concentration of organic fertilizer (g/seedling)			
	0	**4**	**8**	**Average**
0	69.24	83.01	95.12	82.45
50	78.28	86. 78	96.76	87.52
100	85.56	91.12	101.90	92.86
Average	77.69	87.06	97.92	
L.S.D 0.05	Concentration of organic fertilizer = **3.9**, Naphthalene concentration= **3.9**, interaction=**5.92**			

Table 3 : Effect of spraying with naphthalene and organic fertilizer and their interaction in the average diameter of stem (cm).

Naphthalene concentration (mg/L)	Concentration of organic fertilizer (g/seedling)			
	0	**4**	**8**	**Average**
0	0.93	1.02	1.53	1.16
50	1.01	1.07	1.72	1.26
100	1.52	1.71	1.92	1.71
Average	1.15	1.26	1.72	
L.S.D 0.05	Concentration of organic fertilizer = **0.63**, Naphthalene concentration= **0.63**, Interaction= **0.95**			

Table 4 : Effect of spraying with naphthalene and organic fertilizer and their interaction in the 1-average number of branches (branch / seedlings).

Naphthalene concentration (mg/L)	Concentration of organic fertilizer (g/seedling)			
	0	**4**	**8**	**Average**
0	3.33	4.00	5.33	3.66
50	3.66	4.66	6.00	4.77
100	5.33	5.66	7.44	6.14
Average	4.10	4.77	6.72	
L.S.D 0.05	Concentration of organic fertilizer = **0.45**, Naphthalene concentration = **0.45**, Interaction= **0.9**			

The average length of branches (cm)

Table 5 shows that the treating with organic fertilizer has a significant effect on the average length of branches, where the treatment (8 g/seedling) was excelled by giving it the highest average amounted of 59.85 cm, while the control treatment gave the lowest average amounted of 37.07 cm. The same table shows that naphthalene acetic acid had a significant effect on the average length of branches where the highest average amounted of 56.47 cm at concentration of 100 mg/L compared with the lowest average which amounted of 42.55 cm in the control treatment (Al-Dabbagh *et al*., 2002). As for the overlap between the concentrations of organic fertilizer and naphthalene concentrations was significant in increasing the average length of branches. The highest values were 59.85 cm in the treatment of 8 g/ seedling organic fertilizer with 100 mg/L naphthalene compared to the lowest average for branch length which amounted of 37.07 cm in the control treatment. The increase in branch length may be due to the same reasons as the increase in plant height.

Average number of leaves (leaf/seedlings)

Table 6 indicates that the treatment of organic fertilizer significantly affected the average number of leaves, where the treatment (8 g / seedling) recorded the highest average amounted of 334.53 leaves/plant, while the control treatment gave the lowest average amounted of 293.09 leaves/plant. This may be due to the role of organic fertilizer and its nutrient components such as nitrogen, which is involved in the formation of amino acids, proteins and enzymes that promote increasing divisions and elongation of cells and thus increase tissue elongation (Al-Naimi, 1987). It is also noted from the same table that spraying with naphthalene at a concentration of 100 mg/L gave the highest average amounted of 368.67 leaves /plant, while the control treatment gave the lowest average of this trait amounted of 276.21 leaves/plant. The increase may be due to the role of naphthalene in increasing cell division and its elongation, which promotes growth and increases the formation of leaves (Abdul and Saleh, 1987). This leads to an increase in leaf buds and the reflection of their increase in the end to increase the number of leaves. The results of the interaction between concentrations of organic fertilizer and naphthalene showed a significant effect in this trait, where the treated seedlings with 8 g/seedling of organic fertilizer with 100 mg/L concentration of naphthalene were excelled by recording, it the highest number of leaves amounted of 386.02 leaves/plant compared to the lowest averages amounted of 248.13 leaves/plant. The reason for the increase in the number of leaves as a result of spraying organic fertilizer and naphthalene to the same reasons that explained the increase in the height of seedlings, the number and length of branches where increasing these traits the number of leaves was increased.

Table 5 : Effect of spraying with naphthalene and organic fertilizer and their interaction in theaverage number of branches (branch / seedlings).

Naphthalene concentration (mg/L)	Concentration of organic fertilizer (g/seedling)			
	0	**4**	**8**	**Average**
0	27.22	45.78	54.67	42.55
50	35.14	53.15	56.11	48.13
100	48.85	51.78	68.79	56.47
Average	37.07	50.23	59.85	
L.S.D 0.05	Concentration of organic fertilizer = **2.44**, Naphthalene concentration= **2.44**, Interaction= **4.96**			

Table 6 : Effect of spraying with naphthalene and organic fertilizer and their interaction in the average number of leaves (leaf / seedlings).

Naphthalene concentration (mg/L)	Concentration of organic fertilizer (g/seedling)			
	0	**4**	**8**	**Average**
0	248.13	283.03	297.47	276.21
50	295.12	305.98	320.11	305.40
100	341.04	378.95	386.02	368.67
Average	293.09	322.65	334.53	
L.S.D 0.05	Concentration of organic fertilizer = **3.1**, Naphthalene concentration= **3.1**, Interaction= **5.9**			

Table 7 : Effect of spraying with naphthalene and organic fertilizer and their interaction in the average leaf area (cm^2/plant).

Naphthalene concentration (mg/L)	Concentration of organic fertilizer (g/seedling)			
	0	**4**	**8**	**Average**
0	465.8	489.1	578.45	511.11
50	486.0	654.12	681.02	607.04
100	571.92	679.27	741.15	664.11
Average	507.90	607.49	669.87	
L.S.D 0.05	Concentration of organic fertilizer = **11.90**, Naphthalene concentration= **11.90**, Interaction= **14.75**			

The average leaf area (cm²/plant)

Table 7 shows that the treating of seedlings with organic fertilizer have an effect on the average leaf area where the treated seedling with 8 g/seedling gave the highest average amounted of 669.87 cm², while the control treatment gave the lowest average amounted of 507.90 cm². The increase in the average leaf area may be due to the effect of organic fertilizer in filling the plant's need for important mineral elements in the process of cell division and its extinction, and bio-processes such as photosynthesis and respiration (Awad and Atawia, 1995). Spraying seedlings with naphthalene concentrations led to increase the leaf area with increasing concentration where the largest leaf area amounted of 664.11 cm² at 100 mg /L concentration while the control treatment, which gave the lowest leaf area amounted of 511.11 cm². It may be due to the fact that naphthalene works to increase the transfer of processed materials to parts of the plant and increase the division and elongation of leaf cells, which reflects positively on the increase of the leaf area (Abdul, 1987). The interaction between organic fertilizer concentrations and naphthalene concentrations gave the highest averages to the highest concentrations used and may be due to the positive effect of both organic fertilizer and naphthalene.

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