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EFFECT OF FOLIAR SPRAYING WITH GROWTH REGULATOR (THIDIAZURON) AND NUTRIENT SOLUTION (FOLIZYME-GA) IN SOME GROWTH TRAITS OF MARUMI KUMQUAT (*Fortunella japonica*) SAPLINGS

Res. R. E. Y. AL-Hayali* **Assist. Prof.Dr. A. M. I. AL-Janabi****

***Ministry of Science and Technology - Department of Provincial Affairs**

****University of Anbar - College of Agriculture**

Email: iaqeel64@yahoo.com

ABSTRACT:

Lath house trial was conducted out at Horticulture and Landscape Design Department, College of Agriculture, University of Baghdad (Abu-Ghraib), the alternative porition of University of Anbar, for the period from April 2017 to January 2018 to study the effect of foliar spraying with growth regulator (Thidiazuron) (TDZ) and nutrient solution (Folizyme-GA) in some growth and minerals traits of Marumi Kumquat saplings, 108 uniform saplings were selected in their growth as much as possible at the age of three years, a factorial experiment was conducted according to the Randomized Complete Block Design (RCBD), with three replicates for each treatment, the experiment included spraying with four concentrations of growth regulator (0 , 10 , 20 and 30 mg l^{-1}), and three levels of spraying with nutrient solution (0 , 1 and 2 ml l^{-1}) . The results showed that the two factors of the study had a significant effect in all studied traits, especially the foliar application treatment of (TDZ) at 20 mg l^{-1} and spraying with nutrient solution of Folizyme-GA at a concentration of 2 ml L^{-1}, where achieved a significant superiority in the average increase in number and length of main shoots, number of leaves, leaves area, dry weight of vegetative parts, percentage of carbohydrates in shoots, leaves content of nitrogen, phosphorus, Potassium and chlorophyll, which recorded 9.50 shoot . sapling $^{-1}$, 8.58 shoot . sapling $^{-1}$, 32.86 cm, 32.64 cm, 417.8 leaf . sapling $^{-1}$, 394.1 leaf . sapling $^{-1}$, 84.99 dm^2, 78.96 dm^2, 124.30 gm, 112.98 gm, 9.40, 9.19, 2.52, 2.47, 0.30, 0.31, 1.69, 1.72%, 10.98 mg gm^{-1} fresh weight and 10.80 mg gm^{-1} fresh weight respectively for both factors of the study, while the control treatment gave the lowest values for all above traits .

Keywords: Cytokinins, Phosphorus, Potassium, Foliar application, Citrus, Vegetative growth

تأثير الرش الورقي بمنظم النمو (Thidiazuron) والمحلول المغذي (Folizyme-GA) في بعض صفات نمو شتلات الكمكوات المستديرة (*Fortunella japonica*)

الباحثة رغد عماد يحيى الحيالي* **أ.م.د. اثير محمد اسماعيل الجنابي****

***وزارة العلوم والتكنولوجيا - دائرة شؤون المحافظات**

****جامعة الانبار - كلية الزراعة**

Email: iaqeel64@yahoo.com

****Research is derived from a master's thesis of first researcher**

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الخلاصة:

نفذت تجربة في الظلة الخشبية التابعة لقسم البستنة وهندسة الحدائق / كلية الزراعة / جامعة بغداد (ابو غريب)، الموقع البديل لجامعة الانبار، للمدة من نيسان 2017 لغاية كانون الثاني 2018 لدراسة تأثير الرش الورقي بمنظم النمو Thidiazuron (TDZ) والمحلول المغذي Folizyme-GA في بعض صفات النمو الخضري والمعدني لشتلات الكمكوات المستديرة ، اذ تم انتخاب 108 شتلة بعمر ثلاث سنوات متجانسة في نموها قدر الامكان، نفذت تجربة عاملية وفق تصميم القطاعات الكاملة المعشاة (R.C.B.D.) وبواقع ثلاثة مكررات لكل معاملة، اذ تضمنت التجربة الرش بمنظم النمو Thidiazuron (TDZ) وبأربعة تراكيز (0 ، 10 ، 20 و 30 ملغم لتر$^{-1}$)، وثلاثة مستويات من الرش بالمحلول المغذي Folizyme-GA (0 ، 1 و 2 مل لتر$^{-1}$). اظهرت النتائج ان لعاملي الدراسة تأثيرا معنويا في كافة الصفات المدروسة لاسيما معاملة الرش بمنظم النمو بالتركيز 20 ملغم لتر$^{-1}$ والرش بالمحلول المغذي بالتركيز 2 مل لتر$^{-1}$ اذ حققتا تفوقا معنويا في معدل الزيادة لعدد واطوال الافرع الرئيسة، عدد الاوراق، المساحة الورقية، الوزن الجاف للمجموع الخضري، النسبة المئوية للكربوهيدرات في الافرع، محتوى الاوراق من النتروجين، الفسفور، البوتاسيوم والكلوروفيل الذي بلغ 9.50 فرع . شتلة$^{-1}$، 8.58 فرع . شتلة$^{-1}$، 32.86 سم، 32.64 سم، 417.8 ورقة . شتلة$^{-1}$، 349.1 ورقة . شتلة$^{-1}$، 84.99 دسم^2، 78.96 دسم^2، 124.30 غم، 112.98 غم، 9.40، 9.19، 2.52، 2.47، 0.30، 0.31، 1.69، 1.72%، 10.98 ملغم غم$^{-1}$ وزن طري و 10.80 ملغم غم$^{-1}$ وزن طري بالتتابع لكلا عاملي الدراسة، في حين سجلت معاملة المقارنة ادنى القيم للصفات اعلاه .

الكلمات المفتاحية: السايتوكاينينات ، الفسفور ، البوتاسيوم ، الرش الورقي ، الحمضيات ، النمو الخضري.

INTRODUCTION:

Marumi Kumquat (*Fortunella japonica*) which is belonged to the Rutaceae family, it is a small trees or evergreen shrubs, slow growing and small size, it is suitable to be decorative plants as they are few or no thorns almost, and is characterized by adapting to various environmental conditions where the trees stop growing and become inactive to resist the cold, where they ranked after trifoliate orange (*Poncirus trifoliata*) in period of dormancy as well as that their thermal requirements for growth are high, fruits round shape small size between 2 - 2.5 cm and are used in several ways either fresh fruit or canned, and used in the manufacture of sweets, fruits are eaten fully with their husk which is sweet taste as eating seven fruits provides the human body with at least 20% of its daily needs of fiber as well as vitamin C (Saunt, 2000) .

One of the major problems of citrus seedlings is their slow growth and relatively long period of time to reach the appropriate stage for the budding or transfer to a permanent place, thus increasing their production costs, which calls requines for the use of other means to accelerate the seedlings reach to the appropriate size, including foliar application with plant growth regulators such as thidiazuron (TDZ), which is a type of synthetic cytokinins belongs to bis-substituted urea derivatives, TDZ is more effective compared to the Adenine-based cytokinins (Mok *et al*., 1982 ; Shudo, 1994) due to its high stability in the plant tissues where it is not degradation by the enzyme cytokinin oxidase / dehydrogenase (CKX) (Nisler *et al*., 2016), Its physiological efficacy is represented by stimulate cell division and its expansion, breaking of apical dominance, activate the translocation and assimilation of nutrient elements and metabolic materials, delay the senescence of leaf, enhance photosynthesis activity, maintain chlorophyll concentration, increase stress tolerance, increase fruit size, hormonal regulation of plant morphogenesis and other influences (Guo *et al*., 2011 ; Nisler, 2018), several studies have indicated the importance of cytokinins treatment because it has a role in stimulating the growth and development of plants, such as Amarante *et al*. (2002) when spraying two cultivars of apple trees with thidiazuron, Muralidhara *et al*. (2014) when spraying benzyl adenine (BA) on mango seedlings, Al-Ahbaby (2016) when spraying the grape seedlings with KT-30, Al-Hameedawi (2016) when spraying the fig trees with thidiazuron, Al-Janabi and Al-

Shabani (2017) when spraying the soure orange seedlings with CPPU, Aly *et al*. (2017) when spraying pear trees with CPPU .

Foliar nutrition plays an important role in improving the traits of growth by ensuring the availability of nutrient elements, especially the macro elements such as phosphorus and potassium, which contribute to the formation of a plant capable of growing in a balanced manner, where it consider the driving forces of vital activities where it participates in the metabolic processes and many important functions and lack of them cause a physiologic disruption as a result of nutritional imbalance, which negatively affects the growth and productivity of the plant (Marschner, 2012), a number of researchers indicated to the importance of foliar spraying with nutrient solutions, especially those containing phosphorus and potassium, in improving the plant's nutritional status as well as vegetative growth, such as Fathy *et al*. (2010) when spraying apricot trees with Actosol nutrient solution, Stino *et al*. (2011) when sprayed with potassium phosphate for pear trees, Yousef *et al*. (2011) when foliar spraying for olive seedlings with potassium dihydrogen phosphate, Hagagg *et al*. (2012) when spraying NPK fertilizer for olive seedlings, Mosa *et al*. (2015) when spraying apple trees with potassium sulfate and the Actosol solution .

MATERIALS AND METHODS

This study was conducted in lath house, department of horticulture and landscape desgin, college of agriculture, university of Baghdad (Abu Ghraib), for the period from April 2017 to January 2018 to study the effect of foliar spraying with growth regulator (Thidiazuron) and nutrient solution (Folizyme-GA) in some of the growth characteristics of Marumi Kumquats (*Fortunella japonica*), 108 uniform saplings were selected in their growth as much as possible at the age of three years and growing on the rootstock of the Rough Lemon (*Citrus jambhiri* Lush), cultivated in plastic plant pots of 7 kg where brought to the study site on 15 / 2 / 2017, samples of leaves were taken randomly to find out content from some mineral elements before the experiment was conducted, which were 2.31%, 0.16% and 1.12% for the elements of nitrogen, phosphorus and potassium respectively, all service operation for saplings were conducted such irrigating, weeding and pesticides when needed, soil samples were taken for the purpose of conducting some chemical and physical analysis prior to the implementation of the experiment as shown in (Table 1).

Table 1. Physical and chemical soil analysis

Physical analysis (g.kg^{-1} soil)				
Sand	**Loam**	**Clay**	**Texture**	
624.5	184.3	191.2	Sandy loam	
Chemical analysis				
pH	**EC (1:1) ds.m^{-1}**	**N (g.kg^{-1} soil)**	**P (mg.kg^{-1} soil)**	**K (mg.kg^{-1} soil)**
7.1	2.51	75.2	16.8	231.5

A factorial experiment was conducted with two factors, The first factor included spraying saplings with Thidiazuron (TDZ) solution with four concentrations: T0 (sprayed with distilled water), T1 (10 mg L^{-1}), T2 (20 mg L^{-1}) and T3 (30 mg L^{-1}), the plant growth regulator solution was prepared after the weight of the growth regulator crystals according to each concentration and its was dissolved in the acetone (98%) (Tomlin, 2004) and then completed the volume to 1 L with distilled water, Thidiazuron (A.I. 95%) produced by Xi'an Wison Biotechnology Technology Co., Ltd. China.

The second factor: spraying with the Folizyme-GA solution with three concentrations: F0 (sprayed with distilled water), F1 (1 ml L^{-1}) and F2 (2 ml L^{-1}), the nutrient solution was produced by (Napnutri Science Co., Ltd. Thailand), contains (P_2O_5) with a concentration of 17% and (K_2O) at a concentration of 5%, and the recommendation of the fertilizer is (1-1.5 ml L^{-1}) according to the manufacturer company.

The foliar applied of (TDZ) was conducted according to the following dates: (10/4/2017), (10/5/2017), (10/9/2017), (10/10/2017), as for foliar nutrition with the nutrient solution, it was sprayed after one day of spraying with the growth regulator solution and for each date using a manual sprayer of (16 liters) until drip point with the addition of a wetting agent (Triton B) to the spray solution (0.1%), a factorial experiment with two factors (4 × 3) was conducted according to the Randomized Complete Block Design (RCBD), with three replicates and each replicate containing three seedlings for each treatment, the data were analyzed according to the statistical program GeneStat, the arithmetic averages were compared by using the least significant differences (L.S.D) test, with a probability level of (0.05) (Al-Mohammedi and Al-Mohammedi, 2012).

Studied traits:

Average increase in number and length of the main shoots: the number of shoots (shoot.sapling^{-1}) and shoots length (cm) was calculated on the main stem of the seedling (before conducting the treatments) in April of 2017, it was calculated at the end of the experiment in the January of 2018, the average increase was calculated by the difference between the two readings.

Number of leaves (leaf.saplings^{-1}): the number of leaves was calculated at the end of the experiment in the month of January of 2018.

Leaves area (dm^2): a ten fully expanded leaves were taken from the node of the fifth - eighth of the shoots tip (Reisinauer, 1978) in January of 2018, then taken from each leaf a disk by cork borer (disk diameter 1 cm or with area of 0.786 cm2), put the leaves and disks in an electric oven (containing the dump) at a temperature of 65°C until the stability of weight, the average of leaf area was then calculated according to (Dvornic et al., 1965).

Leaves area of the sapling = number of leaves per seedling x leaf average area (cm^2).

Dry weight of vegetative parts (gm): was measured for two saplings from each treatment of per replicate, the total vegetative system was separated from the root system and washed with distilled water several times and then placed in an electric oven at 65 °C until the stability of weight.

Percentage of total carbohydrates in shoots: was estimated in January of 2018 according to (Dubois et al., 1956).

Leaves content of Nitrogen, Phosphorus and Potassium (%): the completed growth leaves samples (Smith, 1966) were taken at the end of the experiment, total nitrogen (%) was estimated using Microkjeldahl, phosphorus (%) was estimated using Spectrophotometer while Potassium (%) was measured using the Flamephotometer and according to the methods mentioned (Bahargava and Raghupathi, 1999).

Total chlorophyll content in leaves (mg g^{-1} fresh weight): fully expanded leaves samples were taken at the sixth to eighth node of the shoots tip in January of 2018 for the extraction of chlorophyll a and b, which was estimated according to method of (Bajracharya, 1999).

RESULTS AND DISCUSSION

Average increase in number of main shoots (shoot.saplings^{-1}) and their length (cm):

Table 2 shows the significant effect of foliar spraying with the growth regulator (Thidiazuron) (TDZ) in increasing the number and length of the main shoots, especially the T2 concentration, which achieved the highest average of increase, which amounted to 9.50 shoot.sapling^{-1}, 32.86 cm compared to the rest of the treatments, while the lowest average was at the concentration T0, which amounted to 5.44 shoot.sapling^{-1}, 26.51 cm for the number and length of the main shoots respectively. Spraying with the nutrient solution (Folizyme-GA) led to a significant increase in these two traits by increasing levels of spraying, the level F2 achieved the highest average of 8.58 shoot. sapling^{-1}, 32.64 cm while the lowest average of increase in the number of main shoots and their length at F0 level was 6.00 branch.sapling^{-1}, 27.68 cm respectively. The results in the same table showed the non-significant effect of the interaction between the two factors in the increase the number of main shoots while it had a significant effect in increasing the length of the main shoots by achieving the treatment T2 X F2 the highest value while the treatment T0 X F0 recorded the lowest value.

Table 2. Effect of foliar spraying with growth regulator (Thidiazuron) and nutrient solution (Folizyme-GA) and their interaction in average increase in the number and length of main shoots

Average increase in main shoots number (shoot . sapling^{-1})					Average increase in main shoots length (cm)			
Thidiazuron mg L^{-1} (T)	Folizyme-GA ml L^{-1} (F)			Means (T)	Folizyme-GA ml L^{-1} (F)			Means (T)
	F0	F1	F2		F0	F1	F2	
T0	4.00	5.50	6.83	5.44	21.63	28.71	29.18	26.51
T1	5.83	7.33	8.33	7.17	29.14	31.74	33.34	31.41
T2	8.17	9.83	10.50	9.50	30.92	32.75	34.90	32.86
T3	6.00	7.17	8.67	7.28	29.02	32.26	33.13	31.37
Means (F)	6.00	7.46	8.58	Means (F)	27.68	31.37	32.64	
LSD 0.05	T	F	TxF		T	F	TxF	
	0.93	0.80	N.S.		1.00	0.86	1.73	

The reason for the superiority of the treatment with (TDZ) may be attributed to the increase in number and length of the shoots to its role in breaking of apical dominance and stimulating the growth of lateral buds (Bangerth *et al.*, 2000 ; Murch and Saxena, 2001 ; Pai and Desai, 2018), as well as its role in stimulating the formation of nucleic acids (DNA and RNA) and proteins and polyamines in the lateral buds and its association with its growth, which increased the number of branches (Wang *et al.*, 1986), the increase in shoot lengths due to the growth regulator may be attributed to its role in increasing cellular division in apical meristems and adding new cells to the plant (Guo *et al.*, 2011), these results agree with Amarante *et al.* (2002) that the spraying with thidiazuron for two cultivars of apple (*Malus domestica* Borkh.) trees has led to a significant increase in the lengths of shoots, this results also agree with Al-Ahbaby (2016) which showed a significant increase in the lengths of shoots of two cultivars of grape (*Vitis vinifera* L.) seedlings when spraying with growth regulator (KT-30), and agreed with results of Al-Hameedawi (2016) which showed a significant increase in the number and length of shoots when spraying fig (*Ficus carica* L.) trees with TDZ. The importance of nutrient solution (Folizyme-GA) is focused in its positive effect in increasing the number and length of the main shoots through its content of the elements of phosphorus and potassium, phosphorus enters the formation of nuclear and amino acids, plant membranes, energy-rich compounds, and co-enzymes, that contribute to the plant's vital activities such as photosynthesis, metabolism of carbohydrates and fatty acids (Havlin *et al*., 2005 ; Hawkesford *et al*., 2012) which leads to stimulate vegetative growth of the saplings, as for the role of potassium, it works as an activator of many enzymes responsible for a number of physiological processes such as photosynthesis and the transport of their products to growth and storage areas and the formation of chlorophyll, proteins and starch (Hawkesford *et al*., 2012) which leads to the activity of vegetative growth, including the number and length of shoots, as well as its role in elongation of cells as the elongation of cells depends on the concentration of dissolved materials, such as potassium, which is considered one of the main dissolved in cells, where the osmotic pressure is increased and accordingly increase the elongation of cells (Taiz and Zeiger, 2006), which reflect positively on the growth traits, including lengths of shoots, these results agree with Stino *et al*. (2011) where their results showed a significant increase in the length of shoots when spraying the pear (*Pyrus communis*) trees with potassium phosphate, also consistent with Mosa *et al*. (2015) where the length of the shoots significantly increased when sprayed the apple trees with potassium sulfate and the nutrient solution (Actosol), It is also agreed with the results of Abd El-Rhman and Attia (2016), which showed that the number and length of shoots of olive (*Olea europaea* L.) trees increased significantly as a result of spraying potassium nitrate.

Number of leaves (leaf.sapling^{-1}) and leaves area (dm^2):

Table 3 shows that the number of leaves and leaves area increased as a result of treatment with TDZ, especially the T2 concentration, which was significantly excelled on the rest of the concentrations, where achieved a value of 417.8 leaf.sapling^{-1}, 84.99 dm^2, while the lowest values were 265.7 leaf.sapling^{-1}, 49.46 dm^2 at the concentration T0, in addition, the spraying with Folizyme-GA showed a significant increase in these two traits, especially the F2 treatment which achieved the highest values of 394.1 leaf.sapling^{-1}, 78.96 dm^2 while the lowest value at T0 treatment of these two traits which reached 284.4 leaf.sapling^{-1}, 54.11 dm^2, the interaction between the growth regulator and nutrient solution had a significant effect on the increase in the number of leaves and leaves area, the T2 x F2 treatment achieved the highest values while the T0 x F0 recorded the lowest values for both traits.

The reason for the increase in the number of leaves as well as leaves area of the saplings derived from treatment with (TDZ) may be attributed to the role of cytokinines in promoting the growth of leaves primordia through cell division and differentiation (Davies, 1994), TDZ also influence the

Table 3. Effect of foliar spraying with growth regulator (Thidiazuron) and nutrient solution (Folizyme-GA) and their interaction in the number of leaves and leaves area

Leaves number (leaf . seedling^{-1})					Leaves area (dm^{2})			
Thidiazuron mg L^{-1} (T)	Folizyme-GA ml L^{-1} (F)			Means (T)	Folizyme-GA ml L^{-1} (F)			Means (T)
	F0	F1	F2		F0	F1	F2	
T0	203.5	264.5	329.0	265.7	36.87	48.55	62.96	49.46
T1	280.0	348.5	382.5	337.0	52.82	68.41	76.19	65.81
T2	357.5	426.5	469.5	417.8	70.63	86.61	97.74	84.99
T3	296.5	327.0	395.5	339.7	56.10	62.87	78.94	65.97
Means (F)	284.4	341.6	394.1	Means (F)	54.11	66.61	78.96	
LSD 0.05	T	F	T×F		T	F	T×F	
	8.53	7.39	14.78		1.77	1.53	3.06	

allocation of nutrients and assimilates in the plant towards treated tissues with it (Beck, 1996 ; Guo *et al*., 2011) and their use in the building of vegetative parts, including the increase in number and area of leaves, it may also be attributed to the fact that foliar spraying with (TDZ) has improved the vegetative growth traits, including the number and length of shoots as shown in table (2) which leading to an increase in the number of leaves and thus increasing the leaves area, these results are consistent with Al-Hameedawi (2016) when spraying the fig trees with the TDZ, which significantly increased the leaf area, it also agree with Al-Janabi and Al-Shabani (2017) where their results showed a significant increase in the number of leaves and leaves area of sour orange (*Citrus aurantium* L.) seedlings when foliar spraying with growth regulator CPPU. The result of the increase in number of leaves and leaves area due to foliar spraying with (Folizyme-GA) may be due to its positive effect of what its containing of macroelements of phosphorus and potassium in their availability form and their physiological role in improving the vegetative traits including the number and length of shoots as well as improving the nutritional status and accumulation of carbohydrates in the saplings and the relationship of that with increase in the number of leaves and leaves area, these results agree with Yousef *et al*. (2011) where their results showed a significant increase in number of leaves and leaves area of olive seedlings when foliar spraying with potassium dihydrogen phosphate, also consistent with Al-Asadi (2016) were the number of leaves and leaves area significantly increased when spraying the olive seedlings with NPK.

Dry weight of vegetative parts (gm) and shoots content of carbohydrates (%):

The study treatments affected the dry weight of vegetative parts and the percentage of carbohydrates in shoots, Table 4 shows that spraying with the growth regulator at T2 concentration has achieved a significant increase by giving it the highest values which reached 124.30 gm , 9.40% compared to the rest of the concentrations while the lowest values were 74.06 gm , 8.19% at T0 treatment, it was noted from the same table that there were significant differences as a result of treatment with nutrient solution where these two traits increased by increasing the levels of spraying, where the level of F2 achieved the highest values which amounted to 112.98 gm , 9.19% , While the lowest values were 82.19 gm , 8.38% at the level of F0, the interaction between the two factors showed its significant effect by achieving the treatment T2 X F2 the highest dry weight of vegetative parts and the percentage of carbohydrates in shoots compared to the lowest in the interaction treatment T0 X F0.

Table 4. Effect of foliar spraying with growth regulator (Thidiazuron) and nutrient solution (Folizyme-GA) and their interaction in the dry weight of vegetative parts and the percentage of carbohydrates in shoots.

Dry weight of vegetative parts (gm)					Shoots content of carbohydrates (%)			
Thidiazuron mg L^{-1} (T)	Folizyme-GA ml L^{-1} (F)			Means (T)	Folizyme-GA ml L^{-1} (F)			Means (T)
	F0	F1	F2		F0	F1	F2	
T0	56.04	75.38	90.75	74.06	7.84	8.21	8.53	8.19
T1	81.63	94.78	110.52	95.64	8.33	8.67	9.13	8.71
T2	106.27	127.44	139.18	124.30	8.96	9.35	9.89	9.40
T3	84.81	91.19	111.47	95.82	8.41	8.58	9.22	8.73
Means (F)	82.19	97.20	112.98	Means (F)	8.38	8.70	9.19	
LSD 0.05	T	F	T×F		T	F	T×F	
	3.27	2.84	5.68		0.14	0.11	0.22	

The reason for increase in the dry weight of vegetative parts as well as the shoots content of carbohydrates may be due to the strength and activity of vegetative growth of the saplings resulting from spraying with (TDZ) and (Folizyme-GA) which is represented by increasing the number and length of shoots and the number and area of leaves as shown in Tables (2 and 3), in addition to its content of chlorophyll and its reflection in increasing the efficiency of photosynthesis and an increase the carbohydrates synthesis (Jordan and Ogren, 1984), these results agree with Abou Aziz *et al*. (2011) which founds that spraying olive trees with BA growth regulator has increased the dry weight of leaves and their carbohydrate content, it also agree with the results of El-Badawy and Abd El-Aal (2013) where the dry weight of the leaves and their carbohydrate content increased significantly for the mango (*Mangifera indica* L.) seedlings when spraying with the kinetin, it also agreed with Al-Janabi and Al-Shabani (2017) that spraying the sour orange seedlings with CPPU had led to increase the dry weight of vegetative system and the percentage of carbohydrates in the stem, and agreed with results of Helmi and Majeed (2015) which indicated an increase in the percentage of dry matter and carbohydrate in leaves when peach (*Prunus persica* L.) seedlings were sprayed with NPK, it also agrees with Kurdi (2016) when spraying the apricot (*Prunus armeniaca* L.) trees with nutrient solution (Foliartal) which led a significant increase in dry matter percentage in leaves as well as the shoots content of carbohydrates.

Percentage of nitrogen and phosphorus in leaves:

Table 5 indicates that the percentage of nitrogen and phosphorus in the leaves increased significantly due to treatment with the (TDZ), especially the treatment T2, which achieved the highest percentages which amounted 2.52, 0.30 % while the lowest percentage at T0 treatment, which amounted to 2.39%, 0.21% for nitrogen and phosphorus respectively, the spraying with the nutrient solution showed its significant effect on these two traits where the level of F2 achieved the highest leaves content of nitrogen and phosphorus which amounted 2.47, 0.31%, while the level of F0 gave the lowest content which reached 2.42, 0.21%, the interaction between the two study factors did not gave a significant effect in these two traits.

Table 5. Effect of foliar spraying with growth regulator (Thidiazuron) and nutrient solution (Folizyme-GA) and their interaction in the percentage of nitrogen and phosphorus in leaves.

Nitrogen content in leaves (%)					Phosphorus content in leaves (%)			
Thidiazuron mg L^{-1} (T)	**Folizyme-GA ml L^{-1} (F)**			**Means (T)**	**Folizyme-GA ml L^{-1} (F)**			**Means (T)**
	F0	**F1**	**F2**		**F0**	**F1**	**F2**	
T0	2.36	2.40	2.42	2.39	0.17	0.22	0.26	0.21
T1	2.42	2.45	2.46	2.44	0.21	0.25	0.30	0.25
T2	2.50	2.53	2.55	2.52	0.27	0.30	0.35	0.30
T3	2.43	2.47	2.48	2.46	0.22	0.28	0.33	0.27
Means (F)	2.42	2.46	2.47	**Means (F)**	0.21	0.26	0.31	
LSD 0.05	**T**	**F**	**T×F**		**T**	**F**	**T×F**	
	0.03	0.02	N.S.		0.04	0.03	N.S.	

Percentage of potassium in leaves and their content of chlorophyll (mg gm^{-1} fresh weight):

Table 6 indicates significant differences in the percentage of potassium in leaves as well as their content of chlorophyll as a result of spraying with TDZ, where the concentration of T2 was significantly excelled on the rest of the concentrations by giving it the highest values of 1.69%, 10.98 mg gm^{-1} fresh weight while the concentration T0 showed the lowest values which were 1.42 %, 10.06 mg gm^{-1} fresh weight, the foliar spraying with Folizyme-GA led to a significant increase in these two traits, especially the F2 treatment which achieved the highest values 1.72%, 10.80 mg gm^{-1} fresh weight while the lowest values were 1.40%, 10.26 mg gm^{-1} fresh weight at T0 treatment, the interaction between the two factors was significantly effect in the concentration of phosphorus in leaves, the treatment T2 X F2 achieved the highest percentage compared to the treatment T0 X F0, which recorded the lowest percentage, while the interaction between the two study factors had no significant effect in leaves content of chlorophyll.

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