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STUDY THE FOLIAR TIMES NUMBERS AND ATOINK STIMULATOR ON THE GROWTH AND YIELD OF CUCUMBER (SAIF CULTIVAR) CULTIVATED IN UNHEATED PLASTIC HOUSES

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Abstract

The experiment was conducted during the agricultural season 2017 in plastic houses in Al-Azawiya region, Babylon Province. The experiment consisted of eight treatments that corresponded to the number of spraying times (two spraying, three spraying) with four levels of foliar spraying with Ationk growth regulator of (0, 0.5, 0.75, 1 ml.L^{-1}) on cucumber plant (Saif cultivar). A factorial experiment was applied according to Randomized Complete Block Design (RCBD), with three replicates. The results showed a superiority of three times spraying treatment with Ationk on spraying treatment of two times in the average of plant height (307.0 cm), number of leaves (77.08 leaf), thickness of stem (11.33 mm), fruit length (20.50 cm), fruit diameter (34.43 mm), fruit weight (109.3 g), number of fruits (41.31 fruit. $plant^{-1}$) and the yield of one plant (4.518 kg). All foliar spraying treatments showed a significant excelling in the average trait of vegetative and fruit growth compared to the control treatment. The results showed significant excelling of the spraying treatment of three times at level of (0.75 ml.L^{-1}) in the length of the plant (328.3 cm), the number of leaves (93.33), the leaf thickness, the thickness of the stem (12.60 mm), the length of the fruit (22.83 cm), the fruit diameter (37.47 mm), the weight of the fruit (111.92 g), the number of fruits (45.73 fruit.$plant^{-1}$), the yield of one plant (5,120 kg).

***Keywords*:** Foliar nutrition, Atoink, Cucumber, Plastic houses. Spraying times

Introduction

Cucumber (*Cucumis sativus* L.) is considered a common summer vegetable crop belonging to the Cucurbitaceae family. It is a major vegetable in Iraq and the world. India and Africa are the home of its origin, its economic and nutritional importance and its diverse uses with many foods. It contains vitamins C, B1, B2, Niacin, protein, Carbohydrates and nutrient elements are especially iron, calcium, phosphorus and potassium and water forms a large percentage of the fruit weight (Arnaout, 1980, Hammadi, and Al-masheal 1987). The cucumber plant has many medical uses. It reduces swelling and helps to increase and decrease blood pressure, maintain eye glasses and purify the body of toxins and as sedative for headaches (Dujoi, 1996; Sumathi *et al*., 2008). The cucumber fruits are desirable to the consumer, so demand is increasing throughout the year. In order to meet this growing demand, there has been a significant development in the field of cucumber production, both in open fields or under tunnels and in plastic and glass houses. Iraq's 2015 production of the cucumber is 156.3 thousand tons, with an average productivity of (9.897 tons.ha^{-1}) (Central Organization of Statistics, 2015). Fertilization is considered one of the most important processes of the service of the crop and the most important means of production and its impact on the physiological processes of plants, especially nutrients. The application of these substances during growth and development can improve the nutrient balance of crops, which, in turn, leads to increased yield and quality, (Henk, 2018; Al-Taey *et al*., 2018a). The beneficial effects of this practice in terms of improved crop productivityby enhanced the plant growth (Al-Taey *et al*., 2018 b). Therefore, careful nutritional management is very important to get the optimum yield, Plant response to fertilizers depends on many factors in the root zone In arid and semiarid regions, low organic matter and low fertility are of great concern (Al-Juthery *et al*., 2018; Al-Taey *et al*., 2017). The foliar spraying method is considered the fastest and best way to reduce nutrient elements deficiencies as well as to avoid the stabilization of certain elements (Prakash, 2011). Hyland and Werner (2000) show that foliar fertilization saves both effort and money and also reduces the energy needed for the transport of nutrient elements within the plant. Al-Janabi (2005) indicated that the spraying of the total vegetation is necessary in the Iraqi soils because of the washing, stabilization and sedimentation of the nutrient elements in order to secure the plant's needs of these nutrient elements, in addition to fertilizers, especially in aggressive environmental conditions. Several studies have been conducted using spraying with Atonik substance on plants. Atonik is one of the modern growth regulators. It is an aromatic nitro compound that causes the increase of the biological

activities in the plant without causing any deformation or toxicity to the plants treated with it. Chemically, It is a Sodium guicplatew and Sodium nitro phenolate and their chemical composition Sodium O- nitro phenolate (Al-Hitti, 2000). Obeid *et al*. (2011) found that the spraying of cucumber plants (*Lihuluba cultivar*) cultivated in the plastic house with the growth regulator (Atonik) at a concentration of (2.5, 5, 10 ml.10 L^{-1} water), where the spraying treatment with Atonik (5 ml.10 L^{-1} water) was significantly excelled in the number of leaves per plant, leaf area per plant, the number of flowers, the percentage of set fruits and the number of fruits. Al-Ghanmi *et al*. (2003) reported that the spraying of Squash plant (*Opalin cultivar*) with the growth regulator (Atonik) at the beginning of the flowering led to a significant increase in the plant length, number of branches and leaves, and the number of fruits for the plant and the early and total yield, when increasing the concentration used from 5 to 15%.Pandite *et al*. (1982) reported that spraying of watermelon plants with Atonik at 5% concentration led to a significant increase in the number of fruits and total yield compared to the control treatment. Al-Hitti *et al*. (2000) confirmed that spraying the tomato plants in the plastic house with the growth regulator (Atonik) at a concentration of 80 ppm led to a significant increase in the average of plant height, number of branches, leaves, fruits and total plant yield. Sarhan *et al*. (2011) showed that spraying the bread yeast with a concentration of (6 $g.L^{-1}$) or seaweed extract (alga 600) at a concentration of (0.33 $g.L^{-1}$) and seaweed extract (Seaforce 2) at a concentration of (2.5 $ml.L^{-1}$) on cucumber plant has a significant effect on the vegetative growth traits compared to the control treatment. Hussein and Attallah (2017) mentioned that spraying the Fol Spray Fertilizer with a concentration of (2, 2.5, 3 $g.L^{-1}$ Water) for three sprays on two cultivar of cucumber (Karima, Grass) during flowering and at intervals of 10 days between spray and another cultivated in the plastic house, where the concentration of (2.5 $g.L^{-1}$) gave a significant increase in the average of plant height, number of leaves, the thickness of stem, fruit length, its weight, number of fruits and plant yield compared to the control treatment. Bayoumi and Hafiz (2006) indicated that spraying of the cucumber plants with three concentrations of (0.5, 0.75, 1 $ml.L^{-1}$) for one of seaweed extract after 45 of cultivating for two consecutive seasons, so the concentration of (0.5 $ml.L^{-1}$) gave the highest yield and highest number of fruits. Al-layla (2011) showed that spraying of the seaweed extracts plants (Algamax and Algreen) on the watermelon plants led to early maturity and increase the number of fruits per plant and the total yield. This study aims to determine the effect of the number of spraying times with the growth regulator (Atonik) in the growth and yield of cucumber cultivated in plastic houses.

Materials and Methods

The experiment was conducted during the agricultural season 2017 in one of plastic houses in Al-Azzawiya region, north Al-Hillah city. The experiment consisted of eight treatments are the number of spraying times (two spraying, three spraying), with four levels of foliar spraying with growth regulator (Ationk) as shown in Table (1) on cucumber plant (Saif cultivar produced by Dutch company Nunhems). The first spraying was conducted during flowering and the second spraying after two weeks of the first and the third after two weeks of the second. It was applied as a factorial experiment with two factors and according to Randomized Complete Block Design (RCBD), with three replicates, the first factor considered is the number of spraying times:

1- Two spraying

2- Three spraying

The second factor: Levels of the growth regulator (Atonik) from the production of (Asahi chemical MFG) Japan company includes:

1- Without spraying (control)

2- 0.5 $ml.L^{-1}$

3- 0.75$ml.L^{-1}$

4- 1$ml.L^{-1}$

Growth regulator components (ATONIK)

1- Sodium othro- nitro phenolate.

2- Sodiumpara- nitro phenolate.

3- Sodium 5- nitro phenolate.

Random samples were taken from the soil of the plastic house at a depth of 0-30 cm. Soil analysis was conducted in the Agricultural Research Laboratory of Babylon Agriculture Directorate as shown in Table (1).

The soil of the plastic house was plowed, smoothed and divided into plots and then divided into experimental units of (24) experimental units with length of 2 m and width 60 cm. The seeds were planted in the arboretum on 4/1/2017 and then transferred to the plastic house on 16/1, The length of the line and the distance between the line and another 50 cm and the distance between plant and another 40 cm and the number of plants in each experimental unit 10 plants on both sides of the raw. a The plants were sprayed at flowering on 26/2/2017 and all the recommended agricultural operations during the period of growth in the field of irrigation, fertilization, Grubbing, weeding and control of diseases and insects were conducted in a similar manner to all the experimental units and began to reap fruits on 7/3 and continued until 22/5/2017.

Studied traits:

A. Vegetative growth traits:

1) **Plant length (cm):** it is measured at the end of the season by measuring tape and taking the average length of four plants from each experimental unit and each replicate.
2) **Number of leaves per plants:** The number of leaves at the end of the season was calculated for four plants from each experimental unit and each replicate.
3) **The thickness of the stem (mm):** It is measured by the vernier and taking the average thickness of four plants from each experimental unit and each replicate.

B. Traits of fruits growth:

1) **Fruit length (cm):** The average length of the fruit was calculated by the normal ruler and for three fruits.
2) **Average of Fruit diameter (mm):** The average of fruit diameter was calculated by the vernier and for three fruits.
3) **Average fruit weight (gm):** Based on the total number of each experimental unit divided by the total number of fruits of that experimental unit throughout the season.
4) **Average number of fruits per plant**: This trait was calculated from All genes throughout the harvest period for each experimental unit of all replicates and then divided the total number of fruits in each experimental unit by the number of plants in that unit.
5) **Plant yield (kg):** Determination based on the unit of each experimental unit throughout the growing season divided by the number of plants in the experimental unit.

The results were analyzed according to the design, and the least significant difference was used to compare the averages at the probability level of 0.05 (Al-Sahuki and Wahib, 1990). Genstat program was used in statistical analysis.

Results and Discussion

Table (2) indicates that the three-time spraying treatment with growth regulator (Atonik) has significantly excelled on the two-time spraying treatment in vegetative traits by giving it the highest average of plant length, number of leaves and stem thickness was (307.0 cm, 77.08, 11.33 mm), respectively. The results showed that spraying treatment with growth regulator (Atonik) had a significant effect on the average of the above trait. All spraying treatments showed a significant increase in the average of these three traits compared to the control treatment. The spraying treatment with Atonik at a concentration of 0.75 ml.L^{-1} was achieved The highest values, where the length of the plant amounted to (321.0) and the number of leaves (83.83 leaf) and thickness of the stem (11.37 mm). The results showed that the interaction between the growth regulator Atonik and the number of spraying times had a significant effect on plant height, number of leaves and stem thickness. The three-times spraying treatment with the growth regulator (Atonik) at concentration of (0.75 ml.L^{-1}) was excelled by giving it the length of the plant (328.3), and the highest average number of leaves (93.33 leaf) and the thickness of stem (12.60 mm) compared to the control treatment, which reached (265.0 cm, 53.67 leaf, 8.05 mm), respectively. This may be due to the availability of nutrient elements and plant needs in the process of cell division and expansion, especially N, which enters the building of chlorophyll, protein and nucleic acids and then increase the ability of the plant to perform photosynthesis and contribute to the manufacture and accumulation of food, Which leads to an increase in the initiator of the leaves and then increase their number, and increase the thickness of the stem, as well as elongation of the plant and this was reflected on the large vegetative growth when spraying by this regulator. These results agree with (Pandite *et al*., 1982; Al-Hitti *et al*., 2000, Al-Ghanemi *et al*., 2003; Obaid *et al*., 2011).

2. Traits of fruits growth:

Table (3) that the number of spraying times with the growth regulator (Atonik) had a significant effect on all traits. The three-times spraying treatment was significantly excelled on the two-times spraying in the average of fruit length, fruit diameter, fruit weight, number of fruits and yield of one plant (20.50 cm ,34.43 mm, 109.09 g, 41.30 fruit. $plant^{-1}$, 4.518 kg), respectively. The results showed that the spraying with Atonik had a significant effect on the average of the above traits. All spraying treatments showed a significant increase in the average of these three traits compared to the control treatment. The spraying treatment with Atonik at a concentration of (0.75 ml.L^{-1}) achieved the highest values were: fruit length (22.00 cm), fruit diameter (36.53 mm), fruit weight (110.80 g), fruit number (43.12 fruit.$plant^{-1}$), and yield of one plant (4.782 kg).The results showed that the interaction between the growth regulator (Atonik) and the number of spraying times significantly affected the fruit length, fruit diameter, fruit weight, number of fruits and yield of one plant. Where the three-times spraying treatment with growth regulator (Atonik) at a concentration of (0.75 ml.L^{-1}) was excelled in the average of Fruit yield by giving it an value fruit length (22.83 cm), fruit diameter (37.47 mm), fruit weight (111.92 g) and

number of fruits (45.73 fruit.plant^{-1}) and the yield of one plant (5.120 kg) compared with the control treatment of (16.33 cm, 30.22 mm, 100.13 g, 32.03 fruit.plant^{-1}, 3,213 kg), respectively. This may be attributed to the fact that Atonik contains Auxins and cytokinines, which led to an increase in the number of fruits and their weight and the yield of one plant. This increase can be attributed to the effect of Atonik in increasing the vegetative growth of the plant and therefore reflected on the accumulation of manufactured Nutrient materials and then increase the number of fruits and total yield. this results agree with (Arora *et al*., 1982; Pandite *et al*., 1982; Al-Hitti *et al*., 2000; Al-Ghanemi *et al*., 2003; Obaid *et al*., 2011). It is concluded from this study that the three-times spraying treatment showed a significant superiority over the two-times spraying treatment in the traits of vegetative and fruit growth. Foliar Spraying at a concentration of (0.75 ml.L^{-1}) led to a significant increase in the vegetative and fruit growth traits of cucumber plant. The three-times spraying treatment with growth regulator (Atonik) at a concentration of (0.75 ml.L^{-1}) gave the best average for yield traits during the cultivating season.

Table 1: Some soil chemical and physical characteristics

Texture	Traits								
	pH	Ec ds.m^{-1}	Organic matter (%)	N (ppm)	P (ppm)	K (ppm)	Clay (%)	Sand (%)	Silt (%)
Sandy loam	7.4	3.7	1.13	52.5	8.7	360	4	80.20	15.80

Table 2: Effect of the foliar times numbers and Atoink stimulator on and their interaction in the vegetative traits.

Plant length (cm)					
Concentration / Foliar times numbers	Without spraying	0.5 ml.L^{-1}	0.75 ml.L^{-1}	1 ml.L^{-1}	Average Foliar times
Two spraying	265.0	281.7	313.7	304.3	291.2
Three spraying	290.7	300.0	328.3	309.0	307.0
Average concentration	277.8	290.8	321.0	307.7	
L.S.D 0.05	Foliar times numbers =5.13	To concentration = 7.26			To interaction = 10.27
Number of leaves per plant					
Two spraying	53.67	58.00	74.33	63.00	62.25
Three spraying	67.33	72.00	93.33	75.67	77.08
Average concentration	60.50	65.00	83.83	69.33	
L.S.D 0.05	Foliar times numbers =1.74	To concentration = 2.46			To interaction = 3.48
The thickness of the stem (mm)					
Two spraying	8.05	9.19	10.13	9.61	9.25
Three spraying	10.49	11.26	12.60	10.99	11.33
Average concentration	9.27	10.23	11.37	10.30	
L.S.D 0.05	Foliar times numbers =0.54	To concentration =0.76			To interaction = 1.07

Table 3 : Effect of the foliar times numbers and Atoink stimulator on and their interaction in the fruit traits.

Fruit length (cm)					
Concentration / Foliar times	**Without spraying**	**0.5 ml.L^{-1}**	**0.75 ml.L^{-1}**	**1 ml.L^{-1}**	**Average Foliar times**
Two spraying	16.33	18.83	21.17	20.67	19.25
Three spraying	18.67	20.00	22.83	20.50	20.50
Average concentration	17.50	19.42	22.00	20.58	
L.S.D 0.05	**Foliar times numbers** =0.75	To concentration= 1.06			To interaction = 1.49
Fruit diameter (mm)					
Two spraying	30.22	32.82	35.59	34.11	33.18
Three spraying	31.95	34.22	37.47	34.08	34.43
Average concentration	31.09	33.52	36.53	34.09	
L.S.D 0.05	**Foliar times numbers** =0.88	To concentration= 1.25			To interaction = 1.77
Fruit weight					
Two spraying	100.13	107.37	109.67	107.80	106.24
Three spraying	106.62	108.47	111.92	109.35	109.09
Average concentration	103.37	107.92	110.80	108.58	
L.S.D 0.05	**Foliar times numbers** =1.48	To concentration= 2.10			To interaction = 2.97
Number of fruits per plant					
Two spraying	32.03	35.33	40.50	37.57	36.36
Three spraying	36.00	40.67	45.73	42.83	41.30
Average concentration	34.02	38.00	43.12	40.20	
L.S.D 0.05	**Foliar times numbers** =2.75	To concentration= 3.89			To interaction = 5.50
The yield of one plant (kg)					
Two spraying	3.213	3.797	4.443	4.050	3.876
Three spraying	3.840	4.430	5.120	4.683	4.518
Average concentration	3.527	4.113	4.782	4.367	
L.S.D 0.05	**Foliar times numbers** =0.29	To concentration= 0.41			To interaction = 0.58

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