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EFFECT OF SEAWEED EXTRACT AND CYTOKININ (CPPU) SPRAYING ON GROWTH OF LEMON (*CITRUS LIMON* L.) SEEDLING BUDDED ON SOUR ORANGE

Tahani Jawad Mohammed Ali[1] and Farah Fadhil Nuri AL-Araji[2]

Department of Horticulture and Landscape Planning, College of Agriculture, Al-Qasim Green University, Babylon, Iraq.

Abstract

The study was carried out in a private nursery in Al-Qasim district located in Babil governorate in the period from 1/9/2018 to 1/9/2019 to study the effect of spraying with marine algae extract (Agazone) and cytokinin spray (CPPU) on the growth of local sour lemon grafted on the origin of *Citrus aurantium*. The experiment was carried out according to the design of the complete random sectors and three replicates, where the experiment included spraying four concentrations of seaweed extract (Agazone) 0, 3, 6, 9ml /L^{-1} and four levels of spray regulator growth (CPPU) 0,2,4,8 mg/L^{-1}. The results showed a significant effect in all the studied traits, especially the treatment of spraying with Agazone algae extract at the concentration of 9 mL/$^{-1}$ and spraying with growth regulator CPPU at the concentration of 8 mg/ L^{-1} as it achieved a significant increase in seedling height, number of leaves, area of leaves, increase plant stem diameter rate. The stem was 78.75 cm, 83.42 cm, 63.83 leaves. Seedlings^{-1}, 65.33 leaves. Seedlings^{-1}, 1401.25 creamy 2. Seedlings^{-1}, 1633.56 creamy 2. Seedlings^{-1}, 1.65 mm, 1.44 mm as well as leaf content of chlorophyll and nitrogen were 47.89 SPAD, 47.98 SPAD, 2.47%, 2.44% respectively for both study factors.

Key words : Seaweed extract, CPPU, Citrus Limon, Agazone.

Introduction

Burm (*Citrus limon* L.) belongs to the Citrus genus of the Rutaceae family, whose trees grow in the tropical and subtropical areas of Southeast Asia (RE, 1998). Citrus was known around 2000 before BC (Gmitter and Hu, 1990), estimated the number of lemon trees planted in Iraq (320,611) tree and estimated Iraq's production of lemon fruits 6073 tons, while the average production of one tree (9,18) kg (Central Statistical Organization, 2014). Lemon is economically important because it is highly desirable because its fruits are excellent quality, small in size, juicy, thin skin, and acidity is less than the global varieties (Khafaji *et al.*, 1990). The lemon fruit is also characterized by being rich in mineral salts needed to build the human body such as Magnesium, sodium and phosphorus are also a source of many vitamins, including vitamin A, B1, and B2, and large quantities of vitamin C (Jameeli and Dujaili, 1989). Lemon fruits are used in fresh consumption and the manufacture of juices, as well as used as flavorings for many foods as well as for its effective effect in the treatment of scurvy (Forté, 2011). Sea weed extracts are important organic sources used in agricultural production. They are complementary to fertilizers, but are not substitutes for them. It works to stimulate the physiological functions in the plant because it contains macronutrients and micronutrients and more than a group of growth-stimulating substances such as auxins, gibberellins and cytokines, as well as some vitamins, organic acids and amino acids (Hegab *et al.*, 2005), also have significant physiological effects when sprayed on plants or added to the soil, as it increases the resistance of the plant inappropriate conditions, infection of diseases and insects, these extracts are one of the sources Photovoltaics used in agricultural production, where about fifteen million tons are used annually in various countries across the world (Spinelli *et al.*, 2009). Plant growth regulators play a major role in many important physiological activities as well as regulate plant

growth. These organizations (CPPU) include chloro-4-pyridyl-N-phenglurea N- (2), it is also called Forchlor KT-30 fenuron and is a highly effective synthetic cytokines, the high-efficiency industrial that is more than 100 times higher than Appenzell Adenine (BA) works to break the apical sovereignty and stimulate the growth of lateral shoots (Mackay *et al.,* 2002). It is resistant to rapid metabolism so, it has a long duration effect and has a great role in stimulating cell division (Davies, 2010); and stimulation of leaf enlargement as a result of increased cell division and expansion and expansion of walls as much To improve the quality and quantity of many horticultural crops (NeSmith, 2002). The aims of this research to improve the qualities of growth lemon seedlings by spraying marine algae extract and Agazone growth regulator CPPU to get a good seedling growth.

Materials and Methods

The study was carried out in a private nursery in Al-Qasim district located in Babil province during a period from 1/9/2018 to 1/9/2019 to study the effect of spraying with seaweed extract (Agazone) and cytokinin spraying CPPU and interfering with them in the growth of local lemon saplings grafted on the origin of *Citrus aurantium.* Lemon saplings grafted on the origin of one year old *Citrus aurantium* were brought from a reliable native nursery, and 144 homogeneous seedlings were selected as possible as in their growth. Seedlings were transported to the study location and were planted in plastic bags capacity (1 kg) and then transferred to larger bags capacity (5 kg) at (1/6/2018) then, filled with soil and the seedlings were all service operations of irrigation, fertilization and removal of bushes and insects when needed, soil samples were taken for the purpose of conducting some chemical and physical analyzes prior to the experiment. It included spraying the total vegetative of seedlings with seaweed extract (Agazone), Agazone is a plant tonic that contains more than 30 natural compounds and 4.5% K_2O, as well as natural growth catalysts oxins, gibberlins, cytokines, amino acids and carbohydrates, as well as micro and micro nutrients as mentioned in the marine extract pack. By the producing company (Al-Joud Local Production Company affiliated to the threshold of Husseinieh) (Annex 1) With four concentrations comparison treatment (spraying with water only) symbolized with F0 symbol, spraying with concentration (3 ml.L) symbolized with symbol F1, spraying with concentration (6 ml.L) symbolized with symbol F2, spraying with concentration (9 ml.L) symbolized with symbol F3, Spraying was carried out for the total vegetative seedlings with seaweed extract solution early in the morning using a hand spray 3 liters until full wetness with the addition of a diffuser (T20) to the spray solution to reduce the surface tension and facilitate the absorption process. A mobile wooden barrier has been placed between the seedlings for the purpose of preventing the spray solution from spreading to other treatments, and sprayed 15 days before spraying with CPPU.

It included spraying the total vegetative with CPPU cytokinin. CPPU spray was prepared by CPPU (produced by Green Plantchem Co., Ltd., China). Concentration of the active substance (98%) as shown in Annex (2) some chemical and physical properties of CPPU. It was prepared after the growth regulator crystals were weighed according to each concentration using a sensitive electrical balance and dissolved in the Aseton concentration (98%) to make a base solution, then the required concentrations were prepared. Comparative treatment (spraying with water only) symbolized by C0, spraying with concentration (2 mg) symbolized by symbol C1, spraying with concentration (4 mg) symbolized by symbol C2, spraying with concentration (8 mg) symbolized by symbol C3 The growth regulator solution according to the following expectations :-(1/10/2018) (1/11/2018) (1/3/2019) (1/4/2019). A two-factor 4x4 experiment was carried out with three replicates and each repeater contains (48) seedlings for each repeater (144 seedlings). Number of seedlings used in the experiment using Randomized Complete Block Design (RCBD), then was analyzed according to the Genstat Statistical Program. The arithmetic averages were compared with LSD at a probability level of 0.05 (Al-Rawi and Khalaf-Allah, 1980). The average number of leaves per transaction is calculated and then the rate is extracted for each repeater. The leafy area was measured by taking 20 tablets of known area from five leaves of three plants and air dried and then placed in an electric oven at a temperature (68 ° C) until the weight stability, and then the leafy area was calculated according to the method of Watson and Watson (1953), according to the following equation:

$$\frac{\text{Leaf area tablets} \times \text{Dry weight of leaves}}{\text{Dry weight of tablets}} = \text{Leaf area } (dm^2)$$

Initial readings (before the treatment) were taken for the diameter of the stem at a height (15-20 cm) from the surface of the sachet soil, using the foot Vernier caliper (Head, 1968), then took secondary readings after the finishing of the transactions and taking the difference between the two readings, the diameter of the stem was calculated per repeater and an increase rate was calculated for each treatment. Potassium (%) is estimated

using the Flamephotometer according to Bhargava and Raghupathi (1999). The magnesium percentage in the leaves is estimated according to the method of Kalra (1998) as mentioned by Mosli (2015).

Table 1: Some chemical and physical characteristics of the experimental soil.

Characters		Values	Units
Ready Nitrogen		22.00	Mg/kg^{-1}.soil
Ready phosphorus		16.20	
Ready Potassium		34.10	
The degree of soil reaction PH		7.9	———
Electrical conductivity EC		15	ds m^{-1}
Organic matter		7.4	g/kg
Calcium carbonate caco3		17.6	g/kg
Soil separations	Sand	587.2	g/kg $^{-1}$.soil
	Silt	95.4	
	Clay	317.4	
Sandy loam			Soil texture

The soil chemical and physical properties were analyzed in the laboratory of the College of Agriculture, Al-Qasim Green University.

Results and Discussion

Influence in number of leaves and it is an area

The results of table 2 showed that there were significant differences in the number of leaves as a result of the treatment with a marine algae extract, where treatment F3 outperformed by giving the highest number of leaves at 63.83 leaves. $Seedlings^{-1}$ compared to the F0 comparison, which recorded the lowest value of 48.67 sheets. $Seedling^{-1}$ Regarding the treatment of the growth regulator CPPU, the spray treatment C3 outperformed the rest of the treatments by giving it the highest number of leaves at 65.33. $Seedlings^{-1}$ compared to the measurement treatment C0 that gave 49.00 leaves. $Seedlings^{-1}$, the interaction between marine and algae extract and growth regulator treatments showed a significant effect on the number of leaves. F3C3 exceeded the other treatments, which gave the highest rate of 78.33 leaves. $Seedlings^{-1}$ compared to the measurement treatment that gave 35.33 leaves $seedlings^{-1}$.

Regarding the leafy area, it increased by increasing the concentration of marine algae extract where treatment F3 outperformed by giving it the highest rate in leaf area which reached (1401.25) dm^2 $seedlings^{-1}$, regulator growth CPPU has increased the concentration of treatment C3, which significantly exceeded other of the concentrations, where the value of (1633.56) fat^2 $seedlings^{-1}$ in comparison with the measurement treatment C0 (843.23) fat^2 $seedlings^{-1}$. The effect of spraying with marine algae extract and growth regulator had a significant effect, where the treatment exceeded F3C3 concentration by giving it the highest rate in leaf area of (2159.27) dm^2 $seedlings^{-1}$ compared to the measurement treatment that gave the lowest rate of (563.33) fat^2 $seedlings^{-1}$.

The increase in the number of leaves and their area in seedlings treated with seaweed extract compared to untreated seedlings is due to the cytokines content of these extracts encourages physiological activities inside the plant and increase the content of leaves of chlorophyll, which positively affects photosynthesis and carbohydrate composition leading to increase the vegetative growth (Thomas, 1996). Also, the extracts alter the plant hormonal balance, thereby affecting the biological processes that improve metabolism, thus increase the plant vegetative growth (El-Baky *et al.*, 2008). Our results agreed with the results of (Ibrahim, 2013).

As for the effect of increasing the number of leaves and leaf area when spraying with CPPU, it increases ratio of the total chlorophyll, thus increasing food processing, storing surplus in the branches, activating roots and withdrawing nutrients, all of which lead to increased plant growth (Jendia, 2003). These results are in line with the results of (Issawi, 2013).

Rate of increase in stem diameter and seedling height

The results of table 3 showed that spraying with marine algae extract increased significantly in this capacity by increasing spray levels where F3 achieved a significant increase over other treatments, where it achieved 1.65 mm compared to the treatment F0 which achieved 0.99 mm. Regarding the spraying with growth regulator CPPU, C3 increased significantly in the diameter of the leg to 1.44 mm compared to the comparison treatment C0, which gave 1.18 mm. As for the interaction between marine algae extract and growth regulator, the F3C3 interaction showed a significant increase in stem diameter, which reached 1.75 mm compared to F0C0 treatment which gave 0.64 mm, as well as there was a significant effect of treatment with algae extract (Agazone) on seedling height rate. F3 treatment gave the highest rate of this height as it reached 78.75 cm compared to the comparison treatment F0, which gave 62.00 cm, CPPU spraying caused a positive effect on the height of the seedlings. The treatment C3 significantly exceeded the highest value of (83.42) cm compared to the C0 that gave (63.75 cm). The dual interference between marine algae extract and spraying of growth

Table 2: Effect of spraying with Agazone Seaweed Extract and CPPU Growth solution on leaf count and area.

Marine algae extract (Agazone) (F) Ml.ltr-1	Leaves area $dm^2 \cdot$ seedlings $^{-1}$					Leaves numbers				
	Growth regulator CPPU (C) mg. L^{-1}				Effect (F)	Growth regulator CPPU (C) mg. L^{-1}				Effect (F)
	C0	C1	C2	C3		C0	C1	C2	C3	
F0	563.33	812.73	959.60	1082.63	854.58	35.33	50.33	51.67	57.33	48.67
F1	880.67	1089.67	1198.33	1637.00	1201.42	44.00	53.67	53.33	59.67	52.67
F2	900.93	1145.00	1230.67	1655.33	1232.98	58.00	55.00	55.33	66.00	58.58
F3	1028.00	1048.43	1369.30	2159.27	1401.25	58.67	56.00	62.33	78.33	63.83
Effect C	843.23	1023.96	1189.48	1633.56		49.00	53.75	55.67	65.33	
L.S.D 0.05	F	C	FXC			F	C	FXC		
	114.65	114.65	229.30			3.76	3.76	7.52		

Table 3: Effect of Spraying with Agazone Seaweed Extract and CPPU Growth Rate on Stem Diameter and Seedling Height.

Marine algae extract (Agazone) (F) Ml.ltr-1	Leg diameter (mm)					Seedling height (cm)				
	Growth regulator CPPU (C) mg. L^{-1}				Effect (F)	Growth regulator CPPU (C) mg. L^{-1}				Effect (F)
	C0	C1	C2	C3		C0	C1	C2	C3	
F0	0.64	0.98	1.17	1.16	0.99	52.00	61.67	62.33	72.00	62.00
F1	1.21	1.13	1.23	1.32	1.22	64.33	68.67	76.67	84.67	73.58
F2	1.31	1.37	1.35	1.52	1.39	68.33	73.33	76.33	78.67	74.17
F3	1.55	1.65	1.63	1.75	1.65	70.33	72.67	73.67	98.33	78.75
Effect C	1.18	1.28	1.34	1.44		63.75	69.08	72.25	83.42	
L.S.D 0.05	F	C	FXC			F	C	FXC		
	0.094	0.094	0.188			3.78	3.78	7.56		

Table 4: Effect of spraying with Agazone Seaweed extract and CPPU on Percentage of Potassium and Magnesium Leaf Content.

Marine algae extract (Agazone) (F) Ml.ltr-1	Magnesium % %					Potassium				
	Growth regulator CPPU (C) mg. L^{-1}				Effect (F)	Growth regulator CPPU (C) mg. L^{-1}				Effect (F)
	C0	C1	C2	C3		C0	C1	C2	C3	
F0	0.21	0.24	0.34	0.28	0.27	0.87	1.19	1.32	1.33	1.18
F1	0.29	0.28	0.28	0.33	0.30	1.15	1.23	1.37	1.45	1.30
F2	0.30	0.31	0.30	0.34	0.31	1.21	1.30	1.43	1.56	1.37
F3	0.31	0.32	0.33	0.47	0.36	1.32	1.31	1.59	2.07	1.57
Effect C	0.28	0.29	0.32	0.35		1.14	1.26	1.43	1.60	
L.S.D0.05	F	C	FXC			F	C	FXC		
	0.03	0.03	0.06			0.12	0.12	0.24		

regulator CPPU had a significant increase on the seedling height rate, F3C3 recorded the highest rate of 98.33 cm compared to F0C0 which recorded the lowest value (52.00) cm.

The increase in stem diameter when sprayed with seaweed extract is due to the fact that it contains nutrients that increase the metabolic activity of the plant, which significant affects the stem growth, thus increase the stem diameter, our results are agreed with the results of (Ismail and Ghazai, 2012), respecting to the impact of CPPU, the increase in stem diameter is due to the fact that growth regulators stimulate the formation of nucleic acids, particularly RNA, proteins and enzymes that play important role in stimulating cell division, accidental elongation and increased size (Al Khafaji, 2014). The reason for the increase in seedling height as a result of the treatment of marine algae extract (Agazone) may be attributed to the content of this extract on plant hormones,

especially auxins, gibberellins and cytokines, which are increasing plant height by stimulating cellular division elongation (Stirk *et al.*, 2003), amino and organic acids, it has a significant effect in the plant biological activities (Osman *et al.*, 2010). Regarding the effect of CPPU spraying, it may be attributed to the role of cytokines to increasing cell division in apical and cambium maristems and adding new cells to the plant which leads to increased growth, then increase the height of seedlings (Mazher *et al.*, 2011).

Magnesium and potassium percentages in the leaves

The results in table 4 showed a significant increase in the magnesium content of leaves when treated with seaweed extract where treatment F3 outperformed the other treatments which gave 0.36% compared to F0 comparison which gave 0.27%. A value of 0.35% compared to the C0 treatment that gave 0.28%, the results shown in the same table indicate a significant interference between the two study factors where F3C3 outperformed the other treatments which gave 0.47% compared to the F0C0 measurement which was 0.21%.

Also, the same table showed a significant effect of the marine algae extract treatment on the potassium leaf content rate. Spraying with CPPU achieved a positive effect on the leaf content of potassium. C3 gave the highest rate of 1.60% compared to the measurement treatment of C0 to be 1.14%, the interference between marine algae extract and growth regulator F * C affected significantly, the percentage of potassium in the leaves F3C3 gave the highest value of 2.07% compared to F0C0 which gave 0.87%.

These results are due to the effect of marine algae extract in increasing the percentage of these elements, this increase occurs due to the inclusion of this extract on the major nutrients, especially N, P, K, Mg (Appendix 1) as well as micro-elements, which are absorbed directly when sprayed on the leaves, thus increase its ratio in plants (Khan *et al.*, 2009). The effect of growth regulator on the nutrient increase in leaves where cytokines increase the stomatal opening through ABA acid inhibition (Cowan *et al.*, 1999). As a result of this enlargement, the transpiration rate will increase and the absorption and transfer of the metal ions driven by transpiration will increase (Haroun *et al.*, 2003). These results are agreed with Janabi (2014), which found a significant increase in leaf content of elements (N, P, K) when CPPU spraying on orange seedlings.

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