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EFFECT OF SPRAYING CYTOKININ AND SEAWEED EXTRACT ON SOME FLOWER GROWTH TRAITS OF ROSELLE *HIBISCUS SABDARIFFA* L.

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Abstract

A field experiment was conducted at the research station affiliated to the Department of Field Crop – College of Agricultural Engineering Sciences- University of Baghdad, Jadrya during the spring season 2018-2019 aimed to determine the repose of Roselle *Hibiscus Sabdariffa* L. plants to the flower induction affected by spraying cytokinin and seaweed extract that affect some traits of the growth, yield and chemical characteristics of the plants. The study was carried out as a factorial experiment system within the Randomized Complete Block Design (RCBD) of three replicates. The experiment included two factors: the first was spraying four concentrations (0, 50, 100, and 150 mg.l^{-1}) of the growth regulator, Cytokinin and the second was spraying four concentrations (0, 1, 2, and 3 ml.$^{-1}$)of seaweed extract as well as the interaction between the two factors. Results revealed a significant effect of both the cytokinin growth regulator and the seaweed extract and the interaction between them on the flower growth traits. The treatment C3A3 produced the highest results of the traits: Number of cups per plant (327.67 calyxes. plant^{-1}), cup fresh weight (525.33 g.plant^{-1}), Cup dry weight (117.83 g.plan^{-1}), calyx fresh weight (342.62 g. experimental unit^{-1}), calyx dry weight (62.15 g. experimental unit-1), and calyx thickness (2.97 mm.plant^{-1})

Keywords **:** Roselle, flower induction, cytokinin, and seaweed extract.

Introduction

Treatment by medical plants and herbs in itself a call to the greatness of the Almighty Creator who created these plants before the creation of man on earth and made these plants the reason for human being and other creatures to live on earth. Man used plants as food before using them as a medication. Using bio-stimulators was increased in recent years which decreased the chemical compounds used in agricultural production. Among these are Seaweed Extracts that represent a group of seed herbs contained several microelements, vitamins, amino acids, and growth regulators which affect the cell growth and enlargement positively as well as they encourage flowering induction thus enhance the productivity in quantity and quality. The fears associated with the use of growth regulators represented by their environmental and health effects in addition to their high costs are an incentive to search for naturally healthy and environmentally safe alternatives and comparing between their effects. Seaweed Extracts are the most important bio regulators (AL-Ugeidi, 2011; Elansary, 2016). Roselle (*Hibiscus Sabdariffa* L.) is one of the economically important medicinal plants belongs to the Malvaceae family (Nasaralla, 2012). In view of the problems facing rosella growing in Iraq, it is necessary to find a new mechanism to overcome them such as using growth regulators (Hassoon *et al*., 2017) including cytokinin that stimulates plant branching through inducing cell division and enlargement, delaying senility, enhancing flowering, and improving cups fertilization (Hassan and Zahwan, 2017; Hassoon *et al*., 2017; Saeid *et al*., 2011).

Materials and Methods

The studied growth indicators:

Number of cups.plant^{-1}
Cup fresh weight (g.plant^{-1})
Cup dry weight (g.plant^{-1})
Calyx fresh weight (g. experimental unit^{-1})
Calyx dry weight (g. experimental unit^{-1})
Calyx thickness (cm^2. experimental unit^{-1})

Results and Discussion

Results in Table 1 reveal significant differences among the cytokinin treatments in the number of cups per plant. The treatment C_3 (150 mg.l^{-1}) was superior affecting positively this trait giving 255.25 cups.plant-1on average compared to the control treatment C_0 (sprayed be distilled water only) producing the lowest number of cups averaged 143.58 cups.plant^{-1}. It is clear in the same table the significant Seaweed Extract effect which increased positively with the Seaweed Extracts spray concentration increment as the treatment A_3 (3ml.l^{-1}) recorded the highest values of the trait averaged 264.92 cups.plant-1compared to the other spray treatments. The interaction between the spray by cytokinin and by seaweed extract treatments effect was insignificant and behaved reversely to each factor, however, the treatment C_3A_3 recorded the 327.67 cups.plant-1on average. These effects of the two factors may be attributed to the increment and stimulation of the vegetative growth represented by the plant height, number of branches, leaf area, etc. that increased the nutrients synthesized in leaves then translocated to the active growth regions and encouraged the formation a great number of the flower buds thus increased the number of cups (Al-samaraee, 2012 and Al-Shoaily, 2013 and Hussain, 2014).

Table 2 illustrates the significant effect of spraying cytokinin as the highest cup fresh weight averaged 360.81 g.plant^{-1} were obtained from the treatment C3 (150 mg.l^{-1}), while the treatment of distilled water recorded the lowest value averaged 190.33 g.plant^{-1}. The same table also shows that seaweed extract affected the cup fresh weight significantly. The plants treated by A_3 (3ml.l^{-1}) and A_2 (2ml.l^{-1}) were superior and gave 385.17 and 341.17 g.pant^{-1} on average respectively compared to the treatment spraying distilled water that gave the lowest average (123.13 g.plant^{-1}). The table results also refer to the superiority of the interaction treatment C_3A_3 (150mg.l^{-1} cytokinin with 3ml.l^{-1} seaweed extracts) producing the highest cup fresh weight (525.33 g.plant^{-1}) compared to the other treatments. The co-effect of the two factors, as previously mentioned, is due to their one-direction accumulative act i.e. when they are

together, they effect greater than applying any factor alone. This effect reflected positively on the photosynthesis intensity, enzyme activity, and carbohydrate and protein assimilation thus the vegetative growth increased and reflected on increasing the yield traits including the cup yield (AL-Samaraee and Hassan,2012, Abdel-Mawgoud, 2010, and Osman,2010).

It is noticed in Table 3 significant difference in cup dry weight affected by spraying cytokinin. The two cytokinin treatments C_3 (150 mg.l^{-1}) and C_2 (100mg.l^{-1}) revealed the highest cup dry weight averaged 75.90 and 64.41 g.plant^{-1} respectively compared to the treatment of distilled water producing 28.11 g,plant-1 on average with a declining percentage of 15.13% compared to the superior treatment (C_3). The table demonstrates that seaweed extract affects the cup dry weight of the Roselle plants similarly in a linearly significant response. The plants treated by A_3 or A_2 were superior giving the highest averages (28.51 and 71.44 g.plant^{-1} respectively) compared to the other seaweed extract treatments as well as to the treatment of spraying just distilled water giving the lowest average (20.02 g.l^{-1}). Concerning the effect of interaction between spraying cytokinin and spraying seaweed extract, the results in the table refer to the superiority of interaction treatment A_3C_3 (150mg.l^{-1} cytokinin plus 3ml.l^{-1} seaweed extract) achieving 117.83 g.plant^{-1} on average compared to the other interaction treatments. It is believed that the role of the two factors in increasing the cup dry weight is they provide plant greatly with the bio- activators such as cytokinins, auxins, gibberellins, amino acids, and proteins i.e. supplying more nutrients thus accumulating more biomass (AL-Nuaymi, 2012, Hassoon , 2017, Mounir, 2015).

Results of Table 4 illustrate the highly significant effect of spraying cytokinin treatments on the calyx fresh weight where the treatment C_3 (150mg.l^{-1}) recorded the highest average of the trait (277.90 g. experimental unit^{-1}) as a linear response, while the lowest average was recorded by the treatment of spraying distilled water (185.00g. experimental unit^{-1}). The table also shows the significant effect of the spraying seaweed extract treatments on the calyx fresh weight. The treatment of spraying extract A_3 produced the highest calyx fresh weight averaged 288.38 g. experimental umit^{-1}, while the control treatment A_0 produced the lowest values averaged 165.24 g. experimental unit^{-1}. The interaction between cytokinin and seaweed extract revealed a significant effect on the trait where the plants of the treatment C_3A_3 (150 mg.l^{-1} cytokinin plus 3ml seaweed extract) were characterized by showing the highest values averaged 342.62 g. experimental unit^{-1}. The increment happened by the interaction treatments may be, as mentioned previously, due to the active role of the two factors in the cell division and enlargement that increased the vegetative growth and reflected on the plant inflorescence, since the two factors have a highly physiological importance through the functional role they play in the plant growth and development and in translocating the biotic energy to the inflorescence parts (Al-Shoaily, 2013,Salih and Taha, 2012 ,Mazher,2011).

Results of Table 5 reveal the superiority of the treatment C_3 (150 mg.l^{-1}) in showing the highest average of calyx dry weight (48.40 g. experimental unit-1) compared to the control treatment producing the lowest average (30.48 g. experimental unit^{-1}). The Table also demonstrates the same significant effect of the treatment A_3 (3 ml.l^{-1} seaweed extract) recording the highest values averaged 50.28 g. experimental unit^{-1} compared to the control treatment (A_0) recording the lowest values averaged 25.61g. experimental unit^{-1}. The interaction between spraying cytokinin and spraying seaweed extract affected the trait significantly. The treatment C_3A_3 (150 mg.l^{-1} cytokinin with 3ml seaweed extract) showed a significant effect on the plants characterized by producing the highest values of the trait averaged 62.15 g. experimental unit^{-1}. This interaction effect may be due to the fact that their act is not isolated from each other, but they also show common and overlapping effects by increasing the hormonal level within the plant by the effect of their high levels in the plant that attracts the synthesized food from the leaves towards the calyx (AL-taee, 2017; Hassan *et al*., 2013; Hassan and Isa, 2010).

Results of Table 6 show the significant effect of spraying cytokinin treatments on the calyx thickness which did not go so far from each other. The plants treated by C_3 (150 g.l^{-1}) produced 2.66 mm.plant^{-1} on average compared to the treatment of spraying distilled water only (C_0) that recorded 2.31 mm.plant^{-1} on average i.e. the treatment C_3 exceeded the treatment C_0 by 15%. The table results also refer that calyx thickness increased significantly affected by seaweed extract where the plants sprayed by A_3 (3ml.l^{-1}) recorded calyx thickness reached 2.72 mm.plant^{-1} on average, while the treatment of spraying distilled water only (A_0) recorded calyx thickness averaged 2.07 mm.plant^{-1} average, so the treatment A_3 exceeded the treatment A_0 by 31%. The interaction between spraying cytokinin and spraying seaweed extract was not significant on this trait. The treatment C_3A_3 (150 mg.l^{-1} cytokinnin and 3ml.$^{-1}$ seaweed extract) produced calyx thickness of 2.97 on average. The effect of cytokinin and the seaweed extract is attributed to their hormone content that stimulates the secondary growth centers in the flower buds thus increasing the number and size of the cups (AL-Samaraee and Hassan, 2012; AL-Nuaymi, 2012; Humadi *et al*., 2012).

Table 1 : Number of cups.plant^{-1} affected by spraying cytokinin and seaweed extracts.

Seaweed extract (ml.l^{-1})	Cytokinin concentration (mg.l^{-1})				Mean
	0	50	100	150	
0	67.33	84.33	102.67	127.33	95.42
1	148.87	221.00	235.00	254.00	214.67
2	182.67	279.33	273.33	312.00	261.83
3	175.67	261.33	295.00	327.67	264.92
LSD	39.98				19.99
Mean	143.58	211.50	226.50	255.25	209.21
LSD	19.99				

Table 2. Cup fresh weight (g.plant^{-1}) affected by spraying cytokinin and seaweed extracts.

Seaweed extract (ml.l^{-1})	Cytokinin concentration (mg.l^{-1})				Mean
	0	50	100	150	
0	64.38	108.24	142.67	177.23	123.13
1	216.95	269.00	285.33	306.33	269.40
2	228.00	318.67	383.67	434.33	341.17
3	252.00	345.33	418.00	525.33	385.17
LSD	54.89				27.44
Mean	190.33	260.31	307.42	360.81	279.72
LSD	27.44				

Table 3 : Cup dry weight (g.plant^{-1}) affected by spraying cytokinin and seaweed extracts.

Seaweed extract (ml.l^{-1})	Cytokinin concentration (mg.l^{-1})				Mean
	0	50	100	150	
0	11.57	16.49	25.85	26.17	123.13
1	28.98	45.00	49.70	55.58	269.40
2	32.15	65.51	84.08	104.00	341.17
3	39.74	74.47	98.00	117.83	385.17
LSD	19.84				27.44
Mean	28.11	50.37	64.41	75.90	279.72
LSD	9.92				

Table 4 : Calyx fresh weight (g. experimental unit^{-1}) affected by spraying cytokinin and seaweed extracts.

Seaweed extract (ml.l^{-1})	Cytokinin concentration (mg.l^{-1})				Mean
	0	50	100	150	
0	152.53	161.25	170.85	176.34	165.24
1	185.74	217.40	254.72	261.63	229.78
2	195.66	276.03	310.43	331.02	278.28
3	206.10	290.07	314.74	342.62	288.38
LSD	30.95				15.47
Mean	185.00	236.19	262.68	277.90	240.31
LSD	15.47				

Table 5 : Calyx dry weight (g. experimental unit^{-1}) affected by spraying cytokinin and seaweed extracts.

Seaweed extract (ml.l^{-1})	Cytokinin concentration (mg.l^{-1})				Mean
	0	50	100	150	
0	21.84	23.90	27.59	29.10	25.61
1	31.12	38.48	41.16	44.61	38.84
2	34.10	47.29	51.21	57.74	47.59
3	36.29	49.18	53.51	62.15	50.28
LSD	3.13				1.56
Mean	30.84	39.71	43.37	48.40	40.58
LSD	1.56				

Table 6 : Calyx thickness (cm^2. experimental unit^{-1}) affected by spraying cytokinin and seaweed extracts.

Seaweed extract (ml.l^{-1})	Cytokinin concentration (mg.l^{-1})				Mean
	0	50	100	150	
0	1.96	2.03	2.11	2.19	2.07
1	2.39	2.45	2.50	2.59	2.48
2	2.52	2.65	2.76	2.90	2.71
3	2.39	2.71	2.82	2.97	2.72
LSD	0.19				0.09
Mean	2.31	2.46	2.55	2.66	2.50
LSD	0.09				

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