Plant Archives Vol. 19, Supplement 2, 2019 pp. 1656-1663 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

EFFECT OF GIBBERELLINS ON GROWTH AND PRODUCTION OF TWO CULTIVARS OF RANUNCULUS PLANT UNDER DIFFERENT ENVIRONMENTAL CONDITIONS

Mohammed Majed Habeb Albethani and Nabil Jwad Kadhum Al-Aamry
Agricultural Engineering Sciences, University of Baghdad, Iraq

Abstract

The experiment was conducted in one of the research stations affiliated to the college of Agricultural Engineering Sciences - University of Baghdad - Aljadriyah. To study the effect of the growth regulator gibberellins on growth and production of cut flowers of Ranunculus plant cultivars. The experiment was conducted according to the NISTD design which included three factors: three concentrations of gibberellins (0, 100, 200 mg.L^{-1}), two different cultivars of Ranunculus plant (Magic and viprant) were planted in three different environments: (open field, shading with plastic nets 60%, greenhouse) With three replicates each of them included nine plants in the experimental unit. The spraying of the growth regulator gibberellins was applied three times first spray when the plant reaches the stage 4-6 real leaves. And the second after one month of the first spray and the third during the formation of floral buds stage. The results showed that the concentration of 200 mg.L^{-1} of gibberellins was superior that gave the higher value in plant height, number of flowers and the length of floral stem. While the concentration of 100 mg.L^{-1} gave the largest diameter of flowers and the longest vase life. The treatment of shading with plastic nets 60% was superior in plant height, number of flowers per plant, floral stem length, flower diameter, and vase life. As for the cultivars, the orange cultivar gave the highest values in plant height and the flowers number per plant and the floral stem length while the white cultivar gave the largest diameter of flowers. The interaction treatment of concentration 100 mg.L^{-1} with the orange cultivar under the plastic net environment was superior in the plant height and the floral stem length. While the triple interaction treatment of the concentration 200 mg.L^{-1} with the white cultivar under the plastic net environment were superior in flowers diameter.

Keywords **:** *Ranunculus asiaticus*, gibberellins, cultivar,

Introduction

The ranunculus plant (*Ranunculus asiaticus)* belongs to the Ranunculaceae family and dicotyledons plants. It is one of the annual flowering bulbs. The height of the plant is about 45 cm. It is known by many names such as the garlic, anemone, buttercup, Persian, celery flower and other (Ricard, 2011). Gibberellins are one of the plant growth regulators of the second group discovered after the auxins, which are produced within the plant tissues in the gymnospermae plants, angiosperms plants, monoecious and dioecious Plants, bacteria, fungi and ferns, more than 136 types of plant or fungal Gibberellins were isolated. The physiological effects of gibberellins on plants are increasing the stems length of the plant and its role in the division of cells as well as expanding and increasing the size of older cells by absorbing water and increasing their protoplasm content, thus increasing the surface area of the plant. Also it has other active roles such as encouraging seeds to germinate and stimulate elongation of the internodes in many plants and thus the extension of the plant, identification of plant sex, fruits set and increase the leaves area, and the stimulation of flowers, as well as pushing the plant to the maturity stage (Taiz and Zeiger 2010). The lighting is one of the main and important factors that directly influence many of the biological processes in plants through their effect on the phases of light reactions of photosynthesis, as well as the effect on the activity of some enzymes, and also indirectly affect some of the thermal properties of plant tissues. In general, the increase and decrease in light intensity from the normal rates which needed by the plant may adversely affect these vital activities, as this high percentage is harmful to the plant tissues by its effect in the destruction of chlorophyll pigments and thus reduce the process of photosynthesis. The decrease in intensity of light from the required rate leads to the reduction of growth and plants development through the effect on the compensation point (Fitter and Hay, 2002 and Anderson, 2012).

Pudelska and Podgajn (2013) were found after spraying the vegetative part of dahlia plant at concentration 50,100 mg.L^{-1}. The concentration of 100 ppm increased plant height to reach 34 cm. In a study of (Ganesh *et al*., 2013) to determine the effect of GA_3 on the growth and yield of the tuberose plant, found that the concentration of 200 ppm resulted in a significant increase in the floral stem length that reached (100.59 cm), number of flowers (45.74) and floral stem length (7.24 cm). Kumar *et al*. (2013) confirmed that the foliar application with gibberellins at concentrations of 100, 200, 400 ppm on Tulip plant (*Tulipa gesneriana*) they found that the concentration of 400 ppm was superior in flowering period (28.46 days), vase life (11.26 days) and flowering date (141.30 days). Devadanam *et al.* (2007) obtained the longest stem (87.20 cm), stem diameter (2.84 cm), peduncles length (6.56 cm) and florets diameter (3.88 cm) when sprayed with GA_3 at 150 PPM concentration on tuberose plant. Also Sudhakar and Kumar (2007) showed that there is an effect of shading on growth and quantity of Heliconium plant flowers. The plant was planted under the influence of three levels of shading (0, 50, 70% shading). The results showed that the shading level 50% gave the highest values in stem length reached 30.21 cm, the peduncles length 13.21 cm and the number of flowers per plant 4.02 which was superior to other shading levels.

Alrubai (2015) showed that the shading level 50% led to improve vegetative and floral characteristics such as plant

height, number of leaves per plant, chlorophyll content, floral stem length, number of florets, flower diameter, vase life, dry weight of vegetative parts and flowers, number of bulbs, total dry weight and bulbs diameter compared to other shading levels.

The study objective the is the production of picking flowers using treatments of growth regulator (gibberellins), in addition to determinate the best environment suitable for the growth of two cultivars of ranunculus plant.

Materials and Methods

The experiment was conducted in one of the research stations affiliated to the college of Agricultural Engineering Sciences - University of Baghdad - Aljadriyah. To study the effect of the growth regulator gibberellins on growth and production of cut flowers of Ranunculus plant cultivars. The experiment was conducted according to the NISTD design which included three factors: first: three concentrations of gibberellins (0, 100, 200 mg.L^{-1}) which named C_0, C_1, C_2, two different cultivars of Ranunculus plant (Magic and viprant) named V_1, V_2 were planted in three different environments: (open field, shading with plastic nets 60%, greenhouse) which named S_1, S_2, S_3 With three replicates each of them included nine plants in the experimental unit. The means were compared using the least significant difference (L.S.D) below the 5% significance level. The spraying of the growth regulator gibberellins was applied three times first spray when the plant reaches the stage 4-6 real leaves. and the second after one month of the first spray and the third during the formation of floral buds stage.

Studied characters

1. Plant height (cm): The plant height was calculated from the soil surface to the top of the flower using the metric tape measure using group of plants and then calculating the average of the treatment.
2. Leaf area (cm^2): 5 leaves were randomly collected from the plants of each experimental unit and the area was calculated using Digimizier program and the result is calculated according to the following equation:
   The leaf area of the plant (cm^2) = the average of one leaf per cm^2 × the leaves number per plant.
3. Leaves content of chlorophyll:
   The weight of 2 g was taken from the fresh plant leaves (full growth) to estimate the total chlorophyll, then extracted using acetone 80% with the addition of calcium carbonate in order to stabilize the dye. And then the light absorption by the sample was then measured. using a spectrophotometer on the 665 and 645 nanometers, according to the equation described by Abbas and Abbas (1992).
4. Number of flowers (flower.$plant^{-1}$): The number of blooming flowers on each plant was calculated for all plants of the experimental unit and then according to the rate of the ranunculus plant.
5. The floral stem length (cm): The floral stem length was measured using the metric measuring tape from the floral stem contact zone up to the top, all plants in the experimental unit were measured and then extracting the rate.
6. The diameter of the flower (mm): measured at the farthest points of the flower using the micro vernier for all plants of the experimental unit and then extracting the rate.
7. Vase life (day): Calculated by the number of days from the appearance of color in flower buds until the loss of their coordination value.

Results

The results of Table (1) show that G_2 treatment was superior and gave the highest plant height that reached 48.01 cm compared to G_0 control treatment which gave the lowest plant height value reached 36.62 cm. The treatment of shading environment S_2 gave the highest value of plant height reached 51.23 cm, while the lowest value of plant height obtained from open field treatment S_1 and the greenhouse treatment S_3, as well as the orange cultivar was significantly superior compared to the white cultivar in this character by giving 44.81 cm.

As for the interaction, the results of the same table show the superiority of the shading treatment by plastic net and the foliar application at the concentration 200 ppm ($G_2.S_2$) which gave the highest plant height reached 55.35 cm compared to the other treatments while the lowest plant height obtained from greenhouse treatment and spray with distilled water only (control treatment) $G_0.S_3$ which gave 32.08 cm. As for the interaction of environments with cultivars, the interaction treatment (V_2S_2) of orange cultivar that planted in the plastic net environment was superior by giving the highest plant height reached 52.82 cm compared to 38.06 cm which obtained from the white cultivar grown in the open environment ($V_1.S_1$). in terms the interaction between the gibberellins concentrations and the cultivars did not have a significant effect in this character.

As for the triple interaction between the experimental factors, the interaction treatment of orange cultivars with the concentration of 100 ppm of gibberellins with plastic net environment ($G_1V_2S_2$) was superior by giving the highest plant height reached 55.71 cm, compared to the lowest plant height which obtained from the interaction treatment of the orange cultivar and spraying with distilled water and planted in the greenhouse ($V_1G_0S_3$) that reached 30.33 cm.

The results of table (2) indicate that the plant leaf area was significantly affected by the treatment of gibberellins. The concentration of G_2 gave the maximum leaf area reached 374.1 cm^2 compared to the treatment G_0 which gave 204.5 cm^2. As for the environment, the plastic net S_2 gave the highest value of leaf area reached 471.3 cm^2 while the treatment S^1 gave the lowest leaf area 199.5 cm^2. Also the results of the same table show the superiority of orange cultivar by giving the highest value of area reached 322.3 cm ^{2} compared to 283.3 cm^2 obtained from the white cultivar. As for the interactions between the factors, the results showed that S_2G_2 was superior by giving the highest leaf area reached 575 cm^2 compared to the lowest leaf area which obtained from the interaction treatment $S_1.G_1$ that reached 111.9 cm^2.

The results of the same table showed that the interaction treatment S_2V_2 was superior compared to the other treatments by giving the highest value of leaf area reached 534.6 cm^2 while the lowest leaf area obtained from interaction treatment V_1S_1 which gave 183.9 cm^2. Also we note from the interaction treatments between the gibberellins concentration and the cultivars that the treatment G_1V_2 was superior by giving the highest leaf area reached 371.7 cm^2 while the lowest leaf area obtained from the interaction treatment G_0V_1 which gave 188.9 cm^2.

In terms of the triple interaction among the treatments, the highest leaf area obtained from the interaction treatment $V_2G_2S_2$, which gave 640.2 cm^2. While the lowest leaf area

was 79.5 cm^2 obtained from the interaction treatment $V_1G_0S_1$.

The results of Table (3) indicate that the gibberellins at the concentration of G_1 was superior by giving 162.8 mg .gm^{-1} fresh weight compared to G_0 treatment which gave the lowest value reached 151.2 mg.gm^{-1}fresh weight). the shading treatment S_2 was also superior that gave highest value of chlorophyll in leaves reached 175.5 mg.gm^{-1}fresh weight compared to the lowest value obtained from environment S_1 reached 145.1 mg.gm^{-1}fresh weight. also the white cultivar was the best compared to orange cultivar that gave the highest value of chlorophyll reached 163.0 mg.gm^{-1} fresh weight.

In terms of the interactions, we observe from the results of the same table that the interaction between the gibberellins concentration and the environment showed significant differences between the treatments. the interaction treatments (G_0S_2 and G_1S_2), were superior by giving (174.3 and 183 mg.gm^{-1}fresh weight) respectively while the lowest quantity obtained from interaction treatment G_0S_1 that reached 120.4 mg.gm^{-1} fresh weight. as for interactions between environments and cultivars, as well as a gibberellins and cultivars did not have any significant differences.

while triple interaction the table results indicates that the interaction treatment $S_2G_1V_2$ was superior by giving the highest value of chlorophyll 194 mg.gm^{-1}fresh weight but was not different from interaction treatments ($S_2G_0V_1$, $S_2G_2V_1$, $S_3G_0V_1$) compared to the interaction treatment ($S_1G_0V_1$), which gave the lowest value reached 112.2 mg.gm^{-1}fresh weight.

The results of Table 4 show that the treatment with gibberellins led to a significant increase in the number of flowers. The treatment G_2 was superior by giving the highest number of flowers per plant reached 5.069 flower.$plant^{-1}$ and did not differ significantly from the treatment G_1. In terms of the environments, the environment of plastic net S_2 gave the highest number of flowers per plant reached 5.893 flower.$plant^{-1}$ compared to the lowest number that obtained from open field S_3 and reached 3.199 flower.$plant^{-1}$. the orange cultivar also was superior compared to the white cultivar in the number of flowers that gave 4.670 flower.$plant^{-1}$.

the interaction between the factors, the interaction treatment S_2G_2 gave the highest number of flowers per plant reached 7.125 flower.$plant^{-1}$ compared to the lowest number of flowers that obtained from the interaction treatment S_3G_0 2.125 flower.$plant^{-1}$, as well as the interaction between gibberellins and cultivars, the interaction treatment G_1V_2 gave the highest number of flowers per plant by giving 5,564 flower.$plant^{-1}$ while the lowest number of flowers per plant obtained from the interaction treatment of G_1V_1 reached 2.342 flower.$plant^{-1}$. the interaction between the environments and cultivars as well as the triangular interaction, there were no significant differences between the treatments.

The results of table 5 show a significant increase in the floral stem length when treated with gibberellins. The treatment of G_2 gave the longest floral stem that reached 44.28 cm compared to the lowest floral stem length obtained from the treatment of G_0 which was 33.29 cm, the environment treatments had the greatest effect as the environment treatment S_2 gave the highest value of floral stem length reached 47.50 cm while the lowest value of floral stem length obtained from S3 treatment was 35.27 cm. From the results of same table, It is clear the superiority of the orange cultivar that gave the highest value of floral stem length reached 40.96 cm compared to 39.40 cm obtained from the white cultivar.

The interaction between the gibberellins and the environments, there were significant differences between them, the treatment S_2G_1 was superior by giving the longest floral stem 51.65 cm compared to the interaction treatment S_3G_0 which gave the lowest of floral stem length was 29.28 cm. As opposed to bilateral interactions (S.V) and (G.V), which showed that there are no significant differences between their treatments. The triple interaction showed that the treatment $S_2G_1V_2$ was superior by giving the longest floral stem reached 53.22 cm compared to the lowest floral stem length obtained from the treatment $S_3G_0V_1$ reached 27.68 cm.

The results of Table 6 show that the flower diameter was significantly affected by the gibberellins treatments. The treatment of G_1 was superior by giving the largest diameter reached 77.4 which was not significantly different from the treatment of G_2 which gave 77.1 mm compared to the lowest diameter that obtained from control treatment G_0 that reached 68.5 mm. in terms of the environment the S_2 treatment gave the largest diameter reached 78.5 mm, compared to the S_1 environment which gave 71.3 mm. As for the cultivars, the white cultivar gave the largest diameter (76.1 mm).

The interaction treatments showed significant differences between them. We note that the interaction between the environments and the gibberellins concentrations was superior. the treatment of S_2G_2 gave the largest flower diameter reached 83.3 mm as well as the interaction between the environments and cultivars, the treatment S_2V_1 was superior by giving 81.4 mm as well as the interaction between gibberellins and cultivars, the treatment of G_1V_1 excelled in this character and gave 78.9 mm and did not differ significantly from the treatment G_2V_1. As for triple interaction, We note the superiority of the interaction treatment $S_2G_2V_1$, which gave the largest flower diameter reached 87.5 mm compared to the lowest flower diameter 61.5 mm that obtained from interaction treatment $S_2G_0V_2$.

The results of Table 7 confirm that the vase life increased with gibberellins treatments. The concentration G_1 gave the highest value of vase life reached 8.58 days compared to the lowest vase life that obtained from control treatment. As well as the environments had an effective role in this characters as the environment of plastic net increasing the vase life to (8.67 days) which was significantly superior to other environments. As for the interaction between environments and cultivars, we note that the interaction treatment S_2V_2 was superior by giving the longest vase life reached 8.94 days compared to the lowest period that obtained from the interaction treatment S_3V_2 which reached 6.89 days.

While the interaction between the gibberellins and varieties, we note the superiority of the interaction treatment G_1V_1 by giving the longest vase life of 8.89 days, But did not differ significantly from the following treatments G_1V_2 , G_2V_2 compared to G_0V_1 treatment which gave the lowest vase live reached 6.94 days. While in terms of the interaction between the gibberellins concentration and the environment as well as the triple interaction, the results of table showed no significant differences among them.

Table 1 : Effect of different concentrations of gibberellins in the plant height of two varieties of Ranunculus growing under three different environmental conditions.

Environment (S)	Gibberellins (G)	Variety (V)		S . G
		V1	V2	
S1	G0	33.64	33.58	33.61
	G1	39.61	44	41.8
	G2	40.94	46.22	43.58
S2	G0	42.33	46	44.16
	G1	52.67	55.71	54.19
	G2	53.94	56.77	55.35
S3	G0	30.33	33.83	32.08
	G1	43.38	42.49	42.94
	G2	45.55	44.66	45.11
LSD S.C.V		1.38		0.99
Variety (V)		42.49	44.81	
LSD (V)		0.30		

Environment X Variety (S . V)			
Environment (S)	V1	V2	Environment (S)
S1	38.06	41.27	39.66
S2	49.65	52.82	51.23
S3	39.75	40.33	40.04
LSD (S . V)	0.56		LSD (S) 0.5

Gibberellins X Variety (G. V)			
Gibberellins (G)	V1	V2	Gibberellins (G)
G0	35.43	37.8	36.62
G1	45.22	47.4	46.31
G2	46.81	49.22	48.01
LSD (G . V)	N.S		LSD(G) 0.64

Table 2 : Effect of different concentrations of gibberellins in the leaf area of two varieties of Ranunculus growing under three different environmental conditions.

Environment (S)	Gibberellins (G)	Variety		S . G
		V1	V2	
S1	G0	79.6	144.2	111.9
	G1	215.4	282.7	249
	G2	256.9	218.5	237.7
S2	G0	310.4	368.6	339.5
	G1	403.8	595	499.4
	G2	509.8	640.2	575
S3	G0	176.8	147.6	162.2
	G1	243.9	237.2	240.6
	G2	352.6	266.7	309.7
LSD S.C.V		35.21		26.94
Variety (V)		283.3	322.3	
LSD (V)		6.74		

Environment X Variety (S . V)			
Environment (S)	V1	V2	Environment (S)
S1	183.9	215.1	199.5
S2	408	534.6	471.3
S3	257.8	217.2	237.5
LSD (S . V)	18.98		LSD (S) 18.51

Gibberellins X Variety (G. V)			
Gibberellins (G)	V1	V2	Gibberellins (G)
C0	188.9	220.1	204.5
C1	287.7	371.7	329.7
C2	373.1	375.1	374.1
LSD (G . V)	18.82		LSD(G) 15.66

Table 3 : Effect of different concentrations of gibberellins in the chlorophyll of two varieties of Ranunculus growing under three different environmental conditions.

Environment (S)	Gibberellins (G)	Variety		S . G
		V1	V2	
S1	G0	112.2	128.6	120.4
	G1	167.3	150.7	159.0
	G2	160.2	151.7	156.0
S2	G0	187.4	161.2	174.3
	G1	172.2	194.0	183.1
	G2	174.8	163.3	169.0
S3	G0	179.0	138.9	159.0
	G1	156.1	136.5	146.3
	G2	157.7	155.7	156.7
LSD S.C.V		19.5		14.01
Variety (V)		163.0	153.4	
LSD (V)		6.0		

Environment X Variety (S . V)			
Environment (S)	V1	V2	Environment (S)
S1	146.6	143.7	145.1
S2	178.1	172.8	175.5
S3	164.3	143.7	154.0
LSD (S . V)	N.S		LSD (S) 8.3

Gibberellins X Variety (G. V)			
Gibberellins (G)	V1	V2	Gibberellins (G)
C0	159.5	142.9	151.2
C1	165.2	160.4	162.8
C2	164.2	156.9	160.6
LSD (G . V)	N.S		LSD(G) 8.7

Table 4 : Effect of different concentrations of gibberellins in the number of flowers of two varieties of Ranunculus growing under three different environmental conditions.

Environment (S)	Gibberellins (G)	Variety		S . G
		V1	V2	
S1	G0	1.833	2.583	2.208
	G1	3.167	4.250	3.708
	G2	4.083	4.333	4.208
S2	G0	3.110	4.333	3.722
	G1	5.167	8.500	6.833
	G2	6.583	7.667	7.125
S3	G0	2.083	2.167	2.125
	G1	3.250	3.943	3.597
	G2	3.500	4.250	3.875
LSD S.C.V		N.S		0.719
Variety (V)		3.642	4.670	
LSD (V)		0.496		

Environment X Variety (S . V)			
Environment (S)	V1	V2	Environment (S)
S1	3.028	3.722	3.375
S2	4.953	6.833	5.893
S3	2.944	3.453	3.199
LSD (S . V)	N.S		LSD (S) 0.578

Gibberellins X Variety (G. V)			
Gibberellins (G)	V1	V2	Gibberellins (G)
C0	2.342	3.028	2.685
C1	3.861	5.564	4.713
C2	4.722	5.417	5.069
LSD (G . V)	0.604		LSD(G) 0.367

Table 5 : Effect of different concentrations of gibberellins in the floral stem length of two varieties of Ranunculus growing under three different environmental conditions.

Environment (S)	Gibberellins (G)	Variety		S . G
		V1	V2	
S1	G0	31.18	31.43	31.30
	G1	38.55	39.12	38.84
	G2	41.59	44.75	43.17
S2	G0	38.96	39.62	39.29
	G1	50.08	53.22	51.65
	G2	49.91	53.22	51.57
S3	G0	27.68	30.87	29.28
	G1	38.25	38.57	38.41
	G2	38.40	37.83	38.12
LSD S.C.V		1.68		1.26
Variety (V)		39.40	40.96	
LSD (V)		0.53		

Environment X Variety (S . V)				
Environment (S)	V1	V2	Environment (S)	
S1	37.11	38.43	37.77	
S2	46.32	48.69	47.50	
S3	34.78	35.76	35.27	
LSD (S . V)	N.S		LSD (S)	0.90

Gibberellins X Variety (G. V)				
Gibberellins (G)	V1	V2	Gibberellins (G)	
C0	32.61	33.97	33.29	
C1	42.29	43.64	42.97	
C2	43.30	45.27	44.28	
LSD (G . V)	N.S		LSD(G)	0.71

Table 6 : Effect of different concentrations of gibberellins in the flower diameter of two varieties of Ranunculus growing under three different environmental conditions.

Environment (S)	Gibberellins (G)	Variety		S . G
		V1	V2	
S1	G0	65.1	66.1	65.6
	G1	76.9	74.4	75.6
	G2	72.2	72.8	72.5
S2	G0	76.0	69.9	72.9
	G1	80.9	77.6	79.3
	G2	87.5	79.2	83.3
S3	G0	72.4	61.5	66.9
	G1	79.0	75.5	77.3
	G2	75.0	75.8	75.4
LSD S.C.V		3.19		2.27
Variety (V)		76.1	72.5	
LSD (V)		1.13		

Environment X Variety (S . V)				
Environment (S)	V1	V2	Environment (S)	
S1	71.4	71.1	71.3	
S2	81.4	75.6	78.5	
S3	75.5	71.0	73.2	
LSD (S . V)	1.73		LSD (S)	1.37

Gibberellins X Variety (G. V)				
Gibberellins (G)	V1	V2	Gibberellins (G)	
C0	71.2	65.8	68.5	
C1	78.9	75.9	77.4	
C2	78.2	75.9	77.1	
LSD (G . V)	1.85		LSD(G)	1.39

Table 7 : Effect of different concentrations of gibberellins in the vase life of two varieties of Ranunculus growing under three different environmental conditions.

Environment (S)	Gibberellins (G)	Variety		S . G
		V1	V2	
S1	G0	6.33	6.67	6.50
	G1	9.00	8.50	8.75
	G2	7.00	8.00	7.50
S2	G0	7.67	7.67	7.67
	G1	8.67	9.33	9.00
	G2	8.83	9.83	9.33
S3	G0	6.83	6.00	6.42
	G1	9.00	7.00	8.00
	G2	6.17	7.67	6.92
LSD S.C.V		N.S		N.S
Variety (V)		7.72	7.85	
LSD (V)		N.S		

Environment X Variety (S . V)				
Environment (S)	V1	V2	Environment (S)	
S1	7.44	7.72	7.58	
S2	8.39	8.94	8.67	
S3	7.33	6.89	7.11	
LSD (S . V)	0.61		LSD (S)	0. 50

Gibberellins X Variety (G. V)				
Gibberellins (G)	V1	V2	Gibberellins (G)	
C0	6.94	6.78	6.86	
C1	8.89	8.28	8.58	
C2	7.33	8.50	7.92	
LSD (G . V)	0.64		LSD(G)	0.48

Discussion

The significant increase in plant height after foliar application may be due to the interaction between the added gibberellins to the plant and the auxins within the plant. its levels increase either by increasing its creation or by preventing its destruction, the effect of gibberellins requires the presence of auxins (Atea and Jaddoa,1999) Which may cause an increase in vegetative parts. Also it can be explained that the added gibberellins stimulates elongation of the cells and encourages their division and expansion. The young cells respond to the division opposite the older cells which expand only by increasing the flexibility of the new cell walls, which have a role in increasing the division and elongation of the cells located below the Subapical meristem of stem (Yaseen, 2001). These results is in agreement with results of (Zainaldeen, 2016).

While the effect of gibberellins in increasing leaf area may be due to an increase in the level of internal auxins, resulting in rapid cell division and expansion in leaf tissue (Salunkhe *et al*., 1989). or that the reason is may be that gibberellins worked to increase the transfer of mineral elements from the root to the vegetative parts, causing increased cell growth and expansion (Devlin and Wetham, 2000). And that the spraying of gibberellins has increased the permeability of the cell wall and made it a center for the polarization of nutrients and increase its susceptibility to division and elongation. These results are in agreement with results of (Sadik, 2011 and Khalil, 2016).

The cause of the gibberellins effect in increasing the concentration of chlorophyll dye in the leaves may be due to its role in reducing chlorophyll degradation and increase the process of proteins and nucleic acids creation (Yaseen, 2001), or because of its effect in stimulating and increasing cellular division which resulted in increasing the plant leaf area (table 2), which means the increasing of green plastids number, and then increase the leaves content of total chlorophyll. as well as the role of gibberellins in stimulating the expansion of leaf cells, and then increase the photosynthesis of plants that have been treated.

The effect of gibberellins in increasing the flowers number per plant may be attributed to the role of gibberellins in compensating the buds for the light or cold which need in the flowering process (Yaseen, 2001) or for its role in increasing the creation of internal auxins, which encourages the flowering process (Alkhafaji, 2014).

It was noted that the effect of GA3 in the process of elongation of the floral stem includes the stimulation of cell division and elongation, especially the areas of subapical meristem of stem, The evidence shows that the gibberellins also inhibit the process of cell division in the subapical meristem. However, the addition of gibberellins with one of these anti-GA3 compounds leads to the elimination of the effect of these inhibitors (Taiz and Zeiger, 2010). This result is consistent with results of (Sarkar *et al*, 2014) that the spraying of gibberellins on gladiolus plant has increased the length of floral stem.

While the cause of the effect of gibberellins in increasing the flowers diameter may be due to its role in directing the transport of nutrients from the leaves to flowers, which eventually increases its diameter (Devlin and Wetham, 2000).

While the increase of vase life under the effect of gibberellins may be due to the effect of gibberellins in increasing the plant leaf area (table 2), and the flowers

diameter (table 6), leaves content of chlorophyll, this indicates that the spraying process with this growth regulator at these concentrations worked to increase the previous indicators and thus increased the vase life of flowers, may be the reason of these increases that gibberellins affects cell division as well as its role in the transfer of nutrients (Penot, 1979).

References

Alkhafaji, M.A. (2014). Plant Growth Regulators Applications and horticultural uses. college of Agriculture. Baghdad University. Ministry of Higher Education and Scientific Research. Iraq.

Alrubai, N.M.A. (2015). Effect of Shading, Brassinolide and Salicylic acid on Growth and Yield of Gladiolus CV White prosperity . college of Agriculture at the University of Baghdad.

Andersn, M. (2012). Plant Reproduction, Growth and Ecology. First Edition. Britannica Educational Publishing. 29 East 21st Street New York, YY 10010.

Atteah, H.J. and Jadoua, K.A. (1999). Growth regulators of plant theory and application Ministry of Higher Education and Scientific Research. Iraq.

Devadanam, A.; Shinde, B.N.; Sable, P.B. and Vedpathak, S.G. (2007). Effect of foliar application of plant growth regulators on flowering and vase life of tuberose (*Polianthes tuberosa* L.). J. Soil Crops, 17(1): 86-88.

Devlin, R.M. and Wetham, F. (2000). Plant physiology. Translated by Mohamed Mahmoud Sharaki; Abdelhadi Khader; Ali Saad Eddin Salama and Nadia Kamel. Arabic Publishing Group. Egypt.

Fitter, A.H and Hay, R.K. (2002). Environmental Physiology of Plants Third Edition. 32 Jamestown Road, London. UK.

Ganesh, S.; Soorianathasundaram, K. and Kannan, M. (2013). Effect of plant growth regulators and micronutrients on growth, floral characters and yield of tuberose (*Polianthes tuberose* L.) cv. "Prajwal". Asian J. Hort, 8(2): 696-700.

Khalil, N.H. (2016). Crown diameter, chilling, and gibberellic acid interactions influence growth and reproductive of strawberry cv. festival. The Iraqi Journal of Agricultural Sciences 47(2): 672-676.

Kumar, R.; Ahmed, N.; Singh, D.; Sharma, B.; Lal, O.C.S. and Salmani, M.M. (2013). Enhancing blooming period and propagation coefficient of tulip (*Tulipa gesneriana* L.) using growth regulators. Afr. J. Biotechnol. 12(2): 168-174.

Penot, M. (1979). Demonstrate the phenomenon of the hormones directed transport. (C.F. Lukwill, L.C. 1981. Growth regulator in crop production studies in biology on 129. Edward Arnold (publishes) Limited.).

Pudelska, P.K. and Podgajna, E. (2013). Decorative value of three dahlia cultivars (*Dahlia×cultorum* Thorsr. et Reis) treated with gibberellins .Modern Phytomorphology (4): 83–86.

Rickard, S. (2011). The New Ornamantal Garden CSIRO Publishing Australian, 267.

Sadik, S.K.; Kalaf, S.M.; Salman, A.D. (2011). Effect of dipping in gibberllic acid and spraying nutrient solution agro leaf on some vegetative growth and yield of jerusalum artichoke. The Iraqi Journal of Agricultural Sciences, 47(4):951-958.

Salunkhe, D.K.; Bhat, N.R. and Desai, B.B. (1989). Post harvest biotechnology of flower and ornamental plants. Mahatma phule Agriculture University. Rahuri District. India.

Sarkar, M.A.H.; Sarkar, M.I.; Hossain, A.F.; Uddin, M.J.; Uddin, M.A.N. and Sarkar, M.D. (2014). Vegetative, floral and yield attributes of *gladiolus* in response to Gibberellic acid and corm size Sci. Agric., 7 (3): 142-146.

Sudhakar, M. and Kumar, R. (2007). Effect of different shading conditions on growth, flowering and yield of heliconium (*Heliconia* sp.) cv. Golden torch. the asian journal of horticulture, 7(2): 512-514.

Taiz, L. and Zeiger, E. (2010). Plant Physiology. 4th edition. Annals of Botany Company. Publisher: Sinauer Associates. Tissue & Org. Cult., 53:79 - 84.

Yaseen, T.B. (2001). The Basics of Plant Physiology. Qatar University Library of Qatari dar alkutub.

Zainaldeen, M.A. and Abdul Rasool, I.J. (2016). Effect of Folair Application of Gibberellins and Nutrients on Growth and Yield of Potato Var. "BURREN" Iraqi Journal of Agricultural Sciences, 1027:49(2): 168-176.