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Stimulating postharvest characteristics and artificial coloring of gladiolus (*gladiolus hybrid cv. White prosperity*) cut spikes.

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ABSTRACT

This investigation was conducted to evaluate the influence of some edible colors and plant growth regulators in the pulsing treatments of gladiolus cut spikes. 25ppm GA_3 and 5ppm kin with two pulsing periods (1 and 2 hours) for each, plus the distilled water as a control were used. Each growth regulator treatment was trans-located into nine dyeing treatments, as two edible colors [ponceau 4R (red) and brilliant blue (blue)] were used under two concentrations (3 and 6 g/l) for two dyeing periods (2 and 3 hours), beside the control (distilled water without any dyeing substance). The results showed that the superior combination of 25 ppm GA_3 for 2h and 6 g/l blue dye for 3h, recorded the highest values of the vase life, change of fresh weight water loss, water balance and finally the least average of bacterial count.

Keywords: plant Growth Regulator, GA_3, Kin, Postharvest and gladiolus.

INTRODUCTION

Gladiolus (*Gladiolus hybrid* cv. White Prosperity) plants are planted for their cut flowers and corms. They are very important flowers harvest for local and foreign market places. Gladiolus is a member of the Iridaceae family. The genus Gladiolus comprises 260 species; 10 species are native to Eurasia and 250 species are native to sub-Saharan Africa, mostly South Africa. Aesthetic value is due to the multiplicity of flowers on the stem.

Gladiolus is a flower of glamour and perfection which is known as the queen of bulbous flowers due to its flower spikes with florets of massive form attractive shapes and varying size. Gladiolus stands fourth in the international cut flower trade after carnation, rose and chrysanthemum. The longevity of gladiolus cut flowers is very short. The typical vase life of individual florets is just 4 to 6 days and senescent florets remain at the bottom of the spikes after the opening of the upper florets (Yamada *et al*., 2003).

The preservative materials which are used as pulsing or holding solutions looked to prolong flower longevity. In this respect, some chemical preservatives, i.e., hydroxy quinolone sulphate (8-HQS), citric acid (CA), and sucrose as holding solutions were used for prolonging vase length. Growth regulators and commercially available conditioners in pulsing solution are recommended to prolong the postharvest longevity (Rubinowska *et al*., 2012). Also, Plant growth regulators such as cytokinins and gibberellins have been reported in several studies to improve the postharvest vase life of many cut flowers. In this regard, the use of some growth regulators such as kinetin (kin) and gibberellic acid (GA_3) as pulsing solutions seemed to prolong flower longevity.

It is really great to imagine and envision the existence, blue or red flowers rather than of white flower in vase or bouquets with longer vase life. The use of floral preservatives to promote the quality and to extend vase life has been known many years (Viradia *et al*., 2015).

So, the aim of this study was to examine the influence of some growth regulators under different concentrations beside the effect of some edible dyes in postharvest characters and creation of new color variations of gladiolus cut spikes.

MATERIALS AND MOTHEDS

This study was carried out at the Postharvest Laboratory of Vegetable and Floriculture Department, Faculty of Agriculture, Mansoura University, Egypt, during 2014-2015 seasons to evaluate some plant growth regulators and edible dyes in the pulsing solutions on postharvest parameter and chemical contents of gladiolus cut spikes.

1: Plant Material.

Gladiolus cut spikes (*Gladiolus hybrida* cv. White Prosperity) were obtained from a well-known commercial orchard in El-Mansoura City, Daqahlea, Egypt. Uniform spikes were cut in the early morning with 75 cm length. The spikes were pre-cooled by placing them in a cold water for 30 min to remove the field heat. After that, flowers were re-cut at 5cm from the end of the stem (before treatments). The leaves on the lower third part of the stems were then removed. Gladiolus spikes were weighed and their original fresh weights were recorded.

2: Growth regulators and dyeing treatments.

Five growth regulator treatments were used in the pulsing stage, as, GA_3 at 25ppm and kin at 5ppm with two pulsing periods (1 and 2 hours) for each plus the control (distilled water) were evaluated. Each treatment contained 45 spikes. The dyeing process was as follow, each gladiolus cut spike from the previous pulsing groups was dipped in a warm solutions (40^o) from the two edible dyes (ponceau 4R and brilliant blue), (Fig 1) under two concentrations of 3 and 6g/l for two periods (2 and 3h), plus the distilled water (as control).

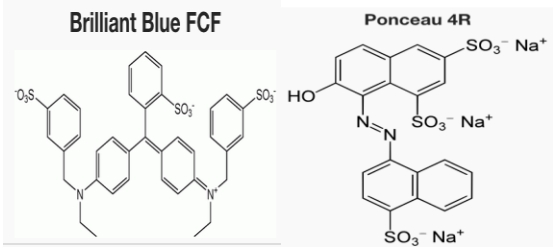

Fig (1): Chemical structure of ponceau 4R (Red dye) and brilliant blue (Blue dye), used in the dyeing treatments.

3: Holding solution.

After the end of the pulsing and dyeing periods gladiolus cut spikes were held till the end of the experiment in preservative solutions (in cylinder glass of 100 ml) under lab condition fluorescent light about 1000 lux, temperature of 20°C ± 2 and relative humidity between 50-56% as follows:

Each treatment from the nine dyeing solutions was held in a preservative solution containing 10 % sucrose + 150 ppm 8-HQS + 150 ppm citric acid plus a fixed concentration from the two edible dyes (0.5 gram), as each spike was dyed in the previous pulsing treatments, except for the control, as it was distilled water without any dye concentration. All the growth regulators, dyeing pulsing and holding solutions were measured to estimate the values of the pH of them as shown in Table (1)

Table [1]: pH values of the growth regulators, dyeing and the holding solutions used.

Solutions	PH
Distilled water	7.00
Kinetin (5 ppm)	4.58
Gibberellin (25 ppm)	6.55
Red 3g /l	8.22
Red 6g /l	8.45
Blue 3g /l	6.21
Blue 6g /l	6.00
10 % sucrose + 150 ppm 8-HQS + 150 ppm citric acid+ 0.5 g/ red dye	7.30
10 % sucrose + 150 ppm 8-HQS + 150 ppm citric acid + 0.5 g/l blue dye	5.00

4: Experimental Design.

Five growth regulators treatments (GRs) x nine dyes treatments = forty five treatments in the present research were arranged in a factorial experiment in complete randomized design (CRD). Each treatment had five replicates, each had one spikes.

5: Data recorded.

A: Post harvest characteristics.

1: The vase life (days).

The vase life of gladiolus cut spikes (days) was evaluated, and was judged to have ended when 50% or more of the flowers on a spike were seemed unattractive (Cho *et al*., 2001).

2: Change in fresh weight (%).

The change in fresh weights of cut gladiolus spikes were measured every two days during the vase life. The original fresh weight was measured immediately after cutting spike stem and before immersing in holding solutions (He *et al*., 2006).

3: Water relation measurements..

Water uptake (ml/100 g f.w. /2 day).

Water uptake was recorded at 2nd, 4 th, 6 th, … days, during the shelf life periods by reading the change in the volume of solution in the graduated glass cylinder (after correction with the mean evaporation value), and the amount of solution uptake was related to 100 g of the spike fresh weight as follows:

Water uptake (ml/100 g f.w. /2 days)

$$= \frac{\text{2days solution uptake of the spike}}{\text{2days fresh weight(g) of the same spike}} \times 100$$

Water loss (ml/100 g f.w. /2 days).

Water loss every 2 days was calculated as the difference between changes in fresh weights every 2 days and the amount of water uptake every 2 days as the following formula:

Water loss = water uptake – (±change of fresh weight)

Water loss (ml/100 g f.w. /2 days)

$$= \frac{\text{2days water loss of the spike}}{\text{2days fresh weight(g) of the same spike}} \times 100$$

Water balance (ml/100 g f.w. /2 days).

Water balance (water uptake – water loss) was recorded at 2nd, 4th, 6th … days, during the shelf life periods.

B: Bacterial counts.

Averages of bacterial counts (C.F.U /ml) were determined in the keeping solutions after 3 days, where 1 ml was taken from each sample and diluted by using sterilized distilled water from the first dilution to the sixth dilution. After that 1 ml of each fourth, fifth and sixth dilution were inoculated in Petri dishes on media consisting of peptone 5 g, beef extract 3 g, NaCl 5 g, agar 15 g, distilled water 1000 ml and pH 6.8 – 7.2 (Atlas (1997). It was then incubated for 72 hours at 30°C and the colonies were counted according to Allen (1959) procedure.

4: Statistical Analysis.

All data obtained were subjected to analysis of variance (ANOVA) according to Gomez and Gomez (1984). Treatment means were compared by using L.S.D. at 5% test, and the combined analysis of the two seasons were calculated according to Steel and Torrie (1980).

RESULTS AND DISCUSSION

1: Vase life (days).

For effect of the growth regulators pulsing treatments on the vase life, data presented in Table (2) and illustrated in Figure (2) cleared that all the growth regulators treatments significantly increased the vase life periods comparing with the control one (distilled water). They gone values ranged from 10.93 to 11.15 day and the control was 9.82 day. These results are in agreement with the results obtained by Ahmadi and Hassani (2015) on rose regarding GA_3 effect and El-Saka (1992) on tuberose and bird of paradise respecting kin and GA_3 effect. Meantime, influence of the dyeing treatments in that parameter presented in the same table showed that the blue dye at 6 g/l for 3h significantly is still higher than all the other cases in enhancing the gladiolus cut spikes vase life, since it was 12.13 days. In contr'st, the shortest vase life value of 9.47 days was recorded for the control one. These results are in agreement with the results obtained by Abd El-Kafie *et al*., (2016) on mums cut spikes.

As for the interaction effects, data presented in Table (2) and illustrated in Figure (2) revealed that the interaction between 25 ppm GA_3 for 2h with the two edible dyes (blue and red at 6 g/l for 3h) increased the vase life. The highest vase life was 13.33 and 13.00 days, respectively. The shortest vase life of 9.33 days was obtained when gladiolus cut spikes were treated

with the combination of distilled water (without dyeing) and GA_3 at 25 ppm for 1h or 2h or kin at 5 ppm for 2h. Generally, the interactions between GA_3 at 25 ppm for 2h and the dyeing solutions used of the two edible colors (blue and red for 6 g/l for 3h) were more effective in that regard, comparing with the combination of kinetin or the control pulsing treatments and the studied dyes.

Table (2): Effect of growth regulators pulsing, dyeing treatments and their interactions on vase life (days) of gladiolus cut spikes.

GRs pulsing treatments (A) / Dyeing treatments (B)		Control (d.w.)	25 ppm GA_3		5 ppm kin		`Mean of
		1h	1h	2h	1h	2h	(B)
Control (d.w. without dyeing)		9.67	9.33	9.33	9.67	9.33	9.47
3g/l red dye	2h	9.67	11.33	10.33	10.67	10.33	10.47
	3h	9.67	10.33	10.33	10.67	11.00	10.40
6g/l red dye	2h	9.67	11.33	11.00	11.33	10.00	10.67
	3h	9.67	11.33	13.00	11.67	12.67	11.67
3g/l blue dye	2h	9.67	10.33	10.67	10.33	10.67	10.33
	3h	10.00	10.67	10.67	10.67	10.67	10.53
6g/l blue dye	2h	10.00	11.67	11.67	11.33	11.33	11.20
	3h	10.33	12.33	13.33	12.00	12.67	12.13
Mean of (A)		9.82	10.96	11.15	10.93	10.96	
L.S.D 5 %		A (0.34)		B (0.45)		AB (1.02)	

Control (Without dyeing) **Red 6g for 3h** **Blue 6g for 3h**

Fig (2): Interaction effect of growth regulators pulsing and dyeing treatments on vase life of *Gladiolus hybrida* cv. White Prosperity.

2. Change in fresh weight %.

Data presented in Table (3) showed that the combination between 25 ppm GA_3 for 2h and 6 g/l blue dye for 3h was more effective an increasing the change of fresh weight percentage, comparing with most of the other interactions, during the shelf life period followed by, using 25 ppm GA_3 for 1h with 6g/l red dye for 3h. On the other hand, the combination between the distilled water without any growth regulator (control) and most of the dyeing treatments produced a lower percentage in this regard, when compared with most of the other combinations. Moreover, these effects were more obvious on the 6^{th} day of the shelf life period.

3: Change in water uptake (ml/100g fw/2day).

Data presented in Table (4) showed that in the 4^{th} day, the maximum changes of water uptake (47.40 and 42.53 ml/100g f.w. /2 day) were recorded when combinations of either 25 ppm GA_3 for 2h + 6 g/l blue dye for 3h or 5 ppm kin for 2h + 6 g/l blue dye for 2hours respectively were used. Moreover, these two combinations were still giving higher amounts of water uptake till the 6^{th} day from the beginning of the shelf life period comparing with most of the other combinations.

4: Change of water loss (ml/100g fw/2days).

For the interaction between growth regulators and dyeing treatments on change of water loss (ml/100 g f.w. /2 days), data presented in Table (5) cleared that the negative combination in maximizing the water loss of gladiolus cut spikes was for 5 ppm kin for 2h + the control (distilled water without any dyeing substance) since they gave higher amounts of water loss, especially from the 4^{th} to the 8^{th} day of the vas life. This means that GA_3 had the upper hand in most of the combinations with the dyeing treatments more than the kin one. The positive combinations in decreasing water loss were recorded for the interaction between 25ppm GA_3 for 2h + 6 g/l blue dye for 3h, the same plant growth regulators (GA_3) with the same pulsing time + 3 g/l red dye for 2h or 25 ppm GA_3 for 1h + 6g/l red dye for 3h during most of the vase life days.

Table (3): Effect of the interaction between growth regulators pulsing and dyeing treatments on change in fresh weight (%) of gladiolus cut spikes

Pulsing treatments (A)	Dyeing treatments (B)		2th	4th	6th	8th	10th
Control (Distilled water) 1hour	Control (d.w. without dyeing)		6.73	5.93	-1.03	-1.90	——
	3 g/l red dye	2h	8.50	8.80	0.57	-.0.03	——
		3h	7.47	4.03	0.87	-0.27	——
	6 g/l red dye	2h	9.10	7.93	-0.30	-0.47	——
		3h	8.37	3.37	-1.27	-.2.33	——
	3 g/l blue dye	2h	6.57	12.33	-.0.77	-2.10	——
		3h	9.07	11.80	1.63	1.20	-6.87
	6 g/l blue dye	2h	7.63	13.17	2.30	0.83	-6.90
		3h	8.33	11.67	2.60	0.80	-.3.13
25 ppm GA_3 1 hour	Control (d.w. without dyeing)		9.93	12.63	1.13	-2.23	-2.80
	3 g/l red dye	2h	7.73	11.67	2.87	1.20	-7.27
		3h	9.40	13.27	0.90	0.60	-6.90
	6 g/l red dye	2h	8.83	13.30	3.77	2.27	-7.33
		3h	10.97	15.40	3.87	3.17	-2.93
	3 g/l blue dye	2h	8.40	14.60	0.97	-0.07	-7.20
		3h	9.80	14.37	4.03	0.63	-7.30
	6 g/l blue dye	2h	7.60	12.03	1.73	1.80	-3.73
		3h	9.93	12.03	0.53	-0.90	-7.80
25 ppm GA_3 2 hours	Control (d.w. without dyeing)		9.37	7.53	-1.67	-4.50	-3.20
	3 g/l red dye	2h	10.33	14.77	3.03	2.83	-3.43
		3h	10.23	7.43	1.57	1.67	-2.90
	6 g/l red dye	2h	7.93	14.60	7.10	2.97	-4.73
		3h	8.83	14.03	5.30	-3.93	-4.87
	3 g/l blue dye	2h	10.20	9.87	2.63	0.63	-7.70
		3h	8.97	10.33	2.00	-0.33	-6.67
	6 g/l blue dye	2h	10.50	14.07	2.03	0.83	-4.40
		3h	11.40	16.53	6.30	3.60	-2.73
5 ppm kin 1 hour	Control (d.w. without dyeing)		6.07	7.10	1.93	1.27	-2.90
	3 g/l red dye	2h	10.93	9.57	-1.47	-0.63	-4.57
		3h	9.07	12.97	1.43	-0.20	-6.73
	6 g/l red dye	2h	7.33	8.47	2.17	-2.10	-3.20
		3h	8.40	10.63	2.43	-1.53	-5.73
	3 g/l blue dye	2h	10.17	11.47	2.17	0.60	-4.03
		3h	6.63	8.33	-1.13	-3.50	-3.83
	6 g/l blue dye	2h	9.40	6.67	-0.23	-1.77	-6.33
		3h	9.23	7.90	-0.07	-2.07	-2.87
5 ppm kin 2 hours	Control (d.w. without dyeing)		7.93	4.47	-1.13	-1.80	-6.03
	3 g/l red dye	2h	8.80	14.17	1.87	-0.57	-6.97
		3h	8.27	12.50	2.10	1.43	-6.73
	6 g/l red dye	2h	9.03	9.40	0.17	-2.40	-2.83
		3h	9.07	10.77	2.93	1.20	-4.20
	3 g/l blue dye	2h	7.10	12.17	3.07	2.87	-5.23
		3h	8.47	11.30	-1..03	-1.73	-7.37
	6 g/l blue dye	2h	9.80	13.20	0.07	0.13	-6.17
		3h	5.90	12.00	1.50	0.47	-6.90
L.S.D at 5%			3.54	4.77	5.08	4.27	4.06

Table (4): Effect of the interaction between growth regulators pulsing and dyeing treatments on change of water uptake (ml/100g fw/ 2days) of gladiolus cut spikes.

Pulsing treatments (A)	Dyeing treatments (B)		2th	4th	6th	8th	10th
Control (Distilled water) 1hour	Control (d.w. without dyeing)		17.77	35.00	19.83	13.83	------
	3 g/l red dye	2h	18.37	34.97	18.13	14.97	------
		3h	20.83	41.90	19.13	15.70	------
	6 g/l red dye	2h	19.27	33.43	16.20	13.97	------
		3h	18.20	38.00	16.23	13.70	------
	3 g/l blue dye	2h	20.43	41.20	20.97	14.67	------
		3h	18.20	39.87	19.00	16.73	6.03
	6 g/l blue dye	2h	18.33	42.43	19.00	15.40	5.33
		3h	18.20	33.07	21.33	14,73	2.63
25 ppm GA_3 1 hour	Control (d.w. without dyeing)		15.13	31.70	17.60	12.03	1.17
	3 g/l red dye	2h	21.83	34.63	20.17	16.50	7.50
		3h	20.03	32.77	21.50	17.10	6.20
	6 g/l red dye	2h	22.93	35.33	22.93	17.60	6.50
		3h	21.50	34.03	17.13	14.30	4.80
	3 g/l blue dye	2h	20.30	38.13	21.83	15.40	5.50
		3h	21.97	35.37	21.10	15.77	5.23
	6 g/l blue dye	2h	20.93	33.43	23.43	18.13	7.27
		3h	21.23	32.83	18.83	15.33	5.57
25 ppm GA_3 2 hours	Control (d.w. without dyeing)		19.90	33.37	16.50	14.83	2.97
	3 g/l red dye	2h	15.77	29.90	19.17	15.77	4.93
		3h	21.63	35.77	19.57	14.80	7.03
	6 g/l red dye	2h	20.43	38.57	21.73	15.17	4.73
		3h	23.33	40.53	23.23	16.77	6.30
	3 g/l blue dye	2h	20.50	39.33	22.03	16.17	5.23
		3h	22.80	39.33	20.97	16.77	6.07
	6 g/l blue dye	2h	20.57	31.07	20.80	14.93	4.80
		3h	23.70	47.40	24.57	19.40	9.07
5 ppm kin 1 hour	Control (d.w. without dyeing)		16.73	33.40	17.53	14.17	3.20
	3 g/l red dye	2h	19.07	34.87	18.20	15.43	6.50
		3h	19.63	39.20	20.23	16.93	6.77
	6 g/l red dye	2h	17.67	33.90	19.87	16.20	6.00
		3h	19.00	38.43	22.80	18.20	7.37
	3 g/l blue dye	2h	20.00	31.57	21.33	16.40	6.13
		3h	19.70	37.27	20.63	15.50	5.77
	6 g/l blue dye	2h	16.50	33.23	21.07	15.90	6.63
		3h	19.17	38.67	21.43	17.83	7.60
5 ppm kin 2 hours	Control (d.w. without dyeing)		17.07	34.80	19.23	15.27	2.73
	3 g/l red dye	2h	18.93	41.90	19.87	16.13	5.93
		3h	19.37	40.30	21.07	17.10	6.50
	6 g/l red dye	2h	20.60	38.17	23.87	17.67	4.87
		3h	19.10	39.83	23.40	16.13	7.63
	3 g/l blue dye	2h	20.37	41.93	20.30	16.63	5.80
		3h	17.57	41.57	20.57	17.43	7.50
	6 g/l blue dye	2h	21.10	42.53	23.93	19.10	8.60
		3h	20.70	41.23	20.43	16.93	4.67
L.S.D at 5%			2.84	5.46	4.07	3.12	3.46

Table (5): Effect of the interaction between growth regulators pulsing and dyeing treatments on change of water loss (ml/100 g fw/2days) of gladiolus cut spikes

Pulsing treatments (A)	Dyeing treatments (B)		2th	4th	6th	8th	10th
Control (Distilled water) 1hour	Control (d.w. without dyeing)		19.47	40.27	30.90	24.33	-----
	3 g/l red dye	2h	27.13	36.27	33.40	30.67	-----
		3h	27.00	43.67	27.67	24.33	-----
	6 g/l red dye	2h	15.00	30.67	24.23	22.00	-----
		3h	17.00	34.57	19.90	19.53	-----
	3 g/l blue dye	2h	30.37	49.57	28.00	21.87	------
		3h	17.30	43.17	26.13	22.97	21.20
	6 g/l blue dye	2h	20.57	44.50	24.57	21.17	19.73
		3h	24.43	49.27	34.33	35.97	15.87
25 ppm GA_3 1 hour	Control (d.w. without dyeing)		25.50	42.07	34.97	21.50	19.40
	3 g/l red dye	2h	19.07	42.30	28.17	24.47	27.67
		3h	19.40	28.93	26.73	23.50	20.90
	6 g/l red dye	2h	22.10	44.93	26.23	19.60	12.90
		3h	15.13	19.20	18.87	16.03	7.70
	3 g/l blue dye	2h	21.50	32.47	28.57	21.13	19.30
		3h	20.67	28.70	22.23	19.57	17.83
	6 g/l blue dye	2h	23.90	32.97	24.03	25.60	18.57
		3h	19.53	29.77	28.77	25.63	22.50
25 ppm GA_3 2 hours	Control (d.w. without dyeing)		19.97	42.53	37.87	36.97	12.70
	3 g/l red dye	2h	6.43	16.17	15.77	13.00	8.23
		3h	20.37	44.23	33.37	26.67	17.13
	6 g/l red dye	2h	25.13	36.63	20.50	16.23	13.50
		3h	26.87	41.03	25.63	21.43	16.53
	3 g/l blue dye	2h	18.10	30.87	25.20	19.97	18.40
		3h	28.03	48.23	30.60	27.77	23.17
	6 g/l blue dye	2h	16.97	30.90	27.47	20.70	9.13
		3h	4.97	15.27	13.27	11.50	6.90
5 ppm kin 1 hour	Control (d.w. without dyeing)		17.50	32.67	22.07	19.27	11.57
	3 g/l red dye	2h	12.83	36.23	29.03	25.13	18.33
		3h	19.90	38.60	26.40	24.30	21.20
	6 g/l red dye	2h	19.80	42.00	28.17	22.10	14.90
		3h	19.03	48.17	30.00	29.43	23.87
	3 g/l blue dye	2h	20.63	41.17	31.53	24.83	15.40
		3h	24.33	46.33	35.37	32.73	18.83
	6 g/l blue dye	2h	10.73	36.30	29.40	24.93	20.37
		3h	18.73	49.60	34.87	29.43	17.90
5 ppm kin 2 hours	Control (d.w. without dyeing)		21.83	61.13	41.80	37.70	23.23
	3 g/l red dye	2h	19.63	41.73	26.30	24.63	21.20
		3h	22.40	43.77	28.60	23.07	21.60
	6 g/l red dye	2h	22.13	49.33	33.70	33.43	14.63
		3h	21.33	56.03	29.77	25.63	18.37
	3 g/l blue dye	2h	18.27	46.53	25.33	18.83	16.37
		3h	17.93	47.30	34.30	31.37	27.73
	6 g/l blue dye	2h	17.50	33.13	26.83	21.47	11.27
		3h	26.27	43.07	27.10	23.27	19.87
L.S.D at 5%			10.66	14.12	10.00	10.26	12.24

Table (6): Effect of the interaction between growth regulators pulsing and dyeing treatments on change of water balance (ml/100 g FW/ 2days) of gladiolus cut spikes.

Pulsing treatments (A)	Dyeing treatments (B)		2th	4th	6th	8th	10th
Control (Distilled water) 1hour	Control (d.w. without dyeing)		-21.03	-25.57	-22.70	-23.73	------
	3 g/l red dye	2h	-9.40	-20.63	-16.83	-15.13	-------
		3h	-16.33	-16.33	-15.00	-14.00	-------
	6 g/l red dye	2h	-13.77	-28.93	-19.67	-26.30	--------
		3h	-6.33	-7.23	-7.90	-5.70	--------
	3 g/l blue dye	2h	-9.13	-17.93	-15.00	-12.53	-------
		3h	-7.63	-17.17	-13.47	-11.63	-17.53
	6 g/l blue dye	2h	-10.90	-16.50	-11.57	-10.50	-16.60
		3h	-6.30	-7.57	-12.13	-10.03	-5.70
25 ppm GA_3 1 hour	Control (d.w. without dyeing)		-15.80	-14.27	-20.73	-20.67	-23.67
	3 g/l red dye	2h	-11.23	-9.97	-12.03	-13.50	-6.23
		3h	-8.40	-6.60	-11.40	-11.17	-16.90
	6 g/l red dye	2h	-6.77	-20.27	-9.23	-5.93	-8.23
		3h	-0.13	7.80	-4.20	-7.53	-12.20
	3 g/l blue dye	2h	-7.83	-4.80	-12.57	-9.80	-15.63
		3h	-7.67	-2.70	-5.90	-7.23	-14.17
	6 g/l blue dye	2h	-14.50	-21.73	-20.30	-13.93	-14.23
		3h	-7.20	-6.77	-15.77	-15.30	-19.17
25 ppm GA_3 2 hours	Control (d.w. without dyeing)		-16.70	-24.57	-17.60	-17.43	-19.83
	3 g/l red dye	2h	6.90	14.40	3.90	3.33	-4.13
		3h	-8.03	-21.23	-21.03	-19.67	-13.13
	6 g/l red dye	2h	-14.80	-11.30	-4.83	-4.90	-10.17
		3h	-16.53	-14.70	-9.30	-7.10	-12.20
	3 g/l blue dye	2h	-6.10	-1.53	-8.20	-7.30	-14.73
		3h	-9.30	-22.20	-25.53	-28.30	-11.37
	6 g/l blue dye	2h	-4.67	-7.00	-12.90	-12.33	-15.40
		3h	9.03	16.83	4.73	4.17	-3.23
5 ppm kin 1 hour	Control (d.w. without dyeing)		-6.17	-10.00	-9.73	-9.27	-9.57
	3 g/l red dye	2h	-0.50	-10.57	-16.03	-14.47	-14.33
		3h	-8.90	-11.60	-12.07	-12.30	-16.87
	6 g/l red dye	2h	-10.47	-21.00	-15.50	-11.43	-11.23
		3h	-8.37	-19.83	-14.33	-17.10	-18.20
	3 g/l blue dye	2h	-11.63	-22.17	-18.20	-14..50	-11.73
		3h	-13.67	-23.00	-18.23	-15.67	-11.97
	6 g/l blue dye	2h	0.27	-11.97	-14.07	-13.60	-16.03
		3h	-8.40	-25.60	-21.53	-22.77	-14.50
5 ppm kin 2 hours	Control (d.w. without dyeing)		-11.17	-24.67	-22.03	-20.43	-15.57
	3 g/l red dye	2h	-9.63	-13.73	-12.63	-13.63	-17.53
		3h	-12.40	-17.77	-14.60	-11.40	-17.60
	6 g/l red dye	2h	-11.13	-39.13	-28.13	-28.03	-18.57
		3h	-11.00	-25.03	-13.77	-12.30	-13.37
	3 g/l blue dye	2h	-8.93	-18.53	-7.33	-6.17	-12.37
		3h	-8.17	-20.63	-21.30	-20.70	-23.73
	6 g/l blue dye	2h	-14.60	-14.73	-12.77	-11.27	-16.20
		3h	-4.60	-3.80	-11.17	-9.13	-9.27
L.S.D at 5%			11.23	15.47	11.02	11.38	10.98

5: Change in water balance (ml/100g fw/2 day).

According data presented in Table (6), it was noticed that the maximum water balance for most of the interaction treatments were recorded from the 2nd to 4th day from the beginning of the vase life. Moreover, combinations of 25 ppm GA_3 for 2h + 6g/l blue dye for 3h or 25 ppm GA_3 for 2h +3g/l red day for 2h especially on the 4th day were superior in that respect. In contrast, the lowest water balance values were recorded on the 4th day from the beginning of the experiment when the interactions of 5 ppm kin for 2h + 6g/l red dye for 2h, control (distilled water) for 1h + control (without dyeing), and control (distilled water) for 1h + 6g/l red dye for 2h were used.

6. Bacterial counts.

The results presented in Table (7) revealed that the least average of bacterial count (25 x 10^2 and 77 x 10^2 C.F.U/ml) was obtained by using 25 ppm GA_3 for 2h + 6 g/l blue dye for 3h or 5ppm kin for 2h + 3 g/l red dye for 2h, respectively.

On the other hand, the maximum average (85 x10^7 C.F.U/ml) of bacterial count was recorded for the interaction between the control growth regulators solution (distilled water) and 6 g/l red dye for 3h.

Table (7): Average bacterial counts (CFU/ml) of the different interaction treatments under study.

GRs treatments (A)		Control (d.w.)	25 ppm GA_3		5 ppm kin	
Dyeing treatments (B)		1h	1h	2h	1h	2h
Control (d.w. without dyeing)		$63x10^5$	$29x10^7$	$38x10^4$	$28x10^4$	$81x10^4$
3 g/l red dye	2h	$34x10^5$	$40x10^6$	$74x10^5$	$31x10^5$	$22x10^5$
	3h	$26x10^6$	$11x10^6$	$35x10^4$	$32x10^5$	$77x10^2$
6 g/l red dye	2h	$74x10^4$	$73x10^6$	$54x10^5$	$42x10^4$	$35x10^5$
	3h	$85x10^7$	$84x10^4$	$65x10^5$	$76x10^5$	$13x10^3$
3 g/l blue dye	2h	$39x10^5$	$84x10^5$	$35x10^4$	$71x10^6$	$10.5x10^6$
	3h	$64x10^4$	$64x10^4$	$35x10^3$	$40x10^5$	$62x10^5$
6 g/l blue dye	2h	$47x10^5$	$51x10^5$	$11x10^7$	$75x10^5$	$27x10^6$
	3h	$74x10^4$	$38x10^4$	$25x10^2$	$54x10^6$	$48x10^6$

DISCUSSION

Occlusions which located in the basal stem end of the cut flowers are probably caused by growth of microbes and vascular blockage led to decrease the flowers vase life, (Alimorrdi *et al*., 2013). GA_3 and kin play an important role as plant growth regulators in prolonging vase life, increasing fresh weight of flower stems, soluble protein content, protecting enzyme activity in the petal, decreasing the accumulation of malondialdehyde (MDA) and maintain the stability of cell membrane and it is more effective an preventing leaf yellowing, (Zhang *et al*., 2009). In addition, the simulative reaction of GA_3 may be due to the fact that gibberellins improve carbohydrate and protein accumulation in the petals and leaves, (Faraji *et al*., 2011). Moreover, GA_3 delay or decrease, the degradation of chlorophyll and increases flower fresh weight and water uptake, (Hatamzadeh *et al*., 2012) Also, (Mohammadi *et al*., 2013) stated that GA_3 stimulate the activity of superoxide dismutase enzyme which led to increase the anthocyanin pigment content. The main initial effect of kinetin was on increasing water uptake, as kinetin slowed down processes associated with both senescence and stress (RNase activity and dry weight reduction), and maintained petal turgidity for an extended period (Mayak and Halevy 1974).. As for using the edible dyes in artificial coloring many authors studied it's influence in artificial coloring on many cut flowers, and they found that these dyes did not affect the vase life of these cut flowers comparing with the control treatments [Kumar *et al*., (2003) on tuberose, Liu *et al*., (2004) on chrysanthemum, and Patil and Dahduk (2007) on candytuft]. Also, (Patil and Dahduk 2008) on *Pinpinella monoica* cut flowers indicated that the color shade which was obtained in inflorescences was directly dependent on the dye concentration and time of immersion. As, when the time of immersion and dye concentration increased, the color shades on the inflorescences were also increased. The increase in the positive postharvest parameters by using these edible dyes may be related with the contents of these dyes from carbohydrates, proteins, fatty acids, vitamin, etc. which affect the vase life and the other postharvest characteristics.

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تحفيز صفات مابعد الحصاد و التلوين الصناعي لأزهار الجلاديولس

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أجريت هذه الدراسة في معمل الابحاث ومعاملات ما بعد الحصاد بقسم الخضر والزينة ـ كلية الزراعة- جامعة المنصورة خلال الموسمين ٢٠١٤ و ٢٠١٥ . وكان الهدف من الدراسة هو محاولة تحسين صفات ما بعد الحصاد من خلال دراسة تاثير بعض منظمات النمو (حمض الجبرليك والكينتين) وكذلك ايجاد تنوع فى الوان نورات ازهار الجلاديولس صنف White Prosperity باستخدام بعض الصبغات القابلة للأكل Brilliant blue (blue) و Ponceau 4R (red) وكذلك معرفة تاثير هذه الصبغات على صفات مابعد الحصاد لزهرة الجلاديولس. واوضحت النتائج ان استخدام معاملات التفاعل بين حامض الجبرليك بتركيز ٢٥ مجم/لتر والغمس لمدة ساعتين ثم الغمس في الصبغة الزرقاء بتركيز ٦ جم/لتر لمدة ثلاث ساعات ادى الى الحصول على اطول فترة بقاء للازهار(٣٣, ١٣) واكبر كمية ماء ممتص (٤٠, ٤٧) واعلى زيادة للوزن الطازج (٥٣, ١٦) واقل نسبة ماء مفقود (٩٧, ٤) وافضل توازن مائي (١٦,٨٣) وكذلك الحصول على اقل عد بكتيري ($25x10^2$) عند حفظ ازهار الجلاديولس المقطوفة .