



FLORAL CHARACTERS OF GERBERA (*Gerbera jamesonii*) AS AFFECTED BY FOLIAR APPLICATION OF HUMIC ACID AND CALCIUM CHLORIDE

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ABSTRACT: This study was conducted in lath house, Horticultural Department, College of Agriculture, University of Baghdad- Jadriya, Iraq during the spring and fall seasons of 2015 to investigate the influence of foliar application of humic acid and calcium chloride on “Yanara” gerbera cultivar. This study included two factors; humic acid spray (H) and calcium chloride spray (Ca). The first factor was represented by four levels which were; 0 (H₀), 5 (H₅), 7.5 (H_{7.5}) and 10 ml.l⁻¹ (H₁₀) and four levels of calcium chloride; 0 (Ca₀), 50 (Ca₅₀), 100 (Ca₁₀₀) and 150 mg.l⁻¹ (Ca₁₅₀). Data were recorded during spring and fall seasons. The experimental results showed that spraying plants with humic acid at 10 ml.l⁻¹ and calcium chloride at 150 mg.l⁻¹ (H₁₀Ca₁₅₀) gave the highest values of flower number/plant (3.60 and 6.87), flower diameter (8.71 and 11.33 cm), vase life (11.90 and 11.34 day) for both seasons, respectively. The lowest values of these parameters were recorded with control treatment (H₀Ca₀). It could be concluded that spraying plants with humic acid at H₁₀ and calcium chloride at Ca₁₅₀ had improved flower characteristics in gerbera plant cv. Yanara.

Key words: Floral characters, gerbera, foliar application, humic acid, calcium chloride.

INTRODUCTION

Gerbera (*Gerbera jamesonii*) belongs to family *Asteraceae* and has 40 species scattered from Africa to Madagascar into tropical Asia and South America. Gerbera is popular plant for the backyard and their daisy-like bloom make ongoing cut flora (Gowda and Srinivasa, 2009). The leaves are elongated, slim and covered with hair (pubescent) underneath, up to 10 inch lengthy and 4 inch broad (Tjia *et al.*, 2008). Gerbera flora computes 4 to 7 inch transversely and can be fair or tinted lenses of yellow, caroty, crimson or scarlet. The midpoint (eye) of the flower can be green, brown, black or dark red. There are five diverse flora forms primarily base on the rows of petals and how they lie on top: solitary, twice or duplex, crested doubles, full crested doubles and quelled crested doubles (Clay, 1983).

Humic based fertilizers and mineral contents are the excellent combination which provides

the ideal environmental condition for plant growth and development (Dorer and Peacock, 1997). The use of humic acid (HA) is a promising natural resource to be utilized as an alternative for increasing crop production. Humic acids make important contributions to improve soil stability, fertility, improves flower quality that lead to exceptional plant growth and micronutrient uptake (Calvo *et al.*, 2014). Nikbakht *et al.* (2008) studied the exogenous effect of humic acid on flower characteristics and vase life of gerbera flower. Humic acid also improved NPK concentrations, flower quality, flower diameter and flower longevity. Higher humic acid levels prolong the vase life of gerbera flowers.

Calcium is an essential element as well as a crucial regulator of growth and development in plants. It is present in cell walls, so its role relates to cell wall firmness which results in increased disease resistance. It also plays a role

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in developing lateral buds and in meristems with concurring mitoses (Tobias *et al.*, 1992). Calcium treatment causes a delayed protein and phospholipids reduction off the cell membrane; and increases the ATP activity in petals (Malakooti, 2001). Previous studies emphasized the beneficial effects of calcium spray on floral characters and vase life of gerbera flower (Attoa, 2008; Andreasen *et al.*, 2014; Deljou and Gholipour, 2014).

The target of this study was to evaluate floral characters and vase life of “Yanara” gerbera cultivar as affected by foliar application of humic acid and calcium under Iraq conditions.

MATERIALS AND METHODS

This study was conducted in the lath house, Horticultural Department, College of Agriculture, University of Baghdad- Jadriya, Iraq during the spring and fall seasons of 2015 to investigate the influence of humic acid and calcium chloride foliar application on “Yanara” gerbera cultivar. This study included two factors; humic acid spray (H) and calcium chloride spray (Ca). The first factor was represented by four levels *i.e.*; 0 (H₀), 5 (H₅), 7.5 (H_{7.5}) and 10 ml.l⁻¹ (H₁₀) while calcium chloride was included four levels *i.e.* 0 (Ca₀), 50 (Ca₅₀), 100 (Ca₁₀₀) and 150 (Ca₁₅₀) mg.l⁻¹. The statistical layout of this experiment was randomized complete block design. Each treatment was replicated three times. Each replicate contained five plants.

At full flowering stage the following measurements were recorded: number of flowers, flower diameter (cm), length of the flower stalk (cm), fresh weight of flowers and stalk (g) and dry weight of flowers and stalk (g), vase life (day) was determined with visible wilting of petals and their rolling to the outer part (Safa *et al.*, 2012). Data were recorded during spring and fall seasons.

The obtained data were subjected to analysis of variance according to Elsahookie and Wuhaib

(1990) using LSD for comparing differences between various treatment means.

RESULTS AND DISCUSSION

Effects of Humic acid and Calcium on Number of Flowers, Flower Diameter and Length of the Flower Stalk

As shown in Table 1 the maximum number of flowers/plant during spring season were belonged to the combination between the highest humic acid concentration (H₁₀) and medium (Ga₅₀) or high (Ca₁₀₀) concentrations of calcium, without significant difference between both treatments. Moreover, during fall season, the interaction treatments between the highest concentration of humic acid and all applied calcium levels gave the ultimate numbers of flowers, without significant differences among these treatments. It is worth to mention that number of flowers produced during fall season surpassed those obtained during spring season. The largest flower diameter (8.71 and 11.33 cm) were produced during spring and fall seasons, respectively. Concerning flower stalk length, it was observed that the tallest flowers were belonged to the combination treatments between the highest concentration of humic acid (H₁₀) and different calcium levels during either spring or fall seasons.

These results are in parallel with those of Mazhar *et al.* (2012) who studied the effect of four concentrations of humic acid (0, 1, 1.5 and 2%) used as a foliar spray on flower parameters of chrysanthemum plant and found that humic acid (2%) gave a significant increase in flower number. Also these results are in harmony with those obtained by Pradeep *et al.* (2014) on gladiolus, and Palanisamy *et al.* (2015) on gerbera plants. Also these results are in harmony with those obtained by (Attoa, 2008 ; Deljou and Gholipour, 2014) who studied the effect of calcium spray on flower characters of gerbera plants.

Table 1. Effects of foliar application of humic acid and calcium on number of flowers/plant, flower diameter and length of Yanara gerbera cultivar during spring and autumn seasons

Humic acid (ml.l ⁻¹)	Calcium chloride (mg.l ⁻¹)	Number of flowers/plant		Flower diameter (cm)		Flower stalk length (cm)	
		Spring	Fall	Spring	Fall	Spring	Fall
0	0	2.60	4.27	8.42	8.50	38.11	31.44
	50	2.67	4.40	8.76	8.66	43.97	32.49
	100	2.87	4.47	8.50	8.66	45.03	34.18
	150	3.07	4.47	7.65	8.87	33.89	40.16
5	0	2.73	4.67	8.04	8.93	37.78	33.19
	50	2.93	5.47	8.14	9.15	37.84	35.78
	100	2.73	5.20	8.01	10.23	39.51	40.22
	150	3.20	5.53	8.33	10.54	41.46	42.37
7.5	0	2.87	5.27	7.79	9.67	34.04	34.95
	50	3.07	5.80	8.08	9.99	41.25	37.88
	100	3.20	6.07	8.19	10.45	40.04	42.90
	150	3.33	6.27	8.52	10.86	40.88	44.87
10	0	3.00	6.07	8.54	10.26	42.72	37.91
	50	3.27	6.33	8.57	10.53	44.01	40.82
	100	3.40	6.60	8.52	10.07	41.63	45.13
	150	3.60	6.87	8.71	11.33	42.20	47.78
LSD 5%		0.26	0.74	0.22	0.78	2.33	6.46

Effects of Humic Acid and Calcium on Fresh and Dry Weights of Flowers and Stalk and Vase Life

Results presented in Table 2 show that however during spring season there was no significant difference between control treatment and many of applied treatments concerning flower fresh weight, the highest fresh weight of flower was obtained during fall season by spraying plant with the highest concentration of both humic acid (10 ml.l⁻¹) and calcium chloride (150 mg l⁻¹). Dry weight of flower did not significantly affected by spraying plants with either humic acid or calcium chloride at any applied concentration. Vase life of flowers was significantly extended by treating plants with

high concentration of humic acid combined with medium or high concentrations of calcium chloride. These treatments gave the maximum vase life during spring season without significant difference between both treatments. Meanwhile, during fall season the highest vase life values were recorded by treating plants with the medium or high levels of calcium chloride either alone or combined with different concentrations of humic acid without significant differences among these treatments in most cases.

This result is consistent with the findings of Nabigol (2012) on rose plants; Andreasen *et al.* (2015) on gerbera plants and Ali *et al.* (2015) on tulip plants.

Table 2. Effect of foliar application of humic acid and calcium on fresh and dry weights and vase life of Yanara gerbera cultivar flowers during spring and fall seasons

Humic acid (ml.l ⁻¹)	Calcium chloride (mg.l ⁻¹)	Fresh weight of flowers and stalk (g)		Dry weight of flowers and stalk (g)		Vase life (day)	
		Spring	Fall	Spring	Fall	Spring	Fall
0	0	13.82	9.83	1.48	1.27	9.11	9.74
	50	13.21	11.29	1.39	1.33	9.34	10.18
	100	15.11	11.32	1.29	1.34	9.47	10.50
	150	10.00	12.11	1.53	1.39	9.82	10.56
5	0	11.43	11.45	1.20	1.48	9.54	9.90
	50	11.50	13.15	1.26	1.41	9.95	10.27
	100	13.98	13.65	1.52	1.44	10.26	10.71
	150	13.25	14.87	1.39	1.53	10.67	10.96
7.5	0	13.11	19.25	1.45	1.57	10.02	10.07
	50	13.02	15.97	1.05	1.63	10.48	10.35
	100	12.30	16.18	1.28	1.67	10.91	10.79
	150	13.21	18.33	1.17	1.70	11.05	11.12
10	0	13.05	19.88	1.57	1.59	10.41	10.39
	50	16.63	20.78	1.32	10.62	10.80	10.88
	100	14.23	23.92	1.06	1.60	11.66	11.18
	150	13.46	28.28	1.12	1.55	11.90	11.34
LSD 5%		0.92	4.04	N.S	N.S	0.74	0.92

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تأثير الإضافة الورقية لحمض الهيوميك وكلوريد الكالسيوم على الخصائص الزهرية لنبات الجيربيريا

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أجريت هذه التجربة في الظلة النباتية التابعة لقسم البستنة وهندسة الحدائق، كلية الزراعة، جامعة بغداد، الجادرية، العراق خلال الموسمين الربيعي والخريفي لعام 2015 لمعرفة تأثير رش حامض الهيوميك وكلوريد الكالسيوم على صنف الجيربيريا Yanara، وقد تضمنت الدراسة عاملين هما الرش بحامض الهيوميك (H) وكلوريد الكالسيوم (Ca)، العامل الأول كان في أربعة مستويات هي صفر (H₀) و 5 (H₅) و 7.5 (H_{7.5}) و 10 ملجم/لتر⁻¹ (H₁₀) والعامل الثاني بأربعة مستويات من كلوريد الكالسيوم هي صفر (Ca₀) و 50 (Ca₅₀) و 100 (Ca₁₀₀) و 150 ملجم/لتر⁻¹ (Ca₁₅₀)، وقد أظهرت النتائج أن معاملة التداخل Ca₁₅₀H₁₀ قد تفوقت على باقي المعاملات من حيث عدد الأزهار (3.60 و 6.87 زهرة) وقطر الزهرة (8.71 و 11.33 سم) العمر المزهري (11.90 و 11.34 يوم) لموسمي الدراسة، بالتتابع، وقد سجلت أقل القيم لهذه القياسات في معاملة المقارنة Ca₀H₀، ونستنتج من هذا البحث أن معاملة رش النباتات بحامض الهيوميك عند المستوى H₁₀ وكلوريد الكالسيوم عند المستوى Ca₁₅₀ قد أدت إلى تحسين الصفات الزهرية في نباتات الجيربيريا صنف Yanara.

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