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Response of *Fressia hybrida* plant to spraying with liquid universal fertilizer and Salicylic acid in growth parameters

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Abstract

An experiment was conducted at the lath house of Agriculture Faculty \Kufa University during the growing seasons of 2015-2016 to study the response of freesia plant to spraying liquid universal fertilizer and salicylic acid on growth parameters. Experiment was adopted a Randomized Complete Block Design (R.C.B.D) with three replicates in two factors. First three concentration of spraying liquid universal fertilizer *i.e.*(0, 3 and 6)ml.L⁻¹. Second three concentration of Salicylic acid *i.e.*(0, 40and 80)mg.L⁻¹. Means were compared by using the Least Significant Difference (L.S.D.) test at probability 0.05

Results showed that spraying liquid universal fertilizer at a concentration 6ml.L⁻¹ and Salicylic acid at a concentration of 40mg.L⁻¹ significantly increased the number of leaves per plant, shoot dry weight, number of inflorescence per plant, inflorescence stalk length, diameter of inflorescence stem, number of florets per inflorescence, diameter of florets, floret dry weight to 7.33 leaf.plant⁻¹, 5.15g, 7.33 inflorescence. plant⁻¹, 42.03cm, 5.43mm, 13.33mm,7.93cm and 3.10g respectively, and decrease the number of the days until opening the first flower bud to 140.60days. Spraying liquid universal fertilizer at a concentration of 6ml.L⁻¹ and Salicylic acid at a concentration of 80mg.L⁻¹ significantly increased the content of total chlorophyll and carbohydrates to 41.77mg.100g⁻¹fresh weight and 13.43mg.100g⁻¹ dry weight, , compared to the control treatment which gave the lowest vales (3.66 leaves.plant⁻¹, 2.37g, 3.33inflorescence. plant⁻¹, 30.13cm, 1.60mm, 6.33floret. inflorescence⁻¹ ,3.36cm and 1.08g, 35.11mg.100g-1 fresh weight, 7.50mg.100g-1 dry weight respectively), and increased the days until opening the first flower bud to 169days.

Introduction

The freesia plant is belong to Iridaceae family, it is a corm plant, with wintry herbaceous that reached 40cm in height, inflorescences in different colors such as white, yellow, red an aromatic odor, its flowers are suitable for picking, it is native to South Africa[1].Planting in basin, its prefer light soils rich organic matter[2].

Foliar nutrition is defined as spraying liquid nutrients through the leaf surfaces into the tissue of a plant. Kannan(1980)[3] and Joly (1993)[4] mentioned that foliar nutrition were economy way because it is decrease the quantity of the miner nutrients compared to anther ways, also it is quick responsibly, but it's not altimetry to soil fertilization[5]. Abbass *et al.* (2016)[6] found that sprayer foliar nutrition KomBe at a

concentration of 4ml. L⁻¹ on *Antirrhinum majus* L. plant increased the number of leaves, shoot dry weight, length inflorescence and the number of flowers per inflorescence. Abbass *et al.* (2013)[7] stated that spraying PRO.SOIL nutritional solution on *Cazania splendor* L. at a concentration of 10mg. L⁻¹ significant increased the number leaves, shoot dry weight, content of total chlorophyll and total carbohydrates in leaves, number of flower per plant and dry weight of flowers. Safana (2103)[8] found that spraying Humic fertilizer on Dahlia hybrid plant increased in leaves area and stem length of inflorescence. Salicylic acid was a phenol compound, chemical structure was C₆H₄(OH)COOH[9] that organizes the growth and flowering of the plant, effecting in many biological processes in plant, such as flowering stimulated, formation of chlorophyll and efficiency photosynthesis, via its roles in cells division and elongation[10]. Martin- Max *et al.*(2003)[11] noted that treated *Sinninga specios* L. with Salicylic acid at a concentration of 10⁻⁸mol increased the number of leaves. Al- Abbasi *et. al.*(2015)[12] stated that spraying *Zinnia elegans* L. with Salicylic acid at a concentration of 50mg. L⁻¹ increased the number of leaves, number of flower per plant and flowers dry weight.

For the important of freesia plant as a international cut flower[13]. This study aim to encouragement the logical product(liquid universal fertilizer product in Basrah university) and Salicylic acid to improvement growth and flowering parameters.

Material and Methods

An experiment were carried out in the lath houses of the University of Kufa Faculty of Agriculture during the growing season 2015 – 2016, Freesia plant that were planted on 2016 \ 10 \ 15 from the producer Inc. De Ree Holland, in pots with a diameter of 25cm which contain 4kg of sandy soil(soil texture were 2.00 Clay, 5.20, Sand 92.80). Soil pH, Electric Conductivity (Ec) , Organic matter, N, P, K⁺ were 7.20, 3.40Ds.M⁻¹, 0.95%, 0.55ppm, 2.55mg.L⁻¹, 15.20mm.L⁻¹ respectively.

The experiment was adopted into Randomized Complete Block Design (R.C.B.D) with two factors, three concentrations of liquid universal fertilizer product in Department of Soil Science and Water Resource\ College of Agriculture\ Basrah university\ Iraq. Its combination(7%N, 5%P, 0.5%Mg and Potassium humiate) i.e.(0, 3 and 6ml. L⁻¹) and three concentrations of Salicylic acid i.e. (0, 40 and 80mg.L⁻¹)[4]. Liquid universal fertilizer and Salicylic was first sprayed after three true leave stage, the second spray was conducted after 21 days from the first spray. Their means were compared by Least Significant Difference(L.S.D) at the probability level 5% (Al-Rawi and Khalaf Allah(2000)[14]. All service operations like irrigation and weeding for this experimental units were done when required. At the end of the experiment in 01\02\2017 we measured the following parameters:

Number of leaves(leaf.plant⁻¹), shoot dry weight(g):The shoot were dried in oven of 65C° for 72 hours until the weight stabilized. Content of total chlorophyll in leaves(mg.100g⁻¹ fresh weight): estimated according to Goodwin (1976)[15]. Total soluble carbohydrates in leaves(mg.g⁻¹ dry weight): measured according to Duboies *et.al*(1956)[16], number of inflorescence per plant(inflorescence. plant⁻¹), inflorescence stalk length(cm), diameter of inflorescence stem(mm): measured by Varner calipers, floret diameters(cm): measured by Varner calipers between two far points, number of floret per inflorescence(floret. Inflorescence⁻¹), floret dry weight: the floret were dried in a well- ventilated room for ten days until the weight stabilized and number of days until opening the first flower bud (days): measured from corms cultivation to the opening the first flower bud.

Results and Discussion

Resulted in Table(1)show that spraying liquid universal fertilizer at a concentration of 6ml.L⁻¹ significantly increased the number of leaves per plant to 6.22 leaf.plant⁻¹, shoot dry weight to 4.22g, content of total chlorophyll in leaves to 39.74 mg.100g⁻¹ fresh weight and content of total soluble carbohydrates to

12.05 mg.g⁻¹ dry weight respectively compared with the control treatment which gave the lowest values(4.00 leaf.plant⁻¹, 2.58g. 35.54 mg.100g⁻¹ fresh weight and 7.49 mg.g⁻¹ dry weight respectively).

Spraying Salicylic acid at a concentration 40mg.L⁻¹ also significantly increased the number of leaves per plant to 5.44 leave.plant⁻¹ and shoot dry weight to 3.77g respectively. Spraying Salicylic acid also at a concentration of 80mg.L⁻¹ significantly increased the content of total chlorophyll in leaves to 38.55 mg..100g⁻¹ fresh weight and content of total soluble carbohydrates to 10.57 mg.g⁻¹ dry weight respectively, compared to the treatment that only used distilled water (control) which gave the lowest values(4.66, 2.98. 37.02 and 9.16 respectively) (Table 1).

From the interaction between the two factors result showed that spraying liquid universal fertilizer at a concentration of 6ml. L⁻¹ and Salicylic acid at a concentration of 40mg.L⁻¹ significantly increased the number of leaves per plant to 7.33 leaf. plant⁻¹, shoot dry weight to 5.15g , Spraying liquid universal fertilizer at a concentration of 6g. L⁻¹ and Salicylic acid at a concentration of 80mg.L⁻¹ also significantly increased the content of total chlorophyll in leaves to 41.77 mg.100g⁻¹ fresh weight and content of total soluble carbohydrates to 13.43 mg.g⁻¹ dry weight respectively. Meanwhile control treatment gave the lowest values.(Table 1).

Resulted in Table(2) showed that spraying liquid universal fertilizer at a concentration of 6ml.L⁻¹ significantly increased the number of inflorescence per plant to 5.56 inflorescence. plant⁻¹, inflorescence stalk length to 39.82cm, and diameter of inflorescence stem to 4.52mm, floret per inflorescence. floret to 10.11floret. Inflorescence⁻¹, diameters of inflorescence to 6.51 and florets dry weight 2.64g and decreased the number of days until opening the first flower bud to143.00 days, compared to the control treatment which gave the lowest values(3.89, 31.03, 1.78, 3.63 and 1.39 respectively), and increased the number of days until opening the first flower to 163.70 days.

Spraying Salicylic acid at a concentration 40mg.L⁻¹ significantly increased the number of inflorescence per plant to 5.44 inflorescence. plant⁻¹ and number of floret per inflorescence to 9.44 floret. Inflorescence⁻¹. Meanwhile Spraying Salicylic acid at a concentration 80mg.L⁻¹ significantly increased the inflorescence stalk length to 36.04cm, diameter of inflorescence stem to 3.57mm, floret diameters to5.53 cm and florets dry weight to 2.52g, and decreased the number of days until opening the first flower bud to 149.80 days, compared to the distilled water only spraying treatment (control) which gave the lowest values(4.11inflorescence. plant⁻¹, 33.51cm,2.57mm, 7.56floret.inflorescence-1, 4.33cm and 1.62g) respectively, and increased the number of days to flowering time to 133.00days (Table 2).

Spraying liquid universal fertilizer at a concentration of 6ml. L⁻¹ and Salicylic acid at a concentration of 40mg.L⁻¹ significantly increased the number of inflorescence per plant to 7.33 inflorescence. plant⁻¹, inflorescence stalk length to 42.03cm, and diameter of inflorescence stem to 5.43mm, floret diameters to 7.93cm, florets dry weight 3.10g and decreased the number of days until opening the first flower bud to140.00 days, compared to distilled water spray treatment (control) which gave the lowest values(3.33 inflorescence. plant⁻¹, 30.13cm, 1.60mm, 3.36cm, 6.33 floret. Inflorescence⁻¹ and 1.08g respectively), and increased the number of days until opening the first flower bud 169.00 days (Table 2).

Results in Table (1) showed that there was a significant effect in growth parameters when Liquid universal fertilizer were sprayed, that may be due to the availability of nutrient in the solution such as nitrogen which plays an important role in plant growth where nitrogen is directly involved in chlorophyll structure, along with magnesium, and also amino acids, protein and enzymes. Nitrogen plays a crucial role in biosynthetic activities, photosynthesis[17]. It promotes hormones activation which helps increasing cell size and elongation[18]. Phosphorous likewise plays an important role in number of biosynthetic processes through its role, in production of high energy components, i.e., ATP, cell division, chloroplast membranes and nucleic and amino acids components[19]. Magnesium plays an important role in the manufacture of chlorophyll molecule and activate many enzymes[18].Organic matter rich in the nitrites like nitrogen, phosphorus, potassium and micro element, in addition to Humic acid and Humin [20]. Organic matter also content natural growth regulator such as Cytokinnan, vitamins and amino acid(Molo and Oilveria

(1999)(21), finally that lead to improves growth parameters of plant. These results are in agreement with Abbass *et al.* (2013)[7] on *Cazania splender* L. plant.

Table -1: Effect of spraying Liquid universal fertilizer and Salicylic acid and their interaction on growth characteristics of Freesia plant

Treatments		Number of leaves (leaf.plant ⁻¹)	Shoot dry weight (gm)	Leaves content of Total Chlorophyll (mg.100gm ⁻¹ fresh weight)	Leaves content of Total Soluble Carbohydrates (mg. g ⁻¹ dry weight)	
Liquid universal fertilizer (g..L ⁻¹)	0	4.00	2.58	35.54	7.49	
	3	5.00	3.30	37.39	9.52	
	6	6.22	4.22	39.74	12.05	
L.S.D. 0.05		0.402	0.319	0.588	0.273	
Salicylic acid(mg.L ⁻¹)	0	4.66	2.98	37.02	9.16	
	40	5.44	3.77	37.10	9.77	
	80	5.11	3.35	38.55	10.57	
L. S. D 0.05		0.402	0.319	0.588	0.273	
Liquid universal fertilizer X Salicylic acid	0	0	3.66	2.37	35.11	7.50
		40	4.00	2.76	35.56	7.93
		80	4.33	2.61	35.95	8.40
	2	0	4.66	2.89	36.69	9.16
		40	5.00	3.39	37.57	9.50
		80	5.33	3.62	37.92	9.90
	4	0	5.66	3.67	39.51	10.83
		40	7.33	5.15	37.94	11.90
		80	5.66	3.83	41.77	13.43
L.S.D. 0.05		0.696	0.552	1.018	0.473	

Table (2) show that were significant increases in flowering parameters when spraying Liquid universal fertilizer that may be related to the role of nutritional solution component (N, P, Mg and Potassium humiate), This nutrients stimulates enzymes activity, cell division and protein synthesis which improve plant tissue growth[22]. Potassium also has indirect role in transporting carbohydrates and protein to the flowers during plant growth stages, which is reflected by the increase in flowering parameters. These results are supported by Abbass *et al.* (2016)[6] results on *Antirrhinum majas* L.

Results in Table (1) showed that there were a significant effect in growth parameters by applying Salicylic acid that may be due to the important physiological roles of Salicylic acid in plant growth, absorption of ions by plant, also stimulating chlorophyll formation, some enzymes and photosynthesis processes that lead to activated carbohydrates manufacturing, also it was suggested that it has an important role in the synthesis of chloroplasts[17], finally that lead to improved growth parameters. Similar findings have been reported by Al- Abbasi *et al.*(2015)[12] on *Zinnia elegans* L. plant.

Results in Table(2) showed that were a significant increase in flowering parameters when spraying Salicylic acid that may be due to the role of SA which is attributable to improve vegetative growth(Table 1) and that lead to an increase in the absorption of nutrients, also it promotes photosynthesis in plant that lead to increased carbohydrate manufacturing which affected clearly in the differentiation of flowers and increased their number of inflorescence and floret. Salicylic also involve in Auxin increasing, which enhance flower growth[23] and [24], finally improved flowering parameters. Similar result have been mentioned by Al-Dulaymy (2012)[25] on Chinese ester plant *Callistephus chinensis* L

Table -2: Effect of spraying Liquid universal fertilizer and Salicylic acid and their interaction on growth characteristics of Freesia plant

Treatment		number of inflorescence per plant (inflorescence. plant ⁻¹)	inflorescence stalk length (cm)	diameter of inflorescence stem(mm)	number of floret per inflorescence (floret. Inflorescence ⁻¹)	Floret diameter (cm)	Floret dry weight (g)	number of days until opening the first flower bud (days)	
Liquid universal fertilizer (g..L ⁻¹)	0	3.89	31.03	1.78	6.78	3.63	1.39	163.7	
	3	5.33	34.64	3.13	8.56	5.18	2.35	150.8	
	6	5.56	39.82	4.52	10.11	6.51	2.64	143.0	
L.S.D 0.05		0.548	0.462	0.219	0.535	0.322	0.248	0.726	
Salicylic acid(mg.L ⁻¹)	0	4.11	33.51	2.57	7.56	4.33	1.62	155.7	
	40	5.44	35.94	3.28	9.44	5.46	2.18	151.8	
	80	5.22	36.04	3.57	8.77	5.53	2.52	149.8	
L. S.D 0.05		0.548	0.462	0.219	0.535	0.322	0.248	0.726	
Liquid universal fertilizer X Salicylic acid	0	3.33	30.13	1.60	6.33	3.36	1.08	169.0	
	40	3.67	30.80	1.83	6.67	3.66	1.40	164.0	
	80	4.67	32.16	1.93	7.33	3.86	1.69	158.3	
	0	4.33	32.86	2.56	7.67	4.30	1.66	154.3	
	3	40	5.33	35.00	2.60	8.33	4.80	2.04	151.6
	80	6.21	36.06	4.23	9.67	6.46	3.36	146.6	
	0	4.67	37.53	3.56	8.67	5.33	2.32	144.3	
	6	40	7.33	42.03	5.43	13.33	7.93	3.10	140.0
	80	4.61	39.90	4.56	8.33	6.26	2.51	144.6	
L. S.D 0.05		0.950	0.430	0.558	0.927	0.558	0.430	1.257	

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