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Hussein Wissam Kharbat
 Department of Horticulture
 and Landscape Engineering,
 College of Agriculture, Al-
 Qasim Green University,
 Babylon, Iraq

Manar Ismail Alwan
 Department of Horticulture
 and Landscape Engineering,
 College of Agriculture, Al-
 Qasim Green University,
 Babylon, Iraq

Mahmoud Haider Salim
 Department of Horticulture
 and Landscape Engineering,
 College of Agriculture, Al-
 Qasim Green University,
 Babylon, Iraq

Corresponding Author:
Hussein Wissam Kharbat
 Department of Horticulture
 and Landscape Engineering,
 College of Agriculture, Al-
 Qasim Green University,
 Babylon, Iraq

Effect of adding organic fertilizers and spraying with calcium chloride on some flowering and chemical traits of freesia plants

Hussein Wissam Kharbat, Manar Ismail Alwan and Mahmoud Haider Salim

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Abstract

The experiment was conducted in one of the nurseries affiliated with Babylon province in 2023 to study the effect of adding organic fertilizers and spraying with calcium chloride on some flowering and chemical traits of freesia plants. A factorial experiment was conducted with two factors and three replicates. The first factor included two types of organic fertilizers and was designated F1, including (F1) humic acid at a concentration of 2 ml/L F2, and seaweed extract at a concentration of 2 ml/L in addition to the control treatment (F0). The second factor, represented by calcium chloride, included concentrations (C2 4, C1 2 ml/L in addition to the control treatment (C0). The results showed that calcium chloride had a significant effect on the inflorescence weight and the stalk diameter in treatment C2. As for the interaction between the treatments, treatment C2F3 achieved a significant increase in inflorescence weight and stalk diameter, while treatment C3F2 achieved a significant increase in the inflorescence age on the plant, nitrogen content, and phosphorus content, while treatment C1F3 significantly increased potassium content.

Keywords: Freesia, organic fertilizers, calcium chloride

1. Introduction

Freesia. *Freesia hybrid L.* is a winter annual bulb native to South Africa and belongs to the monocotyledonous *Iridaceae* family, which includes more than 50 genera, including 19 species. The common genus is a hybrid derived from the freesia subspecies *F. techinnni*, *F. carymbese*, *F. refacta*, *F. alba*, and *Arumitage* (Laushman, 2003) [9]. Freesia is a potted plant, as well as being cultivated in containers. The plant reaches a height of approximately 30-40 cm. The leaves are flat, sword-shaped, green, and the flowers are funnel-shaped. The inflorescence is comb-shaped and has an attractive, fragrant scent. It is arranged in clusters and bears the flower stalks on a flower stalk that is tilted at a right angle of 29° to the rest of the flower stalk. The number of flowers ranges from 4-10, and they come in various colors. Yellow, red, carnation, blue, cream, and white. The fruit is a three-lobed capsule containing black seeds. The freesia plant was discovered in South Africa more than 200 years ago, and commercial flower production dates back to 1873. Specialists became interested in improving the freesia plant in 1900, after which they were able to obtain freesia bulbs with multi-colored flowers. It became known in Europe in 1945, and the cultivated area is estimated at 600 hectares (Al-Masry, 2004) [4]. Foliar or ground application of organic fertilizers is considered one of the most important factors that increase the growth, completion, and quality of flowers (Abu Dahi *et al.*, 1988) [5]. These are substances produced from animal waste and plant remains and are rich in water and carbon compounds (Mengel, 1982) [18]. Humic acid is one of the economic and commercial products that is widely used at the present time (Anonymous, 2005), and contains many nutritional elements that increase the growth and yield of the plant (Lee, Bartlette, 1976) [17], as (Al-Araji and Al-Hamdani, 2012) [6]. indicated that humic acid is considered the most important component of humus due to its high cation exchange capacity. It contains nitrogen, carbon, oxygen and hydrogen in varying proportions, resulting in the formation of compounds with different molecular

weights (Sensei, 1992). Baldotto, 2013) ^[11]. explained that adding humic acid to Caladium plants at concentrations of (20, 30, 40, 10) mmol. L⁻¹ led to an increase in the number of flowers and inflorescences. Seaweed extracts are considered an organic resource used in agricultural production, as they complement fertilizers, not replace them (Nooris, 2012). These extracts stimulate plant growth, leading to improved chemical and physical properties due to their content of macro- and micronutrients and growth regulators, such as auxins, cytokinins, organic and amino acids, vitamins, hormones, and polysaccharides. They also increase the plant's tolerance to salinity and drought (Verkleij, 1992) ^[25]. Al-Dulaimi (2005) ^[1]. demonstrated that applying a seaweed extract at a concentration of 2 ml/L to carnation plants improved flower characteristics. Calcium chloride has been widely used as an essential element, as it is a component of the middle lamella of the cell wall and plays an important role in activating many enzymes (Schnacher *et al.*, 1977) ^[23].

Materials and Methods

The experiment was conducted in a nursery in Babylon province during the fall season of 2023 to study the effect of adding organic fertilizers and spraying with calcium chloride on flowering and chemical characteristics. Freesia corms of the white variety *Freesia leichtlinii* subsp. *alba* were obtained from a Turkish agricultural company. Healthy corms of consistent size and weight were selected and distributed in pots with a diameter of (13) cm, with one corm per pot. The pots were filled with a culture medium consisting of river sand and peat moss at a ratio of 1:3. A factorial experiment was carried out with two factors and three replicates. The first factor included two types of organic fertilizers and was symbolized by F1, including F2: humic acid at a concentration of 2 ml/L, and F0: seaweed extract at a concentration of 2 ml/L, in addition to the control treatment. The second factor, represented by calcium chloride, included concentrations of (C2 4, C1 2 ml/L, in addition to the control treatment C0). The randomized complete block design (RCBD) was used, and the data were analyzed according to the Gen Stat program. The averages were compared by choosing the least significant difference (LSD) at the probability level. 0.05 (The Narrator and Khalaf Allah, (2000).

Traits studied

Flowering Traits

Inflorescence Weight

The weight of five inflorescences from the experimental unit's plants was calculated, and the average for the experimental unit was calculated from this.

Inflorescence Diameter

Five plants were randomly selected from each experimental unit, and the diameter of their inflorescences was measured in the area below the flower at the second node using a Micro Vernier digital caliper, and the average was then calculated.

Inflorescence Age: The number of days from the opening of the first inflorescence of each plant in the experimental unit until the loss of its decorative value was calculated. The average for each experimental unit was then calculated.

Chemical traits

Nitrogen Content

The percentage of nitrogen was estimated using a nitrogen distillation apparatus (Macrokjeldhal, Germany) according to the method (Cresser, Parsons, 1979). This was accomplished by adding 10 ml of the digested sample solution and 10 ml of NaOH (35%) to a distillation flask containing 50 ml of H₃BO₃ (4%) in the apparatus to collect the ammonia (NH₄). The contents were boiled to distill the ammonia for 10-15 minutes. The acid containing the ammonia was then titrated with sulfuric acid (0.05 M). The volume of acid consumed (during the titration process) was then calculated. The equation below was used to estimate the percentage of nitrogen:

$$100 / ((\text{digested sample weight}) \times (\text{total sample volume}) / (\text{volume used for estimation}) \times (\text{equivalent nitrogen weight} \times \text{standard} \times \text{consumed acid volume}) / 1000 = \text{Nitrogen (\%)})$$

Phosphorus content: The percentage of phosphorus was estimated in a spectrophotometer at a wavelength of 420 nm, according to the method of spectral phosphorescence molybdate mentioned in (Cressero, 1979) and according to the following equation:

$$p\% = \frac{Cx \, df \times 100}{1000000} = \frac{Cx \times 1000 \times 100}{1000000} \times \frac{C}{10}$$

Represents

C: Phosphorus concentration (μg mL⁻¹) as measured in the standard curve.

df: Dilution factor, which is 100 x 10 = 1000, and is calculated as follows:

0.2 g of sample diluted to 100 ml (100 times).

5 ml of sample solution diluted to 50 ml (10 times).

1000000: Conversion factor from micrograms to grams.

Potassium content: Potassium was estimated according to the method followed by (Hesse, 1971) using a flame-photometer.

Results and Discussion

Flowering Traits

Inflorescence Weight

The results of Table 1 showed that organic fertilizers had no significant effect on inflorescence weight, while calcium chloride had a significant effect on inflorescence weight, with the highest mean for the trait reaching 4.92 g in treatment C2, while treatment C1 had the lowest mean for the trait, reaching 4.23 g.

The interaction between organic fertilizers and calcium chloride showed a significant superiority for the C2F3 treatment, which recorded the highest mean for the trait, reaching 5.35, while treatment C1F2 recorded the lowest mean for the trait, reaching 4.10 g.

Table 1: Effect of organic fertilizers, calcium chloride and their interactions on inflorescence weight

Organic fertilizers F	Calcium chloride C			Average
	C1	C2	C3	
F1	4.17	4.36	4.56	4.36
F2	4.10	5.06	5.30	4.36
F3	4.42	5.35	4.85	4.36
Average	4.23	4.92	4.90	
L.S.D, 0.05	C, 0.647		F, 0.647	interaction 1.120

Flower stalk diameter

The results of Table 3 showed that organic fertilizers had no significant effect on flower stalk diameter, while calcium chloride had a significant effect on flower stalk diameter. Treatment C2 recorded the highest mean for the trait, at 3.340 cm, while C1 recorded the lowest mean for the trait, at 2.720 cm.

The interaction between organic fertilizers and calcium chloride showed a significant superiority in C2 F3, recording the highest mean for the trait, at 3.527 cm, while C1 F2 recorded the lowest mean for the trait, at 2.577 cm.

Table 2: Effect of organic fertilizers, calcium chloride, and their interactions on flower stalk diameter

Organic fertilizers F	Calcium chloride C			Average
	C1	C2	C3	
F1	2.780	3.130	2.940	2.950
F2	2.577	3.363	3.473	3.138
F3	2.803	3.527	3.027	3.119
Average	2.720	3.340	3.147	
L.S.D 0.05	C 0.2452	F 0.2452		interaction 0.4248

3. The age of the inflorescence on plant

The results of Table 3 showed that the organic fertilizer factor did not show any significant difference in inflorescence age on the plant, nor did calcium chloride. However, the interaction between organic fertilizers and

calcium chloride did show a significant difference, as the C3 F2 factor recorded the highest yield for the trait, at 12.67 days, while the C3 F1 factor recorded the lowest yield for the trait, at 9.00 days.

Table 3: Effect of organic fertilizers, calcium chloride, and their interactions on inflorescence age on the plant (days)

Average	Calcium chloride C			organic fertilizers F
	C3	C2	C1	
9.89	9.00	11.00	9.67	F1
11.00	12.67	11.00	9.33	F2
9.89	9.33	9.67	10.67	F3
	10.33	10.56	9.89	Average
interaction 3.619	F N.S		C N.S	L.S.D عند مستوى 0.05 احتمال

Chemical traits

1. Nitrogen Percentage: N

The results of Table 1 showed that organic fertilizers did not show any significant difference in nitrogen content, while calcium chloride did. Treatment C3 recorded the highest yield for the trait, at 2.246 cm, while C1 recorded the lowest yield for the trait, at 1.500 cm.

The interaction between organic fertilizers and calcium chloride showed a significant superiority in C3 F2, which recorded the highest yield for the trait, at 2.380 cm, while C1 F1 recorded the lowest yield for the trait, at 1.437 cm.

Table 4: Effect of organic fertilizers, calcium chloride, and their interactions on leaf nitrogen content

Average	calcium chloride C			organic fertilizers F
	C3	C2	C1	
1.979	2.212	2.287	1.437	F1
2.025	2.380	2.231	1.465	F2
1.888	2.147	1.923	1.596	F3
	2.246	2.147	1.500	Average
Interaction, 0.8945	F, N.S		C, 0.5164	L.S.D, 0.05

2. Phosphorus percentage (P)

The results of the table showed that the organic fertilizer factor did not show any significant difference in the percentage of phosphorus within the plant, while calcium chloride had a significant difference. Treatment C2 recorded the highest yield for the trait, reaching 0.393 cm, while C1 recorded the lowest yield for the trait, reaching 0.180 cm.

The interaction between organic fertilizer and calcium chloride showed a significant superiority in C3 F2, which recorded the highest yield for the trait, reaching 0.463 cm, while C1 F1 recorded the lowest yield for the trait, reaching 0.131 cm.

Table 5: Effect of organic fertilizers, calcium chloride, and their interactions on leaf phosphorus content

Average	Calcium chloride C			organic fertilizers F
	C3	C2	C1	
0.283	0.269	0.449	0.131	F1
0.336	0.463	0.392	0.154	F2
0.277	0.239	0.337	0.255	F3
	0.324	0.393	0.180	Average
interaction 0.1240	F N.S		C 0.0716	L.S.D 0.05

3. Percentage of phosphorus (K): The results of Table 3 showed that organic fertilizer treatments showed no

significant difference in potassium, and calcium chloride also showed no significant difference in potassium. However, the interaction between organic fertilizers and calcium chloride showed a significant difference, with the C1F3 factor recording the highest yield for the trait, at 3.057, while the C2F1 factor recorded the lowest yield for the trait, at 2.173.

Table 6: Effect of organic fertilizers, calcium chloride, and their interactions on leaf potassium content

Average	calcium chloride C			Organic fertilizers F
	C3	C2	C1	
2.516	2.677	2.173	2.697	F1
2.587	2.507	2.803	2.450	F2
2.762	2.577	2.653	3.057	F3
	2.587	2.543	2.734	Average
interaction 0.8316	F N.S		C 0.4801	L.S.D 0.05

The results showed that treatment with calcium chloride led to an increase in leaf content of elements such as nitrogen, phosphorus, and potassium. This is because calcium improves the structure of cell walls, including root tissue, and thus improves the active absorption of elements, increasing their concentration within the plant (Al-Sahaf, 1989) [7]. These results are consistent with what was found

by Sahi (2006) ^[6]. on Halq al-Saba' plants and Atto (2008) ^[10]. on Gerbera plants. Calcium is also important in the plant life cycle, playing a key role in the process of meiosis, thus increasing flower growth. This is consistent with what Sharma *et al.* (2013) ^[24]. found on Gladiolus plants, which was effective in improving most traits, especially inflorescence and flower size

References

1. Al-Dulaimi HA. The effect of some nutrients, growth media, and cultivation methods on carnation flower production. Master's thesis, College of Agriculture, University of Basra; 2005. 125 p.
2. Al-Zaidi KAN. The effect of adding wheat peat and spraying its extract on the growth and production of red cabbage. Master's thesis, College of Agriculture, University of Baghdad; 2016.
3. Safanah HS. The effect of humic acid spraying on some vegetative and flowering growth traits of Dahlia hybrida. Thi Qar University Journal of Agricultural Research. 2013;2(1):[page numbers].
4. Al-Masry JR. Ornamental plants and garden landscaping, home gardens. Amman: Dar Al-Shorouk for Publishing and Distribution; 2004.
5. Abu Dahi YM, Al-Younis MA. Plant nutrition guide. Baghdad: Dar Al-Hikma Printing and Publishing House; 1988.
6. Al-Araji JMA, Al-Hamdani RI. Organic agriculture and the environment. Mosul: College of Agriculture and Forestry, University of Mosul; 2012.
7. Al-Sahaf FH. Agriculture systems without the use of soil. Baghdad: House of Wisdom for Publication, Translation and Distribution; 1989.
8. Ecochem. Humic acid, organic plant food and root growth promoters. [Internet]. [cited 2007 Feb 17]. Available from.
9. Armitage A, Laushman J. Specialty cut flowers. 2nd ed. Portland (OR): Timber Press; 2003.
10. Attoa GE. Response of gerbera to mineral fertilizers, irrigation intervals, and growth retardants. Annals of Agricultural Science, Moshtohor. 2008;46(1):21-30.
11. Baldotto MA, Baldotto LEB. Gladiolus development in response to bulb treatment with different concentrations of humic acids. Rev Ceres. 2013;60(1):138-142.
12. Brunetti G, Plaza C, Clapp CE, Senesi G. Compositional and functional features of humic acids from organic amendments and amended soils in Minnesota, USA. Soil Biol Biochem. 2006;39:1355-1365.
13. Hassan FAS. Postharvest studies on some important flower crops. Doctoral thesis, Department of Floriculture and Horticulture, Corvinus University of Budapest; 2005.
14. He S, Lopyce DC, Irving DE, Faragher JD. Stem end blockage in cut Grevillea 'Crimson Yul-lo' inflorescences. Postharvest Biol Technol. 2016;41(1):78-84.
15. Hopkins WG, Hüner N. Introduction to plant physiology. 3rd ed. New York: John Wiley & Sons; 2003.
16. Kirsten RS, Asger RP. Increased levels of calcium in nutrient solution improve the postharvest life of potted roses. J Am Soc Hortic Sci. 1997;122(6):863-868.
17. Lee YS, Bartlett RJ. Stimulation of plant growth by humic substances. Soil Sci Soc Am J. 1976;40:876-9.
18. Mengel K, Kirkby EA. Principles of plant nutrition. 4th ed. Bern: International Potash Institute; 1982.
19. Morales-Payan JP, Norrie J. Accelerating the growth of avocado (*Persea americana*) in the nursery using a soil-applied commercial extract of the brown alga *Ascophyllum nodosum*. In: International Seaweed Symposium; 2010; [Location]. [Publisher]; 2010. p. [page numbers].
20. Peter MB, Carl JR, Harold FW. Leaf edge burn and axillary shoot growth of vegetative poinsettia plants: influence of calcium, nitrogen form, and molybdenum. J Am Soc Hortic Sci. 1990;115(1):73-78.
21. Sadik KS, Al-Taweel NS, Dhyeab NS, Kalaf MZ. New computer program for estimating leaf area of several vegetable crops. Am Eurasian J Sustain Agric. 2011;5(2):304-309.
22. Sahi BG. Effect of liquorice root extract and calcium chloride spray on growth and flowering of *Antirrhinum majus* L. Iraqi J Agric Sci. 2006;37(3):39-44.
23. Schnnacher R, Frankhauser F, Stadler W. Experiments with calcium chloride, antitranspirants, and boric acid to reduce the occurrence of bitter pit. Hort Abst. 1977;047-02306.
24. Sharma J, Gupta AK, Kumar C, Gautam RKS. Influence of zinc, calcium, and boron on vegetative and flowering parameters of gladiolus cv. Aldebran. The Bioscan. 2013;8(4):1153-1158.
25. Verkleij FN. Seaweed extracts in agriculture and horticulture: a review. Biol Agric Hortic. 1992;8(4):309-24.