Effect of spraying with alpha tocopherol and soaked black cumin extract on root growth and chemical traits of *Freesia hybrid* L.

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Abstract:

The experiment was conducted during season 2021-2022 in a fabric lathhouse covered with a saran cover belonging to the Department of Horticulture and Landscaping at the College of Agriculture / University of Basrah, To study the effect of spraying with alpha tocopherol and extract of black cumin soaked on the vegetative and flowering growth of Freesia hybrid L.For spraying with alpha-tocopherol at a concentration of (0,60,120) mg.L⁻¹ and the extract of soaked black cumin $(0,40,80 \text{ g.L}^{-1})$ The experiment was carried out in a completely randomized design (R.B.C.D) Randomized Block Compelete Design. The results showed that spraying plants with alpha-tocopherol at a concentration of 120 mg.L^{-1} improved all the indicators of root and chemical growth, which included (the number of corms, fresh weight, dry weight, chlorophyll, carbohydrates, carotenoids, nitrogen, phosphorous and potassium). As for spraying plants with black cumin extract infused at a concentration of 80 g.L^{-1} a significant increase in (number of corms, fresh and dry weights, and leaf content of chlorophyll, carbohydrates, carotenoids and major elements nitrogen, phosphorous and potassium) respectively compared to the control plants. As for the bi-interactions between alpha-tocopherol at a concentration of 120 mg.L^{-1} and black cumin extract soaked at a concentration of 80 g.L^{-1} as compared to the control plants. As for the bi-interactions between alpha-tocopherol at a concentration of 120 mg.L^{-1} and black cumin extract soaked at a concentration of 80 g.L^{-1} as compared to the control plants. As for the bi-interactions between alpha-tocopherol at a concentration of 120 mg.L^{-1} and black cumin extract soaked at a concentration of 80 g.L^{-1} , it gave the highest rates compared to the control plants.

Key words: freesia, alpha-tocopherol, black cumin .

Lntrduction:

Freesia hybrid It belongs to the Iridaceae family and was discovered by the scientist Friedrich Heinrich Itodor in 1876 in southern Africa. The name of the genus belongs to the Swedish doctor and scientist Frees.[11,60]. It is annual winter plant that contains bright green flat sap leaves, while the flowers are trumpet-shaped, carrying in comb inflorescences of different colors, including vellow, orange, white and red, and it has an aromatic smell. The plants bloom in the spring and are suitable for cut flowers . The freesia plant occupies the seventh place in the world among the cut flowers in terms of importance after the flowers of rose, chrysanthemum, tulip, carnation and gerbera[28 lily,]. The importance of the freesia plant as a cutting flower is concentrated due to the beauty of its

multi-colored flowers and sizes and the long period of flowering after cutting. It is of great importance due to the multiplicity of its cultivation purposes, where it is grown in houses whose conditions are controlled to obtain flowers suitable for cutting throughout the year [14]. Freesia multiplies by seeds or corm in autumn and spring [23].Foliar nutrition Spraying solutions of nutrients on the vegetative of plants, and it is of great importance in providing plants with the nutrients necessary for their continued growth and achieving an improvement in their quantitative and qualitative qualities, It allows direct supply to the leaves of nutrients at the necessary period, and helps the activity of the system to obtain optimal mineral nutrition for plants [39,43]. The amount of fertilizer used in foliar feeding is small, which leads to reducing the risks of environmental pollution of soil and water, as well as the ability to address the shortage of the plant and quickly, and the spread of the fertilizer material over all the vegetative mass, and the entry of the nutrient element into the plant easily, as it reduces the amount of energy required for the transfer of nutrients within plant [48]. Among these vitamins (Vitamin E), Alpha-tocopherol is one of the most important lipid antioxidants that play a protective role for the cell's membrane system, making it an important part of the plant defense mechanisms that maintain the integrity of the natural function of the photosynthesis system. To copherols are found in all higher plants in both tissues that have the ability to photosynthesis, In addition, it is a component of chloroplast membranes that are very rich in polyunsaturated fatty acids. It protects the plastid membranes from oxidative stress through the formation of intrinsic lipid antioxidants [49,56] found[35] Spraying Hibsisus rosa Sinensis L. with tocopherol at concentrations of 50 and 100 mg.L⁻¹ led to a significant increase in growth indicators, which included plant height and fresh weight of stem and roots The treatment with a concentration of 100 mg.L ⁻¹ gave the highest values. The developers (2013) concluded that spraying okra plants Abelmoschus esculentus L. with tocopherol at concentration (0, 50, 100)and 150) mg.L⁻¹. led to a significant increase in vegetative growth, which included plant height and number of leaves.Leaf area, number of lateral branches of plant, percentage of total soluble carbohydrates in leaves, amount of chlorophyll and flowering growth at concentration 150 mg.L⁻¹ compared to control plants. Studies have shown that there are many plant extracts that have an effect in encouraging the vegetative and flowering growth traits of many plants. The reason for this is that these plants contain a number of natural chemical compounds, which differ qualitatively and quantitatively according to the different species and plant parts, as well as according to the different environmental conditions and stages of plant growth to which it is exposed [51].[46] found that some plant extracts encourage lateral root branching (root dispersal) by containing

cytokinin, which stimulates the growth of lateral roots and the role played by these roots in transporting materials and nutrients inside the plant more, which increases the rate of vegetative growth of plants. Treatment with extracts.Among these extracts (black cumin)[18] noted that black cumin extract provides the seedlings with carbohydrates by 20-35%, and that this increase in the level of carbohydrates allows the vegetative meristem cells to accelerate their division and elongation. [9]

Materials and methods:

The experiment was coundected in a fabric canopy coverinh with a saran belonging to the Department of Horticulture and Landscaping at the College of Agriculture - University of Basra, Karmat Ali location, for the period from 1/10/2021 to 1/5/2022. The plants were The characteristics of the corms used are hybrids with a diameter of 3.5 cm Before planting it was placed at a temperature of 4 C 4 days before planting in pots with a diameter of 25 cm and filled with a medium consisting of and peat moss. and at a ratio of 1:1, respectively (Table 1). Plants were sprayed with Alpha Tocopherol (Vitamin E) in three concentrations (0,60,120) mg.L⁻¹ It was prepared by dissolving the required weights with a little distilled water and then completing the volume to the liter and extract soaked black cumin in three concentrations (80,40,0 g.L⁻¹ Prepare by dissolving the required weights of dry powder in a liter of warm distilled water at a temperature of 50°C and for 24 hours. A few drops of Tween-20 diffuser were added to all solutions before spraying [44]. Then the plants were sprayed using a 2-liter manual sprayer to the degree of complete wetness, at an average of three sprays between one spray and another 15 days during the growing season, in addition to the control treatment that was sprayed with distilled water containing the diffuse substance and sprayed in the early morning. The experiment was conducted according to a randomized complete block design (R.B.C.D), which is a factorial experiment consisting of two factors and their interactions with three

replicates, the means were compared using the least significant difference test to compare the

means at the 0.05 probability level.[20]

Units	Values	Trraits
$\mathbf{D}\mathbf{s}m^{-1}$	5.54	electrical conductivity (EC)
	8.13	рН
mg.kg ⁻¹	23.4	Total nitrogen (N)
mg.kg ⁻¹	56.18	Available phosphorus (P)
mg.kg ⁻¹	7125 – 485	Available Potassium (K)
		Soil Separators
%	78	Sand
%	10	Silt
%	12	Clay
	Loamy sand	soil texture

Table (1) chemical and physical properties of the soil used in the experiment.

Table (2): Chemical and physical properties of peat moss (Klass-man).

Values	Traits
3.5 - 4.5	pH
95 – 97	Organic matter (%)
1	Total Nitrate (%)
50	Moisture retention (%)
70 – 90	Density (g. cm

The corms formed on plants were calculated for each experimental unit and their average was extracted after flowering ended.

corms fresh weight (gm)

The corms were washed well with water to remove the dust suspended in them and left in a shaded place for the washing water to evaporate.

corms dry weight (gm)

After taking the fresh weight, the corms were dried in an electric oven at a temperature of 70 °C for a period of 72 hours, after which the dry weight was calculated and their average was recorded.

Chemical traits of leaves.Total chlorophyll content of leaves (mg.100g⁻¹)

The total chlorophyll pigment in green leaves was estimated by taking samples from each plant of the experimental unit (Abbas and Abbas, 1992).It was washed with water well and left to dry in the air. Then 0.5 gm of each sample was taken and 10 ml of 80% acetone was added to it in two batches. The tissue was crushed with a ceramic mortar until the tissue was white, then filtered using filter paper [40].Leaves content of total soluble carbohydrates (mg.gm⁻¹)

Modification of Phenol-Sulphric acid Colorimetric Method described from [33] and as follows. The content of the papers from the elements (N, P, K)

It was estimated using the method [29] according to the following steps: Then the elements were estimated in the digestion solution of the plant samples (leaves) as follows: The percentage of nitrogen using the Micro kjeldahl device according to the method

[52]. The percentage of phosphorous was estimated by a spectrophotometer at a wavelength of 470 nm according to the method [50]. The percentage of potassium was estimated by a flame photometer according to the . method [52]. Pigment content of leaves

3-9-2 Content of the total carotenoid pigment in flower inflorescences (mg 100gm fresh weight) The carotenoid pigment in flower petals was determined according to the method described by [1].

Results and discussion

1- The number of corms (corms . plant ⁻¹)

It is clear from the results in Table (3) that spraying with vitamin Alpha Tocopherol had a significant effect on trait of the number of corms, The plants sprayed with this vitamin at a concentration of 120 mg.L⁻¹ significantly excelled on each of the plants treated with the same vitamin, but with a concentration of 60 $mg.L^{-1}$ and the control plants that made up 2.99 and 2.25 corm. plants ⁻¹, respectively, and at the same time, the plants treated with alpha-tocopherol at a concentration of 60 $mg.L^{-1}$. The reason for this may be attributed to the role of the vitamin Alpha-tocopherol in increasing the activation of the photosynthesis process as a result of an increase in the number of table leaves and an increase in the leaf area. Increasing the total chlorophyll content of the leaves, which ensures the presence of new quantities of photosynthesis products to conduct vital activities in the plant, and then an increase in the growth of corms[53]. This is reflected positively on the morale increase in the number of corms or, the reason for the increase in the number of corms may be due to the role of this vitamin in the formation of proteins. amino acids. carbohydrates and enzymatic conjugates that play a role in stimulating the vegetative growth of the plant and thus increasing the efficiency of the photosynthesis process, which is reflected in stimulating the growth of corms and increasing their number[32]. These results agree with the findings of [55] when spraying rose bush plants with Alphatocopherol . It is noted from the same table the moral effect of spraying with black cumin extract on the number of corms. The plants

treated with the extract of soaked black cumin at a concentration of 80 gm. L⁻¹ in the number of their corms, which amounted to 3.44 corms.⁻¹, excelled on each of the plants sprayed with the same extract but at a concentration of 40 g. Liters and control plants, which averaged 2.78 and 2.53 corms. plants ⁻¹, respectively.

Table (3) Effect of spraying with Alpha Tocopherol and extract of black cumin soaked and the interaction between them on the number of corms (corms. plant ⁻¹) of freesia plant.

	Concentration of alpha-tocopher				
average soaked black cumin extract	120	60	0	Concentration of soaked black cumin extract g. L-1	
2.53	3.40	3.00	1.20	0	
2.78	3.13	2.89	2.33	40	
3.44	4.00	3.10	3.21	80	
	3.51	2.99	2.25	Average alpha tocopherol	
L.S.D value at 0.05 . level					
Interaction between soaked black cumin extract and alpha- tocopherol		Vitamin Alpha Tocopherol		soaked black cumin extract	
0.37		0.21		0.21	

As the number of formed corms increased with the increase in the concentration of the extract, this may be due to the content of the extract of the black cumin extract of vitamins, amino acids and proteins that help in improving plant growth, as well as the elements, especially potassium, which has an important role in the process of photosynthesis and thus increase the root growth and then increase the number of corms [21] or, the reason for the increase in the number of corms in the treatment with this extract may be due to the presence of cytokinins in the extract of the seeds of the black cumin, which encourages the growth of the corms and increase their number[47]. The bi-interaction between spraying with alpha-tocopherol and black cumin soaked extract had a significant effect, where the plants sprayed with alpha-tocopherol at a concentration of 120 mg.L⁻¹ and black cumin extract at a concentration of 80 g.L⁻¹ gave 4.00 corms. plant⁻¹.

2- corms fresh weight (gm)

The results in Table (4) showed that spraying plants with alpha-tocopherol had a significant

effect on this trait, where the plants sprayed with alpha-tocopherol at a concentration of 120 mg.L⁻¹ significantly excelled on with the highest fresh weight of 5.42 g compared to the lowest fresh weight of corms which was 4.91 and 4.18 g, formed by plants sprayed with vitamin the same but at a concentration of 60 mg.L⁻¹ and the control plants, respectively,At the same time, the plants sprayed with Alphaat a concentration of 60 mg.L⁻¹ tocopherol excelled on the control plants in this trait. The reason for the increase in the fresh weight of the corms may be due to the role of this vitamin in increasing the vegetative total, represented by the increase in the number of leaves and leaf area, which is reflected in the increase in the products of photosynthesis, and then the increase in the carbohydrates needed for the growth of the root system and the

increase in the fresh weight of the corms [15]. The reason is attributed to the role of this vitamin in cell division and increase in size by processes that include cell expansion and hypertrophy, and then led to an increase in the fresh weight of the corms [6].or it may be due to the fact that spraying with this vitamin led to an improvement in vegetative growth, represented by an increase in the percentage of dry matter and an increase in the percentage of table calcium, which plays an important role in the transfer of carbohydrates and protein building, which encouraged root growth and this was reflected positively on the increase in the fresh weight of the corms [59]. These results are in agreement with [26] on the Antirrhinum majus and [16] on the senna plant.

Table (4) Effect of spraying with alpha-tocopheroland extract of black cumin soaked and theinteraction between them on the fresh weight of corms (gm) of freesia plant.

	Concentration	of alpha-tocoph	nerol mg.L-1	Concentration of
average soaked black cumin extract	120	60	0	soaked black cumin extract g. L-1
4.29	5.40	4.18	3.30	0
4.49	4.75	4.80	3.91	40
5.72	6.10	5.75	5.32	80
	5.42	4.91	4.18	Average alpha tocopherol

L.S.D value at 0.05 . level

Interaction between soaked black cumin extract and alpha-tocopherol	Vitamin Alpha Tocopherol	soaked black cumin extract
0.21	0.12	0.12

Spraying with black cumin extract soaked had a significant effect in this trait, as plants sprayed with this extract at a concentration of 80 g.l⁻¹ significantly excelled on the fresh weight of the corms, which amounted to 5.72 g, compared with the fresh weight of the corms of the control plants, which amounted to 4.29 g. At the same time, the plants sprayed with a concentration of 40 g.l⁻¹ of the same extract excelled on the control plants.The reason for this may be due to the fact that the black cumin extract contains proteins, which are glutamine, albumin and globulin, and these proteins have a positive effect on the formation of enzymes for the effectiveness and creation of growth hormones, including auxin, which is the main reason for the formation of roots on the mother's vine and thus helped absorb nutrients and benefit from them in increasing the transportation of manufactured materials to the stored parts and this was reflected positively on the increase in the fresh weight of the Cormels, or perhaps due to the effect of potassium present in the spray extract [5] mentioned that potassium has a role in transferring the products of the photosynthesis process to the storage parts and then increasing their weight, and this agrees with [46].As for the bi-interaction between spraying with alpha-tocopherol and black cumin extract, it had a significant effect on the fresh weight of the corms .The plants sprayed with alpha-tocopherol at a concentration of 120 mg.l⁻¹ and black cumin extract at a concentration of 80g.1⁻¹ were distinguished for obtaining the largest fresh weight of the corms, which amounted to 6.10 g, compared to the lowest fresh weight of the corms, which was 3.30 gm for control plants.

3- corms dry weight (gm)

The results in Table (5) show that spraying with alpha-tocopherol has a significant effect on the dry weight of the corms .The plants sprayed with Alpha Tocopherol at а concentration of 120 mg.L⁻¹ significantly increased the largest dry weight of the corms which was 2.77 g compared with the plants sprayed with the same vitamin but with a concentration of 60 mg.L⁻¹ and the control plants with the lowest dry weight of the corms was 2.42 and 1.77 g, respectively. The dry weight of the corms increased with the increase in the concentration of the vitamin used, and the reason for this may be due to the role of the vitamin Alpha Tocopherol in increasing the vegetative total, represented by increasing the total number of leaves and the leaf area, which leads to an increase in the activity of the photosynthesis process over time and then the increase of carbohydrates and their transfer to the storage organs and then weight The fresh corms, which was positively reflected on the increase in the dry weight of the corms [13] or it may be due to the role of this vitamin in cell division and increase in their size by processes that include the expansion of cell hyperplasia and then led to an increase in the fresh weight of the corms and positively reflected on the increase in the dry weight of the corms [6]. These results are in agreement with what was found by [26] on the Antirrhinum majus plant.

2.65

3.53

2.77

alpha

average soaked black cumin extract	Concentration of alpha-tocopherol mg.L- ¹			Concentration of
	120	60	0	soaked black cumin extract g. L-1
1.75	2.11	2.06	1.06	0

1.93

2.33

1.77

2.22

2.97

2.42

Table (5) Effect of spraying with alpha-tocopherol and black cumin extract and the interaction between them on the dry weight of corms (gm) of freesia plant.

L.S.D value at 0.05 . level

2.27

2.94

Interaction between soaked black cumin extract and alpha-tocopherol	Vitamin Alpha Tocopherol	soaked black cumin extract
0.33	0.19	0.19

The plants treated with black cumin extract soaked at a concentration of 80 and 40 g.l⁻¹ significantly excelled on the corms dry weight of 2.94 and 2.27 g, respectively, compared to the control plants whose corms weight was 1.75 g. The dry weight of the corms increased with the increase in the concentration used. and the reason for this may be due to the increase in the leaf area that supplies the corms with photosynthesis products [22]. In addition to its high content of nutrients, especially phosphorous and potassium, which play an important role in the transfer of photosynthesis products from the places of manufacture, which is the paper, to the places of consumption (Sink), which is the corms, which increases its dry weight [32]. The biinteraction between spraying with Alpha

Tocopherol and extract of soaked black cumin had a significant effect in this trait, as the plants sprayed with Alpha Tocopherol at a concentration of 120 mg.l⁻¹ and extract of soaked black cumin 80g.l⁻¹ were distinguished by the highest dry weight of the corms which was 3.53 g compared to the lowest weight of 1.06 g for the control plants.

40

80

Average

tocopherol

Chemical traits of the leaves:

1- Total chlorophyll content of leaves (mg.100gm fresh weight)

Table (6)showed that spraying plants with vitamin Alpha Tocopherol has a significant effect on the total chlorophyll content of leaves (mg.100gm⁻¹fresh weight), The plants sprayed with Alpha Tocopherol at a

concentration of 120 and 60 mg.l⁻¹ in the total chlorophyll content of their leaves, which amounted to 57.81 and 52.62 mg.100 gm⁻¹ fresh weight, respectively, excelled on the control plants, as the chlorophyll content of the leaves was 42.85 mg.100gm⁻¹ fresh weight.The reason may be due to the effect of alpha-tocopherol on chlorophyll biosynthesis due to its role in activating enzymes that contribute to the synthesis of carbohydrates in the photosynthesis process [46], which has a role in the manufacture of plant pigments. The reason may be due to the increase in the leaf area of plants, which leads to an increase in the number of chloroplasts and then an increase in chlorophyll pigment [7,37]. This result is consistent with the findings of [45] on the tomato plant and [10] on the sunflower plant.

Table (6) Effect of spraying with alpha-tocopheroland black cumin extract and theinteraction between them on chlorophyll content (mg.100gm-1 fresh weight) of freesia plant.

	Concentration	of alpha-tocoph	erol mg.L-1	Concentration of soaked black cumin extract g. L-1
average soaked black cumin extract	120	60	0	
46.23	55.03	48.00	35.67	0
51.28	58.03	50.81	45.00	40
55.77	60.37	59.06	47.87	80
	57.81	52.62	42.85	Average alpha tocopherol

L.S.D value at 0.05 . level

Interaction between soaked black cumin extract and alpha-tocopherol	Vitamin Alpha Tocopherol	soaked black cumin extract
1.15	0.66	0.66

It is noted from the same table that the plants sprayed with black cumin extract at a concentration of 80 and 40 mg.L⁻¹ were significantly excelled on the content of chlorophyll in their leaves, which amounted to 55.77 and 51.28 mg.100 gm⁻¹ fresh weight, respectively.Compared with the control treatment, which recorded 46.23 mg.100 g⁻¹ fresh weight. The increase in chlorophyll content as a result of spraying with black cumin extract soaked may be due to its content of nutrients in extract, nitrogen is included in the formation of the chlorophyll molecule [22]. As well as iron, whose importance is due to the process of chlorophyll formation in plants, as iron enters as an activating factor for the reactions of the formation of green pigments through a series of reactions that ends with the formation of the chlorophyll molecule [42].or perhaps the reason is due to the increase in the plant's potassium content when spraying plants with black cumin extract, which led to an increase in the concentration of total chlorophyll in the leaves by increasing its construction and preventing its destruction. This is supported by [38] who stated that potassium plays an important role in the metabolism of green pigments.As for the biinteraction between spraying with alphatocopherol and the extract of soaked black cumin, it was significant in this trait. The plants sprayed with alpha-tocopherol at a concentration of 120 mg.l and the extract of soaked black cumin at a concentration of 80 mg.L⁻¹ were characterized by the highest chlorophyll content of 60.37 mg.100 gm⁻¹ fresh weight compared to the lowest chlorophyll content of 35.67 mg.100gm⁻¹ fresh weight for the control plants.

2- Leaves content of total soluble carbohydrates (mg.g⁻¹) dry weight

Table (7) indicated that spraying plants with alpha-tocopherol had a significant effect

on the leaves' content of total soluble carbohydrates. The plants sprayed with alphatocopherol at a concentration of 120 and 60 mg.l⁻¹ had the highest soluble carbohydrates content of 51.90 and 44.88 mg.gm⁻¹, respectively. Compared with the lowest content of 36.14 mg.g⁻¹ was for the control plants. The reason is due to the role of alphatocopherol, which acts as an antioxidant and prevents the destruction of chlorophyll pigments, thus increasing the leaves' content of chlorophyll pigments and carbohydrates[19]. The reason for the increase in the content of leaves of total soluble carbohydrates when sprayed with alpha-tocopherol may be attributed to its relationship to the increase in the number of leaves, leaf area, leaf content of chlorophyll and the percentage of dry matter of the vegetative system. Increasing the growth of the root system, all of these together, was positively reflected in an increase in the efficiency of the photosynthesis process, and then an increase in the processed nutrients in the leaves, which led to an increase in the amount of processed carbohydrates [4].

Table (7) Effect of spraying with alpha-tocopherol and black cumin extract and the interaction between them on the total soluble carbohydrates content of leaves (mg.g⁻¹ dry weight) of freesia plant.

	Concentration of alpha-tocopherol mg.L- ¹			
average soaked black cumin extract	120	60	0	Concentration of soaked black cumin extract g. L-1
34.41	44.14	37.08	22.00	0
48.14	53.41	52.90	38.12	40
50.37	58.14	44.66	48.30	80
	51.90	44.88	36.14	Average alpha tocopherol

L.S.D value at 0.05 . level

Interaction between soaked black cumin extract and alpha-tocopherol	Vitamin Alpha Tocopherol	soaked black cumin extract
3.47	2.00	2.00

had a

Or perhaps the reason is that there is a relationship between the potassium content of the plant and the carbohydrate content of the leaves, as it activates the work of enzymes and an increase in the leaves leads to an increase in growth rates, which was positively reflected on the increase in the carbohydrate content of the leaves and this is similar to what was found [34] on jasmine plant and [54] on flax plant. Spraying with black cumin extract had a significant effect on the leaves' content of total soluble carbohydrates. The plants sprayed with black bean soaked extract at a concentration of 80g.l significantly excelled on the leaves of total carbohydrates as 50.37mg.g⁻¹ over the plants sprayed with the same extract but at a concentration of 40g.1⁻¹.

The carbohydrate content of its leaves was 48.14 mg.gm⁻¹, which in turn excelled on the control plants, whose carbohydrate content reached 34.41mg.gm⁻¹.The increase may be due to the fact that the extract of black cumin soaked contains many organic compounds, macro elements and minor elements, and these elements have a role in activating the enzymes of various growth activities, including the photosynthesis process, as well as the entry of these mineral elements into the composition of the nucleic acids DNA and RNA necessary for cell division, which is reflected on the increase and accumulation of carbohydrates in the leaves, Or perhaps the reason is that the high concentration of black cumin extract soaked led to an increase in the number of leaves and leaf area, which encouraged an increase in the efficiency of the photosynthesis process and the production of carbohydrates [8]. The biinteraction between the two spraying agents with Alpha-tocopherol and the extract of the infusion of the black cumin had a significant effect on this traits. The plants treated with alpha-tocopherol excelled on at a concentration of 120 mg/L and 80 g. Liter-1 extract of soaked black cumin with the highest total carbohydrate content reached 58.14 mg.gm⁻¹ compared to the control plants which recorded the lowest content of 22.00mg.gm⁻¹.

3- Percentage of nitrogen in leaves (%)

in the leaves, The plants treated with alphatocopherol at a concentration of 120 and 60 mg.L⁻¹ had the highest percentage of nitrogen in their leaves, which amounted to 1.454 and 1.171%, respectively, compared to 0.987 % in the leaves of the control plants. At the same time, the plants sprayed with a concentration of 120 mg.l⁻¹ significantly excelled on the plants sprayed with the same vitamin, but at a concentration of 60 mg.l-1.The reason for the increase in the percentage of nitrogen in the leaves when spraying plants with alphatocopherol is due to the improvement of vegetative growth traits by increasing the number of leaves and leaf area, which increased the plants' uptake of nutrients and their accumulation in the leaves [58].or, this may be due to an increase in the growth of gradually improves roots. which the absorption of nitrates in the soil, causing an increase in the nitrogen content of the leaves [22]. These results agree with what was found by [36] on the bean plant and [45] on the tomato plant. As for plants treated with black cumin extract, the same table indicated a significantly excelled of plants treated with a concentration of 80 and 40 g.l⁻¹ of drenched cumin extract with the black highest percentage of nitrogen in its leaves that amounted to 1.434 and 1.216 %, respectively, compared to the lowest percentage of nitrogen that amounted to 0.962 % It was in the leaves of the control plants, and the effect was increased by increasing the concentration of black cumin extract infusion. The reason may be due to the presence of nitrogen in the composition of the black cumin extract, which was positively reflected on the increase in the percentage of nitrogen in the leaves or, the reason may be due to the increase in the activity of vegetative growth caused by this extract represented by the increase in the number of leaves and the large leaf area of the plant, which leads to an increase in the activity of the vital activities of the plant, including the absorption of nutrients in the soil, especially nitrogen, and thus increasing its concentration

The results in Table (8) showed that spraying

significant effect on the percentage of nitrogen

plants with Alpha-tocopherol

in the leaves [12].or perhaps the reason is due to the presence of cytokinins in the extract of black cumin seeds, which encourages the growth of roots and their spread in the soil, which was reflected in the increase in the nitrogen content of the leaves [46]. As for the effect of the bi-interaction between the vitamin Alpha-tocopherol and the extract of the infusion of the black cumin had a significant effect in this traits. The leaves of plants treated with alpha-tocopherol at a concentration of 120 mg.L⁻¹ and 80 mg.L⁻¹ of black cumin extract soaked contained the highest percentage of nitrogen that was 1.810% compared to the lowest percentage of 0.637% which was in the leaves of the control plants.

Table (8) Effect of spraying with alpha-tocopherol and black cumin extract and theinteraction between them on the percentage of nitrogen in leaves (%) of freesia plant.

	Concentration	of alpha-tocoph	Concentration of	
average soaked black cumin extract	120	60	0	soaked black cumin extract g. L-1
0.960	1.240	1.010	0.637	0
1.216	1.313	1.220	1.113	40
1.434	1.810	1.283	1.210	80
	1.454	1.171	0.987	Average alpha tocopherol

L.S.D value at 0.05 . level

Interaction between soaked black cumin extract and alpha-tocopherol	Vitamin Alpha Tocopherol	soaked black cumin extract
0.020	0.012	0.012

4- Percentage of phosphorous in leaves (%)

Table (9) shows that spraying plants with alpha tocopherol had a significant effect on the percentage of phosphorous in the leaves. The plants treated with alpha tocopherol at a concentration of 120 and 60 mg.L⁻¹ had the highest percentage of phosphorous in their leaves, which amounted to 0.133 and 0.103%, respectively, compared to 0.087% for the control plants. The plants sprayed with alpha tocopherol at a concentration of 120 mg.L⁻¹

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significantly increased the percentage of phosphorous in their leaves compared to plants spraved with the same vitamin, but at a concentration of 60 mg.L⁻¹. This may be due to the role of alpha-tocopherol in activating enzymes responsible the for the photosynthesis process and increasing the strength of the root system [57] and then increasing the absorption of macro nutrients, which was positively reflected on the increase in the percentage of phosphorous in the leaves or perhaps the reason is due to the increased

activity of vegetative growth caused by this vitamin, which requires the withdrawal of the largest amount of phosphorous to fill the plant's need from it in the formation of cellular membranes such as the plasma membrane, mitochondria and chloroplasts, as well as its entry into the formation of energyrich compounds that act as cofactors for enzymes [24]. These results agree with [45] on the tomato plant.As for the treatment of spraving with black cumin extract soaked, it is clear from the same table that the leaves of plants sprayed with extract at a concentration of 120 and 60 mg.l⁻¹ were significantly excelled on the percentage of phosphorous in their leaves, which amounted to 0.128 and 0.109%, respectively, compared to 0.087 for the control plants, and the effect increased as the concentration increased. Black cumin extract used. The reason for this may be due to the biological activities that produce organic acids, which leads to the Available of the phosphorous element in the soil [41] or, the reason may be due to the fact that it contains

many nutrients (phosphorous, potassium, iron), protein and carbohydrates, which have a role in increasing the outputs of the photosynthesis process, which led to an increase in the number of leaves and leaf area and an increase in the root system, which was reflected in an increase in the amount of phosphorus absorbed and its increase. Inside the plant [17]. The reason may be that the extract of the black cumin contains many vitamins, including thiamine, niacin and pyridoxine, through its entry into the structural structure of enzymatic chaperones, which have an important role in various vital processes, as well as its entry into the formation of some energy-rich compounds as cofactors for enzymes[7].Which caused a significant increase in the percentage of phosphorous in the leaves of the freesia plant, or perhaps to the role of the microelements present in the extract of the black cumin extract, which increase the absorption of this element and its accumulation in the leaves [25].

Table (9): Effect of spraying with alpha-tocopherol and black cumin extract, and the interaction between them, on the percentage of phosphorous in leaves (%) of freesia plant.

avanaga gaalad	Concentration of alpha-tocopherol mg.L- ¹			Concentration of
black cumin extract	120	60	0	soaked black cumin extract g. L-1
0.087	0.099	0.095	0.067	0
0.109	0.141	0.091	0.094	40
0.128	0.157	0.122	0.104	80
	0.133	0.103	0.088	Average alpha tocopherol

L.S.D value at 0.05 . level

Interaction between soaked black cumin extract and alpha-tocopherol	Vitamin Alpha Tocopherol	soaked black cumin extract
0.003	0.002	0.002

As for the interaction effect between the two spraying agents with alpha tocopherol and black cumin extract, it was significant in this trait.The leaves of plants treated with alpha tocopherol at a concentration of 120 mg.l⁻¹ and black cumin extract at a concentration of 80g.l⁻¹ contained the highest percentage of phosphorus that was 0.157 % compared to the lowest percentage of phosphorus that was 0.067 % in the leaves of the control plants.

5- Percentage of potassium in leaves (%)

It is noted from the results in Table (10) the effect of spraying with Alpha moral tocopherol on the percentage of potassium, as the plants treated with Alpha tocopherol at a concentration of 120 and 60 mg.L ⁻¹ had the highest percentage of potassium in their leaves that amounted to 1.747 and 1.654 % respectively compared to the lowest percentage of potassium which amounted to 1.358 % was in the leaves of the control plants, at the same time, the plants treated with alpha tocopherol at a concentration of 120 mg.L ⁻¹excelled in the percentage of potassium in their leaves compared to plants treated with the same vitamin, but at a concentration of 60 mg.l⁻¹.The reason for this may be due to the stimulation of the vitamin Alpha tocopherol in the transfer of potassium to the developing tops of the leaves As the process of growth and cell division takes place, which leads to an increase in vegetative and root growth as a result of the increase in carbohydrates formed, which leads to an increase in stimulating the plant to absorb this element from the soil and transfer it to the rest of the plant parts [2]. The reason for this may be due to the role of the vitamin Alphatocopherol, which increases the concentration of this element as a result of the addition, and its increase may lead to the activation of the enzymes manufacturing chlorophyll, which results in the withdrawal of leaves for this element to meet the need of the leaf from it, especially as it is a carrier of carbohydrates and an activator of many enzymes [15]. .Or the reason for the increase in potassium in the leaves when spraving plants with Alpha tocopherol is due to its role in increasing the growth of the plant represented by increasing the number of leaves and increasing the leaf area and encouraging the growth of roots and increasing their ability to absorb elements, including potassium and its transfer to the leaves. These results are in agreement with [45].While the same table showed the moral effect of spraying with black cumin extract soaked in the percentage of potassium, The plants treated with black cumin extract at a concentration of 80 and 40 g.l⁻¹ significantly excelled on the potassium percentage in their leaves, which amounted to 1.760 and 1.614%, respectively, compared to 1.384 % for the control plants.

The reason for this may be due to the fact that the extract contains potassium, which led to an increase in its concentration in the leaves, and that the increase in the leaf area, which led to an increase in the efficiency of plant absorption of this element. Or the reason is because the extract contains zinc, which helps absorb elements, including potassium and its accumulation in the leaves, and because it contains vitamins that increase plant growth and increase the number of leaves, which improves the ability of the plant to absorb elements such as potassium [3]. The biinteraction between spraying with alpha tocopherol and extract of soaked black cumin was significant in this traits. The plants treated with vatocopherol at a concentration of 120 mg.l⁻¹ and black cumin extract at a concentration of 80g.1⁻¹ were distinguished by the highest percentage of potassium in their leaves that reached 2.030% compared to the lowest percentage of potassium which was 1.100% in the leaves of the control plants.

Table (10) Effect of spraying with alpha tocopherol and extract of black cumin soaked and the interaction between them on the percentage of potassium in leaves (%) of freesia plant.

	Concentration of alpha-tocopherol mg.L- ¹			Concentration of
average soaked black cumin extract	120	60	0	soaked black cumin extract g. L-1
1.384	1.433	1.620	1.100	0
1.614	1.777	1.610	1.457	40
1.760	2.030	1.733	1.517	80
	1.747	1.654	1.358	Average alpha tocopherol

L.S.D value at 0.05 . level

Interaction between soaked black cumin extract and alpha-tocopherol	Vitamin Alpha Tocopherol	soaked black cumin extract
0.028	0.016	0.016

6- The content of the florets of carotenoid pigment (mg.100g⁻¹) fresh weight

Table (11) shows that spraying plants with alpha-tocopherol had a significant effect on the content of florets of the carotenoid pigment, where the plants treated with alphatocopherol at a concentration of 120 and 60 mg.l⁻¹ significantly excelled on the florets content of this dye, which amounted to 0.020 and 0.017 mg.100 g⁻¹ fresh weight, respectively. Compared to control plants The content of this dye amounted to 0.014 mg.100gm fresh weight, and the plants alphatocopherol sprayed with at а concentration of 120mg.l were significantly superior in the content of their florets of carotenoid pigment compared to plants

sprayed with the same vitamin but at a concentration of 60mg.l⁻¹.The reason may be due to the role of alpha-tocopherol in increasing the efficiency of the photosynthesis process and then increasing the carbohydrates (table (7)), as well as activating the work of enzymes, and this increase was positively reflected on the synthesis of carotenoids [30]. The same table shows that spraving plants with black cumin soaked extract had a significant effect on this trait, where plants sprayed with black cumin soaked extract had a significant effect of 80 g.l⁻¹ in the floret content of this pigment. It was 0.019 mg.100gm fresh weight on each of the plants treated with black cumin extract at a concentration of 40g.l, and the control plants had an average content of carotenoid pigment 0.016 and 0.015 mg.100gm fresh weight, respectively.The effect increased the higher the concentration of the extract used black bean drenched, and the reason may be due to the role of the extract drenched black bean in increasing the average content of leaves from carbohydrates, nitrogen, phosphorous and potassium (table (10,9,8,7) by containing many elements and compounds, and then Entry

Table (11) Effect of spraying with alpha tocopherol and black cumin extract and the interaction between them on the content of florets of total carotenoids (mg.100gm fresh weight) of freesia plant.

	Concentration of alpha-tocopherol mg.L- ¹			Concentration of
average soaked black cumin extract	120	60	0	soaked black cumin extract g. L-1
0.015	0.020	0.015	0.010	0
0.016	0.017	0.016	0.015	40
0.019	0.022	0.020	0.016	80
	0.020	0.017	0.014	Average alpha tocopherol

L.S.D value at 0.05 . level

Interaction between soaked black cumin extract and alpha-tocopherol	Vitamin Alpha Tocopherol	soaked black cumin extract
0.0016	0.0009	0.0009

These elements increase the products of the photosynthesis process represented by carbohydrates that are transformed within the metabolic pathways in the plant. Pyruvic acid, which is converted to CoA-acety, enters a series of vital processes that lead to the formation of many pigments, including the pigment of carotenoids [27]. The carotenoids derived from the metabolism are of isoprenoides, the structural unit of the pigment. As for the bi-interaction between the two spraying agents with Alpha tocopherol

and the extract of the infusion of the black cumin, it was significant in this traits.The florets of plants treated with alpha tocopherol at a concentration of 120 mg.l⁻¹ and black cumin drenched extract at a concentration of 80g.l⁻¹ contained the highest content of carotenoid pigment amounted to 0.022 mg.100 g⁻¹ fresh weight compared to the lowest content of carotenoid pigment that was 0.010 mg.100 g⁻¹ fresh weight. It was in the florets of the control plants.

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