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Effect of Spraying Foliar with Humus and Izomen Biostimulants on Some Vegetative and Flowering Parameters of *Freesia hybrida* L.

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Abstract: **The experiment has been conducted in the nursery of the Department of Horticulture and Landscape Design, College of Agriculture, the University of Basrah to study the effect of Spraying foliar of the biostimulants Izomen and Humus on the growth and flowering of Freesia plants. The corms in similar size were planted in pots with a diameter and height of 25 cm, which filled with 2.5 kg of sterilized loam soil. After 50 days of planting, the plants sprayed with Humus at 0, 1.5, 2.5 ml L^{-1} and after five days sprayed with Izomen at 0, 1.5, 2.5 ml L^{-1}. The different concentrations of biostimulants are sprayed three times, the period between one spray and another 15 is days. The results showed that the spraying of Humus at 2.5 ml L^{-1} significantly increased the plant height, the number of leaves and the leaf content of chlorophyll recorded (29.56 cm, 8.33 and 58.43%) respectively. Moreover, it is recorded early the flowering date (130 days), and the highest flowering mean is (2.12 inflorescence/plant) and the highest period of the remained flowers on the plant and the vase life (10 and 8 days) respectively. The effects of both Humus and Izomen were similar. In addition to the highest mean of their interaction at 2.5 ml L^{-1} for all the studied traits.**

Keyword: **Spraying Foliar, Biostimulants, Flowering, Freesia.**

I. INTRODUCTION

Freesia plant is one of the world's primary cut flowers, which belongs to the Iridaceae family. The importance of Freesia comes from its fragrant flowers, as well as being grown mainly for the production of potted plants or cut flowers, and after carnation in Europe in terms of its adoption as cut flowers [1]. Freesia flowers grow from the Corm and form groups of fragrant flowers of the different color [2]. The growth of the leaves parameters are flat, green, and the flowers are six-petals. The petals are carried on a floral stand at an angle of 90^{o} with primary flowers [3]. Colors of the flowers of Freesia are found in pink, yellow, red, and white [4].

Foliar fertilization helps to increase vegetative growth, improves flowering, and increases the production of corms in plants [2]. The use of Humic fertilizers instead of mineral fertilizers is one of the means to reduce the pollution caused by the use of mineral fertilizers. Humus is a rich source of nitrogen and phosphorus and contains the acids of the Humic and folvoulic [4]. Izomen fertilizer contains the essential nutrients of the plant, including the element of nitrogen, which has a vital role in increasing the content of nucleic acids and the synthesis of proteins necessary to stimulate the increase of cell division and increases the formation of leaf principles and confirms the weak response of freesia plants to soil fertilization [5].

Due to the great economic importance of cut flowers and their frequent use on many occasions, the demand for cut flowers has increased. The main objective of the current study is to use biostimulants such as Humus and Izomen to produce many flowers with high quality and in a short growth period.

II. Materials and Methods

The experiment has been carried out at the nursery of the Department of Horticulture and Landscape Design, College of Agriculture, the University of Basrah to study the effect of spraying with biostimulants Izomen and Humus on the growth and flowering of Freesia plant. Homogeneous size corms are planted in pots with a diameter and height of 25 cm. The pots are filled with the soil of 2.5 kg of sterilized loam soil. After 50 days of planting, the plants are sprayed with the Humus at 0, 1.5, 2.5 ml L^{-1}, and after five days are sprayed with Izomen at 0, 1.5, 2.5 ml L^{-1}. The Tween-20 with 1 ml L^{-1} is used to reduce the surface tension of the particles of the spray solution and to wet the whole parts of the vegetative parts and then the ability of the plant to benefit from them. The different concentrations of biostimulants are sprayed three times, the period between one spray and another is 15 days.

Parameters of Vegetative Growth:

1. Plant Height: The height of the plant measured from the surface of the soil to the top of the tallest leaf in the plant at the flowering stage.

2. Number of Leaves/Plant.

3. Leaf Area (cm^2): The leaf area of the plant is measured according to the method of [6] based on the relationship of leaf area with a dry mass of the leaf.

4. Relative Chlorophyll Content (SPAD): The related content of Chlorophyll in the leaves measured by Chlorophyll meter, 502 Model SPAD from Minolta Ltd.

Flowering Parameters:

1. The Period Required for Flowers (Day): It is calculated by counting the number of days from the date of cultivation until the first flower is opened.

2. Number of Inflorescences (Inflorescence/Plant).

3. The Period of the Remained of Flowers on the Plant (Day): It is calculated by counting the number of days when the flowers remained on the plant until the last flower.

4. Vase life: It is calculated by counting the number of days of picking the floral date when the first flower is bloomed and placed in the solution until the last flower faded [7].

Randomized Complete Block Design (R.C.B.D) with two factors and three concentrations of each biostimulant, is compared to the averages by testing the least significant difference (L.S.D) and at the level of 5% probability. The results are analyzed using the analysis of variance of all studied traits by using the Statistical Package for Social Sciences (SPSS) to ensure that there are significant differences between the traits under study.

III. Results and Discussion

Parameters of Vegetative Growth

1. Plant Height and Number of Leaves

The results of Table (1) show that there is a significant effect of the spraying treatments on the height of the plant and the number of leaves in the plant. The spraying treatment with the Humus at 2.5 ml L^{-1} significantly has exceeded the other concentrations at (29.56 cm and 8.33 leaf), respectively, while the lowest rate of the height of the plant and the number of leaves for control treatment gives (12.34 cm and 6.12 leaf), respectively. Application of Humus at 2.5 ml L^{-1} is significantly higher effect than other concentrations. Also, the treatment of Izomen at 2.5 ml L^{-1} gives the tallest plant height, and a number of leaves are 27.25 cm and 8.11 leaf, respectively, while the lowest rate of the height of the plant and the number of leaves with control is (12.34 cm and 6.12 leaf), respectively. The interaction between the biostimulants shows that the Humus at a concentration of 2.5 ml L^{-1} and the Izomen at 2.5 ml L^{-1} give the highest value of the height of the plant and the number of leaves in the plant reached 33.25 cm and 11.53 leaves, respectively. The positive effect of biostimulants may be due to the role of the elements involved in the synthesis of biostimulants in the activation of growth regulators and enzymes and then increase the division of meristem cells. These results are consistent with several researchers [8], [9], [10], those have found that spraying the nutrients on the plant leads to increase in the height of the plant. The role of the elements in the biostimulants at photosynthesis and the process of protoplasmic construction as it enters the synthesis of nucleic acids RNA and DNA necessary for cell division and then increase in plant height [9].

2. Relative Chlorophyll Content and Leaf Area

The results of Table (2) show that there is a significant effect of spraying treatments on the content of chlorophyll and the area of the leaf and the leaf area in the plant. The spraying treatment with the Humus at 2.5 ml L^{-1} significantly exceeded the other concentrations and is recorded the highest value of chlorophyll and leaf area is 58.43 SPAD and 56.87 cm^2 respectively. The lowest rate of chlorophyll and area of the leaf for the control treatment is 53.53 SPAD and 35.21 cm^2, respectively. Also, the treatment of Izomen at 2.5 ml L^{-1} gives the highest content of chlorophyll in leaf and area of the leaf is 57.00 SPAD and 53.33 cm2 respectively, while the lowest rate of chlorophyll and leaf area of the control treatment is 53.53 SPAD and 35.21 cm^2 respectively.

Table (1) Effect of Spraying Foliar with Humus and Izomen on Height of the Plant and the Number of Leaves

Humus (mg l^{-1})	Height of the plant (cm)	Number of leaves	Izomen (mg l^{-1})	Height of the plant (cm)	Number of leaves	Interaction		Height of the plant (cm)	Number of Leaves
						Humus (mg l^{-1})	Izomen (mg l^{-1})		
0	12.34	6.12	0	12.34	6.12	0	0	12.34	6.12
							1.5	19.00	7.51
							2.5	28.43	8.00
1.5	18.15	7.53	1.5	19.38	7.74	1.5	0	20.21	7.55
							1.5	23.26	9.01
							2.5	28.11	10.53
2.5	29.56	8.33	2.5	27.25	8.11	2.5	0	29.00	8.45
							1.5	31.00	10.22
							2.5	33.25	11.53
LSD 5%	2.33	0.31	LSD 5%	2.56	0.40	LSD 5%		4.21	1.12

For the interaction between the biostimulants, the interaction between the Humus at 2.5 ml L^{-1} and the Izomen at 2.5 ml L^{-1} give the highest value of the content of Chlorophyll and the area of the leaf in the plant is 69.94 SPAD and 87.65 cm^2 respectively. The increase of the content of the chlorophyll in leaves may be due to the attribution of nitrogen in the composition of the compound of porphyrin. Nitrogen stimulates the activity of certain enzymes in the process of photosynthesis. Also, Nitrogen enters the structure of the chlorophyll molecule, and iron helps to build chlorophyll [10]. The increase in the area of the leaf of the plants in biostimulants treatment is because of the elements found in the biostimulants, which have led to an increase in the vegetative growth, especially N, Mg and Fe. In turn, the building of the chlorophyll molecule and amino acids and nucleic acids, which are reflected in the strength of vegetative growth [11]. However, the increase in the number of branches is as a result of encouraging phosphorus to grow lateral buds and increases the number of leaves and area of the leaf [12].

2. Flower Parameters

1. The Period Required for Flowering and the Number of Inflorescences

Table (3) indicate the significant effect of biostimulants treatments on some flower parameters of the plant. The spraying treatment with Humus at 2.5 ml L^{-1} is significantly exceeded the other concentrations and recorded the lowest period required for flowering, and the highest number of inflorescences was 130 days and 2.12 inflorescences/plant respectively while the highest rate of flowering period and the lowest number of floral shoots is in control treatment 138 days and 1.21 inflorescences/plant respectively.

The spraying treatment with Izomen at 2.5 ml L^{-1} is significantly earlier than other concentrations during 130 days, and the highest flowering rate is 2.00 inflorescences/plant, while the minimum number of flowers is 1.21 inflorescences/plant in control.

Table (2) Effect of Spraying Foliar with Humus and Izomen on the Relative Content of the Chlorophyll and Area of the Leaf

Humus (mg l^{-1})	Relative Content of the Chlorophyll (SPAD)	Area of the Leaf (cm^2)	Izomen (mg l^{-1})	Relative Content of the Chlorophyll (SPAD)	Area of the Leaf (cm^2)	Interaction		Relative Content of the Chlorophyll (SPAD)	Area of the Leaf (cm^2)
						Humus (mg l^{-1})	Izomen (mg l^{-1})		
0	53.53	35.21	0	53.53	35.21	0	0	53.53	35.21
							1.5	55.32	41.24
							2.5	58.32	35.33
1.5	55.32	50.11	1.5	55.12	41.24	1.5	0	55.32	50.11
							1.5	58.11	63.54
							2.5	61.34	71.56
2.5	58.32	56.78	2.5	57.00	35.33	2.5	0	57.00	56.87
							1.5	62.22	75.23
							2.5	69.94	87.65
LSD 5%	1.19	3.31	LSD 5%	1.23	3.33	LSD 5%		4.15	7.10

The interaction between the biostimulants Humus at 2.5 ml L^{-1} and the Izomen at 2.5 ml L^{-1} gave the minimum number of days required for flowering, and the maximum inflorescences numbers in the plant are 115 days and 4.22 inflorescences/plant respectively.

These results may be because increasing fertilization leads to increase of chlorophyll formation by increasing the content of the leaves of the nitrogen element. However, in this respect, it increases the activity of the cytokines necessary in the procedure of photosynthesis, which results in the expanded synthesis of carbohydrates and proteins — the development of flowers and the early flowering in line with [13] and [14]. The increase in the number of inflorescences may be related to the role of biostimulants on their contents of nutrients such as Fe, Mn, and Zn, and their role in photosynthesis, N and P penetration in energy-rich compounds, and increase the number of flowers [15].

Table (3) Effect of Spraying Foliar with Humus and Izomen on the Period Required for Flowering and the Number of Inflorescences

Humus (mg l^{-1})	The Period Required for Flowering (Day)	Number of Inflorescences (Inflorescence/Plant)	Izomen (mg l^{-1})	The Period Required for Flowering (Day)	Number of Inflorescences (Inflorescence/Plant)	Interaction		The Period Required for Flowering (Day)	Number of Inflorescences (Inflorescence/Plant)
						Humus (mg l^{-1})	Izomen (mg l^{-1})		
0	138	1.21	0	138	1.21	0	0	138	1.21
							1.5	136	1.72
							2.5	130	2.00
1.5	136	1.91	1.5	135	1.72	1.5	0	135	1.91
							1.5	131	2.53
							2.5	125	3.00
2.5	130	2.12	2.5	130	2.00	2.5	0	120	2.12
							1.5	110	3.11
							2.5	115	4.22
LSD 5%	1.53	0.32	LSD 5%	1.55	0.27	LSD 5%		4.23	1.11

2. The Period of the remained of Flowers on the Plant and Vase life

The data in Table (4) show that the spray treatments have a significant effect on the period of the remained of flowers on the plant and vase life of Freesia. The spraying treatment with Humus at 2.5 ml L^{-1} increases the period of the remained of flowers on the plant and vase life as compared with the other concentrations significantly. Moreover, the highest period of the remained of flowers on the plant and vase life is 10 and 8 days respectively, while the lowest period of the remained of flowers on the plant and vase life in control treatment is 7.12 and 5 days respectively.

The spraying treatment with Izomen at 2.5 ml L^{-1} significantly increases the period of the remained of flowers on the plant and vase life as compared with control. However, the treatment gives the highest period of the remained of flowers on the plant and vase life to 10.87 and 10.50 days respectively, while the minimum period of the remained of flowers on the plant and vase life is 7.12 and 5 days respectively in control treatment.

The interaction between the Humus and Izomen at 2.5 ml L^{-1} increase significantly the period of the remained of flowers on the plant and vase life in the plant to 15.78 and 12.25 days respectively.

The role of the nutrients has been found in the biostimulants in the production of flowers of large sizes, good quality and resistance to the conditions, thus prolonging the period of the remained of flowers on the plant [12]. In addition to its

role in the processing of plant food (sugars), the biostimulants increase the vase life. The biostimulants may have a role in prolonging the life of the flowers and its decisive role in the manufacturing and transferring of processed food, including proteins towards the flower [16]. Moreover, perhaps increase the tissues of the plant which activates the construction work of the cambium and the latter role in reducing the speed of respiration of plant tissue and the lack of consumption of stored carbohydrates and perhaps the lack of the emission of ethylene [17], and increases the vase life. It is known that potassium is vital in maintaining the pH in the tissue and may be due to its role in reducing the speed of respiration and other vital processes may reduce the consumption of carbohydrates and organic acids in flower cells remains the high percentage of total soluble solids [18], and thus prolonging the vase life.

Table (4) Effect of Spraying Foliar with Humus and Izomen on the Period of the Remained of Flowers on the Plant and Vase life

Humus (mg l^{-1})	The Period of the Remained of Flowers on the Plant (Day)	Vase Life (Day)	Izomen (mg l^{-1})	The Period of the Remained of Flowers on the Plant (Day)	Vase Life (day)	Interaction		The Period of the Remained of Flowers on the Plant (Day)	Vase Life (Day)
						Humus (mg l^{-1})	Izomen (mg l^{-1})		
0	7.12	5.00	0	7.12	5.00	0	0	7.12	5.00
							1.5	9.00	7.25
							2.5	10.87	10.5
1.5	9.33	7.00	1.5	9.00	7.25	1.5	0	9.33	7.00
							1.5	12.00	10.75
							2.5	13.13	11.25
2.5	10.00	8.00	2.5	10.87	10.5	2.5	0	11.00	10.00
							1.5	13.33	11.00
							2.5	15.78	12.25
LSD 5%	1.22	0.90	LSD 5%	1.25	0.88	LSD 5%		2.00	1.11

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