The effect of adding bio-fertilizer and spraying vitamins on the growth and flowering of Iris plant (Sapphire Beauty cultivar)

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Abstract

The experiment was conducted in the plastic house belonging to Al-Mussaib Technical College, Al-Furat Al-Awsat Technical University for the autumn season (2020) and the spring season (2021), to study the effect of bio-fertilizers and spraying with vitamins on the growth and flowering of Iris sp Sapphire Beauty cultivar. The experiment included two factors, the first factor included three levels of bio-fertilizers without addition (control treatment) which is symbolized by (S1), Azotobacter SPP bacteria which is symbolized by (S2), and Bacillus spp bacteria which is symbolized by (S3). As for the second factor, it included spraying with vitamins at three levels, without spraying (control treatment) which is symbolized by (F1), spraying with ascorbic acid at a concentration of (200 mg.L^{-1}) which is symbolized by (F2), and spraying with thiamine at a concentration of (200 mg.L^{-1}) which is symbolized by (F3). The factorial experiment was conducted according to the Randomized Complete Blocks Design (R.C.B.D) with three replicates and the averages were compared according to the least significant difference (L.S.D) test under the probability level of 5%, and the results were as follows: The results showed that Azotobacter (S2) treatment was significantly excelled on the rest of the other treatments by giving it the highest average Plant height 75.49 cm, Leaves area 1160.42cm^2, Number of flowers 2.57 flower.plant^{-1}, Flower diameter 110.18 mm, Vase Life 10.73 Day,the spraying treatment with ascorbic acid at a concentration of (200 mg.L^{-1}) was significantly excelled on the rest of the other treatments by giving it the highest values for the traits of Plant height 69.43cm, Leaves area 971.26cm^2, Number of flowers 2.38 flower.plant^{-1}, Flower diameter 101.54 mm, Vase Life 10.22 Day.The bi- interaction treatment consisting of (Azotobacter bacteria + spraying with ascorbic at a concentration of (200 mg.L^{-1}) has excelled on Plant height 79.45cm, Leaves area 1218.96 cm^2, Number of flowers 3.62 flower.plant^{-1}, Flower diameter 117.70 mm, Vase Life 11.42 Day.

Keywords: bio-fertilizer, vitamins, Iris plant

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1.INTRODUCTION

Iris spp. belongs to the Iridaceae family, which includes more than 66 genera. Iris bulbs are true bulbs with Monocotyledon, some of which are annuals in summer or winter, and others are perennials that form a ground stem that buds emerge from the axils of the leaves. Its Linear shape leaves on both sides of the stem to form a palmate growth and end with a beautiful inflorescence with a strong flower stalk suitable for cutting flower [Al-Batal ,2010]. some of them are used as ornamental plants, and the other are used in the manufacture of medicinal drugs [Keresa et al,2009]. The Mediterranean Basin and Japan are its origin country, and wild Iris is found in northern Iraq (Beauchi ,2011). with the addition of bio-bacterial fertilizers, which is one of the modern techniques that were used to reduce the excessive use of chemical fertilizers, Azotobacter and Bacillus bacteria have the ability to Nitrogen fixation and phosphorous and secrete stimulants that help root growth such as gibberellins, cytokines, and auxins [Al-Rawi,2010]. The spraying of vitamins on the vegetative system has an important role in many metabolic processes and is even necessary to make these processes normal. As well as to ensure the work of many enzymes, as adding them to the plant leads to stimulating growth by activating some enzymatic reactions, where vitamins B and C act as coenzymes for some enzymes that contribute to stimulating processes or biological activities as they have a positive effect on carbon dioxide absorption and protein synthesis, and the external addition of vitamins Exogenous application lead to increased production by stimulating the formation of flowers and roots [El – Quesni et al,2009]. In view of the difficulty of production in Iraq for cut flowers, this research was conducted for the purpose of obtaining flowers with high specifications suitable for commercial cutting.In view of the importance of the Iris plant as one of the important cut flowers globally and in Iraq, the study was conducted with the aim of studying the response biofertilizers and vitamins, Determining the best biological fertilizer for the growth and flowering of Iris bulbs and Determine which vitamins are best for the growth and flowering of Iris.

2. MATERIALS AND METHODS

The factorial experiment was conducted according to Randomized Complete Blocks Design (R.C.B.D) in the plastic house belonging to the Al-Mussaib Technical College, AL-Furat Al-Awsat Technical University during the growth season 2020-2021. To study the effect of (control treatment), Azotobacter spp, Bacillus spp) and which are symbolized by(S1, S2,S3) and spraying vitamins(spraying with distilled water (the control treatment), spraying with 200 $mg.L^{-1}$ of Ascorbic acid (vitamin C), spraying with 200 $mg.L^{-1}$ of thymine (B1) and which are symbolized by (F1, F2, F3) on the growth and flowering of Iris Sapphire Beauty cultivar. Biofertilizers were loaded on peat moss in the laboratories of the Agricultural Research Department, Ministry of Science and Technology, as they were added, according to the experiment's treatments, at an average of 10 g. Pot^{-1} into the pit prepared for growing bulbs. It was taken into account that the biological vaccine was in direct contact with the bulbs [Allawi 2013], The process of spraying plants with vitamin C and B1 began after the appearance of two real leaves on the plant, then the spraying process was repeated every ten days, with a difference of two days between spraying one vitamin and another until the time of flowering of the plants. Spraying operations were conducted by backpack sprayer in the early morning until the plant was completely wet with the addition of a few drops of liquid soap as a diffuser to reduce the surface tension of the solutions. Bulbs produced by the Dutch company (Stoop flower bulb) were planted on 01/29/2020 with a diameter of (3 ± 5) cm in plastic pots with a diameter of 27 cm filled with an agricultural medium consisting of (peat moss + river soil + sheep manure) at an average of 1: 1:2) respectively. Random samples were taken from river soil, sheep manure, and peat moss for analysis in the laboratories of Al-Qasim Green University, College of Agriculture as shown in Table (1, 2). The study was conducted as a factorial experiment (3 x 3) according to the Randomized Complete Blocks Design

(R.C.B.D) with three replicates, each replicate containing 18 treatments as shown in Table (3), five plants for each experimental unit. The averages were compared according to the least significant difference (L.S.D) test at a probability level of 5% [Al-Sahoki and Waheeb, (1990).]. The data were analyzed using available statistical program Genstat.

Table 1. Chemical and physical traits of the experimental soil.

Traits	Values	units
pH	**7.60**	**-**
Organic matter	2.17	g.kg/soil
Electrical conductivity (EC)	**3.08**	dsm^{-1}
total nitrogen	**7.89**	$g.kg^{-1}$
availability phosphorous	**17.41**	$mg.kg^{-1}$
soluble potassium	**31.25**	
Soil Separators		
sand	**698.39**	$g.kg^{-1}$
silt	**186.25**	
Clay	**115.36**	
texture	sandy loam	

Table 2. The chemical and physical traits of sheep manure and peat moss.

Traits	**peat moss**	**sheep manure**	**Units**
EC . electrical conductivity	3.10	1.45	$d.S.m^{-1}$
pH	7.10	6.80	---
Organic matter	56.57	410	$g.kg^{-1}$
C / N Ratio	17.74	14.36	---
total nitrogen	12.02	36.54	$g.kg^{-1}$
total phosphorous	6.25	10.30	$g.kg^{-1}$
total potassium	11.87	24.35	$g.kg^{-1}$

3. RESULTS AND DISCUSSION

Plant height (cm)

Table (3) shows that The treatment of Azotobacter (S2) has significantly excelled on the rest of the other treatments and by achieving it the highest average of plant height amounted to (75.49 cm), followed by the treatment of (S3) which gave a plant height amounted to (65.63 cm), while the control treatment (S1) recorded the lowest plant height amounted to (56.40 cm). The results of the same table also show that the treatment of Ascorbic acid (F2) at a concentration of (200 $mg.L^{-1}$) has significantly excelled over the rest of the other treatments by achieving it the highest average of plant height amounted to (69.43 cm), followed by the spraying treatment with Thymine (F3) at a concentration of (200 $mg.L^{-1}$) by achieving it a plant height amounted to (65.86 cm). While the control treatment without spraying (F1) gave the lowest plant height amounted to (62.23 cm). While the interaction treatment between (Azotobacter bacteria + Ascorbic spray at a concentration of 200 $mg.L^{-1}$) gave the highest average of 79.45, while the treatment (without addition (S1) + without spraying (F1)) gave the lowest plant height of 51.95 cm.

Table 3. Effect of bio-fertilizers and spraying with vitamins and their interactions on the plant height (cm) for Iris sp.

bio-fertilizers (S)	**Spraying with vitamins (F)**			**The average of bio-fertilizers**
	Without spraying (F1)	**Spray ing with Ascorbic (200 $mg.L^{-1}$) (F2)**	**Spraying with Thymine at a concentration of (200 $mg.L^{-1}$) (F3)**	
Control (S1)	51.95	60.98	56.29	56.40
Azotobacter (S2)	70.99	79.45	76.02	75.49
Bacillus (S3)	63.75	67.85	65.27	65.63
The average of vitamins	62.23	69.43	65.86	
L.S.D 0.05	**bio-fertilizers=0.87**	**Vitamins=0.87**	Interaction =	

Leaves area (cm^2)

The results in Table (4) showed that The adding bio-fertilizers had a significant effect on the leaf area, The treatment of Azotobacter (S2) significantly excelled on the rest of the other treatments and gave the highest average leaf area amounted to 1160.92 cm2, followed by the treatment of adding Bacillus (S3) bacteria and it gave the lowest leaf area average of 880.21 cm2, while the treatment without adding biofertilizer recorded the lowest average leaf area amounted to 551.42 cm 2. Ascorbic acid spraying (F2) at a concentration of 200 mg.L-1 gave the highest average leaf area of 971.26 cm2, while the treatment without spraying (F1) gave the lowest leaf area of 768.60 cm2.

Where, the interaction treatment (Azotobacter bacteria + Ascorbic acid spray at a concentration of 200 mg.L-1) gave the highest average leaf area of 1218.96 cm2 ,While the interaction treatment (without adding biofertilizers S1 + without spraying vitamins F1) gave the lowest average leaf area amounted to 465.34 cm2.

Table 4. Effect of bio-fertilizers and spraying with vitamins and their interactions on Leaves area (cm^2) for Iris sp.

bio-fertilizers (S)	Spraying with vitamins (F)			The average of bio-fertilizers
	Without spraying (F1)	**Spray ing with Ascorbic (200 mg.L^{-1}) (F2)**	**Spraying with Thymine at a concentration of (200 mg.L^{-1}) (F3)**	
Control (S1)	465.34	662.34	526.59	551.42
Azotobacter (S2)	1070.97	1218.96	1191.33	1160.42
Bacillus (S3)	769.50	1032.48	838.64	880.21
The average of vitamins	768.60	971.26	852.19	
L.S.D 0.05	**bio-fertilizers=11.59**	**Vitamins=11.59**	Interaction =20.08	

Number of flowers (flower.plant^{-1})

The results in Table (5) showed that the cultivars did not show any significant differences between them in the trait of the number of flowers, so the blue cultivar ((C1) gave a number of flowers that amounted to 2.29, 2.29 flowers. Plant^{-1}.While the results showed a role of bio-fertilizers in the significant effect on the number of flowers formed on the plant, the two treatments of Azotobacter (S2) and Bacillus (S3) were excelled and without significant differences between them and gave the highest number of flowers amounted to 2.63, 2.57 flowers. Plant^{-1},Compared to the control treatment, which recorded the lowest number of flowers, 1.65 flowers. Plant^{-1}. Spraying with vitamin Thymine was able to increase the number of flowers formed on the plant.The treatment of Thymine spraying (F3) at a concentration of 200 mg.L^{-1} recorded the highest average of 2.38 flowers. Plant^{-1}, compared to the treatment of Ascorbic spraying (F2) at a concentration of 200 mg.L^{-1}, which gave the lowest number of flowers was 2.13 flowers. Plant^{-1}. Also, the interaction treatment between (Azotobacter bacteria + Thymine spray at a concentration of 200 mg.L-1) significantly excelled on the rest of the other treatments and gave the highest average of the number of flowers reached 3.62 flowers.Plant-1.

Table 5. Effect of bio-fertilizers and spraying with vitamins and their interactions on Number of flowers (flower.plant^{-1}) for Iris sp.

bio-fertilizers (S)	Spraying with vitamins (F)			The average of bio-fertilizers
	Without spraying (F1)	Spray ing with Ascorbic (200 mg.L^{-1}) (F2)	Spraying with Thymine at a concentration of (200 mg.L^{-1}) (F3)	
Control (S1)	2.29	1.38	1.29	1.65
Azotobacter (S2)	1.46	2.83	3.62	2.63
Bacillus (S3)	3.29	2.19	2.23	2.57
The average of vitamins	2.34	2.13	2.38	
L.S.D 0.05	**bio-fertilizers=0.45**	**Vitamins=0.45**	Interaction =0.78	

Flower diameter (mm)

the treatment of adding Azotobacter (S2) was significantly excelled on the rest of the other treatments by giving it the highest average, which amounted to 110.18 mm, followed by the treatment of adding Bacillus S3), which amounted to 97.14 mm, compared to the control treatment (without adding S1), which gave the lowest diameter of the formed flowers reached 77.17 mm. The spraying with vitamins had a significant effect on the flower diameter, where the treatment of spraying Ascorbic acid (F2) at a concentration of 200 mg.L-1 was significantly excelled and gave 101.54 mm, followed by the treatment of spraying Thymine (F3) at a concentration of 200 ml.L-1, which gave a diameter of 94.48 mm Also, the treatment without spraying recorded the lowest average of 88.47 mm.The interaction treatment between (Azotobacter bacteria + Ascorbic acid spray at a concentration of 200 mg.L-1) was significantly excelled on the rest of the other treatments and gave the highest average flower diameter amounted to 117.70 mm, while the interaction treatment (without adding fertilizer S1 + without spraying F1) gave the lowest flower diameter It reached 71.59 mm.

Table 6. Effect of bio-fertilizers and spraying with vitamins and their interactions on Flower diameter (mm)for Iris sp.

bio-fertilizers (S)	Spraying with vitamins (F)			The average of bio-fertilizers
	Without spraying (F1)	Spray ing with Ascorbic (200 mg.L^{-1}) (F2)	Spraying with Thymine at a concentration of (200 mg.L^{-1}) (F3)	
Control (S1)	71.59	84.83	75.11	77.17
Azotobacter (S2)	102.20	117.70	110.62	110.18

Bacillus (S3)	91.65	102.10	97.69	97.14
The average of vitamins	88.47	101.54	94.48	
L.S.D 0.05	**bio-fertilizers=0.97**	**Vitamins=0.97**	Interaction =1.69	

Vase Life (Day)

Table (7), as in the previous tables, showed that The results also showed that adding bio-fertilizers had a significant effect on vase life. The Azotobacter treatment (S2) has significantly excelled over the rest of the other treatments by achieving it the highest average of vase life (10.73 days), followed by the treatment of adding Bacillus (S3) bacteria, which gave an average of vase life amounted to (9.94 days). while a treatment without adding fertilizers gave the lowest average of vase life amounted to (8.89 days). The spraying treatment of Ascorbic acid (F2) at a concentration of (200 $mg.L^{-1}$) gave the highest average of vase life amounted to (10.32 days), followed by a treatment of spraying with Thymine (F3) acid) at a concentration of (200 $mg.L^{-1}$), which gave a vase life amounted to (9.83 days), while a treatment without spraying gave the lowest average of vase life amounted to (9.42 days). while the interaction treatment (Azotobacter bacteria + spraying with Ascorbic acid F2 at a concentration of (200 $mg.L^{-1}$)) gave the highest average of vase life amounted to (11.42 days), while The interaction treatment (without adding bio-fertilizers + without spraying with vitamins F1) gave the lowest average of vase life amounted to (8.54 days).

Table 7. Effect of bio-fertilizers and spraying with vitamins and their interactions on vase life (day)for Iris sp.

bio-fertilizers (S)	**Spraying with vitamins (F)**			**The average of bio-fertilizers**
	Without spraying (F1)	**Spray ing with Ascorbic (200 $mg.L^{-1}$) (F2)**	**Spraying with Thymine at a concentration of (200 $mg.L^{-1}$) (F3)**	
Control (S1)	8.54	9.31	8.82	8.89
Azotobacter (S2)	10.11	11.42	10.66	10.73
Bacillus (S3)	9.61	10.22	10.00	9.94
The average of vitamins	9.42	10.32	9.83	
L.S.D 0.05	**bio-fertilizers=0.05**	**Vitamins=0.05**	Interaction =0.09	

The results in tables (3-7) showed that The increase in the traits may be due the role of Azotobacter bacteria in nitrogen fixation (Panda and Hota, 2007).As well as its role in the secretion of plant hormones such as auxins and gibberellins, which work to increase cell division and widening (Moneral et al., 2012)and Increasing absorption and then increasing the process of photosynthesis and the accumulation of carbon-building products inside the plant (Richardson et al., 2009).and. Increasing the plant's ability to produce nutrients, increasing its accumulation in flowers, pushing the plant to increase the formation of flower buds, and increasing the number of flowers These results are consistent with what was reached by Al-Mamouri (2021) and Al-Shara (2020) on the ranunculus plant and (Narendra Kumar et al., 2019).It can also be due to the role of vitamins, which are among the vital compounds regulating growth, and the few concentrations of them affect the growth of the plant as a result of their entry into most metabolic processes. During the activation of biological processes and their stimulation of some enzymes (Abu Al-Yazid, 2011 and Abd El-Aziz et al., 2007) It is also due to the role of Ascorbic, which encourages vegetative growth by stimulating a number of enzymes involved in biological processes, such as photosynthesis and its action as an enzymatic companion for carbon building processes and the protection of cell membranes and chloroplasts because they are antioxidants and preserve plant cells from premature aging and stimulate cell division (Sharma et al., 2012) and the content of leaves of ascorbic This agrees with Abd El-Aziz et al. (2007) , Nahed et al. (2009) Hashash et al. (2015).

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