ZANCO Journal of Pure and Applied Sciences
The official scientific journal of Salahaddin University-Erbil
https://zancojournals.su.edu.krd/index.php/JPAS

ISSN (print):2218-0230**, ISSN (online):** 2412-3986**, DOI: http://dx.doi.org/10.21271/zjpas**

RESEARCH PAPER

Effect of NPK, Humic Acid, Biofertilizer and Light Intensity on Vegetative Growth and Bulb Production of *Narcissus trilandrus* L. and *Hyacinthus orientalis* L.

Sazar S. Noraldeen [1], Sabiha S. Mustafa[1], Asmaa S. Ahmed[1]

[1]Department of Horticulture, College of Agricultural Engineering Sciences, Salahaddin University-Erbil, Kurdistan Region, Iraq

A B S T R A C T:
The research was carried out in order to compare among effect of three different fertilizers: bio, chemical, and organic. on two plants selected to conduct this research were (*Narcissus trilandrus* and *Hyacinthus orientalis*), under shaded and non-shaded environment from Autumn 2020 to Spring 2021 in Gerdarash field belongs to the college of Agriculture Engineering Sciences. The vegetative and the production of characters, were measured. Regarding Narcissus, the bio-fertilizer showed the most promising result when it came to the number of leaves and bulblets (3.67, 1.67 per plant respectively). The chemical fertilizer showed better results in the height of the plants (32.67 cm) and the diameter of the flowers (11 cm). For the Hyacinth plants, the bio-fertilizer proved its superiority in plant height (27 cm), flower petiole length (12.33 cm), number of flowers (32.33), flower diameter (6.33cm), and new bulblets with three ones compared to another treatment and control. Whereas for non-shad, we recommend planting the ornamental bulbs in open and non-shaded places as it obtained the best results for vegetative and floral traits for both plants.

KEY WORDS: Narcissus, Hyacinths, bulb production, Bio-fertilizers, chemical fertilizers, organic fertilizers, shad
DOI: http://dx.doi.org/10.21271/ZJPAS.35.1.15
ZJPAS (2023) , 35(1);143-150 .

1.INTRODUCTION:

Ornamental bulbs are one of the most important commercial crops that's been widespread in recent decades which had a significant impact on the economy and nature. This had also led to a significant increase in knowledge of flower bulbs; mostly in a few genera such as Hyacinthus, Narcissus, Gladiolus, Lilium, and Tulipa. (Le Nard and De Hertogh, 1993).

Upcoming research on the growth and development of flower bulbs must be exclusive as existing species have been consumed commercially over time with other types having different economic effects. (Le Nard and De Hertogh, 2000).

The *Narcissus trilandrus* L. plants are considered to be one of the most wonderful ornamental plants, which decorate the gardens. It belongs to the family "Amaryllidaceae", and is widely spread in the Mediterranean- from southern France to Greece in particular. (Rizk and Elngar, 2020). It is distinguished from other varieties as it bears from 6 to 10 flowers in one spike. The diameter of the flower is from 2 to 4 cm, and the color of the crown is bright sulfur yellow (Burbidge, 1875).

*** Corresponding Author:**
Asmaa sayed Ahmed
E-mail: Asmaa.ahmed@su.edu.krd
Article History:
Received: 11/09/2022
Accepted: 05/12/2022
Published: 20/02 /2023

The *Hyacinthus orientalis* L. is a herbaceous plant which belongs to family Liliaceae (Hu et al., 2015) . The Flowers are used for decoration in certain occasions and events, as well as in the manufacture of perfumes and essential oils. They emit different colors- such as blue, violet, pink, white and yellow- if they are placed under fluorescent lamps (Dole and Wilkins, 2005). The flowers usually first bloom in February (Smigielska et al., 2014). It is native to the Mediterranean region and South Africa (Hu et al., 2015). The Hyacinths genus includes 30 species, but the variety *H. orientalis* has been widely cultivated as it gives long-lasting cut flowers. Hyacinths normally grow with a height between 10 and 30 cm and comes in an extensive variety of colors. (Darlington et al., 1951). The Flowers are generally between 15 and 20 cm tall. The puffy part consists regularly of a fleshy, and a short, flat stem specialized for food storage. The plant prefers light sandy to sandy soil. Such soil is generally suitable for all conditions, whether acidic, alkaline, or neutral. And the bulbs during the dormant period can withstand all conditions of soil and temperature, even -5 °C (Matthews, 1994). This flower has been used throughout history, particularly during the ancient Roman and Egyptian civilizations for many reasons such as inspiration for artists in clothes design, pots, and drawings on the walls. These flowers are also important for economic and medical reasons. Not surprisingly, it is considered to be the queen of cut flowers and the most type of flowers used in garden designs. (Dana and Lerner, 2001). The aim of the study was to know the effect of light intensity as well as different types of fertilizers; NPK, humic acid bio fertilizer on the vegetative characters of bundles and growth of ornamental bulbs and their flowers of the two ornamental plants *Narcissus trilandrus* L. and *Hyacinthus orientalis* L. The major objective of this experiment was compare the different types of fertilizers, such as chemical fertilizers represented by NPK, organic fertilizers represented by Humic acid and Biofertilizers represented by genetically modified bacterial strain, and its effect on vegetative traits and bulblets production in ornamental bulb plants.This flower has been used throughout history, particularly during the ancient Roman and

2.MATERIALS AND METHODS

2.1. MATERIALS

2.1.1 Plant species under the study:

This study was carried out from Autumn 2020 to Spring 2021 in Gerdarash field, College of Agriculture Engineering sciences. The bulbs of *Narcissus trilandrus* L. and Hyacinthus *orientalis* L were imported from Holland. The average of mother bulbs diameter for Narcissus was 9-12 cm and weight around 29-33 g. For Hyacinth, the average of mother bulbs was around 13-14 cm in diameter and the weight around 30-40g. These were planted on the 1st of October 2020 in a 10 cm deep soil along with a surface of round plastic pots of 20 cm diameters and 25cm in height. Each pot was filled with 3kg of peat moss, sand, and a clay mixture soil at a rate of (2:1:1). The chemical and physical properties of this soil mixture before planting are shown in table (1).

Table 1: The physical and chemical analysis of initial soil mixture:

The Physical Analysis		**The chemical analysis**									
Sandy- loam soil		Organic Matter	Total N	Total P	K	Fe	Zn	Cu	pH	Ec
Sand	65.00 %	%	%	%	%	mg/kg				Ds/m
Clay	20.00 %	1.250	0.421	0.031	0.711	2.0	1.0	1.3	7.4	1.60
Silt	15.00 %									

2.2. Fertilizer addition treatments

2.2.1. NPK- fertilizer: is represented by the "FERSIL 20-20-20" (N20) component from Tradecorp© Turkish Company. It contains 20% N, 20% P_2O_5, and 20% K_2O along with many chelating micronutrients. The doses were applied on soil soak at the rate of 1g/ 1litter 3 times. at first stage chemical fertilizer (NPK) was added with cultivated bulbs and the process was repeated every two weeks.

2.2.2. Humic acid: is liquid Humic acid fertilizer, contains 30% organic matter, 5% organic carbon, 4% total nitrogen, 1% Ammonium nitrogen, 3% urea nitrogen, 5% Potassium, and 13% Humic fulvic acid. Made by Qingdao Future Group. The first stage was added with cultivated bulbs and was repeated every two weeks until flowering and picking of the flowers with Irrigation "soil soak" Where 10 ml was diluted with 1 litter of irrigation water for each pot.

2.2.3. Bio fertilizer preparation of a genetically modified strain.

The bacterial strains that had been used were *Azotobacter chroococcum*, *Bacillus megaterium* var. *phosphaticum*, genetically modified new strain called (TB), were isolated from the soil, *A. chroococcum* was isolated from the soil of Erbil city, Iraq. using Ashby's media for *A. chroococcuma*. Morphological and biochemical tests (Gelatinase, Catalase, Indole test, Oxidase test and Carbohydrate assimilation tests were performed followed stranded model (Atlas et al., 1995, Jackson, 1973, Forbes et al., 2007) and (Mohamed et al., 2016) *Bacillus megaterium* var. *phosphaticum* was isolated from rhizospheric soil in Erbil city using Sperber's medium followed the enrichment culture techniques (Jackson, 1973). Identification was performed through a number of microbiological and biochemical tests. Aerobic spore formers pasteurize a diluted soil sample at 80 degrees for 15 minutes, and are then plated onto nutrient agar and incubated at 37°C for 24 hr. Then the plates were examined for typical colonies identified as catalase-positive, Gram-positive, endospore-forming rods (Reddy et al., 2010). Transconjugant *B. megaterium* var. *phosphaticum* underwent transgenetic processes, conjugation, and the donor cell was *Azotobacter chroococcum*. It had (*nif*) genes located at chromosomal DNA, which is responsible for the non-symbiotic nitrogen fixation. The process turned out to be successful since the transfer by PCR technique proved the existence of those genes in the recipient cells. These results have been previously published (Ahmed et al., 2017), with the data unprovided, 10 ml suspension with 10^6 /ml concentration of previews strain (TB) add to three replicates for each plant case.

2.3. Experiment design and statistical analysis:

The first experiment was conducted to study the effect of light intensity on the vegetative bundle growth and flower production of Narcissus and Hyacinths grown under partially shaded (lath house) and no shading (open environment) condition, The data analyzed using T- test .

The second experiment was designed according as a complete randomized design (CRD) with three replicates in factorial experiment. The statistical analysis was carried out by using SPSS version 25 (Statistical Package for Social Sciences) DMRT. The fertilizer treatments were including; NPK (20: 20:20), humic acid and a bio fertilizer prepared of a genetically modified strain under two conditions of light intensity; lath house and open field. The total experimental units include: 4* 2* 3= 24.

2.4. Experimental parameters:

a- The vegetative bundle growth and flowering traits: were measured at the flowering stage. The bundle growth data were: (Plant height (cm), leaf length (cm), Number. of leaves, petiole length (cm), Number. of flowers, Flower diameter (cm).

b- The bulbs' productivity: was recorded after the end of the season- when the leaves' color was pre-yellowish.

3.RESULTS AND DISCUSSION

3.1 Effect of NPK- fertilizer, humic acid, biofertilizer and light intensity on vegetative growth and bulb production of *Narcissus trilandrus* L.

3.1.1. Plant Height (cm): the height Narcissus height was measured, it turned out to be the longest when treated with NPK fertilizers under non-shaded condition; with a height of 32.7cm to be exact. However, the shortest height was obtained from the plants treated with the bio-fertilizer planted under the shaded location. The best results obtained from the plants treatments which grown in the non-shaded area, followed by those treated with in a combination with both organic and bio-fertilizers, which reached up to 28cm to be precise. These results may agree with (El-Naggar, 2010) overall, but surprisingly, our results showed that the chemical fertilizer had the most effect on the height of the plant in the non-shaded location which has attributed to the effect of the fertilizer chemicals, especially nitrogen, on the process of photosynthesis and its effect on growth hormones. The results of the Narcissus plants are similar to (Jamil et al., 2008) and also the gladiolas plants (Abdou et al., 2019, XIE and YANG, 2009)

3.1.2. Leaf Length (cm): As presented in table (2), leaf lengths of the Narcissus plants cultivated in non-shady area and treated with bio-fertilizer were better, with a length of 30 cm. The plants treated with chemical fertilizers had a length of 28.7 cm. The plants supplemented with organic fertilizers with a height of 22 cm as compared to control, which was 17.6 cm. The length of the leaves was shorter in the plants cultivated under the shade condition, which was a length of 13 cm for both organic and chemical fertilizers. But it was higher in the control along with the bio-fertilizer, with a length of 16.3cm. This is due to the content of the biofertilizer containing many growth stimulants, plant regulators, and vitamins. The data recorded were similar to (Gabra, 2021, Rizk and Elngar, 2020)

3.1.4. Number of Leaves: There were a few minor differences, as it ranged between 3-4 leaves in all the different treatments of fertilizers and locations. We also noticed the stability of the number of leaves, as it's attributed to the varieties (XIE and YANG, 2009).

3.1.5. Petiole length (cm): In general, The Petiole of the Narcissus plants grown under the shaded area were taller. The chemical fertilizer (NPK) with non-shad was also superior for the petiole length, which was around 25 cm. The plant treated with the bio-fertilizer, on the other hand, had the shortest petiole, with a length of about 10.3cm (Gabra, 2021).

3.1.6. Number of Flowers: The number of flowers was relatively stable among the plants, with one flower for each plant. However, the plants treated with bio- fertilizer under the shaded location gave 2 flowers per plant. The data We've obtained show similar results to El-Naggar (2010) (Table 2).

3.1.7. Flower Diameter (cm): The chemical fertilizer was superior in both the shaded and non-shaded conditions with a diameter of 11 cm per flower. The plants treated with the organic or biofertilizer had a diameter of about 10 cm and 9 cm respectively. Applying Organic and bio-fertilizers increased vegetative flowers and bulbs' growth. This result may be due to the enhancement of soil physiognomies by integration between organic manures (vermicomposting) and bio-fertilizers which significantly influenced on Narcissus vegetative, floral, bulb traits and soil structure (Nasir, 2017)

3.1.8. Number of Bulblets: There were significant differences in the number of formed bulblets at the end of the growing seasons, depending on the fertilizer type. As Bio-fertilizers gave 1.67 bulblets followed by organic fertilizers of about 1.33 bulblets per plant. Natural vegetative propagation of Narcissus is very slow, with an annual mean rate of daughter bulb production of 1.6 **(Rees, 1969).** Hassanein and El–Sayed (2009) proved that treatment with all bio-fertilizers would significantly increase Gladiolus corm production and chemical constituent parameters compared to the control plant. The same author stated that bio-organic fertilization has an important role in improving the growth and production of ornamental bulbs, which may be since these fertilizers provide important elements like nitrogen. In this manner, the process of nitrogen fixation, as well as optimization of carbohydrates inside the bulbs increases the number of bulblets and the diameter of flowers with other vegetative traits.

3.2 Effect of NPK- fertilizer, humic acid, biofertilizer and light intensity on vegetative growth and bulb production of *Hyacinthus orientalis* L.

Regarding the plant (Hyacinths), the vegetative and flowering traits showed similar results to Narcissus (table 3).

3.2.1. Plant height (cm): The results showed significant differences between the treatments and planting location. The plants treated with the chemical fertilizer in the non-shaded location had a greater height, with a length of 27 cm. The shortest plants were those treated with the chemical fertilizer and grown in the shaded location, with 19 cm. NPK and PGPR (Plant Growth-Promoting Rhizobacteria) applications considerably affected hyacinth bulbs' concentrations of macro and micro plant nutrient content. N, P, Ca, Fe, Zn, and Cu contents are decreased in hyacinth leaves with bacterial applications, while are increased in those with K, Mg, and Mn contents. Also, with bacterial applications in hyacinth bulbs, while the N, P, Mn, Zn, and Cu content decreases, as an increase in K, Ca, Mg and Fe contents were determined. With the help of bacterial applications to boost nutrient uptake, implement plant growth hormones, and raise chlorophyll content and organic acids, it is possible to increase plant growth (Bintas et al., 2020)

3.2.2. Leaf length(cm): As shown in table 3, there were significant differences in the length of the leaves of the plants. The best results obtained were the plants treated with the chemical fertilizer as the length reached 19 cm. The least length was obtained from the bio-fertilized plants, with a length of 13 cm. The plants cultivated in the non-shaded location outnumbered in the length of the leaves on those planted in the shade location.

3.2.3. Number of Leaves: There were a few significant differences recorded in the number of leaves between fertilizers treatments but no significant in interaction between fertilizers and light intensity . The number of leaves in the plants treated with the NPK fertilizer was 5-7 leaves, which was compared to control and other treatments. The lower number of leaves in Hyancith may belong to the efficiency of the photosynthesis process with white and yellow light playing an important role in the flower growth and blooming process and, thus, the dates of bulb production (Smigielska et al., 2014)

3.2.4. Flower Length (cm): There were no significant differences in flower length among the plants treated with different fertilizers. But the bio-fertilizer proved to be the most effective when it came to the flower length.

3.2.5. Petiole length(cm): There are no significant differences in the treatments of different fertilizers and their effect on the petiole length. The longest petioles were obtained from the plants treated with the bio- fertilizer, then followed by the chemical fertilizer.

3.2.6. Number of Flowers: There are insignificant differences among the treatments. It reached to a total of 35 flowers under bio fertilizer treatment. However, the lowest number were obtained from the plants treated with the chemical fertilizer, as compared to the control. Flowers of Hyacinthus is related to the efficiency of the photosynthesis process. The most efficient lights for the process are white and yellow lights as it plays an important role in the process of flower growth and blooming, and thus affects the dates of bulb production (Smigielska et al., 2014)

3.2.7. Flower diameter (cm): The results exposed that plants treated with bio and NPK fertilizers gave a greater flower diameter with an average of 6 cm compared to the control where it was 5 cm, in hyacinth cultivation, the PGPR applications may have a potential for the production of bio-fertilizer required in organic agriculture because of rendering insoluble phosphates into a soluble form and biological N_2 fixation encouraged directly to improve the plant growth by means of the bacteria. The PGPR applications could be ideal in the cultivation of hyacinth as cut flowers, landscaping plants, and potted plants. So, sustainability in the landscapes may be achieved.(Karagöz et al., 2019)

3.2.8. Number of Bulblets: Plants Treated with the

bio-fertilizer and grown under shaded and non-shaded locations had the greatest number of new bulbs: with 2 new bulbs per plant. Followed by chemically fertilized plants with two bulbs per plant compared to the control, which formed one bulb per plant. In prior experiences, bacterial bio-fertilizer has a very important role, especially those enriched with phosphorous, on the production, size and traits of bulbs, as it was tested in the laboratory and in the open field and gave high vegetative and floral results (Çığ and Çığ, 2019).

4. CONCLUSION

Ornamental bulbs (Narcissus and Hyacinth)are among the most important plants that have a role in landscaping. Therefore, this study came in an attempt to obtain plants with better traits through combination between the different types of fertilizers (bio, chemical as NPK, and organic as Humic acid) and light intensity (Shad and non-shad), clearly stating that the biofertilizer used in the experiment is genetically engineered (GM) to provide two types of phosphorous and nitrogen fertilizers which cultivated in open area (non-shaded) It gave promising results with most traits such as plant high , leaves numbers and new bulb production .

Table (2) : 1 Effect of NPK- fertilizer, humic acid, bio fertilizer and light intensity on vegetative growth and bulb production of *Narcissus trilandrus L.*

		Plant height (cm)	Leaf length (cm)	Number. of leaves	Petiole length (cm)	Number. of Flowers	Flower diameter (cm)	Number. of new bulbs
Light intensity	**Shaded**	12.17 ± 1.03^{b}	14.75 ± 1.39^{b}	3.75 ± 0.22^{a}	11.67 ± 1.46^{b}	1.17 ± 0.11^{a}	8.75 ± 0.46^{b}	1.17 ± 0.11^{a}
	Non-shaded	27.00 ± 2.05^{a}	24.58 ± 2.21^{a}	3.42 ± 0.15^{a}	18.92 ± 1.71^{a}	1.00 ± 0.01^{a}	9.58 ± 0.38^{a}	1.17 ± 0.21^{a}
		**	**	ns	**	ns	**	ns
Fertilizer treatments	**Control**	15.83 ± 2.83^{b}	17.00 ± 2.35^{a}	3.50 ± 0.22^{ab}	18.00 ± 1.95^{a}	1.00 ± 0.01^{b}	7.50 ± 0.22^{d}	0.83 ± 0.17^{b}
	Bio-fertilizer	19.17 ± 4.38^{ab}	23.17 ± 3.47^{a}	3.83 ± 0.17^{a}	10.00 ± 1.24^{b}	1.33 ± 0.21^{a}	8.50 ± 0.22^{c}	1.67 ± 0.21^{a}
	Humic acid	20.67 ± 3.81^{ab}	17.67 ± 3.74^{a}	3.00 ± 0.26^{b}	17.67 ± 1.05^{a}	1.00 ± 0.01^{b}	9.5 0 ± 0.34^{b}	1.33 ± 0.21^{ab}
	NKP fertilizer	22.67 ± 4.52^{a}	20.83 ± 3.6^{a}	4.00 ± 0.26^{a}	15.50 ± 4.26^{a}	1.00 ± 0.01^{b}	11.17 ± 0.17^{a}	0.83 ± 0.17^{b}
		ns	ns	*	**	**	**	*
Interaction of light intensity and fertilizers								
Shaded	**Control**	13.00 ± 0.01^{bc}	16.33 ± 2.33^{b}	4.00 ± 0.01^{a}	14.00 ± 1.73^{cd}	1.00 ± 0.01^{b}	7.00 ± 0.01^{e}	1.00 ± 0.01^{ab}
Shaded	**Bio-fertilizer**	9.67 ± 0.33^{c}	16.33 ± 3.67^{b}	3.67 ± 0.33^{ab}	9.670 ± 2.60d^{e}	1.67 ± 0.33^{a}	8.00 ± 0.01^{d}	1.67 ± 0.33^{a}
Shaded	**Humic acid**	13.33 ± 4.33^{bc}	13.33 ± 4.33^{b}	3.00 ± 0.58^{b}	17.00 ± 1.53^{c}	1.00 ± 0.01^{b}	9.00 ± 0.58^{c}	1.00 ± 0.01^{ab}
Shaded	**NPK- fertilizer**	12.67 ± 0.33^{bc}	13.00 ± 0.01^{b}	4.33 ± 0.33^{a}	6.00 ± 0.01^{e}	1.00 ± 0.01^{b}	11.00 ± 0.01^{a}	1.00 ± 0.01^{ab}
Non-shaded	**Control**	18.67 ± 5.67^{b}	17.67 ± 4.67^{b}	3.00 ± 0.01^{b}	22.00 ± 0.01^{ab}	1.00 ± 0.01^{b}	8.00 ± 0.01^{d}	0.67 ± 0.33^{b}
Non-shaded	**Bio-fertilizer**	28.67 ± 2.40^{a}	30.00 ± 0.01^{a}	4.00 ± 0.01^{a}	10.33 ± 0.88^{de}	1.00 ± 0.01^{b}	9.00 ± 0.01^{c}	1.67 ± 0.33^{a}
Non-shaded	**Humic acid**	28.00 ± 0.01^{a}	22.00 ± 5.69^{ab}	3.00 ± 0.01^{b}	18.33 ± 1.67^{bc}	1.00 ± 0.01^{b}	10.00 ± 0.01^{b}	1.67 ± 0.33^{a}
Non-shaded	**NKP fertilizer**	32.67 ± 1.45^{a}	28.67 ± 1.86^{a}	3.67 ± 0.33^{ab}	25.00 ± 0.58^{a}	1 .00 ± 0.01^{b}	11.33 ± 0.33^{a}	0.67 ± 0.33^{b}
		ns	ns	ns	**	**	ns	ns

*significant at 0,05 level, **significant at 0,01 level, ns: non-significant
* For each parameter, means not followed by the same letter are significantly different by Duncan's Multiple rang test (P>0.05)

Table (3) Effect of NPK- fertilizer, Humic acid, Bio fertilizer and light intensity on vegetative growth and bulb production of *Hyacinthus orientalis* L.

		Plant Height (cm)	**Leaf length (cm)**	**No. of leaves**	**Petiole length (cm)**	**No. of Flowers**	**Flower diameter (cm)**	**No. of new bulbs**
Light intensity	**Shaded**	22.50 ± 0.80^{b}	15.25 ± 0.55^{a}	6.17 ± 0.11^{a}	10.58 ± 0.40^{a}	29.17 ± 1.5^{a}	5.67 ± 0.14^{b}	1.58 ± 0.23^{b}
	Non-shaded	25.17 ± 1.11^{a}	16.29 ± 0.73^{a}	5.83 ± 0.11^{b}	11.33 ± 0.38^{a}	29.42 ± 2.6^{a}	6.08 ± 0.15^{a}	2.33 ± 0.22^{a}
		*	ns	*	ns	ns	*	**
Treatment	**Control**	22.67 ± 1.67^{a}	14.25 ± 0.66^{b}	5.67 ± 0.21^{b}	10.5 ± 0.50^{a}	31.17 ± 4.68^{a}	5.67 ± 0.21^{ab}	1.17 ± 0.17^{b}
	Bio-fertilezer	25.00 ± 1.00^{a}	14.33 ± 0.76^{b}	6.00 ± 0.01a^{b}	11.83 ± 0.54^{a}	31.67 ± 2.01^{a}	6.17 ± 0.17^{a}	2.67 ± 0.33^{a}
	Humic acid	24.67 ± 0.76^{a}	16.33 ± 0.67^{a}	6.33 ± 0.21^{a}	10.83 ± 0.4^{a}	28.17 ± 2.37^{a}	5.5 ± 0.22^{b}	1.5 ± 0.22^{b}
	NKP fertilezer	23.00 ± 2.11^{a}	18.17 ± 0.60^{a}	6.00 ± 0.01a^{b}	10.67 ± 0.71^{a}	26.17 ± 1.99^{a}	6.17 ± 0.17^{a}	2.5 ± 0.22^{a}
		ns	**	**	ns	ns	*	**
Interaction of light intensity and fertilizers								
Shaded	**Control**	24.33 ± 1.33^{ab}	14.67 ± 0.88^{bcd}	6.00 ± 0.01^{b}	10.67 ± 0.88^{ab}	26.67 ± 3.33^{a}	5.67 ± 0.33^{ab}	1.00 ± 0.01^{d}
Shaded	**Bio-Fertilizer**	23.00 ± 1.01^{abc}	13.00 ± 0.58^{d}	6.00 ± 0.01^{b}	11.33 ± 0.67^{ab}	32.33 ± 4.33^{a}	6.00 ± 0.0^{a}	2.33 ± 0.67^{ab}
Shaded	**Humic acid**	23.67 ± 0.67^{abc}	16.00 ± 0.58^{bc}	6.67 ± 0.33^{a}	11.00 ± 0.58^{ab}	28.33 ± 2.40^{a}	5.00 ± 0.01^{b}	1.00 ± 0.01d
Shaded	**NKP Fertilizer**	19.00 ± 1.53^{c}	17.33 ± 0.33^{ab}	6.00 ± 000.01^{b}	9.33 ± 0.88^{b}	29.33 ± 2.33^{a}	6.00 ± 0.01^{a}	2.00 ± 0.01b^{c}
Non-shaded	**Control**	21.00 ± 3.06^{b}c	13.83 ± 1.09^{cd}	5.33 ± 0.33^{c}	10.33 ± 0.67^{ab}	35.67 ± 8.84^{a}	5.67 ± 0.33^{b}	1.33 ± 0.33^{cd}
Non-shaded	**Bio- Fertilizer**	27.00 ± 0.01^{a}	15.67 ± 0.88^{bcd}	6.00 ± 0.01^{b}	12.33 ± 0.88^{a}	31.00 ± 1.01^{a}	6.33 ± 0.33^{a}	3.00 ± 0.01^{a}
Non-shaded	**Humic acid**	25.67 ± 1.20^{ab}	16.67 ± 1.33^{abc}	6.00 ± 0.01^{b}	10.67 ± 0.67^{ab}	28.00 ± 4.73^{a}	6.00 ± 0.01^{a}	2.00 ± 0.01^{bc}
Non-shaded	**NKP Fertilizer**	27.00 ± 2.00^{a}	19.00 ± 1.01^{a}	6.00 ± 0.01^{b}	12.00 ± 0.01^{a}	23.00 ± 2.08^{a}	6.33 ± 0.33^{a}	3.00 ± 0.01^{a}
		*	ns	ns	ns	ns	ns	ns

*significant at 0,05 level, **significant at 0,01 level, ns: non-significant
* For each parameter, means not followed by the same letter are significantly different by Duncan's Multiple rang test (P>0.05)

References

ABDOU, M., ALY, M., EL-SAYED, A. & AHMED, A. 2019. INFLUENCE OF ORGANIC MANURE, BIOFERTILIZER AND/OR SOME VITAMIN TREATMENTS ON: A. VEGETATIVE GROWTH AND FLOWERING ASPECTS OF GLADIOLUS GRANDIFLORUS VAR. GOLD FIELD PLANTS. *Scientific Journal of Flowers and Ornamental Plants,* 6**,** 113-124.

AHMED , A. S., KHIDER, A. K. & MUNIANDY , S. 2017. Transfer of nif genes from Nitrogen fixer Azotobacter chroococcum to phosphors solubilizing Bacillus megaterium var. phosphaticum by conjugation. *ZANCO Journal of Pure and Applied Sciences,* 29**,** 79-111.

ATLAS, R. M., PARKS, L. C. & BROWN, A. 1995. Laboratory manual of experimental microbiology. Mosby-Year Book. *Inc., USA*.

BURBIDGE, F. W. 1875. *The Narcissus: its history and culture with coloured plates and descriptions of all known species and principal varieties,* Reeve.

ÇıĞ, A. & ÇıĞ, F. 2019. The effect of some PGPBs on post-harvest weight, length and width of Hyacinth bulbs planted in different areas. *ICOFAAS 2019***,** 38.

DANA, M. N. & LERNER, B. R. 2001. *Black walnut toxicity,* Department of Horticulture, Purdue University, Cooperative Extension Service.

DARLINGTON, C., HAIR, J. & HURCOMBE, R. 1951. The history of the garden hyacinths. *Heredity,* 5**,** 233-252.

DOLE, M. & WILKINS, H. 2005. Floriculture: principles and species. Prentice-Hall. *Inc. Upper Saddle River, USA*.

EL-NAGGAR, A. H. 2010. Effect of biofertilizer, organic compost and mineral fertilizers on the growth, flowering and bulbs production of Narcissus tazetta, LJ Agric. & Env. *Sci. Alex. Univ., Egypt,* 9**,** 24-52.

FORBES, B. A., SAHM, D. F. & WEISSFELD, A. S. 2007. *Diagnostic microbiology,* Mosby St Louis.

GABRA, G. W. R. 2021. Response of Narcissus Constantinople'Double Roman'Plants of Some Natural and Chemical Fertilizers. *Egyptian Academic Journal of Biological Sciences, H. Botany,* 12**,** 147-160.

HASSANEIN, M. M. & EL–SAYED, S. G. 2009. EFFECT OF SOME ORGANIC AND BIO-FERTILIZATION TREATMENTS ON GLADIOLUS PLANTS 2-CORM PRODUCTION AND CHEMICAL CONSTITUENTS. *Journal of Plant Production,* 34**,** 6577-6588.

HU, F., LIU, H., WANG, F., BAO, R. & LIU, G. 2015. Root tip chromosome karyotype analysis of hyacinth cultivars. *Genet. Mol. Res,* 14**,** 10863-10876.

JACKSON, H. 1973. Soil chemical analysis, pub., prentica hall India pvt. ltd. *New Delhi*.

JAMIL, S. M., AMEEN, S. K. & ABBOOD, B. M. 2008. EFFECT OF METHOD PF PLANTING, BULB WEIGHT AND CHEMICAL FERTILIZATION ON SOME GROWTH TRAITS OF Narcissus tazetta. *Iraqi Journal of Agricultural Science,* 39.

KARAGÖZ, F. P., DURSU, A. & KOTAN, R. 2019. Effects of Rhizobacteria on Plant Development, Quality of Flowering and Bulb Mineral Contents in Hyacinthus orientalis L. *Alinteri Journal of Agriculture Science,* 34**,** 88-95.

LE NARD, M. & DE HERTOGH, A. 1993. Bulb growth and development and flowering. Elsevier.

LE NARD, M. & DE HERTOGH, A. Research needs for flower bulbs (geophytes). VIII International Symposium on Flowerbulbs 570, 2000. 121-127.

MATTHEWS, V. 1994. The New Plantsman (vol 1). *London: Royal Horticultural Society, ISBN***,** 1352-4186.

MOHAMED, A. S. A., KHIDER, A. K. & MUNIANDY, S. Effect of Storage Temperature, Duration and Types of Biofertilizer Carriers on Survival and Numbers of Bacterial Strains Bacillus megaterium var. phosphaticum, Azotobacter chroococcum, Rhizobium leguminosarum and Transformant, Transconjugant B. International Conference on Agricultural, Food, BIological and Health Sciences, 2016.

NASIR, M. H. 2017. Influence of Different Organic Manures and Bio-Fertilisers on Morphological, Floral and Bulb Traits of Narcissus (Daffodil Cv.“Salome”). *International Journal of Agriculture Sciences, ISSN***,** 0975-3710.

REDDY, D., MOHAN, B., NATARAJA, S., KRISHNAPPA, M. & ABHILASH, M. 2010. Isolation and molecular characterization of Bacillus megaterium isolated from different agro climatic zones of Karnataka and its effect on seed germination and plant growth of Sesamum indicum. *Research Journal of Pharmaceutical Biological and Chemical Sciences,* 1**,** 614-625.

REES, A. 1969. The initiation and growth of Narcissus bulbs. *Annals of botany,* 33**,** 277-288.

RIZK, G. W. & ELNGAR, M. A. 2020. Effect of Soil Conditioners, Seaweed Extracts and Chemical Fertilizers: onGrowth, Flowering and Bulbs Production ofNarcissus tazettaL. subsp. *Egyptian Academic Journal of Biological Sciences, H. Botany,* 11**,** 69-79.

SMIGIELSKA, M., JERZY, M. & KRZYMINSKA, A. 2014. The growth and flowering of Hyacinthus orientalis L. forced in pots under fluorescent light of different colours. *Acta Agrobotanica,* 67.

XIE, Y.-P. & YANG, Z.-Q. 2009. The Influence of Day Length on Ornamental Quality of Narcissus [J]. *Northern Horticulture,* 6.