AlQalam
Alq J Med App Sci
https://journal.utripoli.edu.ly/index.php/Alqalam/index eISSN 2707-7179

Original article

Influence of Nitrogen, Potassium and Phosphorus Fertilizers with Foliar Application of Micronutrient of Iron, Zinc and Manganese on Bulb Characteristics of Single Flower Tuberose Plants (*Polianthes Tuberosa*, L.)

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ARTICLE INFO

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Received: *03-06-2024*
Accepted: *26-07-2024*
Published: *31-07-2024*

Keywords. *Tuberose, Fertilizers, Bulbs, Micro-Elements, Fresh Weight.*

ABSTRACT

The global market for flowers and ornamental plants is expected to expand at a rate of approximately 6.3% over the next five years, reaching an estimated value of $57.4 billion USD by 2024. Tuberose (Polianthes tuberosa L.), a summer flower cultivated by small-scale growers primarily for export. The study was aimed to cultivate tuberose plants in Al-Jabal Al-Khader region, introducing them as a new cut flower crop, as a source for tuberose, and leveraging their economic potential. A field experiment was conducted over two summer growing seasons to investigate the impact of different levels of compound fertilizer (nitrogen, phosphorus and potassium, NPK 4:4:4) in application rates (0, 500, 1000, and 1500 kg.ha^{-1}) and foliar sprays of micronutrients iron (Fe), zinc (Zn), manganese (Mn), and a (mixture of these three elements) on tuberose bulbs. The experimental design was a completely randomized block design split-plot with three replications. The NPK fertilizer levels were randomly assigned to the main plots, while the micronutrient treatments were allocated to the subplots. The study found that varying rates of NPK fertilization did not significantly affect the number of bulbs per plant over the two growing seasons. In contrast, the application of micronutrient foliar sprays had a notable impact, with the mixture of Fe, Zn, and Mn yielding the highest significant increase in bulb number per plant in both seasons. It is recommended to apply a mixture of the three micronutrients (Fe, Zn, and Mn) as fertilizer to produce high-quality Tuberose plants for various decorative purposes in landscaping.

Cite this article. *Abdalghani S, Fadhil Z, Rizq M, Muhammed F. Influence of Nitrogen, Potassium and Phosphorus Fertilizers with Foliar Application of Micronutrient of Iron, Zinc and Manganese on Bulb Characteristics of Single Flower Tuberose Plants (Polianthes Tuberosa, L.). Alq J Med App Sci. 2024;7(3):656-663.* https://doi.org/10.54361/ajmas.247330

INTRODUCTION

The introduction should briefly place the study in a broad context and highlight why it is important. It should define the Floriculture products encompass a variety of garden plants, including cut flowers, pot plants, seeds, cut foliage, tubers, bulbs, rooted cuttings, and dried flowers or leaves [1]. In 2022, the international floriculture market reached a valuation of $49.8 billion USD. The cultivation of flowers has recently begun in various countries due to its significant social and economic benefits [2]. Recently, the global area production of the flowers and pot plant production in the world has been estimated to be 650,000 ha [3]. Tuberose (*Polianthes* *tuberosa* L.), a fragrant ornamental flower native to Mexico, has emerged as one of the most significant commercial cut flowers in recent years. It is cultivated extensively in Asia and has spread to various parts of the world, being grown in 16 countries [4-6]. In addition, tuberose is the only bulbous cut flower available during the hot summer months and is known for its hardiness [6-8]. Valuable cut flower and is an important commercial flower of the worlds, belongs to Amaryllidaceae family [6,9,10]. Tuberose is known as a bulbous perennial, perpetuating itself through the bulblets, the colour of the leaves is light green [5,6,11]. There are about fifteen species under the genus Polianthes. Tuberose flowers basically funnel shaped and perianth part highly fragrant and waxy white flowers, about 20-25 mm long [6]. The flowers are economically important as a cut flowers. The inflorescence of tuberose is called spike [5,9]. Tuberose flowers are a good source of essential oils, which serve as valuable raw materials for the perfume industry [12-14]. Tuberose can be successfully cultivated as both a pot plant and bedding plant, offering multiple uses. Commercially, it is utilized for garland making, aesthetic purposes, birthday ceremonies, and floral arrangements such as bouquets, boutonnieres, and potpourri. Tuberose is also favoured for table decorations due to its long-lasting vase life and strong fragrance, which is attributed to the presence of geraniol, nerol, benzyl alcohol, eugenol, and methyl anthranilate [5,6,9,11,15,16]. Mazed et al. reported that tuberose has a high market demand, with significant production and substantial returns [5,17]. Vegetative methods, including bulb division, bulblets, and bulb propagation, are commonly employed for tuberose flower plant propagation. However, seed propagation is seldom utilized due to its inherent difficulty [18]. Plant growth and economic cultivation of tuberose are affected by many factors among them fertilizer is one of the significant factors. Several reports have indicated that fertilizers have great influence on growth, building and flower production in tuberose [19,10].

Tuberose is requiring a high quantity of nutrient (NPK) for increasing flower yield, quality of flower and bulb production of tuberose [5,6]. Tuberose responds the application of organic and inorganic manures. Nitrogen, phosphorus, and potassium have a significant effect on spike production and floret quality [10,20].

NPK has substantial role on increasing the number of bulb production of tuberose. It also increases number of leaves, plant height, increasing the number of spikes and the quality [5,21]. Furthermore, micronutrients plays a key role for better growth of tuberose [12]. A study has indicated that zinc, copper, and manganese are highly effective approaches for plants, acting as cofactors for various enzymes or serving as functional, structural, or regulatory components in various biosynthetic processes such as auxin synthesis, cell division, protein synthesis, and photosynthesis. Additionally, copper plays a crucial role as an activator for several enzymes, including ascorbic acid [12]. Thus, this research was undertaken with the overarching objectives of cultivating tuberose plants in the Al-Jabal Al-Khade region as a novel cut flower crop and a source for tuberose, followed by evaluating the tuberose's response to varying levels of compound fertilizer NPK (4:4:4), along with microelements (Fe, Zn, Mn, and a combination thereof) applied as foliar sprays, focusing on bulb quality attributes.

METHODS

Source of planting material

Two field experiments were carried out in the experimental farm belonging to the Horticulture Department - Faculty of Agriculture - Omar Al-Mukhtar University on single (*Polianthes tuberosa*, L.) flowers throughout the two successive seasons. The *Polianthes tuberosa* bulbs with an average weight of 67.3 g and 4.2 cm in diameter were chosen for the present investigation in the first season while, in the second season the bulbs from untreated plant (control) plants were used in the first season, with an average weight of 72.1 g and an average diameter of 3.6 $cm.bulb^{-1}$. The Bulbs Were purchased from the Medicinal and Aromatic Plants Research Centre affiliated to the Ministry of Agriculture Ad- Doqi Republic of Egypt.

Experimental Site

The experimental site was prepared by blowing and leveling the soil in both seasons. Soil samples were collected from the experiment site to identify some of the natural and chemical properties of the soil of the experiment site (Table 1).

Soil samples were collected at a depth of 25cm before starting the experiment and were analyzed at the soil laboratory of the Soil and Water Department at the- Omar Al-Mukhtar University.

Table 1. Soil Characteristics and Properties of the Experimental Site

Measurements		
Particle Size distribution	Sand (%)	14.13
	Silt (%)	52.61
	Clay (%)	30.99
Organic Matter (%)		2.44
E.C (Mmhos/ cm)		1.17
Total Nitrogen (%)		0.24
Soil pH		7.21
CO3⁻ ⁻%		1.33
P ppm		116
K ppm		280

Experiments factors

Compound fertilizer.

In both study seasons, have been used the compound fertilizer (NPK) with a fertilizer ratio of (4: 4: 4) the rates were used (0, 500, 1000 and 1500 $kg.ha^{-1}$) to fertilize the plants, and was formulated using urea fertilizer (46% N), monocalcium phosphate (15.5% P_2O_5) and potassium sulphate (48% K_2O) were used as sources of nitrogen, phosphorus and potassium respectively.

Micronutrient

The respective source of iron, zinc, and manganese was the commercial fertilizer containing iron, zinc and manganese at (12 ، 12 ،13 %) respectively, in the chelated form. Control plants were sprayed with distilled water. The experimental design was a randomized complete block, split-plot design where the experiment site was divided into three replications, each replicate containing 20 basins.

Nutrient application

The plants were treated with micronutrient iron, zinc and manganese, by spraying after prepared aqueous solutions of each of them at a concentration of 200 ppm individually, then spraying with treatment of a mixture of three elements. In addition, the plants were sprayed with distilled water (control). Accordingly, there are five treatments of the micronutrient (iron - zinc – manganese each treatment), treatment of a mixture of three elements, untreated plant held as a control). Thus, the number of experimental treatments is 20 treatments.

Experimental design

The experimental design used in the two experiments a randomized complete block, split-plot design with three replications, each replicate containing 20 basins with a distance of 1 x 1 m^2, each representing a treatment. The basins were separated from each other inside each replicate with a 50 cm a separating line will be left to avoid any effects of adjacent treatments as much as possible. Moreover, the replicates were also separated from each other by 1m distance. The four fertilizer treatments of compound fertilizer were (4 rates) were distributed randomly in the main plots, while the five of micronutrient treatments were randomly distributed in the sub-plots (Figure 1).

Field treatments

On the first of April in both growing seasons, bulbs were planted in two rows within each basin. A distance of 10 cm was maintained from the start of each row, with bulbs spaced 20 cm apart from each other. Planting was carried out using a wooden stake to reach a depth of 5 cm below the soil surface. Consequently, each row consisted of five plants, resulting in a total of 10 plants per basin. The rates of compound fertilizer allocated to each experimental unit were divided into three equal portions. The first portion was applied adjacent to the plants 25 days after bulb germination. Subsequently, the second portion was applied 15 days after the initial application, followed by the third portion 15 days thereafter. Thus, each fertilization rate was administered to the plants in three doses, at 25, 40, and 55 days after germination. A 200-ppm aqueous solution of the three-micronutrient fertilizer was prepared for use. Each treatment received this solution through spraying onto the vegetative growth of the plants until the spray droplets reached the ground. This application occurred seven days after each addition of compound fertilizer, which took place at 32, 47, and 62 days after bulb germination. All agricultural practices necessary for tuberose plant production, including irrigation and weeding, were conducted punctually and as needed throughout both growing seasons.

Figure 1. Tuberose plant at flowering stage

Observations to be recorded.

bulb measurements

After 210 days of cultivation, the bulbs were produced. The following data were recorded:

Number of bulbs. plant^{-1}.

Fresh weight (g) of bulbs.

Dry weight (g) of bulb dried in a drying oven at 70 °C until weight stability.

Statistical analysis of data

Statistical analysis (analysis of variance) was conducted for each trait in both seasons of the study and the averages of the various coefficients were compared using the Duncan multinomial test at a significance level of 0.05 using the statistical program Mstat according to the method of Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

Effects of different fertilizer levels of NPK compound, foliar sprays micronutrients and their interaction on the number of bulbs / plants.

Number of bulbs per plant in Tuberose varied significantly with different NPK fertilizer levels and micronutrient treatments during the first growing season. The interaction between NPK rates and micronutrient applications was also significant. The highest average number of bulbs per plant was observed with the application of 500 kg.ha^{-1} NPK and the combination of micronutrients (15.66 bulbs.plant^{-1}). In contrast, the lowest bulb count was recorded at the highest NPK rate of 1500 kg.ha^{-1} without any micronutrient application (7.00 bulbs.plant^{-1}). Overall, the treatment combination of micronutrients resulted in the highest average number of bulbs per plant (12.92), while the control had the lowest (8.66). During the second growing season, the pattern of results was somewhat different, showing an increased number of bulbs per plant across all treatments. The highest bulb count was observed with the 1000 kg.ha^{-1} NPK rate combined with the micronutrient mixture (53.00 bulbs.plant^{-1}). The lowest bulb count was seen at 0 kg.ha^{-1} NPK without micronutrient application (29.67 bulbs/plant). The average number of bulbs per plant was highest for the micronutrient combination treatment (47.00), and lowest for the control (32.75) (Table 2). The results from both growing seasons indicate a complex interaction between NPK fertilization and micronutrient application on the bulb production of Tuberose. During the first season, lower levels of NPK (0 and 500 kg.ha^{-1}) combined with micronutrient treatments generally produced more bulbs per plant, suggesting that moderate fertilization coupled with micronutrient supplementation is beneficial for bulb production. In the second season, the overall increase in bulb numbers across all treatments indicates a positive cumulative effect of fertilization and micronutrient application. The superior performance of the 1000 kg.ha^{-1} NPK rate with the combination of micronutrients in the second season suggests that plants might require higher nutrient levels as they mature and develop over time. The significant increase in bulb production with the combination of iron, zinc, and manganese across both seasons highlights the importance of these micronutrients in enhancing tuberose growth and productivity. These micronutrients likely act as cofactors in various enzymatic processes and contribute to improved physiological functions, such as photosynthesis and protein synthesis, leading to better plant health and higher bulb yields [21,22].

Table 2. Effects of different fertilizer levels of NPK compound, foliar sprays micronutrients and their interaction on the number of bulbs. plant^{-1} in Polianthes tuberosa during two growing seasons

First/ second growing season											Average	
Micronutrients NPK rate Kg.ha^{-1}	**Control First /second**		**Fe First/second**		**Zn First/second**		**Mn First/second**		**Combination First/second**			
0	9.66	29.67	12.66	35.67	10.66	29.33	12.00	38.67	13.66	37.33	11.73 A	34.13 C
500	9.66	38.00	10.00	45.00	11.66	40.00	12.66	44.00	15.66	47.67	11.93 A	42.93 A
1000	8.33	32.33	10.33	49.67	7.66	41.00	10.00	44.00	12.66	53.00	9.80 B	44.00 A
1500	7.00	31.00	7.33	34.00	7.33	31.00	8.33	35.00	9.66	50.00	7.93 C	36.20 B
Average	8.66 B	32.75 C	10.08 B	41.08 B	9.33 B	35.33 C	10.75 AB	40.42 B	12.92 A	47.00 A		

**Means followed by the same letter are not significantly different at P <0.05. which evaluated in the study where "a" represents the highest value and "c" the lowest value at P<0.0.*

Effects of different fertilizer levels of NPK compound, foliar sprays micronutrients and their interaction on the fresh weight of the bulbs

In the first growing season, the fresh weight of tuberose bulbs differed considerably depending on the micronutrient treatments and NPK fertilizer doses. The combination of micronutrients and 500 kg.ha^{-1} NPK produced the highest average fresh weight (73.50 g). With no micronutrient treatment, the lowest fresh weight (40.27 g) was observed at 1500 kg.ha^{-1} NPK. Overall, the average fresh weight produced by the combination of micronutrients was highest (66.66 g), while the control had the lowest (45.86 g). In the second growing season, the pattern of fresh weight results was more pronounced.

The highest fresh weight (290.9 g) was observed at 0 kg.ha^{-1} NPK combined with the micronutrient mixture, significantly outperforming other treatments. Conversely, the lowest fresh weight (118.6 g) was recorded at 0 kg.ha^{-1} NPK without any micronutrient treatment. The average fresh weight was highest for the micronutrient combination treatment (240.7 g) and lowest for the control (134.1 g) (Table 3).

Findings from both growing seasons illustrate the significant influence of NPK fertilization and micronutrient applications on the fresh weight of tuberose bulbs. During the first season, the optimal fresh weight was achieved with moderate NPK fertilization (500 kg. ha^{-1}) combined with the micronutrient mixture, suggesting that balanced nutrient supplementation promotes optimal plant growth and bulb development. In the second season, the notable increase in fresh weight across all treatments underscores the cumulative beneficial effects of fertilization and micronutrient application over time. The exceptional performance of the micronutrient mixture even at the lowest NPK rate highlights the critical role of these micronutrients in enhancing plant physiological processes and biomass accumulation. Results of the current study indicate that micronutrients greatly increase the fresh weight of tuberose bulbs, especially when they are combined. These components probably enhance metabolic processes like photosynthesis, nitrogen absorption, and enzymatic activity, which increase biomass output [23]. The better results from the second growing season also suggest that plant productivity can be maintained and even increased over the course of subsequent growing seasons with consistent and appropriate fertilizer management.

Table 3. Effects of different fertilizer levels of NPK compound, foliar sprays micronutrients and their interaction on the fresh weight (g) of the bulbs in Polianthes tuberosa during two growing seasons.

Micronutrients NPK rate Kg.ha^{-1}	Control First /second		Fe First/second		Zn First/second		Mn First/second		Combination First/second		Average	
	First/second growing season											
0	41.17	118.6	57.33	131.7	55.67	131.5	60.33	159.0	60.50	290.9	55.00B	166.3B
500	54.50	123.3	71.00	143.1	56.00	142.0	66.67	224.2	73.50	233.4	64.33A	173.4A
1000	47.50	155.5	54.67	169.4	43.33	167.0	68.33	177.1	67.33	180.8	56.23B	170.0B
1500	40.27	138.9	57.83	139.9	57.83	138.3	63.33	146.0	65.30	125.9	56.91B	164.2 C
Average	45.86 D	134.1 C	60.21 B	146.0 C	53.21 C	145.0 C	64.67 AB	176.6 B	66.66 A	240.7 A		

**Means followed by the same letter are not significantly different at P <0.05. which evaluated in the study where "a" represents the highest value and "c" the lowest value at P<0.0.*

Effects of different fertilizer levels of NPK compound, foliar sprays micronutrients and their interaction on the dry weight (g)of the bulbs.

Different NPK fertilizer levels and micronutrient treatments had a substantial impact on the dry weight of tuberose bulbs in the first trial. The combination of micronutrients and 1000 kg.ha^{-1} NPK produced the highest average dry weight (26.03 g). A dry weight of (13.50 g) was the lowest that was observed at 0 kg.ha^{-1} NPK in the absence of micronutrient supplementation. The average dry weight of the micronutrient combination was the highest at 24.88 g, whereas the control treatment had the lowest at 16.71 g. The dry weight data from the second growth season revealed a clearer pattern. When the micronutrient mixture and 1000 kg.ha^{-1} NPK were mixed, the maximum dry weight (78.87 g) was seen.

On the other hand, with 1000 kg.ha^{-1} NPK without any micronutrient treatment, the lowest dry weight (35.83 g) was observed. The micronutrient combo treatment had the highest average dry weight (73.34 g), while the control treatment had the lowest average dry weight (40.22 g) (Table 4). The micronutrient combination's considerable increase in dry weight in both seasons suggests that these nutrients are essential for several physiological and metabolic functions. The findings imply that the dry weight of tuberose bulbs can be greatly increased by combining the administration of micronutrients with the proper amounts of NPK fertilization. The improved outcomes in the next season provide more evidence of the long-term advantages of this comprehensive nutrition management strategy.

Table 4. Effects of different fertilizer levels of NPK compound, foliar sprays micronutrients and their interaction on the dry weight of bulbs / plant in Polianthes tuberosa during two growing seasons.

Micronutrients NPK rate Kg.ha^{-1}	Control First /second		Fe First/second		Zn First/second		MFirst/second		Combination First/second		Average	
	First/ second growing season											
0	13.50	37.60	15.17	48.80	15.17	43.23	22.83	51.07	22.83	74.23	17.90 C	50.99 B
500	17.76	46.87	20.17	50.70	20.83	47.03	21.13	63.40	26.00	64.60	21.16 B	54.52 AB
1000	19.50	35.83	24.17	56.87	22.17	44.77	24.67	78.53	26.03	78.87	23.31 A	58.97 A
1500	16.17	40.57	21.17	41.13	16.33	39.17	19.97	47.13	24.67	75.67	19.66 B	48.73 B
Average	16.71 C	40.22 D	20.17 BC	49.38 C	18.63 C	43.55 CD	22.15 AB	60.03 B	24.88 A	73.34 A		

**Means followed by the same letter are not significantly different at P <0.05. which evaluated in the study where "a" represents the highest value and "c" the lowest value at P<0.0.*

CONCLUSION

Overall, these findings underscore the critical importance of implementing a balanced fertilization strategy that incorporates both macronutrients and micronutrients. This approach is essential for optimizing various aspects of tuberose cultivation, including bulb production per plant, as well as the fresh and dry weight of the bulbs.

The integration of macronutrients, such as nitrogen, phosphorus, and potassium, with vital micronutrients like iron, zinc, and manganese, plays a pivotal role in enhancing plant growth and maximizing yield. The significant improvements observed in both the number of bulbs and their weights across different treatments highlight the synergistic effects of combined nutrient management. This balanced fertilization not only supports robust plant development but also contributes to achieving higher productivity and better-quality tuberose bulbs, which are crucial for both ornamental and commercial purposes. Looking forward, it is essential to conduct further research to evaluate the economic feasibility of these fertilization treatments. Understanding the cost-effectiveness and return on investment is vital for growers to adopt these practices on a larger scale. Additionally, long-term sustainability studies are necessary to ensure that these fertilization strategies do not lead to soil degradation or other negative environmental impacts over time. By exploring these aspects in greater detail, future research can provide comprehensive and practical recommendations for commercial tuberose cultivation. These insights will aid in developing sustainable agricultural practices that not only enhance productivity but also maintain environmental health, ensuring the viability of tuberose farming for future generations.

Acknowledgments

The authors of this research with to thank the Department of Horticulture, Faculty of Agriculture at Omar Al-Mukhtar University in Al-Bayda, Libya for its support of this experiment. They all gave us significant professional and personal mentoring.

Conflicts of Interest

The authors declare no conflict of interest.

REFERENCES

1. Safeena SA, Thangam M, Devi SP, Desai AR, Singh NP. Ready reckoner on cultivation of tuberose. Tech. Bull. Pac. Tuna Dev. Found. 2015;50: 1-25.
2. 2-Patel DS, Chawla SL, Vithu GN. Effect of botanicals on vase life of cut flowers: a review. Bull. Env. Pharmacol. Life. Sci. 2018 Dec 1;8(1):1-8.
3. Hubner S. International statistics flowers and plants. 2016; 64: 16-19 Cited on 18/6/2024. www.aiph.org/statistical-yearbook
4. Murrithi AN, Wamocho LS, Njoroge JM. Distribution, production, and quality characteristics of tuberose (*Polianthes tuberosa L.)* cut flower in Kenya. Afr J Hort Sci. 2011; 5:26-35.
5. Mazed H, Pulok AI, Rahman H, Monalesa N Partho S. Growth and yield of tuberose as influenced by different levels of manures and fertilizers. Int. J. Multidisci. Res Dev 2015;2(4): 555-558.
6. Mandal M, Maitra S, Mahata D. Production technology of tuberose (Polianthes tuberosa L.) cultivation. J. Pharmacogn Phytochem 2018;7(6):2360-4.
7. Ahmad I, Ahmad T, Asif M, Saleem M, Akram A. Effect of bulb size on growth, flowering and bulbils production of tuberose. Sarhad Journal of Agriculture. 2009;25(3):391-7.
8. Asif M, Ahmad I, Qasim M, Bashir M. Vase water quality impact postharvest performance of cut tuberose (Polianthes tuberosa L.) 'Single' spikes**.** Pak J Agri Sci. 2016;53(4):925-931.
9. Gangwar A, Singh J, and Singh I. Influence of nitrogen and phosphorus fertilizers with nitrogen sources on floral parameters of tuberose (Polianthes tuberosa L.). Hort Flora Research. Spectrum 2013 Jul 3;2(1):40-4.
10. Habib ZF, Hossain I, Mazed HE, Sultana T, Halim A. Growth and Yield of Tuberose (Polianthes tuberosa L.) as Influenced by Nutrient Management. Eur. Acad. Res 2016. Mar 12;(3): 12784-95.
11. Pradnya G, Prakash N, Lahanu G. Role of gibberellic acid in tuberose cultivation. 2022;(9):978-1-102.
12. Jain P. Effect of micronutrients on growth and flowering of tuberose (Polianthes tuberosa L.). (Doctoral dissertation, M.Sc. Thesis, College of Horticulture, Mandsaur, India. 2014.
13. Rajput E, Kumar A, Sharma RK, Gallani R, Saxena S. Performance of different tuberose cultivars for flowering parameters under Malwa Plateau of Madhya Pradesh. Pharma. Innov. J.2022; 11(1): 909-12.
14. Gadakh AS, Kamble SD. Economics analysis of tuberose flower production in Akola district, Maharashtra. Pharma Innov. J.2023: 12(5): 388-389.
15. Qureshi A, Gupta CY, Abrol A. Prospects of value addition in jasmine and tuberose. J. Emerg. Technol. Innov. Re.2018; 7(6): 2360-64.
16. Ali H, Arshad M, Jan IU, Zamin M, Khan J, Ullah I, Ali M. Influence of Various Concentrations of Gibberellic Acid and Micronutrients for Enhancing Growth and Flowering of Tuberose (Polyanthas Tuberosa). Sarhad Journal of Agriculture. 2019 Jun 1;35(2):550-6.

17. Mohanty S, Nath MR, Palai SK. Effect of Organic and Inorganic Sources of Nitrogen on Plant Growth, Bulb Characteristics and Yield of Tuberose (Polianthes tuberose L.) cv. Prajwal. Int. J. Curr. Microbiol. App. Sci. 2020;9(3):1561-6.
18. Sugiartini E, Palupi ER, Widajati E. The effect of bulbs size and induction techniques of tuberose (Polianthes tuberose L.) on its sprouting rate, simultaneity, and bulbs number. InIOP Conference Series: Earth and Environmental Science 2021 Jul 1;800(1):12-25.
19. Polara ND, Dhola SN, Khimani RA, Delvadia DV, Viradia RR. Effect of different levels of inorganic fertilizers on flower quality and nutrient content of tuberose. J. Current Bio. Sci. 2004;(2):194-7.
20. Islam F. Influence of organic amendments and EM on yield and preservatives on vase life of gladiolus. An MS thesis submitted to Dept. of Horticulture. BSMRAU, Salna, Gazipur. 2011; 2(4):1-9.
21. Meena RK, Mahawer LN, Bairwa HL. Standardization of NPK dose for growth, floral, bulb and economic parameters on Phule Rajani tuberose. Indian. J. of Hortic. 2018;75(3):486-91.
22. Kumar P, Arora JS. Effect of micronutrients on gladiolus. J. Ornam. Hortic. 2000;3 (2):91-3.
23. Karuppaiah P. Effect of zinc and boron on growth, yield and quality of tuberose (Polianthes tuberosa L.) cv. Prajwal. Hortic Int J. 2019;3(1):7-11.

تأثير الأسمدة النيتروجينية والبوتاسيوم والفوسفورية مع التسميد الورقي بالعناصر الصغرى من الحديد والزنك والمنجنيز على خصائص بصيلات نباتات مسك الروم أحادية الزهرة(*Polianthes Tuberosa*, L.)

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[2]قسم تقنية الإنتاج النباتي، المعهد العالي للتقنيات الزراعية، العويلية، المرج، ليبيا

المستخلص

من المتوقع أن يتوسع السوق العالمي للزهور ونباتات الزينة بمعدل 6.3٪ تقريبًا على مدى السنوات الخمس المقبلة، ليصل إلى قيمة تقديرية تبلغ 57.4 مليار دولار أمريكي بحلول عام 2024. مسك الروم (*Polianthes tuberosa* L.)،هو زهرة صيفية تزرع علي نطاق صغير لهدف التصدير. هدفت الدراسة إلى زراعة نباتات مسك الروم في منطقة الجبل الأخضر، وتقديمها كمحصول جديد من أزهار القطف كمصدر لمسك الروم، والاستفادة من إمكاناتها الاقتصادية. أجريت تجربة ميدانية على مدار موسمين صيفيين للنمو للتحقيق في تأثير مستويات مختلفة من الأسمدة المركبة) النيتروجين والفوسفور والبوتاسيوم، (NPK 4:4:4في معدلات التطبيق (0، 500، 1000، و 1500 كجم. هكتار -1) والرش الورقي للعناصر الغذائية الدقيقة الحديد (Fe) والزنك (Zn)والمنجنيز (Mn) و (مزيج من هذه العناصر الثلاثة) على بصيلات مسك الروم. كان التصميم التجريبي عبارة عن تصميم كتلة عشوائية كاملة مع تقسيم القطع بثلاثة مكررات. تم تعيين مستويات سماد NPK عشوائيًا للقطع الرئيسية، في حين تم تخصيص معالجات العناصر الغذائية الدقيقة للقطع الفرعية. وجدت الدراسة أن المعدلات المتفاوتة من تسميد NPK لم تؤثر بشكل كبير على عدد البصيلات لكل نبات خلال موسمي النمو. في المقابل، كان لتطبيق الرش الورقي للعناصر الغذائية الدقيقة تأثير ملحوظ، حيث أعطى خليط الحديد والزنك والمنجنيز أعلى زيادة كبيرة في عدد البصيلات لكل نبات في كلا الموسمين. يوصى باستخدام خليط من العناصر الغذائية الدقيقة الثلاثة (الحديد والزنك والمنجنيز) كسماد لإنتاج نباتات مسك الروم عالية الجودة لأغراض الزينة المختلفة في المناظر الطبيعية.

الكلمات المفتاحية. مسك الروم، الأسمدة، البصيلات، العناصر الدقيقة، الوزن الطازج.