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SUPPLEMENTING ORGANO-BIO-STIMULANTS INTO GROWING MEDIA IMPROVES GROWTH, BIOCHEMICAL RESPONSE, FLOWER PRODUCTIVITY AND QUALITY OF LILY BULBS

Eman A. Swedan* and Samah M. Youssef**

* Horticulture Department, Faculty of Agriculture, Damanhour University, Egypt
** Horticulture Department, Faculty of Agriculture, Fayoum University, Fayoum, Egypt

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Corresponding author:
Samah M. Youssef
smy00@fayoum.edu.eg

ABSTRACT: Addition of organo-bio-stimulants may have major impact on bio-chemical attributes of growing media and flower productivity. The current study evaluated the response of lily bulbs for growth, some bio-chemical characteristics, and flowering quality to various growing media which included sand, clay, sand: clay (1:1 v/v), or sand: clay: compost (1:1:1 v/v) supplemented with Humicil and/or Power max. Results proved that the use of growing media led to significant differences in growth, flowering, and chemical component parameters of lily plants. However, there was superiority in these traits due to planting in a medium consisting of a mixture of sand: clay: compost (1:1:1 v/v), followed by sand: clay (1:1 v/v), then clay media. On contrast, planting in sand soil was coincided with a decrease in above-mentioned characteristics compared to the other media. The addition of various organo-bio-stimulants coincided with an improvement in growth, flowering and chemical component measurements. Moreover, adding the mixture of Humicil with Power max, followed by Power max alone showed the greatest effect on improving measurements. The combination between growing media and stimulants showed a significant difference in all measurements of plant growth, flowering and chemical components of lily plants. However, the highest values of these traits coincided with the combination between a mixture of sand: clay: compost (1:1:1 v/v) with the mixture of Humicil and Power max.

Keywords: *Lilium hybrid*; growing media, bio-stimulants, growth, flowering, chemical components

INTRODUCTION

Ornamental plants have become more economically significant, and demand for them has grown quickly outside. The majority of the cut flowers used in the industry are flowering bulbs (Wani *et al*., 2018). The lily plant (*Lilium hybrida* cv. Borsa) belongs to the Liliaceae family and is a bulbous flower with high economic value (Rafiq *et al*., 2021). The plants produce distinctive aromatic flowers and can be grown in multiple climatic conditions in the world (Askari *et al*., 2018; Youssef *et al*., 2019). Due to its great importance, it has been used for a long time to make bouquets (Alam *et al*., 2013), used as potted plants, decorating homes, and as cut flowers that last a long time (Bhandari and Aswath, 2018), and it also has a great export value (Ali *et al*., 2023). Historically, the majority of lily species have been employed as culinary or medicinal plants (Tang *et al*., 2021). Recently, some of these species have been incorporated into traditional dishes (Tang *et al*., 2022). In addition, a variety of Chinese dishes, such as tea, noodles, distilled wine, and snacks, use the bulbs and leaves, whereas Japanese dishes include croquettes, mixed rice, mixed jelly, stew, and other dishes (Chawla *et al*., 2022). Zhang *et al*. (2023)

noted that phenolic compounds, a type of therapeutic ingredient, are present in lily bulbs.

Growing media consumption is rapidly increasing, which poses serious challenges to the sustainability of the floricultural industry (Kaushal and Kumari, 2020). Characteristics of the different growing media have direct and indirect impacts on the plant growth and production. The importance characteristics of ideal growing medium for agriculture are porous with good ventilation, good drainage, and cheap as well as good water retention (Amarin *et al*., 2021). The ideal growing substrate is determined by the characteristics that govern the growth and survival rate of transplanted propagation (Gruda, 2022). There are different growing media like clay, sand, and peat moss, etc. which play an important role in the success of cultivation. There is a difference in growth and flowering characteristics of lily plants as a result of growing plants in different media (Bhat et al., 2019). Results of Aliverdi and Asgari (2022) revealed that applying peat moss as culture media improved growth and productivity of lily plants.

Organic-biostimulants as Humicil or Power max are rich in various nutrients, vitamins, organic acids and plant growth regulators, as well as they are easily absorbed by plant, safe for environment, whether soil, and water or air (CS *et al*., 2023). Humicil serves as a supplemental source for various phenols, which increases the biological efficiency of the plant (Kisvarga *et al*., 2022), enhances nutrient absorption from the soil, promotes plant growth, and activates a variety of microorganisms (Kumar *et al*., 2022). Power max is considered vital bio stimulants for plant production because it contains significant amounts of plant hormones, amino acids, macro- and micro-nutrients, etc. (Chiaiese *et al*., 2018). The beneficial effects of Power max on plants come from inducing them to resist abiotic and biotic stresses. This protects it from salinity, drought, frost, changing light intensity, and colonization by bacteria or fungi (Praveen *et al*., 2021). Furthermore, Power Max has been shown to stimulate a variety of plants' growth, flowering, and productivity (Zamljen *et al*., 2021).

Recognizing the importance of lily plants, the current study was created to assess the effect of various growing media in various combinations supplemented with Humicil and/or Power max on the growth, flowering, and physio-chemical compositions of lily plant.

MATERIALS AND METHODS

Agricultural management and treatments:

This study was conducted at a private farm in Damanhour, Beheira Governorate, Egypt (31° 04° N, 30° 47° E), In two consecutive seasons, 2021/2022 and 2022/2023. In El Kanater El Khayria-Cairo-Egypt, healthy bulbs were bought from a commercial-nursery. For both seasons, bulbs weighing 22–25 g and with a diameter of 2.5–3.0 cm were soaked in a fungicide solution before being planted on 10th October, in PVC pots with a diameter of 30 cm packed with one of the utilized media, i.e. sand, clay, sand: clay (1:1 v/v), or sand: clay: compost (1:1:1 v/v).

The physio-chemical characteristics of the utilized media are summarized in Tables (1-3). The planted bulbs were irrigated thoroughly after planting in pots. One month later, plants were treated with different bio stimulants, namely Humicil, Power max, or mix of them at a rate of 2.5 ml/l. three times a

Table 1. The physio-chemical properties of the sandy soil under study.

Physical properties	Soil texture		Sand %			Silt %		Clay %	
	Sandy		94.0			2.5		3.5	
Chemical properties	**pH**	**EC (dS/m)**	**Soluble cations meq/l**				**Soluble anions meq/l**		
			Na^+	**K^+**	**Ca^{++}**	**Mg^{++}**	**CO_3^{--}**	**HCO_3^-**	**Cl^-**
	8.0	0.33	13.0	7.0	2.2	0.7	0.0	3.9	2.8

Table 2. The physio-chemical properties of the clay soil under study.

Physical properties	**Soil texture**		**Sand %**			**Silt %**		**Clay %**	
	Clay		32.0			25.75		42.25	
Chemical properties	**pH**	**EC (dS/m)**	**Soluble cations meq/l**				**Soluble anions meq/l**		
			Na^+	**K^+**	**Ca^{++}**	**Mg^{++}**	**SO_4^{--}**	**HCO_3^-**	**Cl^-**
	7.80	1.11	4.98	1.45	6.25	3.25	4.27	1.60	10.09

Table 3. The physio-chemical properties of the used compost.

Properties	Values
Chemical	
pH	6.5
EC (dS/m)	2.6
Total organic carbon (%)	20.6
Total organic matter (OM; %)	35.6
Total nitrogen (%)	1.3
Total phosphorus (%)	0.5
Total potassium (%)	0.6
C/N ratio	15.8
Physical	
Bulk density (kg/cm^3)	570.0
Moisture content (%)	30.5
Water holding capacity (g/water/g dry	4.0
Porosity (%)	63.3

season, various organic-biostimulants were used as a foliar spray, with a 15-day gap between applications. Humicil and Power max were purchased from Egyptian Fertilizers Company, Cairo, Egypt, their nutritional components are listed in Tables (4-5). The experimental treatments were arranged factorial in completely randomized blocks design with three replicates; the main plots representing the four different growing media, while sub-plots representing the four biostimulant treatments (control, Humicil, Power max, or mix). Chemical fertilization was applied to all experimental units of lily plants in two stages, thirty- and forty-five days following planting. Each pot received split treatment with 2, 4, and 4 g of calcium nitrate ($Ca(NO_3)_2$), calcium superphosphate ($CaH_4P_2O_8$), and potassium sulphate (K_2SO_4), respectively (Giri and Sashikala, 2018). Measurements of various vegetative and flowering characteristics and chemical compositions were taken from randomly selected lily plants.

Growth parameters:

Plant height (cm) was recorded by measuring the plant length from the collar region to the highest point of growth. Leaf length and width (cm): the length and width of the third leaf were taken from the top of the plant before bud opening. Number of leaves was counted as numbers of leaves produced after planting till harvesting.

Basal stem diameter (cm) was measured by Vernier caliper at the collar region just touching soil surface.

Flowering parameters:

Days to first flowering (days), flower fresh and dry weights (g), flower stalk length and diameter (cm), flower stalk fresh and dry weights (g), number of flowers/plant, and flower diameter (cm) were recorded.

N, P and K determinations in dry leaves:

Nitrogen (N) concentration was ascertained using the microkjeldahl analysis as per AOAC (2005), phosphorus (P) and potassium (K) concentrations were ascertained in accordance with Cottenie *et al.* (1982).

Determination of total carbohydrates in bulbs:

The phenol-sulfuric acid technique was used to measure the concentration of carbohydrates in bulbs, as reported by Saha and Brewer (1994).

Determination of total phenolics:

The Prussian blue technique was used to calculate total phenolics according to Price and Butler (1977).

Table 4. Composition of Humicil.

Character	Appearance	Humic acid (%)	Potassium (K_2O %)	Zn, Fe, and Mn (ppm)	pH	Water solubility (%)
Value	Black powder	81	11	100	9.3	> 97

Table 5. Composition of Power max.

Density (g/cm^3)	OM (g/L)	pH	Macronutrients content (g/l)			Cytokines, Auxins and Gibberellins (g/l)	Free amino acids (mg/kg)
			N	P	K		
0.63	440	5.5	20	9	115	590	20.6

Algenic acid (%)	Manitol (%)	Water solubility (%)	Appearance
11.5	5.5	100	Black powder

Statistical analysis:

Using the SAS program, data on a variety of parameters and the average of the two seasons were analyzed using the L.S.D test at a 5% level of probability, in accordance with Snedecor and Cochran (1980).

RESULTS

Growth parameters:

Table (6) displays the results of the study on the effects of growing media, growth stimulants, and their interactions on the growth characteristics of lily plants. The data indicates that the two factors and their interactions under investigation have a considerable impact on the values of these attributes. Likewise, higher values of plant height, leaves length and width, number of leaves/plant, and basal stem diameter were recorded when planted in a medium consisting of a mixture of sand: clay: compost (1:1:1 v/v), followed by when grown in a mixture of sand: clay (1:1 v/v).

In terms of organic-biostimulants as Humicil or/and Power max had a substantial impact on growth parameters namely plant height, leaves length and width, number of leaves/plant and basal stem diameter. Furthermore, higher records of these traits were obtained as a result of spraying plants with a mix of Humicil and Power max, followed by spraying with Power max alone.

Upon examining the interplay among the investigated variables, we ascertain that these influences have considerable importance for the diverse growth attributes. The highest values for growth attributes listed above were obtained by the interaction of growing medium which consists of sand: clay: compost with the mix of Humicil and Power max.

Flowering parameters:

Data of flowering traits like flower fresh and dry weights, as well as flower stalk diameter and length, in addition, flower stalk fresh and dry weight, number of flowers/plant, and flower diameter in response to the different growing media, organic-biostimulants and their interactions are illustrated in Tables (7 and 8). These characteristics increased as a result of planting in a mixture of sand: clay: compost (1:1:1 v/v), followed by in a mixture of sand: clay (1:1 v/v). Conversely, the lowest flowering characteristic evaluations resulted from planting in sandy soil alone. On the other side, the lowest days to first flowering was recorded with planting in a mixture of sand: clay: compost (1:1:1 v/v). Planting in sandy soil as a growing medium resulted in the longest period to the first flowering and the lowest values of other traits.

Flowering characteristics were improved when plants were sprayed with organic-biostimulants compared to the untreated plants. The best results of flowering parameters produced as a result of spraying with a mix of Humicil and Power max, followed by spraying with Power max alone.

Table 6. Effect of various growing media, organic-biostimulants additives, and their interaction on growth parameters of *Lilium hybrida* cv. Borsa.

Growing Media (A)	Organic-biostimulants (B; 2.5 ml/l)				
	Control	Humicil	Power max	Mix of them	Mean (A)
			Plant height (cm)		
Sand	56.00	61.67	65.00	67.00	62.42
Clay	60.67	65.00	68.00	70.00	65.92
Sand: Clay (1:1 v/v)	65.00	69.00	71.00	73.00	69.50
Sand: Clay: Compost (1:1:1 v/v)	68.00	71.00	72.67	76.00	71.92
Mean (B)	62.42	66.67	69.17	71.50	
LSD 5%	A=1.11		B=0.78	AB=1.74	
			Leaf length (cm)		
Sand	7.77	8.63	8.97	9.30	8.67
Clay	8.97	9.50	10.60	11.43	10.13
Sand: Clay (1:1v/v)	9.33	10.27	11.27	12.10	10.74
Sand: Clay: Compost (1:1:1 v/v)	9.53	10.60	11.53	13.33	11.25
Mean (B)	8.90	9.75	10.59	11.54	
LSD 5%	A=0.13		B=0.19	AB=0.35	
			Number of leaves/plant		
Sand	57.33	63.00	66.00	69.00	63.83
Clay	66.67	67.00	70.00	73.00	69.17
Sand: Clay (1:1v/v)	68.67	71.67	74.00	76.67	72.75
Sand: Clay: Compost (1:1:1 v/v)	71.00	74.00	77.00	82.33	76.08
Mean (B)	65.92	68.92	71.75	75.25	
LSD 5%	A= 1.04		B=1.05	AB=2.08	
			Leaf width (cm)		
Sand	1.30	1.60	1.70	1.87	1.62
Clay	1.50	1.80	2.13	2.30	1.93
Sand: Clay (1:1v/v)	1.70	1.90	2.30	2.50	2.10
Sand: Clay: Compost (1:1:1 v/v)	1.80	2.10	2.40	2.70	2.25
Mean (B)	1.58	1.85	2.13	2.34	
LSD 5%	A=0.06		B=0.10	AB=0.18	
			Basal stem diameter (cm)		
Sand	1.30	1.50	1.60	1.70	1.53
Clay	1.50	1.70	1.90	2.10	1.80
Sand: Clay (1:1v/v)	1.60	1.80	2.00	2.30	1.93
Sand: Clay: Compost (1:1:1 v/v)	1.70	1.90	2.10	2.50	2.05
Mean (B)	1.53	1.73	1.90	2.15	
LSD 5%	A=0.11		B=0.08	AB=0.18	

Table 7. Effect of various growing media, organic-biostimulants additives, and their interaction on flowering parameters of *Lilium hybrida* cv. Borsa.

Growing Media (A)	Organic-biostimulants (B; 2.5 ml/l)				
	Control	Humicil	Power max	Mix of them	Mean (A)
	Days to first flowering (days)				
Sand	65.87	60.37	56.67	54.87	59.44
Clay	67.53	58.63	55.33	54.13	58.91
Sand: Clay (1:1v/v)	61.87	57.57	54.87	53.67	56.99
Sand: Clay: Compost (1:1:1 v/v)	59.57	56.50	54.97	53.13	56.04
Mean (B)	63.71	58.27	55.46	53.95	
LSD 5%	A=0.40		B=0.74	AB=1.34	
	Flower fresh weight (g)				
Sand	13.37	14.67	16.20	17.53	15.44
Clay	14.67	15.77	17.00	17.97	16.35
Sand: Clay (1:1v/v)	15.83	16.47	17.60	18.30	17.05
Sand: Clay: Compost (1:1:1 v/v)	16.50	17.07	18.00	21.50	18.27
Mean (B)	15.09	15.99	17.20	18.83	
LSD 5%	A=0.33		B=0.35	AB=0.69	
	Flower dry weight (g)				
Sand	3.13	3.40	3.60	4.57	3.68
Clay	3.23	3.57	3.90	4.47	3.79
Sand: Clay (1:1v/v)	3.40	3.70	4.13	4.63	3.97
Sand: Clay: Compost (1:1:1 v/v)	3.60	3.80	4.37	5.27	4.26
Mean (B)	3.34	3.62	4.00	4.73	
LSD 5%	A=0.17		B=0.15	AB=0.31	
	Flower stalk diameter (cm)				
Sand	0.66	0.68	0.70	0.73	0.69
Clay	0.69	0.71	0.74	0.75	0.72
Sand: Clay (1:1v/v)	0.73	0.74	0.77	0.84	0.77
Sand:Clay:Compost (1:1:1 v/v)	0.74	0.77	0.79	0.89	0.80
Mean (B)	0.70	0.72	0.75	0.80	
LSD 5%	A=0.10		B=0.09	AB=0.18	
	Flower stalk length (cm)				
Sand	5.50	5.80	6.40	7.50	6.30
Clay	5.73	6.30	6.60	9.40	7.01
Sand: Clay (1:1v/v)	5.97	6.60	7.00	10.47	7.51
Sand:Clay:Compost (1:1:1 v/v)	6.40	6.80	8.10	11.10	8.10
Mean (B)	5.90	6.38	7.03	9.62	
LSD 5%	A=0.25		B=0.15	AB=0.35	

Table 8. Effect of various growing media, organic-biostimulants additives, and their interaction on flower stalk fresh and dry weights, number of flowers/plant, and flower diameter of *Lilium hybrida* cv. Borsa.

Growing Media (A)	Organic-biostimulants (B; 2.5 ml/l)				
	Control	Humicil	Power max	Mix of them	Mean (A)
			Flower stalk fresh weight (g)		
Sand	8.73	9.17	9.67	10.40	9.49
Clay	9.10	9.40	9.83	11.67	10.00
Sand: Clay (1:1v/v)	9.23	9.53	10.53	12.50	10.45
Sand: Clay: Compost (1:1:1 v/v)	9.47	9.67	11.17	13.70	11.00
Mean (B)	9.13	9.44	10.30	12.07	
LSD 5%	A=0.21		B=0.20	AB=0.40	
			Flower stalk dry weight (g)		
Sand	0.90	1.04	1.06	1.09	1.02
Clay	0.97	1.07	1.16	1.23	1.11
Sand: Clay (1:1v/v)	1.04	1.13	1.20	1.27	1.16
Sand:Clay:Compost (1:1:1 v/v)	1.08	1.17	1.23	1.35	1.21
Mean (B)	1.00	1.10	1.16	1.24	
LSD 5%	A=0.02		B=0.02	AB=0.05	
			Number of flowers/plant		
Sand	2.03	2.37	2.50	2.63	2.38
Clay	2.17	2.60	2.70	2.80	2.57
Sand: Clay (1:1v/v)	2.40	2.73	2.83	3.00	2.74
Sand: Clay: Compost (1:1:1 v/v)	2.50	2.80	3.20	3.60	3.03
Mean (B)	2.28	2.63	2.81	3.01	
LSD 5%	A=0.08		B=0.13	AB=0.24	
			Flower diameter (cm)		
Sand	12.53	13.03	12.60	13.07	12.81
Clay	12.70	13.67	13.00	13.67	13.26
Sand: Clay (1:1v/v)	13.23	14.03	14.27	14.60	14.03
Sand:Clay:Compost (1:1:1 v/v)	13.63	14.57	14.63	15.57	14.60
Mean (B)	13.03	13.83	13.63	14.23	
LSD 5%	A=0.10		B=0.21	AB=0.38	

The mix-ups between growth media and organic-biostimulants treatments had a substantial effect on the various flowering parameters. For these features, the intersection between growing media of sand: clay: compost with Humicil and Power Max produced the most effective results.

N, P and K determinations in dry leaves:

It is evident from Figs. (1, 2 and 3) that the relationship between growing media and organic-biostimulants has a significant effect on the N, P, and K contents of lily dry leaves. Plants cultivated in a blend consisting of sand: clay: compost (1:1:1 v/v) and sprayed with a

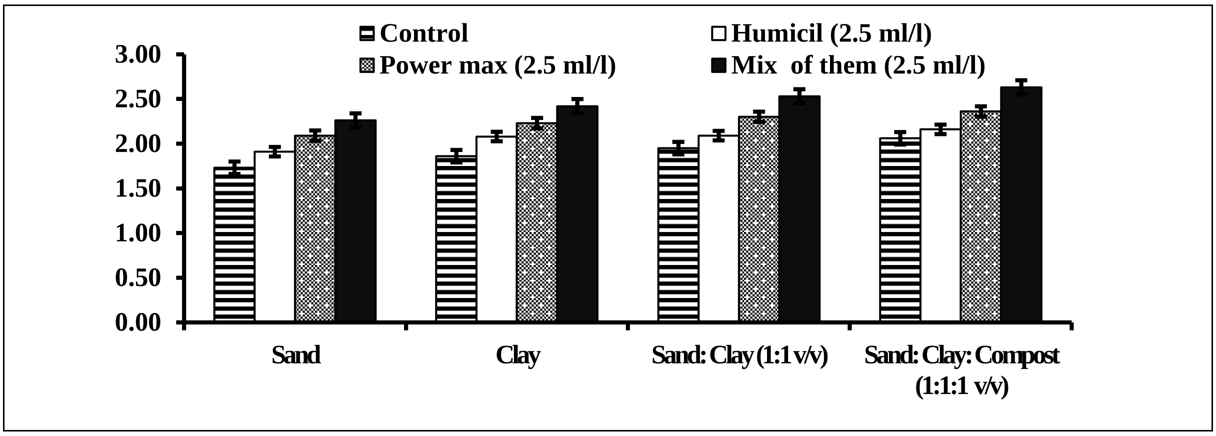

Fig. 1. Effect of the interaction between growing media and organic-biostimulants additives on N % in dry leaves of *Lilium hybrida* cv. Borsa.

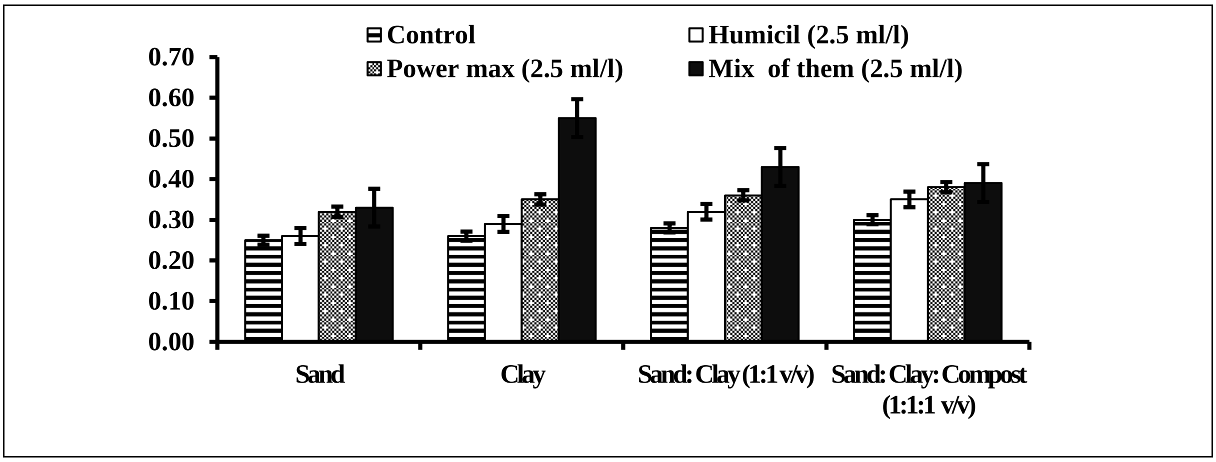

Fig. 2. Effect of the interaction between growing media and organic-biostimulants additives on P % in dry leaves of *Lilium hybrida* cv. Borsa.

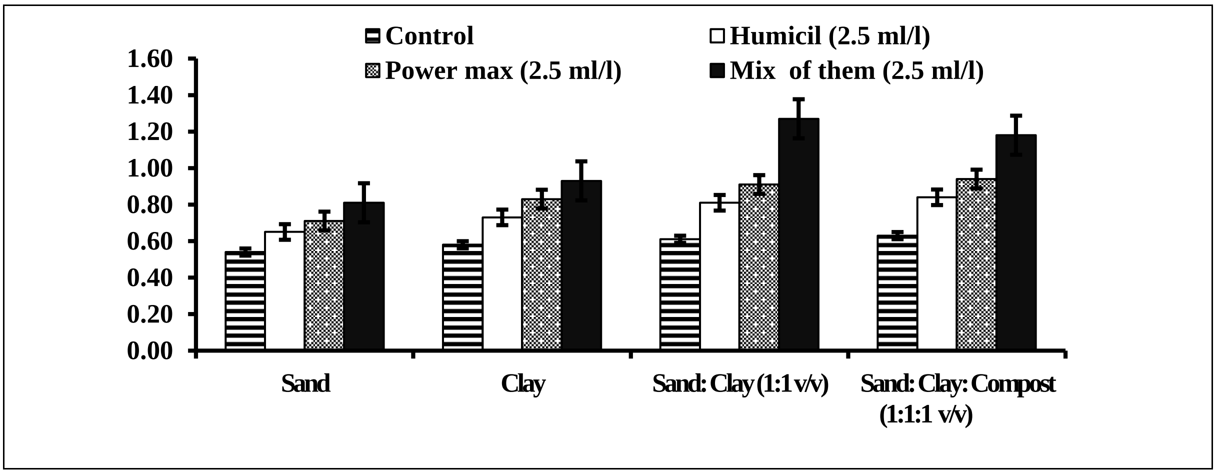

Fig. 3. Effect of the interaction between growing media and organic-biostimulants additives on K % in dry leaves of *Lilium hybrida* cv. Borsa.

mixture of Humicil and Power max outgrew those other reactions in the nitrogen content of the leaves. Additionally, statistical analysis demonstrated that, in contrast to the other treatments, the phosphorus content of the plant leaves increased when they were sprayed with a mixture of Humicil and Power max and grown in clay as a growth medium. Likewise, it can be argued that, spraying lily plants with a mixture of Humicil and Power max and growing them in a sand: clay (1:1v/v) medium is the best option, because it causes the potassium content of the leaves to increase highly.

Determination of total carbohydrate in bulbs:

Data in Fig. (4) illustrate that the total carbohydrates of lily bulbs were affected by the interaction between the growth medium and organic-biostimulants. The growing media of sand: clay (1:1 v/v) followed by the medium as clay and spraying with mix of Humicil and Power max achieved the highest increase in total carbohydrates compared to other treatment.

Determination of total phenolics:

The findings in Fig. (5) show that the growth medium and organic-biostimulants interact to impact the total phenolic content of lily bulbs. When compared to other treatments, the growing medium of sand, clay, and compost (1:1:1 v/v) and spraying with a mixture of Humicil and Power max produced the largest increase in total phenolic.

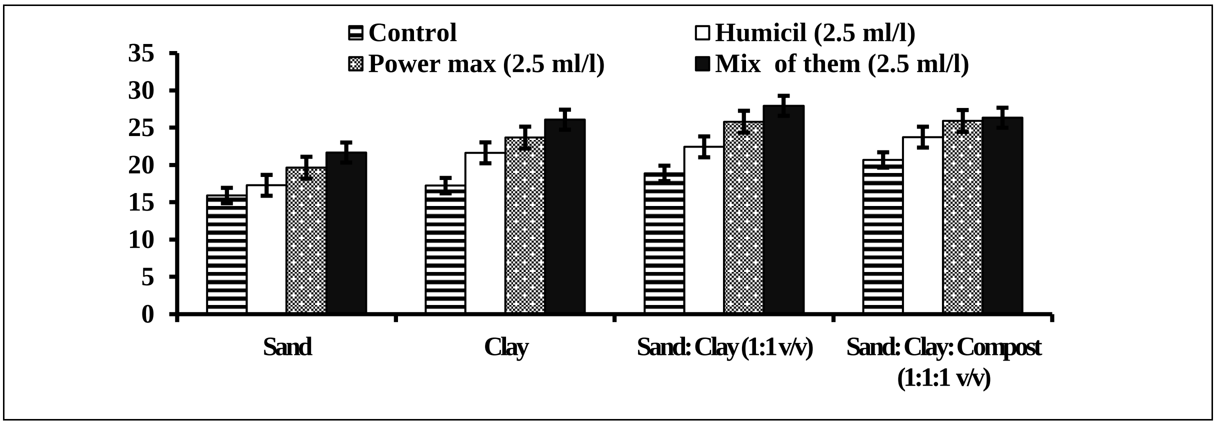

Fig. 4. Effect of the interaction between growing media and organic-biostimulants additives on total carbohydrates (%) in bulbs of *Lilium hybrida* cv. Borsa.

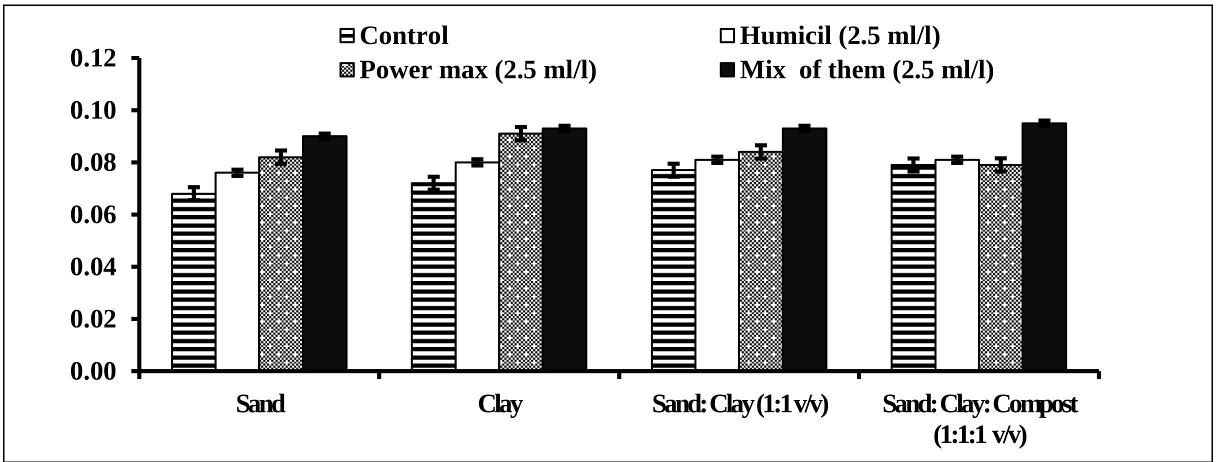

Fig. 5. Effect of the interaction between growing media and organic-biostimulants additives on total phenolic (%) in bulbs of *Lilium hybrida* cv. Borsa.

DISCUSSION

Lily plants underwent an assessment of the impact of applied growing media and organic-biostimulants on various growth, flowering, and chemical composition parameters. Obtained results pointed out that the application of sand: clay: compost (1:1:1 v/v) as a growing medium achieved the highest improvement in different characteristics (Swedan *et al*., 2023). Hewidy *et al.* (2014) pointed out that adding of compost in the growing media improved growth and yield of basil in contrast to mixed media containing vermicompost or peat moss. The beneficial effect of compost as growing medium on marigold growth was recorded with Atiyeh *et al.* (2002). Application of different growing media as peat moss+ sand+ compost improved the flowering, nitrogen, phosphorus, and potassium contents of *Gerbera jamesonii* (Ali *et al*., 2023). Compost may benefit lily plants more than other soil amendments because it is an organic material that can change the characteristics of sandy soil. This is because compost reduces the bulk density of the soil while raising the nutrient availability, porosity, organic matter content, and water-holding capacity (Mostafa *et al*., 2019).

On the other side, addition of compost material lowered pH in soil, improved nutrient uptake by plants (Ahmad *et al*., 2012)**.** The growing media which contained compost can prop the growth and development of some ornamental plants by saving the nutrients (Massa *et al.*, 2018), while, releasing an active organic compounds that led to increase the nutrient use efficiency (Massa *et al*., 2019; Makhlouf *et al.*, 2022).

Our findings indicated that adding organic materials to the soil could give lily plants the nutrients they need to grow (Ebeid and Shebany, 2017), enhance the chemical and physical characteristics of the soil, and then enhance the features of plant growth in comparison to just using sandy soil (Ebeid *et al*., 2022).

Also, this study showed that the growth, flowering and chemical composition measurements of lily plants grown in sandy soil were reduced. This may be due to the characteristics of sandy soil, which contains a high percentage of sand, low organic matter, low of specific surface area, low fertility, low of water retention, and high of infiltration rate, as well as the ease of leaching nutrients through the soil (El–Bially *et al*., 2022).

There were significant increases in the characteristics of vegetative growth, flowering, and chemical components of lily plants when adding various organic-biostimulants compared to the control. The improvement in these traits was clear with the addition of the mixture of Humicil and Power max compared to spraying either of them alone.

The stimulation effect of spraying with Power max, which contains algae, may be due to application a foliar spray attributed to the quickly interacting with plant tissue (Tartil *et al.,* 2016). Power max containing of amino acid led to improve absorption of nutrients and the efficiency of photosynthesis, which results in induction of plant growth, flowering, and chemical components (Youssef and Adawy, 2023).

Similar results were reported by Karim *et al*. (2017), El-Hady (2020), and Archana *et al.* (2023). Also, the remarkable improvement in the growth observed in lily plants may be attributed to that Power max is containing of auxins, cytokinins, and macro and micro-nutrients. These components contribute to cell division and expansion, which accelerates plant growth and development as reported by Machado *et al.* (2014)**.**

The remarkable improvement in the flowering measurements was accompanied by the treatment Power max because it contains nitrogen, phosphorus, potassium, vitamins and macronutrients, which is followed by an increasing in growth, photosynthesis, and a desired C: N ratio, thus improving the flowering characteristics (Pruthvi *et al*., 2017).

On the other side, spraying with Humicil led to a noticeable improvement in the growth, flowering and chemical components compared to untreated lily plants. The highest growth, yield and chemical components of *Lepidium sativum* were recorded in plants which received humic acid at 4% level (Hafiz, 2018). Likewise, the enhancement in the plant growth by humic acid application may be related to its positive effect on the physiological and biochemical processes in plant as well as its biological effects on the soil (Ali *et al*., 2022)**.** The enhancement in the flowering and chemical compositions were found in lily plants received Humicil compared to untreated plants as may be related to the enhancements in the vegetative growth, which in turn improved nutrients uptake and photosynthesis by the plants, then induced the flowering and chemical components (Nasiri *et al*., 2021; Ampong *et al*., 2022). In this respect, results of Chaski *et al*. (2023) proved that bio stimulants that contained seaweed extracts and humic acids improved growth, yield and chemical components of mint crop. The results of Rahbar *et al.* (2023) indicated that foliar spraying with humic acid contributed to increase the carbohydrate rate of the olive leaves.

CONCLUSION

The current study came to the conclusion that growth, flower quality, and production were enhanced by using a growing medium consisting of sand: clay: compost (1:1:1 v/v) in supplementation with an organic-biostimulant mix of Humicil and Power max. Supplementing different agricultural media with organic-biostimulant sprays enhanced the macro-nutrients, carbohydrates, and phenolic contents. Incorporating Humicil or Power Max into several types of growing media has been shown to enhance productivity, and yield stronger-healthier-horticultural-plants.

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إضافة المنشطات الحيوية العضوية إلي وسائط النمو تعمل على تحسين النمو والإستجابة البيوكيميائية وإنتاجية الزهور وجودة أبصال الليليم

إيمان أحمد سويدان*، سماح محمد يوسف**
* قسم البساتين، كلية الزراعة، جامعة دمنهور، مصر
** قسم البساتين، كلية الزراعة، جامعة الفيوم، مصر

قد يكون لإضافة المنشطات الحيوية العضوية لوسائط النمو تأثيراً كبيراً على السمات البيوكيميائية وإنتاجية الزهور. قامت الدراسة الحالية بتقييم إستجابة سمات النمو لأبصال الليليم وبعض الخصائص البيوكيميائية وجودة الإزهار لمختلف وسائط النمو والتي تشمل الرمل والطين والرمل: الطين (١:١ حجم / حجم)، أو الرمل: الطين: الكمبوست (١:١:١ حجم/حجم) مكملة بالهيوميسيل و/أو الباورماكس. أثبتت النتائج أن إستخدام وسائط النمو أدى إلى اختلافات كبيرة في صفات النمو والتزهير والمكونات الكيميائية لنباتات الليليم. إلا أنه كان هناك تفوق في هذه الصفات نتيجة للزراعة في الوسط الذي يتكون من خليط الرمل: الطين: الكمبوست (١:١:١ حجم/حجم)، يليه الرمل: الطين (١:١ حجم/حجم). بينما أدت الزراعة في التربة الرملية إلى إنخفاض في هذه الصفات مقارنة ببقية الأوساط.

أدت إضافة المنشطات الحيوية العضوية إلي تحسين قياسات النمو والإزهار والمكونات الكيميائية. علاوة على ذلك فإن إضافة خليط الهيوميسيل مع الباورماكس ثم الرش بالباورماكس وحده كان له الأثر الأكبر في تحسين القياسات. أظهر التفاعل بين وسائط النمو والمنشطات اختلافاً كبيراً في جميع قياسات النمو والإزهار والمكونات الكيميائية لنباتات الليليم. إلا أن أعلى القيم لهذه الصفات تزامنت مع وسط النمو الخليط من الرمل: الطين: الكمبوست (١:١:١ حجم/حجم) مكملاً برش خليط الهيوميسيل والباورماكس.