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Impact of Organic and Inorganic Fertilization on Flowering and Some Chemical Constitutions of Snapdragon

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ABSTRACT

The purpose of this study was to assess the effects of compost percentages (0, 5, 10, and 20%, w/w) and mineral fertilization treatments (5.5, 11, and 16.5 g NPK/pot, 25 cm diameter) as well as their interactions on the flowering and some chemical compositions of *Antirrhinum majus*, L. during the two consecutive growing seasons of 2022/2023 and 2023/2024 at the Floriculture Farm, Faculty of Agriculture, Minia University.

All used of compost percentages significantly increased flowering traits (inflorescences stalk length, number of inflorescence stalks, number of florets per inflorescence, fresh and dry weights of total florets per plant, and flowering duration), seed yield, photosynthetic pigments and NPK% relative to untreated plants. In all cases, 20% compost was significantly superior to other used treatments.

Mineral fertilization considerably increased all abovementioned traits facing the check treatment. The treatment of 16.5 g/pot, followed by 11 g/pot produced the highest values without significant differences between them.

The most effective interaction treatment was giving snapdragon plants with 20% compost together with 16.5 or 11 g mineral NPK/pot.

KEYWORDS: compost, mineral fertilization, snapdragon, pigments.

1. INTRODUCTION

Antirrhinum majus L. commonly known as snapdragon or dog flower and in Egypt, it is called Hanak ElSabaa and it is belongings to the Scrophulariaceae family, is a perennial species indigenous to the Mediterranean area. In horticultural practices, however, it is often regarded as an annual plant, particularly when cultivated in gardens or utilized as a cut flower, as noted by Gleason and Cronquist in 1991. The flowers of this species, which exhibit an irregular shape, are arranged in terminal racemes and come in a diverse array of colors (Carter and Grieve, 2008). It is one of the principal cut flower crops wherein the flowers are borne on terminal long spikes of many colors and shades. The variation in plant height (12-36 inches) in different types and groups provide wide scope of using *Antirrhinum* for different purposes (Bose, 1989). The economic significance of flowers has risen considerably due to their enduring beauty, associations with love, and ability to evoke tranquility. Flowers serve various purposes, including religious offerings, decorative elements, ingredients in pharmaceuticals, supplements in food, and coloring agents in cosmetics. Among the numerous varieties, the snapdragon stands out as one of the most favored and extensively cultivated garden annuals. The blossoms of the snapdragon are commonly utilized in cut flower arrangements and bouquets, enhancing the aesthetic appeal of floral displays (Verma *et al*., 2019).

According to Al-Badawy *et al*. (1989), Ram and Pathak (2007), Riaz *et al*. (2008) and Brar *et al*. (2019), compost is believed to help produce high-quality flowering plants that are bigger and have more flowers. Sequences greatly enhance vegetative growth characteristics and flowering characteristics. Organic materials ultimately generated regulatory substances like cytokinins, IAA (indole acetic acid), essential plant nutrients, GA (gibberellic acid), and beneficial microorganisms that support plant development and flowering productivity as well as flowering post-harvest life.

Also, mineral fertilization considerably increased all aforementioned characters which reflect the role of macro-elements on the vegetative growth, consequently the yield of flowers, either the quantity or quality. The increase in flower quality and quantity attributes may be due to the beneficial role of macro-elements on physiological processes, such as synthesis of carbohydrates and protein and translocation of these materials to the storage tissue like flowers which in turn augmented number, size and weight of flowers (Senthil-kumar *et al*., 2009; Arab *et al*., 2015; Dikr and Belete, 2017 and Shyala *et al*., 2019).

This goal of this research was to study the effect of organic, inorganic fertilization and their interaction on the flowering and some chemical constituents of *Antirrhinum majus* L.

2. MATERIALS AND METHODS

This study was carried out at Minia University's Faculty of Agriculture's Floriculture Farm throughout the 2022-2023 and 2023-2024 seasons. The goal was to evaluate how the blooming traits, and some chemical constituents of the *Antirrhinum majus*, L. plant were affected by organic fertilization (compost) and inorganic fertilization (mineral), as well as how these two factors interacted.

In the two growth seasons of 2022/2023 and 2023/2024, snapdragon seedlings with three leaves and an average height of 5 cm were moved on December 15th. These seedlings were put in 25 cm-diameter plastic pots that held 4.30 kg of sandy soil apiece. After two weeks, the initial allocation of two seedlings per pot was lowered to one seedling per pot. Table (a) provides specifics on the physical and chemical properties of the soil used in this investigation according to ICARDA (2013).

Table a. The physical and chemical analyses of the sand soil used in the study.

Soil character	Values		Soil Character	Values	
	2022/2023	2023/2024		2022/2023	2023/2024
Physical properties:					
Sand (%)	92.22	93.40	**Total N (%)**	0.01	0.01
Silt (%)	6.68	5.13	**Available P (ppm)**	2.34	2.15
Clay (%)	1.10	1.47	**Extractable K (mg/100 g soil)**	0.63	0.69
Soil type	Sandy	Sandy			
Chemical properties:			**DTPA-Extractable nutrients:**		
pH (1:2.5)	8.24	8.39	**Fe (ppm)**	0.98	0.94
E.C. (dS/m)	1.22	1.24	**Cu (ppm)**	0.28	0.35
O.M. (%)	0.01	0.01	**Zn (ppm)**	0.29	0.26
$CaCO_3$ (%)	14.17	14.78	**Mn (ppm)**	0.46	0.57

A total number of 16 treatments were used in the study, which was set up in a 4 x 4 arrangement and used as a split plot with three replications and a complete randomized design. Four pots with four plants each made up each treatment. The four compost treatments (0, 5, 10, and 20% w/w) were allotted to the major plots, while the four mineral fertilization treatments (0, 5.5, 11, and 16.5 g NPK/pot, 20:20:20) were allocated to the sub-plots.

Over the course of two growth seasons, compost was added to the experimental treatments while the pots were being filled. Table (b) lists the physio-chemical properties of the compost as stated on the manufacturing label. A commercial formulation of Active Top, which contains a balanced ratio of nitrogen, phosphorus, and potassium (N:P:K) at 20:20:20, was used for mineral fertilization. The Ismailia for Chemical Manufacturing Company was the manufacturer of this product. With ten-day gaps between applications, the mineral fertilization was applied three times starting on January 10.

Table b. The physio-chemical characteristics of the used compost* in the study during the two growing seasons.

Properties	Value	Properties	Value
Organic carbon (%)	26.7	**Total P (%)**	0.6
Humidity (%)	24	**Total K (%)**	1.2
Organic matter	46	**Fe (ppm)**	271
C/N ratio	15.7	**Zn (ppm)**	63
pH (1:2.5)	8.1	**Mn (ppm)**	128
E.C. (m. mhos/cm.)	5.2	**Cu (ppm)**	209
Total N (%)	1.7		

* Compost was supplied from El-Nile Factory (Egyptian company specializing in solid waste management)

At the last week of March, the flowering aspects [inflorescences stalk length, number of inflorescence stalks, number of florets per inflorescence, fresh and dry weights of total florets per plant, and flowering duration) were determined. Chlorophyll a, b and carotenoids were performed in the fresh leaves on the first week of March (cited from Fadl and Sari El-Deen, 1978). At the end of the experiment of each season seed yield per plant (g) was measured.

Statistical analysis

The results obtained were organized into tables and subjected to statistical analysis using MSTAT–C (1986). Subsequently, the LSD test at a significance level of 0.05 was employed to compare the means of the different treatments.

3. RESULTS AND DISCUSSION

3.1. Flowering traits

Data presented in Tables (1 and 2) revealed that all percentages of compost (5, 10 and 20%, w/w) led to considerable increase in all studied flowering traits, i.e., inflorescences stalk length, number of inflorescence stalks, number of florets per inflorescence, fresh and dry weights of total florets per plant, and flowering duration relative to untreated plants (control group) during both seasons. The treatment of 20% produced high results in this regard. Similar trends were found by Mjeed and Ali (2017), Sabah *et al*. (2019) and Mohamed and Elagabain (2021) on snapdragon

According to Riaz *et al*. (2008), compost is believed to help produce high-quality blooming plants that are bigger and have more blooms. Sequences greatly enhance vegetative development characteristics and flowering characteristics (Al-Badawy *et al*., 1989). Organic materials ultimately generated regulatory substances like cytokinins, IAA (indole acetic acid), essential plant nutrients, GA (gibberellic acid), and beneficial microorganisms that support plant development and flowering productivity as well as flowering post-harvest life (Ram and Pathak, 2007 and Brar *et al*., 2019).

Regarding mineral fertilization, the data in the same tables showed that, in all experimental seasons, giving *Antirrhinum majus* 5.5, 11, and 16.5 g NPK/pot as opposed to control resulted in a significant increase in all evaluated parameters indicated above. It was shown that increasing the mineral fertilization dosages enhanced the previously indicated parameters without appreciable variations between the high and medium doses of NPK mineral fertilization. These findings are in agreement with those mentioned by Mjeed and Ali (2017), Malik *et al*. (2019), Abd El Gayed and Knany (2020), Mohamed and Elagabain

Table 1. Impact of compost percentages, mineral fertilization and their interactions on inflorescences stalk length (cm), number of inflorescence stalks and number of florets per inflorescence of snapdragon in the two growing seasons (2022/2023 and 2023/2024).

Mineral fertilization treatments (g/pot)	Compost percentages treatments (A)									
	0%	5%	10%	20%	Mean (B)	0%	5%	10%	20%	Mean (B)
	The 1st season (2022/2023)					The 2nd season (2023/2024)				
Inflorescences stalk length (cm).										
Control	28.22	29.91	31.11	32.04	30.32	28.78	30.51	31.73	32.68	30.93
5.5 g NPK	30.34	32.16	33.78	35.46	32.94	31.25	33.12	34.79	36.52	33.92
11 g NPK	32.91	35.21	37.33	39.19	36.16	34.06	36.44	38.64	40.56	37.43
16.5 g NPK	34.11	36.42	38.55	40.43	37.38	35.30	37.69	39.90	41.85	38.69
Mean (A)	31.40	33.43	35.19	36.78		32.35	34.44	36.27	37.90	
L.S.D. at 5 %	A: 1.55		B: 1.25		AB: 2.50	A: 1.60		B: 1.31		AB: 2.62
Number of inflorescence stalks.										
Control	5.35	5.81	6.11	6.30	5.89	5.64	6.12	6.46	6.66	6.22
5.5 g NPK	7.15	7.78	8.18	8.45	7.89	7.47	8.15	8.56	8.83	8.25
11 g NPK	7.38	8.22	8.75	9.06	8.35	7.87	8.72	9.23	9.54	8.84
16.5 g NPK	7.41	8.28	8.82	9.16	8.42	8.04	8.86	9.36	9.65	8.98
Mean (A)	6.82	7.52	7.97	8.24		7.26	7.96	8.40	8.67	
L.S.D. at 5 %	A: 0.26		B: 0.11		AB: 0.22	A: 0.25		B: 0.18		AB: 0.36
Number of florets per inflorescence.										
Control	13.81	14.49	15.07	15.52	14.72	14.09	14.78	15.37	15.83	15.02
5.5 g NPK	15.39	19.31	20.08	20.68	18.87	15.85	19.89	20.68	21.30	19.43
11 g NPK	19.22	20.18	21.19	22.25	20.71	19.89	20.89	21.93	23.03	21.43
16.5 g NPK	19.26	20.22	21.23	22.29	20.75	19.93	20.93	21.97	23.07	21.48
Mean (A)	16.92	18.55	19.39	20.19		17.44	19.12	19.99	20.81	
L.S.D. at 5 %	A: 0.78		B: 0.06		AB: 0.12	A: 0.80		B: 0.08		AB: 0.16

(2021) and Gulmezoglu *et al*. (2024) on snapdragon.

All of the previously described characteristics, which show how macro-elements affect vegetative growth and, in turn, flower yield, both in terms of number and quality, were significantly raised by mineral fertilizer. The beneficial effects of macro-elements on physiological processes, such as the synthesis of proteins and carbohydrates and their translocation to storage tissue like flowers, may be the cause of the increase in flower quality and quantity attributes. This, in turn, may have increased the number, size, and weight of flowers (Senthil-kumar *et al*., 2009 and Shyala *et al*., 2019).

The interaction effect between main and sub-plots treatments was significant for all flowering parameters in both seasons relative to check treatment. The highest values were obtained with compost at 20% plus 11 or 16.5 g NPK/pot or from plants received 10% compost with 16.5 g NPK/pot in both seasons.

3.2. Seed yield per plant (g):

The data in Table (3) demonstrated that either compost or mineral fertilization significantly increased seed yield per plant (g).

The highest weight was obtained with a high percentage of compost (1.77 and 1.79 g/plant in both seasons, respectively). Similarly, reported by Mohamed and Elagabain (2021) on snapdragon, Abedini *et al*. (2015) on *Calendula officinalis*, and Gupta *et al*. (2013) on *Gloriosa superba*.

The highest weight was recorded from a high dose of mineral fertilization (2.01 and 2.02 g/plant in both seasons, respectively). Similar finding were found by Mohamed and Elagabain (2021) on snapdragon and Gupta *et al*. (2013) on *Gloriosa superba*.

Table 2. Impact of compost percentages, mineral fertilization and their interactions on fresh and dry weight of total florets per plant (g), flowering duration (days) of snapdragon in the two growing seasons (2022/2023 and 2023/2024).

Mineral fertilization treatments (g/pot)	Compost percentages treatments (A)									
	0%	5%	10%	20%	Mean (B)	0%	5%	10%	20%	Mean (B)
	The 1st season (2022/2023)					The 2nd season (2023/2024)				
Fresh weight of total florets per plant (g).										
Control	19.95	21.15	22.63	24.44	22.04	21.46	22.74	24.34	26.28	23.70
5.5 g NPK	33.01	34.99	37.44	40.44	36.47	35.52	37.65	40.29	43.51	39.24
11 g NPK	43.97	46.61	49.87	53.86	48.58	48.53	51.44	55.04	59.44	53.61
16.5 g NPK	44.24	46.90	50.18	54.19	48.88	49.67	52.65	56.34	60.85	54.88
Mean (A)	35.29	37.41	40.03	43.23		38.79	41.12	44.00	47.52	
L.S.D. at 5 %	A: 2.70		B: 0.41		AB: 0.82	A: 3.51		B: 1.35		AB: 2.70
Dry weight of total florets per plant (g).										
Control	1.99	2.11	2.26	2.44	2.20	2.15	2.27	2.43	2.63	2.37
5.5 g NPK	2.91	3.08	3.29	3.56	3.21	3.13	3.31	3.55	3.83	3.45
11 g NPK	3.08	3.26	3.49	3.77	3.40	3.40	3.60	3.85	4.16	3.75
16.5 g NPK	3.10	3.28	3.51	3.79	3.42	3.48	3.69	3.94	4.26	3.84
Mean (A)	2.77	2.93	3.14	3.39		3.04	3.22	3.44	3.72	
L.S.D. at 5 %	A: 0.22		B: 0.03		AB: 0.06	A: 0.26		B: 0.11		AB: 0.22
Flowering duration (days).										
Control	43.10	45.20	47.05	48.49	45.96	43.53	45.65	47.52	48.97	46.42
5.5 g NPK	45.15	47.41	48.91	50.51	48.00	45.60	47.88	49.40	51.02	48.47
11 g NPK	46.95	49.30	50.12	50.91	49.32	47.42	49.79	50.62	51.42	49.81
16.5 g NPK	47.01	49.36	50.33	51.32	49.51	47.48	49.85	50.83	51.83	50.00
Mean (A)	45.55	47.82	49.10	50.31		46.01	48.30	49.59	50.81	
L.S.D. at 5 %	A: 1.18		B: 0.22		AB: 0.44	A: 1.20		B: 0.23		AB: 0.46

Table 3. Impact of compost percentages, mineral fertilization and their interactions on seed yield per plant (g) of snapdragon in the two growing seasons (2022/2023 and 2023/2024).

Mineral fertilization treatments (g/pot)	Compost percentages treatments (A)									
	0%	5%	10%	20%	Mean (B)	0%	5%	10%	20%	Mean (B)
	The 1st season (2022/2023)					The 2nd season (2023/2024)				
Control	1.12	1.18	1.25	1.33	1.22	1.13	1.19	1.27	1.35	1.23
5.5 g NPK	1.31	1.38	1.44	1.52	1.41	1.33	1.40	1.46	1.54	1.43
11 g NPK	1.80	1.89	1.98	2.08	1.94	1.82	1.91	2.00	2.10	1.96
16.5 g NPK	1.87	1.97	2.06	2.15	2.01	1.88	1.98	2.07	2.16	2.02
Mean (A)	1.53	1.61	1.68	1.77		1.54	1.62	1.70	1.79	
L.S.D. at 5 %	A: 0.10		B: 0.08		AB: 0.16	A: 0.09		B: 0.70		AB: 0.14

Furthermore, for seed yield per plant in both seasons, the interaction impact between organic and mineral treatments was significant. The interaction treatment of 20% compost with a high or medium dose of mineral NPK, or 10% compost with a high dose of mineral NPK, produced the heaviest seed production per plant.

3.3. Chemical constituents:

3.3.1. Photosynthetic pigment contents (mg/g):

Data presented in Table (4) indicated that significant enhancement in photosynthetic pigments content, via chlorophyll a, chlorophyll b and carotenoids were showed with application of the three percentages used of compost (5, 10

Table 4. Impact of compost percentages, mineral fertilization and their interactions on chlorophyll a, b and carotenoids (mg/g F.W.) of snapdragon in the two growing seasons (2022/2023 and 2023/2024).

Mineral fertilization treatments (g/pot)	Compost percentages treatments (A)									
	0%	5%	10%	20%	Mean (B)	0%	5%	10%	20%	Mean (B)
	The 1st season (2022/2023)					The 2nd season (2023/2024)				
Chlorophyll a (mg/g).										
Control	2.869	3.012	3.163	3.320	3.091	2.895	3.039	3.191	3.350	3.119
5.5 g NPK	3.027	3.178	3.337	3.504	3.262	3.054	3.207	3.367	3.536	3.291
11 g NPK	3.193	3.353	3.520	3.560	3.407	3.222	3.383	3.552	3.592	3.437
16.5 g NPK	3.210	3.371	3.539	3.571	3.423	3.239	3.401	3.571	3.603	3.454
Mean (A)	3.075	3.229	3.390	3.489		3.102	3.258	3.420	3.520	
L.S.D. at 5 %	A: 0.095		B: 0.020		AB: 0.040	A: 0.098		B: 0.016		AB: 0.032
Chlorophyll b (mg/g).										
Control	0.926	0.974	1.024	1.077	1.000	0.935	0.983	1.034	1.087	1.010
5.5 g NPK	0.979	1.029	1.082	1.138	1.057	0.988	1.039	1.092	1.149	1.067
11 g NPK	1.034	1.088	1.143	1.157	1.106	1.044	1.098	1.154	1.167	1.116
16.5 g NPK	1.040	1.094	1.150	1.160	1.111	1.050	1.104	1.160	1.171	1.121
Mean (A)	0.995	1.046	1.100	1.133		1.004	1.056	1.110	1.143	
L.S.D. at 5 %	A: 0.030		B: 0.007		AB: 0.014	A: 0.032		B: 0.008		AB: 0.016
Carotenoids (mg/g).										
Control	0.986	1.034	1.084	1.137	1.060	0.995	1.043	1.094	1.147	1.070
5.5 g NPK	1.039	1.089	1.142	1.198	1.117	1.048	1.099	1.152	1.209	1.127
11 g NPK	1.094	1.148	1.203	1.217	1.166	1.104	1.158	1.214	1.227	1.176
16.5 g NPK	1.100	1.154	1.210	1.220	1.171	1.110	1.164	1.220	1.231	1.181
Mean (A)	1.055	1.106	1.160	1.193		1.064	1.116	1.170	1.203	
L.S.D. at 5 %	A: 0.028		B: 0.006		AB: 0.012	A: 0.030		B: 0.007		AB: 0.014

and 20%, w/w) in both seasons relative to the check treatment (zero compost). The increase in pigments contents was parallel with the increase of compost percent. So, the high percentage of compost (20%) registered the best content in the first and second seasons.

Applying compost has positive effect on pigments content via improvement of nutrients in the soil, reflecting the uptake by plants (El-Naggar, 2010 and Schulz and Glaser, 2012).

Amending soils with organic fertilization as showed in our results were supported by Abdel-Kafie (2002), El-Hindi *et al*. (2006) and Abdou *et al*. (2023a) on cineraria plant; Abdou (2003) and Abdullah *et al*. (2021) on chrysanthemum; Bi *et al*. (2021) on zinnia plant, Dikr and Belete (2017) and Sankar and Gopal (2021) on *Tagetes erecta*; Hassan *et al*. (2014), Sardoei (2014), Sharifian *et al*. (2014) and Abdou *et al*. (2023b) on *Calendula officinalis*; Abdou *et al*. (2018b) on gladiolus plant and Abdou *et al*. (2019) on *Iris tingitana*.

Concerning the effect of mineral fertilization, it is noticed that significant increase on photosynthetic pigments contents facing the control (no fertilization) due to fertilizing plants with 5.5, 11 and 16.5 g NPK/pot in both seasons, without significant differences between 11 and 16.5 g NPK/plant.

Many authors showed that mineral fertilization improved photosynthetic pigments such as Abd El Gayed and Knany (2020) and Gulmezoglu *et al*. (2024) on *Antirrhinum majus*; El-Naggar and El-Sayed (2008) on *Dianthus caryophyllus*; El-Naggar *et al*. (2016) on *Anthurium andreanum*; Hashem (2016) on *Calendula officinalis* and Dikr and Belete (2017) on *Tagetes erecta*.

The interaction effect between compost percentage and mineral NPK fertilization treatment was significant for chlorophyll a, chlorophyll b and carotenoids in both seasons. The highest values of contents were obtained with supplying plants with 20% compost with 16.5 or 11 g NPK/pot or from supplying plants with 10% and fertilizing them with 16.5 g NPK/pot in both seasons.

3.3.2. Nitrogen, phosphorus and potassium percentages:

Data presented in Table (5) indicated that significant enhancement in percentages of N, P and K were observed due to fertilizing plants with compost at 5, 10 and 20% in both seasons facing the control. The macro-element percentages were increased parallel with the increase of compost percentages. So, the high percentage of compost (20%) produced the highest percentages of macro-elements (N, P and K) in both seasons. Adding compost increased mineral contents in the soil, reflecting the uptake by plants (Schulz and Glaser, 2012).

Similar results were obtained by Abdel-Kafie, (2002), El-Hindi *et al*. (2006) and Abdou *et al*. (2023a) on cineraria; Abdou (2003) on chrysanthemum; Riaz *et al*. (2008) and Marashi *et al*. (2021) on *Zinnia elegans*; Bi *et al*. (2010), Dikr and Belete (2017), Sankar and Gopal (2021) and Nair *et al*. (2023) on *Tagetes patula*; Chang *et al*. (2010) on *Anthurium andreanum*; El-Naggar (2010) on *Narcissus tazetta*; Sardoei (2014), Hassan *et al*. (2014) and Abdou *et al*. (2023b) on *Calendula officinalis*; Abdou *et al*. (2018b) on gladiolus; and Abdou *et al*. (2019) on *Iris tingitana*.

Mineral fertilization had positively significant effect on N, P and K percentages facing the control (no fertilizers) in both seasons, as shown in Table (5). It is noticed that the treatment of the high dose (16.5 g NPK/pot) was more effective than other treatments including control in both seasons.

Similar trends were mentioned by Abd El Gayed and Knany (2020) and Gulmezoglu *et al*. (2024)on *Antirrhinum majus*; El-Naggar and El-Sayed (2008) on *Dianthus caryophyllus*; Bi *et al*. (2010) on *Tagetes patula*; Chang *et al*. (2010) and El-Naggar *et al*. (2016) on *Anthurium andreanum*; and Dikr and Belete (2017) on *Tagetes erecta*.

The interaction effect between compost and mineral fertilization treatments was significant for NPK% in both seasons. The highest percentages were obtained with supplying plants with 20% or 10% compost in combination with 16.5 g NPK/pot in both seasons as clearly indicated in Table (5).

4. REFERENCES

Abd El Gayed ME and Knany RE (2020). Effect of foliar application of different potassium forms on the growth and flowering of snapdragon (*Antirrhinum majus* L.) plants. Journal of Plant Production, 11 (11): 1035-1040. https://10.21608/jpp.2020.122660

Abdel-Kafie OM (2002). Irrigation water regime of cineraria plants (*Pericallus x hybrida*) as affected by integrated use of hydrogels and different growing media. 2nd Inter. Conf. Hort. Sci., 10-12 Sept. 2002, Kafr El-Sheikh, Tanta University, Egypt.

Abdou MAH (2003). Growth and flowering of *Chrysantheuum morifélium* plants: 1. effect of growing media and ammonium sulphate on *Chrysanthemum morifolium* cv. super yellow. J. Agric. Sci., Mansoura Univ., 28 (6): 4919-4929.

Abdou MAH, Badran FS, Ahmed ET, Taha RA and Abdel-Mola MAM (2018b). Effect of compost and some natural stimulant treatments on: II. Corms production and chemical constituents of (*Gladiolus grandiflorus* cv. Peter Pears) plants. Scientific Journal of Flowers and Ornamental Plants, 5 (2): 115-126. www.http//:10.21608/sjfop.2018.17771

Abdou MAH, Fouad AHA and Hassan AA (2023a). Influence of compost fertilization and pinching number on growth and flowering of cineraria plant. Scientific Journal of Agricultural Sciences, 5 (2): 17-30. https://doi.org/10.21608/SJAS.2023.21 28 15.1309

Abdou MAH, Mohamed MA-H, Taha RA and Ahmed AM (2019). effect of compost, potassium silicate and amino acids on iris plants cv. Wedgewood. Minia J. of Agric. Res. & Develop., 39 (1): 63-74.

Abdou MAH, Taha RA, Hassan Shimaa A and Gahory AMO (2023b). Response of *Calendula officinalis* to compost, chitosan and thiamine treatments. Minia J. of Agric. Res. & Develop., 43 (3): 345-360.

Abdullah HS, Al-Saad KG and Ahmed OI (2021). Effect of different growth media on growth and flowering of three Dendranthema cultivars *Dendranthema grandiflorum*. Journal of Kirkuk University for Agricultural Sciences, 12 (2): 54-67.

Abedini T, Moradi P and Hani A (2015). Effect of organic fertilizer and foliar application of humic acid on some quantitative and qualitative yield of Pot marigold. Journal of Novel applied sciences, 4 (10): 1100-1103.

Al-Badawy AA, Aly MK and Abdou MAH (1989). Effect of growing media and bayfolan treatments on *Chrysanthemum morifolium*, Ramat cv. Icecap. Minia J. Agric. Res. & Dev., 2 (3): 1141-1163.

Arab A, Zamani G, Sayyari M and Asili J (2015). Effects of chemical and biological fertilizers on morpho-physiological traits of marigold (*Calendula officinalis* L.). European Journal of Medicinal Plants, 8 (1): 60-68.

Bi G, Li T, Gu M, Evans WB and Williams M (2021). Effects of fertilizer source and rate on zinnia cut flower production in a high tunnel. Horticulturae, 7 (10), 333. https://doi.org/10.3390/horticulturae7100333

Bose TK (1989). Antirrhinum. In: Commercial Flowers. Naya Udyog. P. 289.

Brar PS, Kaushal R and Bhardwaj G (2019). A review on beneficial effects of PGPR and noble liquid manures in enhancing soil fertility and sustainability. Int. J. Curr. Microbiol. Appl. Sci., 8: 409-415.

Carter CT and Grieve CM (2008). Mineral nutrition, growth, and germination of *Antirrhinum majus* L.(snapdragon) when produced under increasingly saline conditions. HortScience, 43 (3): 710-718.

Chang KH, Wu RY, Chuang KC, Hsieh TF and Chung RS (2010). Effects of chemical and organic fertilizers on the growth, flower quality and nutrient uptake of *Anthurium andreanum*, cultivated for cut flower production. Scientia Horticulturae, 125 (3): 434-441. https://doi.org/10.1016/j.scienta.2010.04.011

Dikr W and Belete K (2017). Review on the effect of organic fertilizers, biofertilizers and inorganic fertilizers (NPK) on growth and flower yield of marigold (*Targetes erecta* L.). Academic Research Journal of Agricultural Science and Research, 5 (3): 192-204.

El-Hindi K, El-Shikha OM and El-Ghamry AM (2006). Response of cineraria plant to water stress and compost sources under drip irrigation system. Journal of Plant Production, 31 (5): 3129-3146.

El-Naggar AH (2010). Effect of biofertilizer, organic compost and mineral fertilizers on the growth, flowering and bulbs production of *Narcissus tazetta*, L. J. Agric. & Env. Sci. Alex. Univ., Egypt, 9 (1): 24-52.

El-Naggar AH and El-Sayed Sohier G (2008). Response of *Dianthus caryophyllus* L. plants to foliar nutrition. J. Agric. & Env. Sci. Alex. Univ., Egypt, 7 (2): 53-67.

El-Naggar AH, Esmaiel Naglaa M and El-Naggar AA (2016). Effect of mineral and bio-fertilization on vegetative growth and flowering of *Anthurium andreanum* L. plants under greenhouse condition. Alexandria Science Exchange Journal, 37: 1-9.

Fadl MS and Sari El-Deen SA (1978). Effect of N-benzyaladenine on photosynthetic pigments and total soluble sugars of olive seedlings grown under saline conditions. Res. Bull. Fac. Agric., Ain Shams Univ., 843.

Gleason HA and Cronqnist A (1991). Manual of vascular plants of northeastern United States and adjacent Canada. Ed. 2. The New York Botanical Garden, Bronx.

Gulmezoglu N, Yücel C and Yigiter-Saricam S (2024). Mutual effects of humic acid content and nitrogen sources for vegetative development and flowering of snapdragon (*Antirrhinum majus* L.). Acta Scientiarum Polonorum Hortorum Cultus, 23 (1): 3-12.

Gupta LM, Kumar S, Gupta M and Sharma V (2013). Integrated nutrient management for growth and yield in Glory Lily (*Gloriosa superba*

L.). Journal of Medicinal Plants Research, 7 (43): 3197-3201.

Hashem HA (2016). Effect of sowing date and fertilization treatments on growth and chemical constituents of *Calendula officinalis* plants under North Sinai conditions. Middle East Journal of Agriculture Research, 5 (4): 761-774. https://www.researchgate.net/publication/340210582

Hassan AE, Bhiah KM and Al-Zurfya MT (2014). Effect of organic extracts on the growth and flowering of marigold plants (*Calendula officinalis* L.). Journal of Organics, 1 (1): 22-30.

ICARDA, International Center for Agricultural Research in the Dry Areas (2013). Methods of Soil, Plant and Water Analysis: A manual for the West Asia and North Africa region. Third edition, ed. George Estefan, Rolf Sommer and John Ryan. Beirut, Lebanon.

Malik SA, Qadri ZA, Nazki IT, Mir SA, Khan FA and Pukhta MS (2019). Effect of gibberellic acid, spacing and nutrient sprays on growth and flowering in snapdragon (*Antirrhinum majus* L.) cv. Rocket Pink. International Journal of Plant & Soil Science, 28 (1): 1-6. https://10.9734/IJPSS/2019/v28i130098

Marashi M, Shafaghatian D and Mahboub Khomami A (2021). The impact of different levels of azocompost on growth medium chemical characteristics, growth and nutrition of *Zinnia elegans*. Journal of Ornamental Plants, 11 (2): 123-134. https://dorl.net/dor/20.1001.1.22516433.2021.11.2.4.3

Mjeed AJ and Ali MA (2017). Effect of Gyttja and nitrogen applications on growth and flowering of snapdragons (*Antirrhinum majus* L.) plant in the two soils depth. Kurdistan Journal of Applied Research, 2 (1): 1-7.

Mohamed SA and Elagabain NAA (2021). Response of Snapdragon (*Antirrhinum majus* Coronette F1) to compost amendment and foliar fertilization. Sudan Journal of Desertification Research, 13 (1): 57-70.

MSTAT–C (1986). A microcomputer Program for the Design Management and Analysis of Agronomic Research Experiments (version 4.0), Michigan State Univ., U.S.A.

Nair SA, Smitha GR and Kalaivanan D (2023). Influence of container, potting media and nutrients on production and post-production consumer acceptance of potted marigold (*Tagetes patula* L.). Journal of Horticultural Sciences, 18 (1): 113-121. https://doi.org/10.24154/jhs.v18i1.2153

Ram RA and Pathak RK (2007). Integration of organic farming practices for sustainable production of guava: A case study. In: International Guava Symposium 2007, Lucknow, India, 735: 357-363.

Riaz A, Arshad M, Younis A, Raza A and Hameed M (2008). Effects of different growing media on growth and flowering of *Zinnia elegans* cv. Blue point. Pakistan Journal of Botany, 40 (4): 1579-1585. https://www.researchgate.net/publication/26542048

Sabah SS, Manshood MA and Jewan KF (2019). Effect of irrigation by several levels from different types of fertilizer-soaked on growth and length of blooming period for snap dragon plants (*Antirrhinum majus* cv. butterfly). Plant Archives, 19 (1): 1521-1524. https://www.researchgate.net/publication/334289346

Sardoei AS (2014). Vermicompost effects on the growth and flowering of marigold (*Calendula officinalis*). European Journal of Experimental Biology, 4 (1): 651-655.

Sankar M and Gopal N (2021). Standardization of growing medium and growth retardants for compact growth of potted African marigold (Doctoral dissertation, Department of Floriculture and Landscape Architecture, College of Agriculture, Vellanikkara). http://hdl.handle.net/123456789/10889

Schulz H and Glaser B (2012). Effects of biochar compared to organic and inorganic fertilizers on soil quality and plant growth in a greenhouse experiment. Journal of Plant Nutrition and Soil Science, 175 (3): 410-422.

Senthil-Kumar T, Swaminathan V and Kumar S (2009). Influence of nitrogen, phosphorus and bio-fertilizer on growth, yield and essential oil constituents in Raton crop (*Artemisia pallens*). Electron Journal of Environmental and Agricultural Food Chemistry, 8 (2): 86-95.

Sharifian Z, Maghsoudi MAA and Mohamadi N (2014). Effect of different ratios of municipal solid waste compost on growth parameters and yield of Marigold (*Calendula officinalis* Moench.) and Daisy (*Bellis Perennis* L.). International journal of Advanced Biological and Biomedical Research, 2 (1): 43-50.

Shyala MR, Dhanasekaran D and Rameshkumar S (2019). Effect of foliar application of micronutrients and potassium humate on growth and flower yield of African marigold (*Tagetes erecta* L.). Annals of Plant and Soil Research, 21 (2): 101-107.

Verma S, Kumar A and Dwivedi AK (2019). Studies on effect of nitrogen and phosphorus on the performance of snapdragon (*Antirrhinum majus* L.): A review. Journal of Pharmacognosy and Phytochemistry, 8 (4): 2571-2575.

الملخص العربي

تأثير التسميد العضوي وغير العضوي علي التزهير وبعض المكونات الكيميائية لنبات حنك السبع

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هدفت هذه الدراسة إلى تقييم تأثير نسب إضافة الكمبوست (٠، ٥، ١٠، و ٢٠٪، وزن/وزن) ومعاملات التسميد المعدني (٥.٥، ١١، و ١٦.٥ جم NPK/أصيص، قُطر ٢٥ سم) وكذلك تفاعلاتها على الإزهار وبعض التركيبات الكيميائية لنبات حنك السبع *Antirrhinum majus*, L خلال موسمي النمو المتتاليين ٢٠٢٢/٢٠٢٣ و ٢٠٢٣/٢٠٢٤ في مزرعة الزينة بكلية الزراعة جامعة المنيا.

أدت جميع النِسب المستخدمة من الكمبوست إلى زيادة كبيرة في صفات الإزهار (طول الحامل الزهري، عدد حوامل النورات، عدد الأزهار لكل نورة، الوزن الطازج والجاف للأزهار لكل نبات، ومدة الإزهار)، ومحصول البذور والصبغات الضوئية والنسب المئوية للنيتروجين والفوسفور والبوتاسيوم مقارنة بالنباتات غير المعاملة. في جميع الحالات، كان الكمبوست بنسبة ٢٠٪ متفوقًا معنوياً على المعاملات الأخرى المستخدمة.

أدى التسميد المعدني إلى زيادة كبيرة في جميع الصفات المذكورة أعلاه مقارنة بمعاملة الكنترول. أنتجت معاملة ١٦.٥ جرام/أصيص، تليها ١١ جرام/أصيص أعلى القيم دون فروق معنوية بينهما.

كانت معاملة التفاعل الأكثر فعالية هي إمداد نباتات حنك السبع بالكمبوست بنسبة ٢٠٪ مع ١٦.٥ أو ١١ جرام NPK معدني/أصيص.

الكلمات المفتاحية: الكمبوست، التسميد المعدني، حنك السبع، الإزهار – الصبغات.–