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Effect of Different Soil Media and Some Growth Regulators on French Marigold Plants
A. Vegetative, Root Growth and Pigments

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ABSTRACT

During the two experimental seasons of 2016 and 2017, a pot experiment was carried out in the Nursery of Ornamental Plants, Fac. Agric., Minia Univ. to investigate the influence of soil media and specific growth regulators on the vegetative and root growth characteristics and pigments of *Tagetes patula* L. plants. Results indicated that all examined traits of vegetative development (plant height, branches number, stem diameter, areal parts fresh and dry weights), root length, root fresh and dry weights and pigments content were increased with plants grown in clay/sand comparing with clay or sandy media alone during both seasons.

All used concentrations of growth regulators significantly decreased plant height and fresh and dry weights with high concentrations only during both seasons. On contrast, other abovementioned criteria were significantly increased with all used concentration of growth regulators in both seasons. 4-CPA at 300 ppm was more effective in this concern.

The results proved that cultivating *Tagetes patula*, in clay/sandy media and spraying with 4-CPA at 300 ppm recorded the best compact potted plant.

KEYWORDS: *Tagetes patula* – alar – PGA – 4 CPA

1. INTRODUCTION

French Marigold (*Tagetes patula* L.) is Asteraceae's member (Lim, 2014). It is native to the Americas and has spread to other regions including Egypt. It used as pot plant, cut flower and other uses in home gardens. Moreover, leaves and flower are edible (Facciola, 1990). Many researchers proved that growth and production in sandy media can be improved through adding several conditioners such as clay (Nair *et al*., 2023 on *Tagetes patuala*; Aziz *et al*.,

2008 on *Thymus vulgaris*; Abd-Elfattah *et al*., 2009 on Dracena; Keditsu, 2012 on *Gerbera jamesonii*; Gohar, 2017 on *Gardenia jasminoides*; and Kumar *et al*., 2022 on *Calendula officinalis*).

For house owners and garden beautification, ornamental plants can be cultivated in the ground or in containers. According to Megersa *et al*. (2018), the primary benefits of growing these plants in pots are their mobility, adaptability, and compactness. Plant growth regulators play vital role in this regard (Murugan *et al*., 2021 on *Tagetes erecta*; Pinto *et al*., 2005 on Zinnia elegans; Ahmad *et al*., 2007 on carnation and Pobudkiewicz, 2014 on poinsettia).

Thus, the purpose of this study was to examine how various soil medium and growth regulators affect *Tagetes patula* L. plants growth.

2. MATERIALS AND METHODS

In the Nursery of Ornamental Plants, Fac. Agric., Minia Univ. a pot experiment was conducted during two experimental seasons of 2016 and 2017 to examine the effects of soil media and certain growth regulators on the vegetative and root growth criteria of *Tagetes patula* L. plants.

Uniform French Marigold seedlings were obtained from the Nursery of Floriculture plants, Fac. Agric., Minia Univ. averaged 7 cm in height and have 3 leaves, and were transplanted during 1st week of March in the two seasons of 2016 and 2017 in pot (30 cm) filled with 15.250 kg of sandy, clay soil or mixture of them (1:1), two transplants/pot. After 15 days, the transplants were thinned to one plant/pot. Clay soil was taken from The Ornamental Plants Nursery and sandy soil was released from the Agricultural research & Experimental Centr (new reclaimed soil). The physical and chemical analyses of the two used soils were performed according to the methods described by Jackson (1973) as listed in Tables (a and b).

Table a. The physical and chemical analysis of the used sandy soil.

Soil character	Values		Soil character	Values	
	2016	2017		2016	2017
Physical properties:			**Soluble nutrients:**		
Sand (%)	89.11	86.39	**Ca^{++} (ppm)**	132.0	151.0
Silt (%)	3.41	4.21	**Mg^{++} (ppm)**	59.1	65.6
Clay (%)	7.48	9.40	**Na^{+} (ppm)**	81.6	75.2
Soil type	Sandy	sandy	**K^{+} (ppm)**	14.8	22.4
Chemical properties:			**DTPA-Extractable nutrients:**		
pH (1:2.5)	8.13	8.21	**Fe (ppm)**	0.85	0.97
E.C. (dS/m)	1.26	1.34	**Cu (ppm)**	0.42	0.46
O.M. (%)	0.21	0.23	**Zn (ppm)**	0.34	0.37
$CaCO_3$ (%)	13.89	13.68	**Mn (ppm)**	0.53	0.59

Table b. The physical and chemical analysis of the used clay soil.

Soil character	Values		Soil character	Values	
	2016	2017		2016	2017
Physical properties:			**Soluble nutrients:**		
Sand (%)	48.22	46.91	**Ca^{++} (ppm)**	31.75	32.61
Silt (%)	10.65	11.88	**Mg^{++} (ppm)**	1.91	1.86
Clay (%)	41.13	41.18	**Na^{+} (ppm)**	2.52	2.66
Soil type	Clay	Clay	**K^{+} (ppm)**	2.11	2.92
Chemical properties:			**DTPA-Extractable nutrients:**		
pH (1:2.5)	7.79	7.77	**Fe (ppm)**	8.63	8.74
E.C. (dS/m)	1.22	1.25	**Cu (ppm)**	2.07	2.12
O.M. (%)	1.61	1.63	**Zn (ppm)**	2.69	2.78
$CaCO_3$ (%)	2.07	2.04	**Mn (ppm)**	8.27	8.32

The experiment was laid out at split plot design, with three replates. The soil medias i.e., clay, sand and clay/sand (1:1 v/v) treatments were occupied the main plots, while, the sub-plots contained seven treatments [control, alar at 1500 and 3000 ppm, phloroglucinol anhydrous (PGA) at 150 and 300 ppm, and 4-chlorophenoxy acetic acid (4-CPA) at 150 and 300 ppm].

The required quantities of alar were first dissolved in a tiny amount of alcohol (C_2H_5OH), and the volume was then raised to 1000 ml of distilled water to achieve the proper concentrations of alar. Phloroglucinol anhydrous and 4-chlorophenoxy acetic acid were both dissolved in the required volume of distilled water to create the stock solution, which was then diluted prior to spraying.

Using a hand sprayer, all growth regulator treatments were sprayed to full wetness three times at intervals of two weeks, starting on April 1st and continuing through May 1st. For all growing seasons, the control treatment was applied with tab water.

At the flowering stage, the different growth criteria were recorded as follows: plant height (cm), stem diameter (mm) at 5 cm above the soil surface, main of branches/plant, aerial parts fresh and dry weights (g), main root length (cm), and root system fresh and dry weights (g). Also, one month after the last spray (1st June), photosynthetic pigments (mg/g fresh weight) were determined according to Fadl and Sari El-Deen (1978).

The data for each parameter included in the study were exposed to an Analysis of Variance (ANOVA) using the computer program MSTAT–C (1986). Using the Least Significant Difference approach was used to compare factors mean at 5% probability level.

3. RESULTS

3.1.Vegetative growth indicators:

The effect of soil media, growth regulators and their combinations on vegetation and root development of French marigold was listed in Tables (1 to 3). It is clear that soil media considerably enhanced vegetation and root development i.e., marigold height, stem diameter, main of branches number/plant, aerial parts fresh and dry weights, main root length, and root system fresh and dry weights. The clay/sandy media worked better than both of clay or sandy media alone throughout the experimental period, as gave 54.4 and 57.7 cm height, 0.87 and 0.92 mm diameter, 10.7 and 11 branches, 70.25 and 72.24 g plant fresh weight, 24.59 and 25.50 g plant dry weight, 11.86 and 12.26 cm main root length, 36.82 and 37.16 g root system fresh weight, and 18.78 and 19.33 g root system dry weight, during both seasons, respectively. Moreover, the clay media take the second order, while the sandy media came in last one, in both seasons.

It could be enhancing plant and root development in sandy soil by adding various conditioners as reported by Mann *et al*. (2023) and Shalaby *et al*. (2023) on *Tagetes erecta* L.; Kumar *et al*. (2022) on *Calendula officinalis*; Singh *et al*. (2022) on *Chrysanthemum morifolium*; Gohar (2017) on *Gardenia jasminoides*; and Abdou *et al*. (2023 b) on *Cineraria hybrida*.

Except plant height and areal parts weights with high concentrations, all abovementioned criteria were improved by using the three growth regulators throughout both experimental seasons. It is observed that the high concentrations of 4-CPA at 300 ppm, followed by PGA at 300 ppm, then alar at 3000 ppm considerably enhanced development characteristics relative to untreated plants in both seasons.

Generally, growth hormones can cause changes in the physical characteristics of plants as well as in their physiological and developmental responses. In our research, the plant height was deceased as mentioned by Murugan *et al*. (2021) on *Tagetes erecta* L.; Pinto *et al*. (2005) and Abbas *et al*. (2007) on *Zinnia elegans*; Ahmad *et al*. (2007) on carnation; El-Sheibany *et al*. (2007) and Asrar *et al*. (2014) on chrysanthemum; Hashemabadi *et al*. (2012) and Kazemi *et al*. (2014) on *Calendula officinalis*; Taha (2012) on iris plants; and Manasa and Joshi (2022) on China aster. On contrarily, plant growth regulators are intended to enhance other characters as clarified by Murugan *et al*. (2021) on *Tagetes erecta*; Asrar *et al*. (2014) on chrysanthemum; Abbas *et al*. (2007) on *Rosa damascene*; Ahmad *et al*. (2007) on carnation; Renu and Srivastava (2013) and Pobudkiewicz (2014) on poinsettia; Amin *et al*. (2017) on tuberose; Al-Bayati and

Table 1. Response of plant height, diameter and branches number/plant of French marigold to soil media, growth regulators and their interaction treatments during both seasons.

Growth regulators treatments (ppm) (B)	Soil media treatments (A)							
	Clay	Sand	Clay/sand	Mean (B)	Clay	Sand	Clay/sand	Mean (B)
	The first growing season (2016)				The second growing season (2017)			
				Plant height (cm)				
Control (Without)	55.4	53.6	64.9	58.0	58.7	56.8	68.8	61.4
Alar at 1500 ppm	48.8	47.4	55.7	50.6	51.8	50.3	59.1	53.8
Alar at 3000 ppm	47.7	47	49.1	47.9	50.6	49.8	52.0	50.8
PGA at 150 ppm	50.9	40.8	56.1	49.3	54.0	43.2	59.5	52.2
PGA at 300 ppm	45.7	37.1	51.3	44.7	48.4	39.3	54.4	47.4
4-CPA at 150 ppm	51.6	47.6	56.8	52.0	54.8	50.6	60.3	55.1
4-CPA at 300 ppm	40.1	36.1	47	41.1	42.5	38.3	49.8	43.5
Mean (A)	48.6	44.2	54.4	49.1	51.5	46.9	57.7	52.0
L.S.D. at 5 %	A: 4.1		B: 2.3	AB: 4.0	A: 4.8		B: 2.5	AB: 4.3
				Stem diameter (mm)				
Control (Without)	0.79	0.75	0.83	0.79	0.84	0.8	0.88	0.84
Alar at 1500 ppm	0.81	0.77	0.85	0.81	0.86	0.82	0.9	0.86
Alar at 3000 ppm	0.83	0.79	0.87	0.83	0.88	0.84	0.92	0.88
PGA at 150 ppm	0.79	0.75	0.83	0.79	0.85	0.81	0.89	0.85
PGA at 300 ppm	0.86	0.82	0.90	0.86	0.91	0.87	0.95	0.91
4-CPA at 150 ppm	0.80	0.76	0.84	0.80	0.85	0.81	0.89	0.85
4-CPA at 300 ppm	0.90	0.86	0.95	0.90	0.95	0.91	1.01	0.96
Mean (A)	0.83	0.79	0.87	0.83	0.88	0.84	0.92	0.88
L.S.D. at 5 %	A: 0.03		B: 0.02	AB: 0.04	A: 0.04		A: 0.03	AB: 0.05
				Number of branches/plant				
Control (Without)	7.4	5.4	8.8	7.2	7.5	5.5	8.9	7.3
Alar at 1500 ppm	7.6	7.7	8.5	7.9	7.8	7.9	8.7	8.1
Alar at 3000 ppm	8.5	7.1	9.0	8.2	8.7	7.2	9.2	8.4
PGA at 150 ppm	8.7	7.4	11.5	9.2	9.0	7.6	11.8	9.5
PGA at 300 ppm	12.5	9.5	13.1	11.7	13.0	9.9	13.6	12.2
4-CPA at 150 ppm	9.3	6.8	10.9	9.0	9.6	7.0	11.2	9.3
4-CPA at 300 ppm	10.0	6.1	13.1	9.7	10.4	6.3	13.6	10.1
Mean (A)	9.1	7.1	10.7	9.0	9.4	7.3	11.0	9.3
L.S.D. at 5 %	A: 1.1		B: 0.4	0.7	A: 1.2		B: 0.5	AB: 0.9

Table 2. Response of aerial parts fresh and dry weights per plant of French marigold to soil media, growth regulators and their interaction treatments during both seasons.

Growth regulators treatments (ppm) (B)	Soil media treatments (A)							
	Clay	Sand	Clay/sand	Mean (B)	Clay	Sand	Clay/sand	Mean (B)
	The first growing season (2016)				The second growing season (2017)			
	Aerial parts fresh weight per plant (g)							
Control (Without)	48.44	34.06	59.15	47.22	50.38	35.42	61.52	49.11
Alar at 1500 ppm	63.08	34.60	63.47	53.72	65.60	35.98	66.01	55.87
Alar at 3000 ppm	53.05	52.11	56.87	54.01	55.17	54.19	59.14	56.17
PGA at 150 ppm	67.39	39.77	85.32	64.16	68.74	40.57	87.03	65.44
PGA at 300 ppm	74.79	57.45	86.43	72.89	75.54	58.02	87.29	73.62
4-CPA at 150 ppm	72.32	44.75	64.66	60.58	74.49	46.09	66.60	62.39
4-CPA at 300 ppm	69.89	53.03	75.83	66.25	71.99	54.62	78.10	68.24
Mean (A)	64.14	45.11	70.25	61.26	65.99	46.41	72.24	61.55
L.S.D. at 5 %	A: 4.13		B: 3.63	AB: 6.28	A: 4.51		B: 3.85	AB: 6.67
	Aerial parts dry weight per plant (g)							
Control (Without)	17.92	10.56	20.70	16.39	18.14	11.16	21.72	17.00
Alar at 1500 ppm	19.63	16.15	19.91	18.56	19.86	17.07	20.88	19.27
Alar at 3000 ppm	23.34	10.73	22.22	18.76	23.62	11.33	23.30	19.42
PGA at 150 ppm	24.93	12.33	29.86	22.38	24.75	12.78	30.72	22.75
PGA at 300 ppm	27.67	17.81	30.25	25.24	27.19	18.28	30.81	25.43
4-CPA at 150 ppm	26.76	13.87	22.63	21.09	26.82	14.52	23.51	21.61
4-CPA at 300 ppm	25.86	16.44	26.54	22.95	25.92	17.21	27.57	23.56
Mean (A)	23.73	13.98	24.59	20.77	23.76	14.62	25.50	21.29
L.S.D. at 5 %	A: 0.8		B: 0.7	AB: 1.21	A: 0.95		B: 0.86	AB: 2.58

Table 3. Response of main root length and root fresh and dry weights of French marigold to soil media, growth regulators and their interaction treatments during both seasons.

Growth regulators treatments (ppm) (B)	Soil media treatments (A)							
	Clay	Sand	Clay/sand	Mean (B)	Clay	Sand	Clay/sand	Mean (B)
	The first growing season (2016)				The second growing season (2017)			
	Main root length (cm)							
Control (Without)	7.63	10.68	11.30	9.87	7.78	10.89	11.53	10.07
Alar at 1500 ppm	9.31	10.97	12.18	10.82	9.59	11.30	12.55	11.14
Alar at 3000 ppm	10.21	9.70	12.29	10.73	10.41	9.89	12.54	10.95
PGA at 150 ppm	11.71	11.16	12.00	11.62	12.18	11.61	12.48	12.09
PGA at 300 ppm	9.04	10.46	11.21	10.24	9.40	10.88	11.66	10.65
4-CPA at 150 ppm	12.26	14.36	14.72	13.78	12.87	15.08	15.46	14.47
4-CPA at 300 ppm	11.30	12.83	11.76	11.96	11.75	13.34	12.23	12.44
Mean (A)	10.56	11.45	11.86	11.29	10.94	11.86	12.26	11.69
L.S.D. at 5 %	A: 0.50		B: 0.40	AB: 0.69	A: 0.70		B: 0.50	AB: 0.87
	Root system fresh weight (g)							
Control (Without)	16.27	12.71	31.94	20.31	31.94	12.71	35.00	26.55
Alar at 1500 ppm	17.44	13.98	44.71	25.38	44.71	18.58	45.08	36.12
Alar at 3000 ppm	10.42	8.85	43.96	21.08	43.96	14.24	32.78	30.33
PGA at 150 ppm	22.48	8.50	46.10	25.69	46.10	9.81	47.63	34.51
PGA at 300 ppm	17.04	5.41	30.18	17.54	30.18	8.69	33.82	24.23
4-CPA at 150 ppm	20.14	10.15	36.15	22.15	36.15	5.61	37.78	26.51
4-CPA at 300 ppm	14.74	7.87	24.69	15.77	24.69	10.30	28.06	21.02
Mean (A)	16.93	9.64	36.82	21.13	36.82	8.32	37.16	28.47
L.S.D. at 5 %	A: 3.5		B: 0.98	AB: 1.70	A: 3.85		B: 1.02	AB: 1.77
	Root system dry weight (g)							
Control (Without)	8.30	6.48	16.29	10.36	16.61	6.61	18.20	13.81
Alar at 1500 ppm	8.89	7.13	22.80	12.94	23.25	9.66	23.44	18.78
Alar at 3000 ppm	5.31	4.51	22.42	10.75	22.86	7.40	17.05	15.77
PGA at 150 ppm	11.46	4.34	23.51	13.10	23.97	5.10	24.77	17.95
PGA at 300 ppm	8.69	2.76	15.39	8.95	15.69	4.52	17.59	12.60
4-CPA at 150 ppm	10.27	5.18	18.44	11.29	18.80	2.92	19.65	13.79
4-CPA at 300 ppm	7.52	4.01	12.59	8.04	12.84	5.36	14.59	10.93
Mean (A)	8.64	4.92	18.78	10.78	19.15	5.94	19.33	14.80
L.S.D. at 5 %	A: 0.85		B: 0.45	AB: 0.78	A: 0.87		B: 0.51	AB: 0.88

Salih (2021) on Dianthus caryophyllus and Manasa and Joshi (2022) on Callistephus chinensis.

For both seasons, there was a considerable interaction effect between the growth media and growth regulators for abovementioned criteria. The plants cultivated on clay/sand media and sprayed with 4-CPA at 300 ppm, followed by PGA at 300 ppm had the greatest values.

3.2. Pigments content:

According to Table (4), significant augment in chlorophyll a, chlorophyll b, and carotenoids were found with soil media throughout the experimental period. Clay/sandy media was favorable for improving chlorophyll content than either clay or sandy alone in both seasons. The beneficial effects adding of conditioners to sandy soil on pigments were emphasized by Nair *et al*. (2023) on potted marigold (*Tagetes patula* L.); El-Serafy (2015) on carnation; Gohar (2017) on *Gardenia jasminoides*; Abdou *et al*. (2023a) on *Calendula officinalis*; and Abdou *et al*. (2023 b) on *Cineraria hybrida*.

Data in the same Table demonstrated that, in relation to the control, all three growth regulator treatments were considered to have enhanced the three characteristics of pigments i.e., chlorophyll a, b, and carotenoids. In all seasons, PGA (300 ppm) produced the greatest results for carotenoids, chlorophyll a, and b, followed by 4-CPA (300 ppm).

Growth regulators led to increase photosynthetic pigments as mentioned by El-Sheibany *et al*. (2007) and Asrar *et al*. (2014) on *Chrysanthemum morifolium*; Taha (2012), on iris plants; and Al Khalifa (2015) on geranium plants.

For pigment content in both seasons, there was a substantial interaction impact between the growth media and growth regulators. The plants cultivated in clay/sandy medium and sprayed with PGA at 300 ppm in both seasons had the highest content of carotenoids, chlorophyll a, and chlorophyll b. The plants grown in clay media and treated with PGA at 300 ppm for carotenoids alone in both seasons.

4. DISCUSSION

The purpose of adding the amendments (including clay) to the sand media is to increase the media's porosity, while also to provide sufficient nutrients for plants (Malik *et al*., 2023). Combining various soil types improved drainage, porosity, soil aeration, and water and nutrient retention, which resulted in healthy growth and vigor growth (Arora, 2004; Bergi, 2011).

Certain growth regulators can improve the color of the leaf, and prevent or reduce stem elongation or cell division (Dole and Wilkins, 1999). Growth regulators have the ability to impede cell proliferation and elongation in shoot tissue, which can have an impact on the quality and manipulation of pot plants' size, shape, and form (compact plant) (Renu and Srivastava, 2013).

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Table 4. Response of fresh leaves pigments content of French marigold to soil media, growth regulators and their interaction treatments during both seasons.

Growth regulators treatments (ppm) (B)	Soil media treatments (A)							
	Clay	Sand	Clay/sand	Mean (B)	Clay	Sand	Clay/sand	Mean (B)
	The first growing season (2016)				The second growing season (2017)			
	Chlorophyll a (mg/g)							
Control (Without)	3.010	2.950	3.090	3.017	3.070	3.009	3.152	3.077
Alar at 1500 ppm	3.120	3.030	3.210	3.120	3.182	3.091	3.274	3.182
Alar at 3000 ppm	3.160	3.070	3.230	3.153	3.223	3.131	3.295	3.216
PGA at 150 ppm	3.220	3.110	3.296	3.209	3.284	3.172	3.362	3.273
PGA at 300 ppm	3.426	3.346	3.507	3.426	3.495	3.413	3.577	3.495
4-CPA at 150 ppm	3.275	3.180	3.386	3.280	3.341	3.244	3.454	3.346
4-CPA at 300 ppm	3.389	3.276	3.469	3.378	3.457	3.342	3.538	3.446
Mean (A)	3.229	3.137	3.313	3.226	3.293	3.200	3.379	3.291
L.S.D. at 5 %	A: 0.091		B: 0.035	AB: 0.061	A: 0.055		B: 0.022	A: 0.055
	Chlorophyll b (mg/g)							
Control (Without)	0.983	0.963	1.010	0.986	0.993	0.973	1.020	0.995
Alar at 1500 ppm	1.015	0.985	1.045	1.015	1.025	0.995	1.055	1.025
Alar at 3000 ppm	1.023	0.993	1.047	1.021	1.033	1.003	1.057	1.031
PGA at 150 ppm	1.038	1.002	1.064	1.035	1.048	1.012	1.075	1.045
PGA at 300 ppm	1.102	1.075	1.129	1.102	1.113	1.086	1.140	1.113
4-CPA at 150 ppm	1.080	1.042	1.106	1.076	1.057	1.025	1.095	1.059
4-CPA at 300 ppm	1.047	1.015	1.084	1.048	1.091	1.052	1.117	1.087
Mean (A)	1.041	1.011	1.069	1.040	1.052	1.021	1.080	1.051
L.S.D. at 5 %	A: 0.012		B: 0.009	AB: 0.016	A: 0.010		B: 0.008	AB: 0.014
	Carotenoids (mg/g)							
Control (Without)	1.303	1.283	1.330	1.306	1.342	1.321	1.370	1.344
Alar at 1500 ppm	1.440	1.410	1.470	1.440	1.483	1.452	1.514	1.483
Alar at 3000 ppm	1.553	1.523	1.577	1.551	1.600	1.569	1.624	1.598
PGA at 150 ppm	1.673	1.637	1.699	1.670	1.723	1.686	1.750	1.720
PGA at 300 ppm	1.942	1.915	1.969	1.942	2.000	1.972	2.028	2.000
4-CPA at 150 ppm	1.792	1.760	1.829	1.793	1.846	1.813	1.884	1.847
4-CPA at 300 ppm	1.830	1.792	1.856	1.826	1.885	1.846	1.912	1.881
Mean (A)	1.648	1.617	1.676	1.647	1.697	1.666	1.726	1.696
L.S.D. at 5 %	A: 0.020		B: 0.016	AB: 0.028	A: 0.022		B: 0.018	AB: 0.031

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الملخص العربي

تأثير بيئات النمو المختلفة وبعض منظمات النمو علي القطيفة الفرنساوي
أ. النمو الخضري والجذري والصبغات

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خلال موسمي نمو متعاقبين ٢٠١٦ و ٢٠١٧، بمشتل نباتات الزينة، قسم البساتين، كلية الزراعة، جامعة المنيا، أُجريت هذه التجربة لتقييم تأثير بيئات النمو وبعض منظمات النمو، علي صفات النمو الخضري والجذري والصبغات لنبات القطيفة الفرنساوي.

أظهرت النتائج أن جميع صفات النمو الخضري المدروسة (ارتفاع النبات، عدد الأفرع، قطر الساق، والأوزان الطازجة والجافة للأجزاء الهوائية) وطول الجذر الرئيسي والوزن الطازج والجاف للمجموع الجذري ومحتوي الأوراق من الصبغات قد زادت في النباتات المنزرعة في التربة الطينية/الرملية مقارنة بتلك المنزرعة في تربة طينية أو تربة رملية فقط، خلال موسمي النمو.

أدي الرش بجميع منظمات النمو المستخدمة إلي خفض طول الساق والوزن الطازج والجاف للأجزاء الهوائية تحت التركيزات العالية من منظمات النمو. علي العكس من ذلك، فقد ذادت جميع الصفات المدروسة زيادة معنوية نتيجة للرش بجميع التركيزات المستخدمة من منظمات النمو، في كلا موسمي الزراعة. كانت المعاملة بمنظم النمو ٤ حمض الكلوروفينوكسي أسيتيك بتركيز ٣٠٠ جزء في المليون هو الأكثر فاعلية في هذا الشأن.

إن زراعة نباتات القطيفة *Tagetes patula* في تربة طينية/رملية ورشها بمنظم النمو ٤ حمض الكلوروفينوكسي أسيتيك بتركيز ٣٠٠ جزء في المليون أنتجت أفضل نبات أصص متكتل.

الكلمات الافتتاحية: *Tagetes patula* – آلار – فلوروجلوسينول لا مائي – ٤ حمض الكلوروفينوكسي أسيتيك.