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Effect of Different Soil Media and Some Growth Regulators on French Marigold Plants
B. Flowering Characteristics and Antioxidant Activities

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ABSTRACT

During the two experimental seasons of 2016 and 2017, in the Nursery of Ornamental Plants, Fac. Agric., Minia Univ. a pot experiment was carried out to investigate the influence of soil media and specific growth regulators on the flowering characteristics and antioxidant activity (%) of *Tagetes patula* L. plants.

When compared to clay or sandy media used during both seasons, the clay/sandy medium produced more flowers quality and quantity, measured as flower diameter, flower stalk length, number of flowers per plant, and total flower fresh and dried weights. Also, antioxidant activity (%) was increased in the same soil media.

Spraying plans with growth regulators [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] significantly increased all previous characters except flower stalk length in both seasons. The growth regulator (PGA at 300 ppm) was superior in this concern.

The best combination was growing marigold plants in clay/sand media and spray by PGA at 300 ppm.

KEYWORDS: *Tagetes patula* – Flowers production – Alar – PGA – 4 CPA

1. INTRODUCTION

Tagetes patula L. used as pot plant, cut flower and other uses in home gardens. Moreover, leaves and flower are edible (Facciola, 1990). Flowers are used in refreshing drinks and the leaves are used for flavoring food, and at large scale for the beautification of landscape gardens,

indoor decoration and for making garlands (Bown 1995 and Ogbu *et al*., 2021).

In heavy soil without enough drainage, the development of root system is suppressed and plants are most susceptible to soil borne diseases (Beattle and White, 1992). On the other hand, the light texture soils like sand were poor in nutrients and organic matter. Supplemented sandy media by conditioners like clay, improved their physiological, biological and chemical properties. Consequently, producing vigor growth, reflected in to great flower production as indicated by Kispotta and Nag (2023) on *Tagetes erecta*; Ahmad *et al*. (2012) *Gerbera jamesonii*; Padhiyar *et al*. (2017), on chrysanthemum; Quan and Liang (2017) on *Lycoris aurea*; and Kumar *et al*. (2022) on *Calendula officinalis*.

Plant growth regulators play vital role in flower production as emphasized by Kalaimani *et al*. (2017) on *Tagetes*; Karlović *et al*. (2004) on chrysanthemum; Uddin *et al*. (2011) on potted gerbera and Amin *et al*. (2017) on tuberose.

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

2. MATERIALS AND METHODS

In the Nursery of Ornamental Plants, Fac. Agric., Minia Univ. a pot experiment was conducted in each of the two experimental seasons of 2016 and 2017 to examine the effects of soil media and certain growth regulators on the B. flowering characteristics and antioxidant activities 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, while, 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	Values	
	2016	2017	character	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	Values	
	2016	2017	character	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 in split-plot design. The three 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 (PGA) and 4-chlorophenoxy acetic acid (CPA) 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.

The flowers were collected five times with a week interval, starting from 8th October till 12th November, in both seasons (8th, 15th, 22nd, 29th October and 5th November). The following flower characteristics were recorded: flower stalk length (cm), flower diameter (cm), and flower yield, fresh and dry weights per plant (g). In addition, at the end of the experiment, antioxidant activity (%), in the second season only were determined according to Ruzicka and Hansen (1988).

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

3. RESULTS

3.1.Flowering characteristics:

The effect of soil media, growth regulators and their combinations on flowering of *Tagetes patula* was presented in Tables (1 and 2). It is obvious that soil media significantly enhanced flowering production i.e., mean flower diameter, mean flower stalk length, total number of flowers per plant, and total flowers fresh and dry weights per plant. The clay/sandy medium worked better than both of clay or sandy medium alone throughout the experimental period, as gave 2.89 and 2.94 cm for mean flower diameter, 8.62 and 9.82 cm for mean flower stalk length, 46.47 and 49.01 flowers, 79.25 and 94.75 g flower fresh weight, 29.59 and 31.18 g flower dry weight, during both seasons, respectively. Moreover, the increase in flowers yield per plant reached 13.17 and 11.26% over clay medium and reached 44.59 and 55.59% over sandy medium in both seasons, respectively.

It could be enhancing flower production and quality in sandy soil by adding various conditioners as mentioned by Kispotta and Nag (2023) on *Tagetes erecta*; Ahmad *et al*. (2012) *Gerbera jamesonii*; Padhiyar *et al*. (2017), on chrysanthemum; Quan and Liang (2017) on *Lycoris aurea*; and Kumar *et al*. (2022) on *Calendula officinalis*.

All flowering characteristics were enhanced by using the three growth regulators at various used concentrations, except the mean flower stalk length throughout both experimental seasons relative to untreated plants. It is observed that the high concentration of PGA was more effective than other used growth regulators, followed by CPA, then alar. The highest increase in flower mean diameter reached 14.45 and 13.64%, total number of flowers 104.10 and 98.84%, flower fresh weight 96.15 and % 116.75, and flower dry weight 93.90 and 94.01% over the control during both seasons, respectively. On contrarily, the decrease in mean flower stalk length due to PGA at 300 ppm recorded 15.7 and 14.8% under the control, in both seasons, respectively.

In close to our findings were those obtained by Kalaimani *et al*. (2017) on *Tagetes*; Karlović *et al*. (2004) on chrysanthemum; Uddin *et al*. (2011) on potted gerbera and Amin *et al*. (2017) on tuberose.

For both seasons, there was a considerable interaction effect between soil media and growth regulators for flowering characteristics. The best interactions over all were plants cultivated on

clay/sand media and sprayed with PGA at 300 ppm, followed by 4-CPA at 300 ppm.

Table 1. Response of flower diameter, stalk length and yield per plant of French marigold to soil media, growth regulators and their interaction treatments during both seasons.

Growth regulators treatments (ppm) (B)s	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)			
Flower diameter (cm)								
Control (Without)	2.59	2.41	2.68	2.56	2.66	2.51	2.76	2.64
Alar at 1500 ppm	2.65	2.50	2.76	2.64	2.75	2.61	2.84	2.73
Alar at 3000 ppm	2.71	2.57	2.83	2.70	2.79	2.68	2.89	2.79
PGA at 150 ppm	2.91	2.70	2.98	2.86	2.92	2.80	3.01	2.91
PGA at 300 ppm	2.96	2.79	3.05	2.93	3.01	2.90	3.09	3.00
4-CPA at 150 ppm	2.86	2.67	2.93	2.82	2.88	2.79	2.98	2.89
4-CPA at 300 ppm	2.90	2.73	2.98	2.87	2.92	2.83	3.00	2.92
Mean (A)	2.80	2.62	2.89	2.77	2.85	2.73	2.94	2.84
L.S.D. at 5 %	A: 0.06		B: 0.05	AB: 0.09	A: 0.06		B: 0.04	AB: 0.07
Flower stalk length (cm)								
Control (Without)	8.99	8.08	9.90	8.99	9.95	8.74	10.97	9.89
Alar at 1500 ppm	8.47	7.54	8.77	8.26	9.31	8.09	10.27	9.22
Alar at 3000 ppm	8.14	6.93	8.22	7.76	8.64	7.58	9.56	8.59
PGA at 150 ppm	8.37	7.58	8.91	8.29	9.14	8.14	10.19	9.16
PGA at 300 ppm	7.75	6.85	8.13	7.58	8.51	7.42	9.35	8.43
4-CPA at 150 ppm	8.18	7.40	8.56	8.05	9.11	8.07	9.63	8.94
4-CPA at 300 ppm	7.31	6.48	7.84	7.21	8.03	7.15	8.76	7.98
Mean (A)	8.17	7.26	8.62	8.02	8.95	7.88	9.82	8.89
L.S.D. at 5 %	A: 0.75		B: 0.63	AB: 1.09	A: 0.81		B: 0.69	AB: 1.20
Flower yield per plant								
Control (Without)	24.01	17.67	31.20	24.29	27.40	20.93	34.74	27.69
Alar at 1500 ppm	31.76	20.10	35.25	29.04	32.99	23.33	37.76	31.36
Alar at 3000 ppm	36.42	24.82	40.33	33.86	38.31	27.81	42.91	36.34
PGA at 150 ppm	46.66	30.55	51.41	42.87	50.66	33.66	52.69	45.67
PGA at 300 ppm	52.94	31.51	64.27	49.57	58.21	41.01	65.97	55.06
4-CPA at 150 ppm	42.81	30.72	48.64	40.72	45.98	35.66	51.79	44.48
4-CPA at 300 ppm	47.87	34.99	54.19	45.68	50.88	38.09	57.18	48.72
Mean (A)	40.35	27.19	46.47	38.01	43.49	31.50	49.01	41.33
L.S.D. at 5 %	A: 3.55		B: 2.11	AB: 3.66	A: 4.44		B: 2.18	AB: 3.78

Table 2. Response of flower 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)			
	Flower fresh weight per plant (g)							
Control (Without)	46.72	35.08	55.93	45.91	55.09	42.43	61.89	53.14
Alar at 1500 ppm	54.39	41.91	64.54	53.61	71.07	51.82	77.39	66.76
Alar at 3000 ppm	64.02	47.87	74.91	62.27	79.68	60.44	86.14	75.42
PGA at 150 ppm	77.27	60.38	86.15	74.60	100.29	72.80	108.10	93.73
PGA at 300 ppm	90.63	70.69	108.83	90.05	121.97	83.72	139.84	115.18
4-CPA at 150 ppm	60.70	49.89	78.90	63.16	77.49	59.85	89.99	75.78
4-CPA at 300 ppm	67.62	55.96	85.50	69.69	86.43	68.19	99.88	84.83
Mean (A)	65.91	51.68	79.25	65.61	84.57	62.75	94.75	80.69
L.S.D. at 5 %	A: 7.12		B: 4.11	AB: 7.12	A: 8.14		B: 4.85	AB: 8.40
	Flower dry weight per plant (g)							
Control (Without)	17.43	13.36	20.80	17.20	18.90	14.48	21.77	18.38
Alar at 1500 ppm	20.60	15.30	23.24	19.71	22.00	16.85	24.98	21.28
Alar at 3000 ppm	23.69	16.78	27.97	22.81	25.50	19.01	28.88	24.46
PGA at 150 ppm	29.03	21.07	32.08	27.39	30.54	23.83	34.82	29.73
PGA at 300 ppm	34.64	25.43	39.98	33.35	37.47	27.79	41.76	35.67
4-CPA at 150 ppm	25.16	18.43	30.88	24.82	27.68	19.99	32.38	26.68
4-CPA at 300 ppm	27.73	20.80	32.15	26.89	29.81	22.77	33.68	28.75
Mean (A)	25.47	18.74	29.59	24.60	27.41	20.67	31.18	26.42
L.S.D. at 5 %	A: 3.11		B: 2.06	AB: 3.57	A: 3.71		B: 2.13	AB: 3.69

3.2.Antioxidant activity (%):

According to Table (3), plants grown in clay/sandy medium had the highest antioxidant activity (%) than other soil mediums throughout the experimental period. Both clay/sandy and clay mediums were significantly increased antioxidant activity (%) than sandy medium alone in the second season, without significant differences were detected between such two superior media.

Data in the same Table confirmed that, in relation to the control, all three growth regulator treatments were enhanced antioxidant activity (%), except alar at 3000 ppm, which decreased the antioxidant activity facing the control during the second season. The high concentrations were more effective the low concentration of each one. PGA (150 ppm) take the first order, followed by 4-CPA (150 ppm) in the second order, then alar (1500 ppm) came in the last order.

According to Pollterait (1997), antioxidants are radical scavengers that shield the body from free radicals, which can lead to pathological disorders including anemia, asthma, arthritis, inflammation, neurodegeneration, Parkinson's disease, Down syndrome, aging, and perhaps dementia.

By using naturally occurring antioxidant chemicals found in food and medicinal plants, free radicals can be scavenged by chemoprevention (Borelli, and Izzo, 2000). It has been demonstrated that some medicinal plants may treat human illnesses as well as act as chemopreventives (F'guyer *et al*., 2003 and Jaleel *et al*., 2009). Jaleel *et al*. (2007) concluded that all plant growth regulators (including alar, phloroglucinol anhydrous and 4-chlorophenoxy acetic acid) increased the enzymatic antioxidants like Ascorbate peroxidase, Superoxide dismutase, catalase, peroxidase and polyphenol oxidase activities of plants.

For antioxidant activity in the second season, there was no significant effect due to the interaction between the main and sub-plots.

Table 3. Response of antioxidants activities of French marigold to soil media, growth regulators and their interaction treatments during the second season only (2017).

Growth regulators treatments (ppm) (B)	Soil media treatments (A)			
	Clay	**Sand**	**Clay/sand**	**Mean (B)**
Control (Without)	79.5	73.4	79.9	77.6
Alar at 1500 ppm	82.4	80.9	82.7	82.0
Alar at 3000 ppm	77.7	66.4	78.9	74.3
PGA at 150 ppm	83.1	82.7	84.0	83.3
PGA at 300 ppm	82.2	79.7	82.9	81.6
4-CPA at 150 ppm	82.5	81.1	83.4	82.3
4-CPA at 300 ppm	81.1	78.8	81.4	80.4
Mean (A)	81.2	77.6	81.9	80.2
L.S.D. at 5 %	A: 4.1	B: 2.4		AB: N.S.

4. DISCUSSION

proper nursery management starts with choosing a proper growth environment, which is also essential for a robust and healthy root system, strong and healthy plants, high-quality flowers, and production. Field soil or a combination of several types of accessible soils with conditioner made for the ideal habitat (Hartmann *et al*., 2007 and Rahbarl *et al*., 2013).

In order to create compact plants and accelerate or postpone the flowering phase in order to produce more blooms, several plant growth regulators were employed (Kumar *et al*. 2011).

5. REFERENCES

Ahmad I, Ahmad T, Gulfam A and Saleem M (2012). Growth and flowering of gerbera as influenced by various horticultural substrates. Pakistan Journal of Botany, 44 (1): 291-299.

Amin MR, Pervin N, Nusrat A, Mehraj H and Jamal Uddin AFM (2017). Effect of plant growth regulators on growth and flowering of tuberose (*Polianthes tuberosa* L.) cv. Single. Journal of Bioscience and Agriculture Research, 12 (01): 1016-1020.

https://doi.org/10.18801/jbar.120117.123

Beattle DJ and White JW (1992). Lilium-hybrids and species. In: De Hertogh A.A. and Le Nard M. (eds.), The Physiology of Flower Bulbs. Elsevier, Amsterdam.

Borelli F and Izzo AA (2000). The plant kingdom as a source of anti-ulcer remedies. Phytother Res. 14: 581-591.

Bown D (1995). Encyclopaedia of herbs and their uses. Dorling Kindersley, London, 424pp.

F'guyer S, Afaq F and Mukhtar H (2003). Photoprevention of skin cancer by botanical agents. Photoderm Photoimmunol Photomed., 19: 56-72.

Facciola S (1990). Cornucopia. A source book of edible plants. Kampong Publication, Vista, 677pp.

Hartmann HT, Kester DE, Davies JrFT and Geneve RL (2007). Plant Propagation: principles and practices (7th ed.). Prentice- Hall Inc., New Delhi.

Jackson ML (1973). Methods of chemical analysis. Prentic Hall., EngleWood Cliffs, N.T.J.

Jaleel CA, Gopi R, Manivannan P and Panneerselvam R (2007). Responses of antioxidant defense system of *Catharanthus roseus* (L.) G. Don. to paclobutrazol treatment under salinity. Acta Physiol. Plantarum., 29: 205-209.

Jaleel CA, Gopi R, Gomathinayagam M and Panneerselvam R (2009). Traditional and non-traditional plant growth regulators alters phytochemical constituents in *Catharanthus roseus*. Process Biochem., 44:205-209.

Kalaimani M, Sathappan CT, Kandasamy R and Singaravel R (2017). Investigation of different levels plant growth regulators and pinching treatments on flowering and yield parameters of African marigold (*Tagetes Erecta* L.). Chemical Science Review Letters, 6 (22): 741-745.

Karlović K, Vršek I, Šindrak Z and Židovec V (2004). Influence of growth regulators on the height and number of inflorescence shoots in the chrysanthemum cultivar 'Revert'. Agriculturae Conspectus Scientificus, 69 (2-3): 63-66.

Kispotta GS and Nag SSK (2023). Effect of different rooting media on performance of African marigold (*Tagetes erecta* L.) cv. Pusa Basanti Gainda through stem cutting. The Pharma Innovation Journal, 12 (7): 2340-2342.

Kumar A, Kumar J, Mohan B, Singh JP and Ram RN (2011). Effect of plant growth regulators on growth, flowering and yield of African marigold (*Tagetes ercta*, L.) cv. Pusa narangi gainda. Asian J. Hort., 6 (2): 418-422.

Kumar R, Singh AK, Tomar KS and Gupta AK (2022). Effects of different media on growth and flowering traits of *Calendula officinalis* L. Bangladesh Journal of Botany, 51 (3): 417-424.

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.

Ogbu JU, Isienyi NC and Woghiren AI (2021). Growth and flowering response of *Tagetes erecta* L. (Asteraceae) grown in different nursery media mixtures. Nigeria Agricultural Journal, 52 (3): 197-201.

Padhiyar BM, Bhatt DS, Desai KD, Patel VH and Chavda JR (2017). Influence of different potting media on growth and flowering of pot chrysanthemum var. Ajina purple. Int. J. Chem. Stud., 5 (4): 1667-1669.

Polterait O (1997). Antioxidants and free radical scavengers of natural origin. Curr. Org. Chem., 1: 415-440.

Quan M and Liang J (2017). The influences of four types of soil on the growth, physiological and biochemical characteristics of *Lycoris aurea* (L'Her.) Herb. Scientific Reports, 7 (1): 43284. https://10.1038/srep43284

Rahbarl M, Omidi M and Shahram S (2013). Organic transplant production of pot marigold in vermicompost-amended medium. Journal of Applied Science and Agriculture, 8 (5): 548-555.

Ruzicka J and Hansen EH (1988). Flow Injection Analysis, 2nd ed., John Wiley & Sons, New York, p. 23.

Uddin A, Shammy FH, Das C, Habiba SU and Shimasaki K (2011). Regulation of growth and flowering of potted gerbera through foliar application of growth chemicals. International Journal of Sustainable Agricultural Technology, 7 (12): 1-6.

الملخص العربي

تأثير بيئات النمو المختلفة وبعض منظمات النمو علي القطيفة الفرنساوي
ب. الصفات الزهرية ونشاط مضادات الأكسدة

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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 الصفات الزهرية ونشاط مضادات الأكسدة لنبات القطيفة الفرنساوي.

عند مقارنتها بالتربة الطينية أو التربة الرملية خلال كلا الموسمين، فإن التربة الطينية/الرملية أنتجت المزيد من الأزهار من حيث الجودة والكمية (قُطر الزهرة، وطول عنق الزهرة، وعدد الزهور لكل نبات، والوزن الكلي الطازج والجاف للأزهار. كما زادت النسبة المئوية لنشاط مضادات الأكسدة في نفس التربة.

أدي الرش بجميع منظمات النمو المستخدمة (آلار بتركيز ١٥٠٠ و ٣٠٠٠ جزء في المليون – فلوروجلوسينول لا مائي و ٤ حمض الكلوروفينوكسي أسيتيك بتركيزي ١٥٠ و ٣٠٠ جزء في المليون لكلٍ منهما) إلي زيادة جميع الصفات المختبرة، باستثناء طول عنق الزهرة. كانت المعاملة بمنظم النمو فلوروجلوسينول لا مائي بتركيز ٣٠٠ جزء في المليون هو الأكثر فاعلية في هذا الشأن.

وكانت أفضل معاملة تداخل هي زراعة نباتات القطيفة *Tagetes patula* في تربة طينية/رملية ورشها بمنظم النمو فلوروجلوسينول لا مائي بتركيز ٣٠٠ جزء في المليون.

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