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Effect Of Spraying Some Nutrient Solutions On Vegetative And Flowering Growth And Pigments Of Calendula Officinalis L

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Abstract

This experiment was conducted in the lath house belonging to the College of Agriculture, the University of Basrah for the agricultural season 2020-2021. To study the effect of spraying with Kombe nutrient solution at concentrations of 0, 2, 4 g. L^{-1} and Crow more nutrient solution at concentrations of 0, 1.5, 3 g. L^{-1} and the interaction between them in the vegetative and flowering growth of Calendula officinalis L., the experiment was conducted in the Randomized Complete Block Design (RCBD) with three replication, The averages were compared according to the L.S.D test under the 0.05 probability level. The results showed that spraying with Kombe nutrient solution at a concentration of 4 g. L-1 or Crow more nutrient solution at a concentration of 3 g. L^{-1} had a significant effect on growth indicators, as the plant height reached 35.31 and 38.17 cm, the number of lateral branches reached 20.82 and 21.07 branch. Plant-1, the number of leaves was 54.44 and 58.30 leaves. plant-1, The percentage of dry matter of vegetative was 17.36 and 18.14%, the content of the leaves of total chlorophyll was 17.81 and 18.65 mg. 100 g^{-1} fresh weight, the number of flowers amounted to 19.07 and 21.44 flowers. $plant^{-1}$, flower diameter was 6.27 and 6.60 cm, flower stalk length was 12.72 and 13.48 cm,The number of days required for flowering was 121.89 and 118.47 days, the total carotene content of the flowers was 30.17 and 31.47 mg. 100 g^{-1} fresh weight, respectively, compared to control treatment that recorded the lowest values. The results of the bi-interaction between the two experiment factors showed that spraying the Kombe nutrient solution at a concentration of 4 or 2 g. L^{-1} with Crow more nutrient solution at a concentration of 3 g. L^{-1} had a significant effect on all indicators of vegetative and flowering growth compared to the rest of the treatments and the control treatment.

Keywords: Calendula officinalis, Kombe nutrient solution, Crow more. nutrient solution

Introduction

Calendula officinalis L. pot marigold is one of the plants of the Asteraceae family and it is one of the winter annual plants (Al-Shahat, 1996).The origin-country of the plant is the Mediterranean basin. It is cultivated in most parts of the Arab world, Spain, Holland, Germany, and the United States of America. It grows wild in southern and central Europe, North Africa, and Canada (Blumenth, 1998; Ahmed et al., 1993).The plant height reaches about 50 cm and does not branch much. Leaves are spatulate, elongated, 10-20 cm long and 3-5 cm wide, with fine and dense hairs scattered on their surfaces. Leaves are opposite to the position on the stem (Bhattachajee, 2003; Armush, 1999). The flowers are in main or important inflorescences, bearing two types of flowers, which are disc and radial flowers, their colors from yellow to reddish-orange.The radial flowers are

singularly in a pink circumference with one row around the disc flowers or more than two floral circumferences around the disc flowers. The marigold flowers are suitable for cutting(Al-Dajwi, 1996; Tawajen, 1987).Calendula officinalis flowers are used in the treatment of many diseases, including oral infections, complex wounds, intestinal ulcers, blood purification and urine, in addition to its use in the treatment of skin diseases such as wounds, psoriasis and eczema (Gad, 1992; Al-Zubaidi and others, 1996).The plant experiments in which nutrient solutions were used have achieved important results in the agricultural field. Knepper, 2003 (2003).The foliar nutrition method is highly efficient and effective compared to ground fertilization, as well as the speed of nutrients reaching the plant leaf tissues, taking into account the importance of nutrition through the soil by roots. The foliar nutrition reduces the phenomenon of antagonism that occurs between the elements and thus impedes their absorption by plants compared to their absorption through the soil, as well as it reduces costs and effort when mixed with pesticides (Haytova, 2013).Nutrients are characterized by containing macro and micronutrients that directly contribute to the growth and development of the plant through their entry into vital processes such as building proteins and various enzymes in the plant, stimulating the synthesis of chlorophyll and their entry into the transport of carbohydrates and regulating the osmotic effort of plant cells (Al-Sahhaf, 1989).Nitrogen is one of the macro elements that enter into the composition of many important compounds in plant growth, such as proteins and chlorophyll, and the phosphorous element is included in the composition of amino acids, proteins, nucleic acids, RNA, DNA and important energy compounds ATP and others that enter into vital processes ,Potassium is also a catalyst in the formation of carbohydrates and amino acids, as well as its importance in cell division.Nutrients also contain many microelements important for plant growth (Abu Dhahi and Al-Younes, 1989). Abbas et al. (2016) concluded that spraying Antirrhinum majus L with Kombe nutrient solution at a concentration of 4 g. L^{-1} caused a significant increase in plant height, number of leaves, dry weight of vegetative and leaf content of chlorophyll compared to the control plants that recorded the lowest values. Al-Khuzai (2014) found that spraying the Kombe nutrient solution with concentrations of 2 or 4 g. L^{-1} had a significant effect on the vegetative, root, and flower growth traits of Mathiola incana L.. compared to the control plants that recorded the lowest values.Abbas et al. (2012)showed spraying Dianthus caryophllus L. cloves with Foliartal nutrient solution at a concentration of 2 ml. L^{-1} led to a significant increase in both plant height,Number of leaves, dry weight of vegetative, chlorophyll content of leaves, number of flowers and flower diameter compared to the control plants that recorded the lowest values. Amin et al. (2009)showed when spraying Erysimum cheiri L. with different concentrations of copper and magnesium sulfate, the treatment with copper sulfate at a concentration of 0.5 or 1 gm. L^{-1} led to a significant increase in the number of branches, number of leaves and chlorophyll, The treatment of plants also performed at a concentration of 2 g.L^{-1} of magnesium resulted in a significant increase in plant height, number of leaves, root weight of the plant, number of inflorescences and flowering stem length compared to the control plants. Al-Jabri (2009) obtained in her study clove plant from spraying the neutral fertilizer NPK 20:20:20 at a concentration of 600 mg. L^{-1} led to a significant increase in the number of flowers, the length of the flower stalk, and the number of petals for flowers compared to a concentration of 300 mg. L^{-1} and comparison plants.This experiment aims to know the effect of spraying different concentrations of the nutrients Kombe and Crow mor and the interaction between them on the vegetative and flowering traits of Calendula officinalis L. pot marigold plants.

Materials and methods

The experiment was conducted in lathhuose belongs to the Department of Horticulture and Landscaping / College of Agriculture / University of Basrah for the agricultural season 2020-2021.The Calendula officinalis seeds of the local cultivar Calendula officinalis L. va. lemonouccn dated 10/1/2020 in perforated cork dishes with 200 holes filled with peat moss only Table (1) shows the chemical and physical traits of the used peat moss and when the seedlings reach an appropriate height and form 4-5 true leaves on them (45 days after sowing the seeds), They were transferred to plastic pots with a diameter of 20 cm and filled with the medium (loam soil + Peatmoss at a ratio of 1:3), previously sterilized with formalin at a concentration of 4% (Said and Badori, 1982), one plant per pot. Table (2) shows the chemical and physical traits of the soil medium used for cultivation. On 20/11/2020, the plants were sprayed with Kombe nutrient solution at concentrations of 0, 2, 4 g. L^{-1} and Crow more nutritious in concentrations 0, 1.5, 3 g. L^{-1}.After preparing the concentrations of the nutrient solutions, by taking the required weights separately and according to the concentrations of both nutrients, Kombe, Crow more, and complete the volume to a liter of distilled water. Table 3 and 4 show the chemical composition of the nutrient, Kombe and Crow more, respectively. The spraying process was conducted in the early morning until the leaves were completely wet using a 2-liter hand filter after adding 3 drops of Tween 20 diffuser. It was sprayed with 3 sprays during the growing season, between one spray and another 20 days, and the control treatment was sprayed with distilled water only.The experiment was conducted by following the randomized complete block design (R.B.C.D) with a factorial experiment (3 × 3) with three replications, each replicate included 9 factorial treatments, and each treatment included five seedlings, thus the number of seedlings was 135.The results were analyzed according to the analysis of variance and the averages were compared using the least significant difference (L.S.D.) at the probability level of 0.05 (Al-Rawi and Khalaf Allah, 2000).

Table (1): shows the physical and chemical characteristics of the used peat moss.

Values	Traits
6.5-5.5	pH
90	Organic matter
0.3	Electrical conductivity (EC) dS
14-16-18	N.P.K.
50	Moisture retention

Table (2): Some physical and chemical properties of the mixture used in the pot soil

Values	properties
7.35	pH
2.7	Electrical conductivity (EC) dS
0.24	% organic matter
0.52	Total nitrogen (g. kg-1)
0.58	Total phosphorous (g. kg-1)
0.60	Total potassium (g.l-1)
	Soil Separators

10.8	Clay percentage (%)
7.2	Silt (%) Silt
82	Sand (%)
Sandy loam	texture

Table (3) The percentage of elements included in the composition of the Kombe nutrition, according to what is installed on the fertilizer package by the producing company.

%	**elements**	%	**elements**
0.1	Mo	4.0	Fe
1.5	B	9.0	MgO
1.3	S	4.0	Mn
0.05	Co`	1.5	Zn
		1.5	Cu

Table (4) The percentage of the elements and compounds included in the composition of the nutrient fertilizer Crow more, according to what is installed on the fertilizer package by the producing company.

%	**elements**	%	**elements**
0.05	molybdate	3.9	Amonat
0.20	Sulfur	10.2	urea
0.05	copper	5.9	nitrate
0.02	Boron	20	phosphoric
0.10	iron	20	potassium oxide
0.05	manganese	0.05	Calcium
The company did not mention it	NAA	0.05	zinc
The company did not mention it	Vitamin B1	0.10	Magnesium

On 20/4/2021, the studied traits that were taken from three plants randomly from each experimental unit were calculated, including:

vegetative growth traits

1. Plant height (cm)

2. Number of lateral branches (Branch. plant^{-1})

3. Number of leaves (leaf. plant^{-1})

4. Percentage of dry matter in the vegetative%

5. Total chlorophyll content of leaves (mg. 100 g^{-1} fresh weight) was estimated according to the method described by Good win, 1976).

Traits of flowering growth

1. Number of flowers (flower. $plant^{-1}$): The total flowers formed on each plant were calculated and their average was recorded.

2. Flower diameter (cm)

3. Flower stalk length (cm)

4. The number of days needed for flowering since sowing the seeds

5. The content of the inflorescences of total carotene pigment is mg. 100 g^{-1} fresh weight was estimated according to the method described by (Abbas and Abbas, 1992).

Results and discussion

vegetative growth

The results in (Table 5) show that the Kombe nutrient solution was sprayed at a concentration of 4 g. L^{-1} led to a significant increase in the traits of vegetative growth, where the traits of plant height, number of lateral branches, number of leaves, percentage of dry matter of the vegetative total and leaf content of total chlorophyll increased, reaching 35.31 cm and 20.82 branches. plant-1 and 54.44 leaves. plant-1, 17.36% and 17.81 mg. $100g^{-1}$ fresh weight Compared to the control treatment that was sprayed with distilled water only, which gave the lowest average of 28.83 cm and 16.37 branches. $plant^{-1}$ and 42.85 leaves. $plant^{-1}$, 14.13%, and 15.28 mg. $100g^{-1}$ fresh weight.The reason for the increase may be due to the nutrient solution Kombe containing the micro nutrients (Table 3). Including the element boron, which encourages cell division and elongation, where it works to increase the concentration of nitrogen in the plant, and the latter is included in the construction of growth regulators such as auxins and gibberellins, which encourage cell division and cell elongation, as well as its entry into the construction of cytokinins that lead to an increase in the activity of the apical meristem and consequently cell division. , 1987). As well as the importance of boron in the formation of nucleic acids, as it plays an important role in consuming nitrogen and stimulating the vital processes of building DNA and RNA, as well as stimulating the formation of proteins (Minkel, 2000).The nitrogen element also enters into the construction of auxins and gibberellins that encourage and prolong cell division, as well as its entry into the construction of cytokinins that increase the activity of formal apical meristem cell division (Sharaki and Khader, 1985; Abdelkader et al., 1990; Al-Naimi, 1999). The results in Table (5) for the bi-interaction showed that spraying Calendula officinalis plants with Kombe nutrient solution at a concentration of 4 or 2 g. L^{-1} with Crow more nutrient solution at a concentration of 3 g. L^{-1} led to a significant increase in vegetative growth traits.The highest average of plant height, number of lateral branches, number of leaves, and percentage of dry matter in the vegetative total was recorded. The total chlorophyll content of the leaves was 41.75 and 38.92 cm, 22.56 and 21.44 branches. $plant^{-1}$, 60.44 and 63.33 leaves. $Plant^{-1}$, 19.12 and 18.91%, 18.89 and 19.75 mg. 100 g^{-1} fresh weight compared to the control plants, which gave the lowest average, which were 33.67 cm, 13.11 branches. $Plant^{-1}$, 33.67 leaves. $plant^{-1}$, 12.45% and 13.18 mg. 100 g^{-1} fresh weight on the handle.

flowering growth

Table 6 that spraying plants with Kombe nutrient solution at a concentration of 4 or 2 g. Liter-1 had a significant effect in increasing the number of flowers, flower diameter, flower stalk length, number of days needed for flowering, and the content of leaves of total carotene pigment compared to control plants sprayed with distilled water only. While the table did not show a significant difference between plants sprayed with Kombe nutrient solution at a concentration of 4 or 2 g. L^{-1} in all the studied flowering traits. The reason for the increase in flowering traits may be due to the Kombe nutrient solution containing the micro-nutrients important for plant growth and development, which led to the increase in the number of leaves and the content of leaves from chlorophyll (Table (5)), and this, in turn, is the reason for improving the efficiency of the process Photosynthesis and the accumulation of its products in the leaves and the increase of secondary metabolism products and their transfer to the flowers.Which reflected positively in improving the flowering growth traits. The reason may be due to the presence of iron in the composition of the nutrient solution Kombe, which has positive roles in increasing chlorophyll, auxin and gibberellin, which leads to inducing flowering (Pashed and Ahmed, 1997), and this is consistent with what Al-Asadi found (2014).) on Calendula officinalis .The same table indicates that spraying with Crow more nutrient solution at a concentration of 3 g. L^{-1} led to a significant increase in the traits of the number of flowers, flower diameter, flower stalk length, number of days required for flowering, and the content of total carotene pigment in leaves, which amounted to 21.44 flowers. $plant^{-1}$, 6.60 cm, 13.48 cm, 118.74 days, 31.47 mg. 100 g^{-1} fresh weight compared to the control plants sprayed with distilled water only, where the lowest rates were 12.85 flowers. $plant^{-1}$, 4.42 cm, 8.94 cm, 128.37 days, 26.66 mg. $100g^{-1}$ fresh weight respectively,Whereas, the plants sprayed with a concentration of 3 g. L^{-1} were significantly excelled on plants sprayed at a concentration of 1.5 g. L^{-1} in the traits of the number of flowers, the number of days required for flowering, and the content of the flowers from carotene pigment only.The reason may be due to the presence of macro and micro nutrients in the nutrient solution Crow more, which led to an increase in the number of leaves and the content of leaves from chlorophyll (Table 5) and thus increasing the efficiency of the photosynthesis process and the production of carbohydrates and their transfer to the storage parts (flowers) during the stages of growth and development or the reason may be due to the role of nitrogen, one of the components of the nutrient Crow more, which is included in the composition of amino acids, including the amino acid Tryptophan, which is the main source in the manufacture of auxin, which increases the activity of the process of cell division and elongation, as well as the role of nitrogen, which works to find a balance between manufactured carbohydrates and the absorbed nitrogen that works to encourage the emergence and development of flower buds and thus increase the number of flowers (Abdu-El-wahed et al., 2004)).Also, the presence of phosphorous in the nutrient solution Crow more, which is included in th composition of a number of energy-rich compounds from CTP, GTP, ATP, as well as its entry into the construction of nucleic acids, DNA, RNA and the formation of proteins (Minkel, 2000). These important roles of phosphorus caused an increase in the efficiency of the building process. Photosynthesis and the accumulation of its products and their transmission from leaves to flowers and thus helped to improve the flowering traits of the plant. The presence of potassium in the nutrient solution may be a reason for the increases in the flowering growth traits through the important roles of potassium that encourage cell division and the growth of meristem tissues (Mohammed and Al Rayes, 1982; Ahmed and Al Mukhtar, 1987) as well as the role of potassium in transporting carbohydrates manufactured from areas Production (leaves) and its accumulation in the flowers (Awad, 1990) or through its role in regulating the

osmotic effort of cells by regulating the opening and closing of stomata, which allows an increase in the diameter of the flowers (Al-Sahhaf, 1989). The presence of micro-elements in the compound Crow more is of importance in the construction of the various compounds and the conduct of vital processes in the plant, which as a result led to increases in the characteristics of vegetative growth, table (5), which was positively reflected on the flowering growth of the plant. From table (6), it is clear that there is a significant increase in the interaction between spraying with Kombe nutrient solution at a concentration of 4 or 2 g. L^{-1} with spraying with Crow more nutrient solution at a concentration of 3 g. l^{-1} in flowering growth indicators,The highest values were recorded for the number of flowers, the diameter of the flower, the length of the flower stalk, the number of days required for flowering, and the content of carotene pigment in leaves, which reached 23.33 and 21.78 flowers. $Plant^{-1}$, 6.94 and 7.59 cm, 14.33 and 14.58 cm, 116.45 and 118.44 days, 32.18 and 33.34 mg. 100 gm^{-1} fresh weight, respectively, compared to the other treatments and the control treatment, which recorded the lowest values, as it reached 13.11 flowers. $plant^{-1}$, 4.65 cm, 9.25 cm, 128.78 days, 26.23 mg. 100 gm^{-1} lean weight, respectively.

Table (5): Effect of spraying with the nutrients Kombe and Crow more and their interactions on some vegetative growth traits of Calendula officinalis L.

Leaf content of total chlorophyll (mg. 100gm-1 fresh weight)	Percentage of dry matter in vegetative %	The number of leaves (leaf. Plant-1)	The number of lateral branches (branch. plant-1)	plant height (cm)	Studies factors	
15.28	14.13	42.85	16.37	28.83	0	Concentration of the nutrient solution Kombe $g.L^{-1}$
17.16	16.43	49.96	18.92	32.56	2	
17.81	17.36	54.44	20.82	35.31	4	
1.145	1.346	3.530	1.747	2.070	L.S.D. Kombe	
14.66	13.96	39.41	15.11	26.72	0	Concentration of the nutrient solution Crow more $g.L^{-1}$
16.95	15.82	49.55	19.59	31.81	1.5	
18.65	18.14	58.30	21.07	38.17	3	
1.145	1.346	3.530	1.747	2.070	L.S.D. Crow more	
13.18	12.45	33.67	13.11	23.67	0	0
15.35	13.56	43.78	16.78	29.00	1.5	
17.30	16.38	51.11	19.22	33.83	3	
14.61	14.23	39.56	15.00	26.33	0	2
17.12	16.15	47.00	20.33	32.42	1.5	
19.75	18.91	63.33	21.44	38.92	3	
16.19	15.20	45.00	18.22	30.17	0	4
18.36	17.74	57.89	21.67	34.00	1.5	
18.89	19.12	60.44	22.56	41.75	3	

Interaction of Kombe Nutrient Solution and the nutrient solution Crow more

1.984	2.331	6.114	3.026	3.585	Interaction L.S.D.

Table (6): Effect of spraying with the nutrients Kombe and Crow more and their interactions on some traits of flowering growth of Calendula officinalis L.

The total carotene content of the flowers mg. $100g^{-1}$) (fresh weight	The number of days required for flowering(day)	flower stalk length(cm)	flower diameter(cm)	Number of flowers (flower .$plant^{-1}$)	Studies factors	
27.32	126.00	9.43	4.29	14.11	0	Concentration of the nutrient solution Kombe $g.L^{-1}$
29.81	123.15	12.25	6.17	17.19	2	
30.17	121.89	12.72	6.27	19.07	4	
1.009	2.485	1.838	1.227	2.165	L.S.D. Kombe	
26.66	128.37	8.94	4.42	12.85	0	Concentration of the nutrient solution Crow more $g.L^{-1}$
29.18	123.93	11.98	5.71	16.07	1.5	
31.47	118.74	13.48	6.60	21.44	3	
1.009	2.485	1.838	1.227	2.165	L.S.D. Crow more	
25.47	130.67	7.50	3.46	10.44	0	0
27.62	126.00	9.28	4.13	12.67	1.5	
28.88	121.33	11.53	5.26	19.22	3	
26.23	128.78	9.25	4.65	13.11	0	2
29.86	122.22	12.92	6.27	16.67	1.5	
33.34	118.44	14.58	7.59	21.78	3	
28.27	125.67	10.08	5.14	15.00	0	4
30.05	123.56	13.75	6.72	18.89	1.5	
32.18	116.45	14.33	6.94	23.33	3	
1.747	4.305	3.183	2.125	3.750	.Interaction L.S.D	

Interaction of Kombe Nutrient Solution and the nutrient solution Crow more

Conclusions

1. It can be concluded from the research that fertilizing with Kombe nutrient solution at a concentration of 4 or 2 g. L^{-1} with fertilizing with Crow more nutrient solution at a concentration of 3 g. L^{-1} improved the vegetative and flowering growth traits Calendula officinalis

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