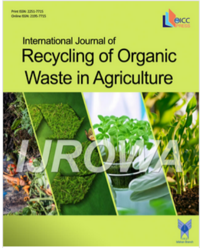

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Effects of recycled organic waste in soilless growing medium on the growth and flowering of Gerbera (*Gerbera jamesonii* Bol.) in pot culture

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Original Research

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Abstract:

Purpose: Cocopeat resources in Iran are limited and unsuitable, and they must be imported from abroad at a high cost. It is therefore essential to evaluate suitable growth media to replace cocopeat.
Method: During this experiment, we conducted a completely randomized experimental design with seven types of growing media in a greenhouse with two layers of hexane coating, at the flower and ornamental plant research station in Lahijan city. Seven growth substrate treatments were investigated, including: (100% perlite), (75% cocopeat +25% perlite), (50% tea waste +25% peanut shells compost +25% perlite), (50% tea waste +25% Azolla +25% Perlite), (50% peanut shells compost +25% azolla +25% perlite), (50% peanut shells compost + +25% tea waste +25% azolla) and (25% peanut shells compost +25% tea Waste +25% azolla +25% perlite).
Results: According to the results, growth media containing peanut shells, Azolla composts, and tea waste are effective and recommended, which can significantly reduce the use of cocopeat. A substrate containing compost had a better effect on the morphological and physiological characteristics of Gerber.
Conclusion: The yield of Gerbera varied greatly among growth substrates, and flower performance was better in some substrates than in cocopeat. The favorable effect of composted substrates on Gerbera yield allows the selection of the growth substrate.

Keywords: Azolla compost; Chlorophyll; Cocopeat; Peanut shells; Tea waste

1. Introduction

Since the late 1970s, greenhouse cultivation has enjoyed increasing popularity in Iran's flower and plant industry, especially due to the possibility of monitoring environmental parameters, higher productivity, a low exchange rate, and the possibility of off-season production. This has created jobs and earned currency. Gerbera, also known as *Gerbera jamesoni* Bolus ex Hooker f., is one of the most famous cut flowers that is grown commercially all over the world today. The plant is distinguished by its attractive appearance, attractive and bright colors, and long vase life. There are many local and international requests to buy it. It is among the top 10 cut flowers. An important part of the florigrowth industry is the production of plants in planting containers. Proper management of potted plants can produce high-quality plants. A suitable growth medium should have a low transportation cost, stability, and light-weight to ensure economic viability (Khomami et al., 2019). The growth and production of plants can be affected by both direct and indirect effects of the growing medium. Plants require adequate amounts of water and nutrients to achieve good growth and performance. The ratio of air to water is approximately equal in a suitable growth medium. The capacity of a growing medium to retain water or air depends on micro-disruption between its components. It is important to provide the oxygen needs of growing plants in hydroponic systems (Marschner, 2011).
The purpose of the planting bed is to maintain plants, water,

and nutrients, as well as to provide air to roots. A suitable growing medium should provide the physical, chemical, and biological needs of the plant, and should be available and easy to work with (Verhagen, 2009). Cocopeat is one of the most popular natural materials used for the cultivation of flowers, especially Gerbera, in greenhouses in Iran. It has several advantages such as good moisture retention, faster plant growth, medium-quality water tolerance, and good drainage, while its disadvantages are the production of more and larger leaves. This leads to a decrease in the number of flowers. Beside these, the rapid heating of this substate in hot weather can lead to the production of weak plants. According to the investigation of Swarupa et al. (2019), the interaction effect of different combinations of growth media and biofertilizers under protected conditions also has a significant impact on the growth and root parameters of Gerbera cv. Natasha. Labeke and Dambre (1998) conducted an experiment to examine the effects of rockwool and cocopeat growth media on the flower production and quality of the Gerbera flower in two open and closed nutrient solution recirculation systems. The results demonstrated that composition of the growth substrate has a significant impact on flower quality.

The flowering stems of plants grown in cocopeat were shorter than those grown in rockwool, whereas the weight of flowering stems in cocopeat was higher than that of rockwool. Research has shown that the growth medium containing coir pith and vermicompost can be a superior growth medium which increases the growth and flowering of Gerbera (Arunesh et al., 2020). Maloupa et al. (1996) conducted an experiment with four cultivars of Gerbera, including Fame, Regina, Party, and Ximena, and five types of planting medium, including Attaullite, rock wool, perlite, zeolite, and sand to determine the appropriate growing medium and its effect on yield and quality. The results of this experiment showed that the performance of plants on the rockwool substrate was lower than that of the other studied substrates.

The highest performance was observed in the Party cultivar, and the lowest was observed in the Ximena cultivar. The highest yield was achieved in the sand bed followed by zeolite and perlite, which were significantly different from rock wool. In a growth medium containing perlite, the longest stem was observed. Lalmuanpuii et al. (2021) compared the effects of growth media containing different combinations of soil, cocopeat, and vermicompost and observed that cocopeat had the highest effect on the growth factors of Gerbera (*Gerbera jamesonii*). Fakhri et al. (1995) compared the yield and flower quality of Gerbera cv. Fam Rosabella and Sunspot in soilless cultivation systems with perlite beds and a mixture of peat and perlite in a ratio of 1 : 1 and pumice, respectively. The results indicated that the yield and quality of the mixture of peat and perlite were equal to or higher than the soil.

The yields and quality of plants grown on pumice substrates were lower than those grown on other growth substrates. The addition of peat to the substrate has improved the conditions for root growth, which in turn increased the quantitative and qualitative characteristics of the flower. In different regions of the world, a variety of raw materials are used to provide a growing medium for agricultural and ornamental plants, particularly Gerbera flowers. These substrates are used either alone or in combination to provide suitable physical and chemical environments for the plants (Maloupa et al., 1996; Labeke and Dambre, 1998). According to Maloupa et al. (1996), three types of growing media had different effects on the growth and yield of Gerbera flowers. The mixed growth media of peat and perlite produced the highest number of flowers, while the pumice growth media alone produced the lowest number of flowers. Furthermore, the combination of perlite and pumice produced the longest flowering stem. The optimal combination of physical and chemical characteristics of the growing medium would enhance the absorption of nutrients to improve the quantity and quality of flower production (Maloupa et al., 1996).

Owing to the fibrous structure, peanut shells have been used in the past to enhance the porosity of potted growth medium for some flowering plants by mixing them with mineral soil. The fibrous structure of peanut shells has a relatively short life span in potting mix and rapidly decomposes in the presence of fertilizer and water. However, they can be suitable for a growth period of 6 to 12 weeks (Dennis et al., 2003). Azolla is an aquatic fern that lives symbiotically with the blue-green algae *Anabaena azolla*, which floats in water. This plant is capable of absorbing atmospheric nitrogen and stabilizing it, and it can replace most chemical fertilizers. Azolla contains different nutrients, and on average, it contains 3.5% nitrogen, 3.8% potassium, and 0.9% magnesium. Azolla is free of lead, mercury, and arsenic (Lumpkin, 1987).

Tea waste increases the growth of roots and vegetative growth, which in turn increases yield and production (Haggag and Sáber, 2007). Tea waste is a good source of potassium and provides essential nutrients for plant growth (Ryan et al., 2005). Khomami et al. (2019) reported that the most important thing being done in the potted flower industry is to find a mixture of locally available organic matter to reduce the use of peat without reducing plant quality. The limited availability of cocopeat in Iran and the prohibitive price of importing it from abroad necessitated this investigation, which sought to examine the possibility of using an alternate growing medium containing composted organic materials of local origin in place of cocopeat.

2. Materials and methods

This experiment was conducted from October 2018 to August 2019 (11 months), in the greenhouse of the Ornamental Plants and Flower Research Station (37°11′44″ N and 50°01′03″ E), Lahijan, Iran. In the greenhouses, there was a double layer of polycarbonate. The tissue cultured seedlings of Gerbera cv. Stanza was obtained from the National Flower and Ornamental Plant Research Center of Mahalat and kept for one week in the waiting greenhouse of the Flower and Ornamental Plant Research Station in Lahijan city. Perlite used in gardening is usually 1.5 to 3 mm. Cocopeat was purchased in the form of block packages from Tonkabon city. The peanut shells were obtained from the shelling factory located in Astana Ashrafieh city. For four months, peanut shells were composted in wooden boxes with dimensions of $1 \times 1 \times 1$ cubic meter, which had pores to provide aerobic conditions and microorganism activity. Azolla was collected from the surface of paddy fields and then composted. Tea waste was collected from tea factories and then composted. After preparing the compost, each Gerbera plant was placed in a 10-cm-diameter plastic pot containing a growth medium (Table 1). According to the growing medium, the plants were grown in a completely randomized design with twelve replicates during the experiment.

During the growing period, the pots were irrigated with distilled water to prevent drainage from the pot. For all pots, 200 cubic cm of OMEX 20-20-20 (N-P-K) solutions were used each week. In order to provide sufficient daylight for Gerbera (Fig. 1), natural sunlight and supplemental light from sodium vapor lamps and LED lamps were utilized in the green-house. The amount of light in the greenhouse was measured using a testo 545 lux meter. The average night and day temperatures during plant growth were 8 ± 2 and 27 ± 2°C, respectively. It was found that the relative humidity was between $65 - 75\%$ (Simon et al., 1976). The average light intensity at the beginning of vegetative growth was between 3000 and 5000 lux, and at the end of vegetative growth and beginning of reproductive growth, it was between 9000 and 14000 lux.

Growth attributes

The effects of treatments on the growth of Gerbera were evaluated using growth factors such as dry weight of flower branch, fresh weight of flower branch, weight of flowering stem, leaf length, length of flowering stem, flower diameter, flower stem diameter, leaf area, number of leaves, number of flower stems, and chlorophyll index. The plants' dry weight was measured after drying them for 48 hours in an oven at a temperature of 75 degrees Celsius. The leaf area was measured using a MK2 video surface meter, made in England. The chlorophyll index was determined using a SPAD 502 PLUS chlorophyll meter from KONICA MINOLTA, Japan.

Physical analyses

The Fonteno (1996) method was employed to determine physical properties such as total porosity, bulk density, air-filled porosity, and container capacity. The physical properties were determined using the following equations (Table 2).

Chemical characteristics

Total nitrogen content was determined using the procedure proposed by Bremner and Mulvaney (1982) following digestion of the samples with concentrated H_2SO_4 and $HClO_4$ (9:1v/v). Total P was analyzed using a spectrophotometer (CECIL2041) following the procedure of Murphy and Riley (1962). Total potassium was analyzed by a flame photometer JENWAYPFP7 as per the procedure outlined by Houba et al. (1989). Munter and Grande (1981) determined the concentrations of Ca, Mg, Fe, Cu, and Zn in the plant and substrate samples by inductively coupled plasma atomic emission spectroscopy. Total organic carbon was determined by using the procedure outlined by Nelson and Sommers (1983). The pH and EC of the substrate were measured by using Metrohm 691 and Metrohm 644, respectively (Verdonck and Gabriels, 1992).

Statistics

The data normality test and data analysis were done by SAS software (SAS Institute Inc 2001), and the means were statistically compared using Tukey's multi-range tests ($p = 0.05$) (Bland and Altman, 1995). The graphs were created using Excel software.

3. Results and discussion

Chemical properties of growth media

As shown in Table 3, the highest pH value (7.0) was recorded in the T1 treatment. Furthermore, the lowest pH value (5.4) was related to the T6 treatment. The pH range suggested by Schaetzl and Thompson (2015) appears to be adequate for Gerbera. We observed the highest EC of 3.84 dS/m in the $T6$ treatment, while the lowest EC (0 dS/m) was observed in the T1 treatment. The observed range of EC is significantly greater than the recommended range suggested by Cavins et al. (2000). It is, therefore, prudent to exercise caution when using nutrient solutions in composted media to ensure that the increase in EC does not adversely affect the plant. Some results have shown that the addition of 25-100% green waste compost instead of peat to the growing media increased the pH and EC of substrates (Grigatti et al., 2007). The highest nitrogen concentration (0.93%) was observed in the T6 treatment, while the lowest was recorded in the T1 treatment. The amount of nitrogen increased when compost was added to the substrate composition. The highest amount of phosphorus (0.194%) was in the T6 treatment and the lowest (0.0%) was noted in the T1 substrate. The highest concentration of potassium (0.67%) corresponded

Table 1. The combination of growing medium.

Combination	Treatment
T1	100% Perlite
T2	75% Cocopeat + 25% Perlite
T3	50% Tea waste + 25% Peanut shells compost + 25% Perlite
T4	50% Tea waste + 25% Azolla compost + 25% perlite
T5	50% Peanut shells compost + 25% Azolla compost + 25% Perlite
T6	50% Peanut shells compost + 25% Tea waste + 25% Azolla compost
T7	25% Peanut shells compost + 25% Tea waste + 25% Azolla compost + 25% Perlite

Figure 1. Gerbera cv. Stanza used in the experiment.

to the growth medium T3 treatment, and the lowest concentration (0%) was in the growth medium T1. The highest amount of calcium (0.22%) was recorded in the T6 treatment, and the lowest amount (0.0%) corresponded to the T1 treatment. The highest amount of iron (3062 mg/kg) was in the T5 treatment, and the lowest amount (0.0%) corresponded to the T1. The highest amount of manganese (1512 mg/kg) corresponds to the growth medium in the T6 treatment, and the lowest amount of manganese (0%) corresponds to the growth medium in T1. The highest amount of zinc (51.8 mg/kg) was recorded in the T6 treatment, and the lowest amount of zinc (0%) corresponded to the T1. The growth media composition of Azolla compost, tea waste, and peanut shell compost available in the region showed the highest levels of nutrients. The nutritional characteristics and humic acid compounds of the substrates containing peanut shells compost, tea waste, and azolla were found to enhance the absorption of nutrients compared to the substrates containing cocopeat and perlite.

The results indicated that increasing the amount of compost in the growing medium increased the concentration of nutrients in the growing medium. Grigatti et al. (2007) reported that by adding compost to the soil in potted growing mediums, the nitrogen and potassium of the growing medium increased compared to the control.

Physical characteristics of growth media

The physical characteristics of the growth media shown in Table 4 indicated that the highest bulk density (0.37 g/cm^3) was in the T4 treatment and the lowest value (0.12 g/cm^3) corresponded to the T1 treatment. The ideal bulk density of growth media is estimated to be between 0.19 and 0.70 g/cm^3, according to Yeager et al. (2007). From this point of view, the treatments of this research had bulk density values within an ideal range. As composts replaced cocopeat, the porosity of the substrates increased. The highest value of container capacity (64.87%) was noted in the T5 treatment while the lowest value (42.34%) was in the T1. Yeager et al. (2007) suggested that the physical characteristics of all substrates, such as container capacity between 45% and 65% are ideal for plant growth. In growing media, the air and water content are the crucial physical parameters (Marfa et al., 1998). Water should be available at a minimum energy level in the substrate besides the air in the root zone (Inbar et al., 1993; Boodt et al., 1974). The ideal container capacity for growing media is estimated to be between 45% and 65%. Therefore, it appears that the container capacity is optimal for growing media containing compost. The highest amount of air-fill porosity (48.29%) was found in the growth medium T1 and the lowest (12.72%) was found in the growth medium T3. The highest amount of total porosity (91.68%) was noted in the T1 treatment, while the lowest amount of total porosity (62.67%) was in the T3 treatment. The air porosity required for adequate gas exchange should be at least 15%, but ideally, it should be between 20 and 35% of the average volume depending on the plant (Jaenicke, 1999). In this experiment, all treatments containing compost were within the ideal range for air porosity, container capacity, and total porosity.

Growth factors

Number of Leaves

The mean comparison (Table 5) revealed that the highest number of leaves (23.25) corresponded to treatment T7, and the lowest number (16.25) corresponded to treatment T2. The greater number of leaves made the plant denser, and in turn, increased the beauty and marketability of the Gerbera potted flower.

Leaf area

The mean comparison (Fig. 2a) revealed that the highest leaf area (357.27 cm^2) was associated with the treatment of T3, whereas the lowest leaf area (299.05 cm^2) was associated with the treatment of T1. It has been shown that leaves are the interface between plants and the atmosphere and that their development is affected by the production of

Table 2. The equation used to determine the physical properties of growth media.

Equation	Components of Equation
Bulk density=(W_{dsp}-W_p/V_p)	W_{dsp}=dry weight of substrates and the container (g).
Air-filled porosity= ($V_{wd}\times100/V_P$)	V_p=Volume of container (cm^3)
Container capacity=((W_{wsp}-W_p)$\times$100/V_P)	V_{wd}=Volume of water drained (cm^3)
Total porosity=air-filled porosity+container capacity	W_{wsp}=substrates and container fresh weight (g).

Table 3. Chemical properties of Gerbera growth media.

Treatment	(%) Total Nitrogen	(%) Total Phosphorus	(%) Total Potassium	Calcium (%)	Mn (mg/kg)	Fe (mg/kg)	Zn (mg/kg)	pH (1:5)	EC (dS/m)
T1	0.00f	0.00d	0.00e	0.00c	0.00f	0.0g	0.0g	7.00a	0.00f
T2	0.21e	0.01d	0.54bc	0.11b	20.5f	38.0f	11.2f	5.86a	1.14e
T3	0.83b	0.12	0.67a	0.14ab	365e	520e	23.0d	5.64a	3.62b
T4	0.58d	0.07c	0.60ab	0.18a	837d	1020.0d	15.6e	6.45a	3.38c
T5	0.74c	0.13b	0.43d	0.18a	1180a	3062.0a	36.2b	6.15a	4.74a
T6	0.93a	0.19a	0.55b	0.19a	1512b	2612.0b	51.8a	5.40a	4.82a
T7	0.86ab	0.12b	0.46dc	0.12b	892c	1253.0c	30.6c	5.53a	3.20d

Table 4. Physical characteristics of Gerbera growth media.

Treatment	Bulk density (g/cm^3)	Container capacity (%)	Air-fill porosity (%)	Total porosity (%)
ET1	0.12	42.34	48.29	91.68
T2	0.15	60.34	24.87	80.36
T3	0.25	49.86	12.72	62.67
T4	0.37	61.69	26.30	87.99
T5	0.34	64.87	23.44	87.32
T6	0.29	56.82	18.66	74.47
T7	0.35	59.58	28.7	86.28
	0.19-0.70*	45-65*	10-30*	50-85*

*Range values are recommended physical characteristics (Yeager et al., 2007).

Table 5. The mean comparison of Gerbera leaves*.

Treatment	Number of leaves	Fresh weight of flower shoots (g)	Dry weight of flower shoots (g)	Flowering stem length (cm)	Number of flower stems
T1	16.41e	170.00a	29.92a	43.50c	4.25d
T2	16.25e	163.24b	28.32ab	51.95a	4.75c
T3	17.75d	156.00d	21.26e	46.54b	4.58cd
T4	19.33c	160.3bc	24.8cd	45.50bc	5.50b
T5	19.21c	158.56cd	22.21e	50.54a	5.58b
T6	21.00b	156.66cd	24.58d	50.16a	5.75b
T7	23.25a	168.00a	26.96cb	49.95a	6.75a

*The means of each column with a common letter according to Tukey are not significant at the 5% probability level.

new leaves with better growth, the increase in size of existing leaves, and the aging of old leaves and their removal (Ranganathan et al., 2001).

Fresh weight of flower shoots

The mean comparison of shoot fresh weight data (Table 5) showed that the highest shoot fresh weight (170 g) was in the T1 treatment and the lowest shoot fresh weight (156 g) was recorded in the T3 treatment.

Dry weight of flower shoots

The mean comparison of Table 5 revealed that the maximum shoot dry weight related to T1 treatment was 29.92 g, and the lowest shoot dry weight (21.26 g) was in T3 treatment. Since it is important to consider the dry weight of the aerial part of the plant when investigating and evaluating the substrates, the increase in the dry weight in the T2 treatment indicated that growth conditions were suitable. Khozuei et al. (2022) observed a significant increase in plant yield and dry weight in growth media containing perlite. However, Ramezanzadeh et al. (2014) observed an increase in the dry weight of English daisy shoots with the application of compost in the growth medium.

Leaf length

The mean comparison showed that the longest leaf length (40.6 cm) corresponded to the T7 treatment which was at par with the values in the T4 and T6 treatments (Fig. 2b). Furthermore, the lowest leaf length (33.58 cm) was related to the T1 treatment. According to current research, the maximum length of plant leaves was obtained in the treatment receiving tea waste, azolla compost, and peanut shell compost, which offer more suitable conditions than cocopeat and perlite in terms of nutrients and nitrogen. The length of plant leaves can be affected by several factors, including nutritional characteristics. The increase in plant height could be caused by changes in cation exchange capacity, pH, or other physical and chemical properties (Lee et al., 2004). Katsoulas et al. (2006) stated that the response range of the plant for growth depends on various factors, such as the properties of the substrate and the humidity required during the growing season. According to Gul et al. (2007), stem

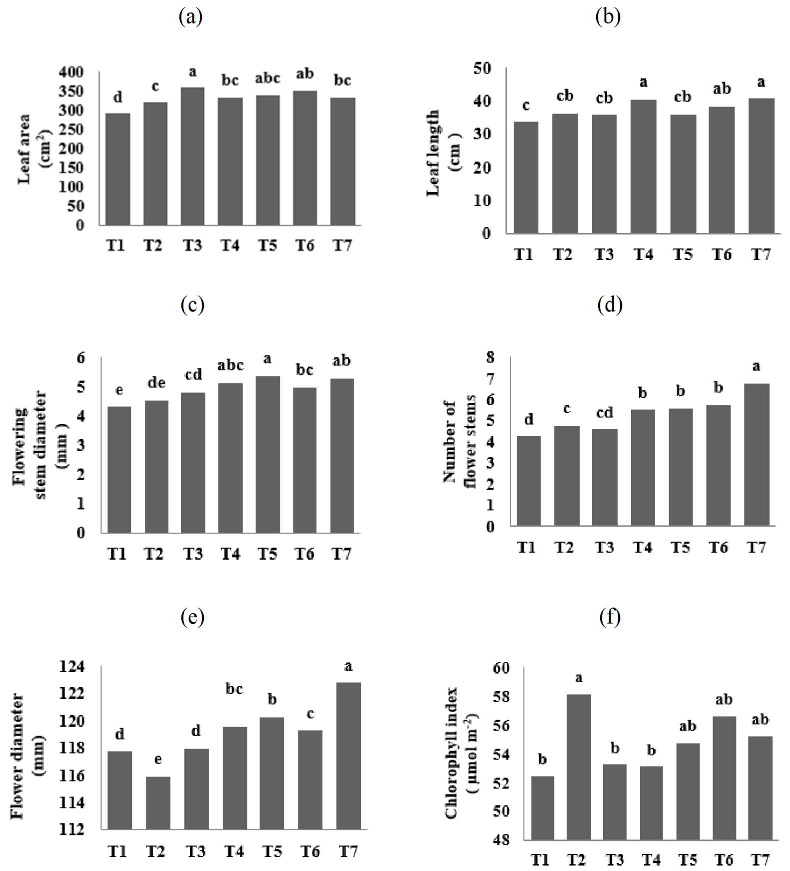

Figure 2. Effect of different treatments on some plant growth attributes and factors.
The histograms having a common letter are statistically not significant at the 5% probability level as per Tukey's test.

length and internodal number were significantly affected by the substrate type.

Flowering stem diameter

The mean comparison showed that the largest diameter (5.36 mm) of the flowering stem corresponded to T5 treatments (Fig. 2c). The T1 treatment had the lowest diameter of the flowering stem (4.31 mm). Khalaj et al. (2011) reported the largest stem diameter of Gerbera in soilless cultivation using a substrate consisting of 25% perlite, 70% peat, and 5% mineral pumice.

Number of flower stems

Table 5 showed that the highest number of flowering stems was related to the T7 treatment (6.75) and the lowest number was related to the T1 treatment (4.25).

Flower diameter

A mean comparison showed that the largest flower diameter (122.75 mm) was related to the T7 treatment (Fig. 2e). It was found that the lowest flower diameter (115.91 mm) was noted in the T2 treatment. The positive effect of compost compared to cocopeat and perlite could be attributed to the presence of humic substances having a growth regulatory effect. Chen et al. (1989) also suggested a similar effect of compost on the growth of Ficus benjamini. The largest flower diameter was observed in the mixture of perlite and peat, and Fakhri et al. (1995) attributed this difference to the presence of organic matter and improved physical and chemical properties of the mixture. It appeared that the

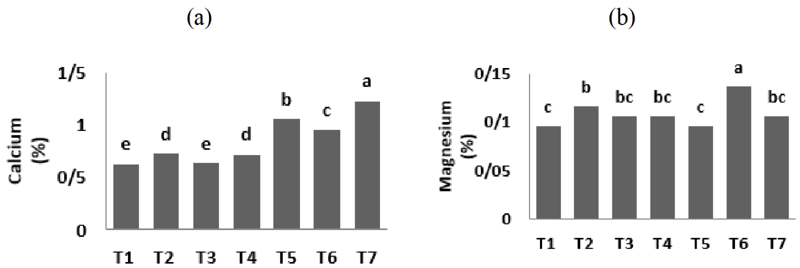

Figure 3. Effect of different treatments on the concentration of nutrients in leaves.
The histograms having a common letter are statistically not significant at the 5% probability level as per Tukey's test.

Table 6. The mean comparison of nutrient elements in Gerbera leaves*.

Treatment	Total Nitrogen (%)	Total Phosphorus (%)	Total Potassium (%)	Iron (mg/kg)
T1	2.18b	0.70a	1.13d	289.33e
T2	1.51d	0.32d	1.19cd	280.00f
T3	1.66c	0.41b	1.14d	405.33a
T4	2.52a	0.40bc	1.05e	361.00b
T5	1.57cd	0.37c	1.45a	321.00c
T6	2.51a	0.37c	1.34b	315.00d
T7	1.65c	0.42b	1.25c	178.00g

*The means of each column with a common letter according to Tukey's test are not significant at the 5% probability level.

effect of compost on growth media was due to the presence of humic substances, compared to cocopeat and perlite.

Chlorophyll Index

The mean comparison (Fig. 2f) revealed that the highest chlorophyll concentration (58.16 μmol/m^2) was in T2 treatments, while the lowest concentration (252.44 μmol/m^2) was recorded in the T1. The amount of chlorophyll is regarded as a useful criterion for assessing the physiological condition of a plant and is an important factor in determining its photosynthetic capacity (Jiang and Huang, 2001). The degree of leaf greenness is primarily used to assess nitrogen nutritional status in high-tech agriculture, which is correlated with chlorophyll content (Kläring and Zude, 2009).

Leaves nutrient elements

The results indicated that the highest leaf nitrogen content was observed in the T4 (2.52%) and T6 (2.51%) treatments. Leaf nitrogen was the lowest (1.5%) in the T2 treatment (Table 6). For leaf phosphorus, the highest amount (0.702%) was in the T1 treatment, and the lowest (0.32%) in the T2 (Table 6). The observed reduction in phosphorus concentration in plant leaves in the growing medium containing compost and organic matter compared to perlite may be due to the conversion of inorganic phosphorus into organic phosphorus during the mineralization of organic matter by microorganisms. Other researchers also stated that the high concentration of nitrogen leads to an increase in the absorption of phosphorus and potassium by soil microorganisms (Gu et al., 2021; Guo et al., 2022). This result matched the results of Tarkashvand et al. (2005). The highest level of leaf potassium was recorded in the T5 (1.45%) treatment, while the lowest content (1.05%) was in the T4 treatment (Table 6). Ramezanzadeh et al. (2014) also observed that with the application of compost in the plant growth medium, the concentration of potassium in English daisy leaves increased compared to the control plant. The mean comparison (Fig. 3a) showed that the highest amount of leaf calcium was in the T7 and the lowest leaf calcium (0.62%) was in the T1 (0.62%) treatment.
The highest concentration of leaf magnesium (0.136%) was associated with T6 and the lowest concentration (0.096%) was associated with T1 and T5 (Fig. 3b).
The highest leaf iron level (405.33 mg/kg) was recorded in the T3 treatment while the lowest levels (178 mg/kg) were in the T7 treatments (Table 6).

4. Conclusion

The performance of Gerbera varied in different growth media, and the flower performance was better in some media than in growth media containing cocopeat. This issue could be related to the differences in the physical and chemical properties of the growth media. The results indicated the favorable effects of compost application on Gerbera yield, allowing the selection of a growth medium based on Gerbera flower quality that increases the desirability of the plant for the market. For the production of Gerbera as cut flowers or potted plants, treatments containing compost can be recommended as an alternative to imported cocopeat.

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Author contribution
All the authors have participated sufficiently in the intellectual content, conception and design of this work or the analysis and interpretation of the data (when applicable), as well as the writing of the manuscript.

Conflict of interest statement
The authors declare that they are no conflict of interest associated with this study.

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