e-ISSN : 2581-6063 (Online)

ISSN : 0972-5210

Plant Archives

An International Journal of Plant Research

An UGC approved Journal (No. : 30969)

This Journal is devoted to the advancement o f basic and applied research in all disciplines of Plant Sciences, Agricultural Sciences, Biotechnology, Microbiology, Phytochemistry, Pharmacology, Ethnobotany & Environmental Sciences

Website :www. plantarchives.org

NAAS Rating : 4.41

Plant Archives

Plant Archives Vol. 19, Supplement 2, 2019 pp. 1247-1258 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

EFFECT OF SPRAYING WITH MORINGA LEAVES EXTRACT AND THE SOAKING SOLUTION OF FENUGREEK SEEDS AND ZINC IN THE TRAITS OF ROOT GROWTH AND CHEMICAL TRAITS FOR THE GERBERA PLANTS (*GERBERA JAMESONII*)

Fakhria A. Al-Abbas and Fatima R.M. Jinnah

Department of Horticulture and Landscape Gardening, College of Agriculture, University of Basra, Basra province, Iraq.

Abstract

The experiment was conducted during the agricultural season 2017 - 2018 in the greenhouse covered with Saran cover belonging to the Agricultural Research and Experimentation Station, College of Agriculture, University of Basra to study the response of *Gerbera jamesonii* to spraying with the leaves extract of Moringa at concentration of (0, 5, 10 $g.L^{-1}$) and the soaking solution of Fenugreek seeds at concentration of (0, 3, 6, $g.L^{-1}$) and zinc at concentration of (0, 60 $mg.L^{-1}$) in the traits of root growth and chemical traits, with rate of three sprayings, the period between one spraying and another is 21 days. The results showed that spraying the plants with the leaves extract of Moringa at concentration of (10 $g.L^{-1}$) led to improve all root growth indicators and chemical traits, while spraying the plants with the leaves extract of Moringa at concentration of (5 $g.L^{-1}$) led to improve root lengths, number of rhizomes, percentage of root system and carbohydrates Chlorophyll, zinc, nitrogen, phosphorus and potassium). As for the spraying of the plants with the seeds extract of the Fenugreek at a concentration of (6 $g.L^{-1}$) led to a significant increase in (number of roots, root lengths, the leaves content of chlorophyll, the leaves content of nitrogen, phosphorus, and potassium. As for the spraying with the seeds extract of the Fenugreek at a concentration of (3 $g.L^{-1}$) led to a significant effect on the number of roots, root lengths, number of rhizomes, the leaves content of carbohydrates, the leaves content of nitrogen, phosphorus, and potassium. Also, the spraying with zinc showed a significant effect on the number of roots, root lengths, percentage of dry matter in the root system, carbohydrates, zinc, nitrogen, phosphorus, and potassium.

***Keywords*:** Gerbera, Moringa, Fenugreek seeds.

Introduction

Gerbera (*Gerbera jamesonii*) belongs to Asteraceae family, it is discovered in 1880 by Robert Jameson in South Africa. The name of the genus is attributed to the German world Traug Gerber (Michael, 2004; Albattal, 2005). It is a Perennial Herbaceous plant that contains a short rhizome stem that grows along with it their roots (Cockshull, 1985). The leaves are with a lobular feather shape that sometimes contains a fluff on the lower side of the leaf, which resembles an Arugula leaf and combination in the flower form where it is Furnished on the surface of the soil (Al-Sultan *et al.*, 1992). The plant is used for cultivating in flower beds, it is suitable as flowerpot plants, it is also important as cut flowers for its attractive flowers (Kessler, 2006), variety their colors and its longevity in the vase (Kanwar and Kumar, 2008). Garbera is common in many countries such as USA, Canada, Italy, Netherlands, Switzerland, United Kingdom, Germany, Norway, Philippines, India (Pattanashetti, 2009). Garbera Propagates with seeds or division and shoots in spring and autumn, it follows the compound family and Asteraceae family (Johnson, 2002). Omran (2004) showed that there are many plant extracts that have an effect in promoting the vegetative and flowering traits of many plants. This is due to the fact that these plants contain many natural chemical compounds, which vary according to the plant parts, stages of growth and the Environmental conditions Which are exposed to plants. Because of the negative side effects of industrial chemicals, the trend towards alternatives to natural compounds that can have a similar effect to industrial chemical compounds (Grimstad, 1995). Among these plant extracts is Moringa leaves extract. Moringa leaves extract has multiple roles in the physiological and bio-activities for the plant. where It accelerates the growth of small plants, strengthens plants, and increases growth indicators such as number of plant leaves, leaf area, fresh and dry weight for plants, number of branches and length of roots when adding Moringa leaf extract at several levels (Prabhu *et al.*, 2010). The Fenugreek seeds extract, the importance of the Fenugreek returns to its seeds that containing many important chemical compounds medically and nutritionally (Bermejo and Leon, 1994). The Fenugreek seeds contain many nutrients, including iron, copper, zinc, manganese, potassium, and others (Moussa *et al.*, 1999). Foliar nutrition can also prepare the plant with a high percentage of its micronutrients when conditions are not suitable in the soil and climate to absorb those nutrients so it can be considered from modern methods. Studies have indicated that micronutrients are as important as macronutrients in increasing production and improving quality (Abu Dahi, 1993). Their importance is highlighted under conditions where nutrient uptake by soil is difficult because it is fixed by soil particles and becomes less available to plants, so spraying is used on plants (Minkle and Kirby, 2000). Zinc is considered one of the most important micronutrient elements in plant growth (Mahmood and Mohammed, 1989), where It works on, activates enzymatic processes within the plant and negatively affects the growth and development of chloroplast and chlorophyll content (Kassel, 2006), and for the importance of the Gerbera plant in the landscaping gardens and presenting it in the occasions as cut flowers, this study was conducted.

Materials and Methods

The experiment was conducted during the agricultural season from 1/10/2017 to 15/6/2018 in the greenhouse covered with Saran cover belonging to the Agricultural Research Station, College of Agriculture, University of Basra, Kerma Ali location. The plants were placed in 20 cm diameter flowerpots filled with agricultural media consisting of Sandyness and peat moss with a ratio of (1: 3), respectively as shown in Table (1). The plants were sprayed with a Moringa leaves extract at three concentrates (0, 5, 10 $g.L^{-1}$) as shown in Table (2). It was prepared by drying the leaves of the plant well and then grinding and taking the fine

powder with a weight of (0, 5,10 g) and dissolved in one liter of Warm distilled water for 24 hours. The soaking solution of Fenugreek seeds with three concentrates of (0, 3, 6 $g.L^{-1}$) as shown in Table (3)where it was prepared by dissolving (0, 3, 6 g) of dry powder per liter of warm distilled water at a temperature of 50 ºC left for 24 h. It was sprayed with zinc at concentrations of (0, 60 $mg.L^{-1}$). It was prepared by dissolving 0.240 mg of zinc sulfate in a liter of distilled water. A few drops of Tween-20 were added to all solutions before spraying (Lazem *et al.*, 2013). The plants sprayed three times (3 sprayings) between one spraying and another is 21 days during the growing season. The factorial experiment was conducted according to The Randomized Complete Block Design (RCBD), with three replicates. The averages were compared using the least significant difference test to compare the averages at a probability level of 0.05 (Al-Rawi and Khalaf Allah, 1980).

Table 1: shows some chemical and physical traits for the soil used in the experiment.

Traits	Values	Units
Electrical conductivity (EC)	1.30	$dS.m^{-1}$
PH	7.71	--
Total Nitrogen (N)	175.00	Ppm
Phosphorus availability (P)	2.71	
The dissolved Potassium (K)	56.00	
Zinc (Zn)	1.39	
Organic matter (OM)	1.06	$g.kg^{-1}$
Soil separators		
sand	865.9	$g.kg^{-1}$
Silt	63.7	
Clay	70.4	
Soil texture	Loamy Sand	

Table 2: shows the content of 100 g of fresh Moringa leaves from mineral and organic ingredients, vitamins and various substances (USAD, 2016).

Substances	Amount	Substances	Amount
Water	78.1 g	Phosphorus	112 mg
protein	9.4 g	Calcium	185 mg
Fats	1.4 g	Magnesium	147 mg
carbohydrate	8.2 g	potassium	337 mg
Fibers	2 g	sodium	9 mg
Vitamin C	51.7 g	iron	4 mg
Folic acid	40 µg	zinc	0.6 mg
Vitamin B6	1.2 mg	copper	0.51 mg
Vitamin A	378 µg	Calories	64 Calories

Table 3: Some nutrition ingredients and mineral elements of fenugreek seeds based on dry weight (Moussa *et al.*, 1999).

The ingredients	%	Element	$\mu g.g^{-1}$
Dissolved in water	34.96	Copper	0.17
Gels	26.20	Fine	1.58
Protein	22.80	Iron	1.07
Humidity	9.82	Manganese	2.76
The reduced sugars	7.76	Magnesium	3.19
The fixed oils	6.25	Sodium	68.02
Total ash	5.58	Potassium	240.19
Fiber	5.19		
The dissolved ash in water	2.51		
The dissolved ash in the acid	2.10		
Volatile Oils	1.04		

The studied traits:

Root growth indicators.

- **The number of roots ($root.plant^{-1}$) :** It was calculated for each plant of the experimental unit and the average was recorded.
- **Root length (cm^{-2}) :** It was measured for each plant of the experimental unit by measuring tape and the average was recorded.
- **The number of rhizomes ($rhizome.plant^{-1}$) :** It was calculated for each plant of the experimental unit and the average was recorded.
- **The percentage of dry matter for the root system (%) :** After taking the fresh weight for the root system, it was dried in an electric furnace at a temperature of 70 ºC for 48 hours until the weight stability, the percentage of dry matter for the root system was then calculated through the following equation:

The percentage of dry matter for the root system (%)

$$= \frac{\text{Dry weight for the root system (g)}}{\text{Fresh weight for root system (g)}} \times 100$$

Chemical traits for leaves

After collecting the leaves from each experimental plant (Walsh and Beaton, 1973), they were thoroughly cleaned and then dried in an electric oven at 70 °C for 48 hours until the weight stability. The leaves were then milled well and the following steps were used to estimating the following traits.

1- The leaves Content of total dissolved carbohydrates (mg.g^{-1}).

It was estimated by the Modification of Phenol-Sulphuric acid Colorimetric Method mentioned in (Dobois *et al.*, 1956).

2- The leaves content of the total chlorophyll (mg.100g^{-1} fresh weight)

The total chlorophyll pigment was estimated in fresh leaves by taking a plant from the plant of each experimental unit (Al-Sahaf, 1989). It was washed well with water and left to dry in the air. 0.5 g was taken from each sample and added to it 10 ml of acetone at a concentration of 80%. The tissue was crushed with a ceramic mortar until whiten the tissue. The tissue was then filtered using filter paper. It was measured with a UV-visible spectrophotometer to measure light absorption for pigment, with two wavelengths (645 and 663 nm). The amount of pigment was calculated using the following equation.

Total chlorophyll=20.2 x D645+ 8.02xD663 (V/Wx1000)x100

where

D663 = reading of light absorption at a wavelength of 663 nm.

D645 = reading of light absorption at a wavelength of 645 nm.

V = the size of the total extract

W = the weight of leafy texture (g)

3- The leaves content from some Macro-nutrients (N, P, K)

Plant specimens were digested by the method of (Cresser and Parsons, 1979). The elements in the digestion solution for plant samples (leaves) were then estimated as follows:

- **Percentage of nitrogen:** it was estimated using the micro-keladahl method according to (Page *et al.*, 1982).
- **The percentage of phosphorus:** It was estimated by Spectrophotometer and at wavelength 470 nm according to (Murphy and Riley, 1962).
- **The percentage of potassium:** It was estimated by the Flame Photometer according to the method (Page *et al.*, 1982). The results were expressed according to a standard curve using potassium chloride.
- **The leaves content of zinc (mg.kg^{-1}):** The leaves content of zinc was estimated using the Atomic Absorption Spectrophotometer, as reported by (Al-Sahaf, 1989).

Results and Discussion

The traits of root growth

Table (4) shows the spraying of plants with Moringa extract has a significant effect on the number of roots. The plants that were sprayed with Moringa leaves at a concentration of (10 g.L^{-1}) were excelled by giving it an average amounted to (48.61 root.plant^{-1}) compared to the plants that were sprayed with a concentration of (5 g.L^{-1}) and the control plant which the average number of their roots amounted to (40.78, 43.56 root.Plant^{-1}), respectively. The same table shows the superiority of the plants that were sprayed with a soaking extract of Fenugreek seeds with a concentration of (6 or 3 g.L^{-1}) in the average of root number which amounted to (56.11, 39.78 root.plant^{-1}), respectively, compared to the control plants, which gave an average number of roots amounted to (37.06 root.plant^{-1}). It was also found that there was a significant effect between the two concentrations where the number of roots increased by increasing the concentration of the soaking extract of the Fenugreek seeds. As for the effect of spraying with zinc, it had a significant superiority in this trait, where the plants that sprayed with a concentration of (60 mg.L^{-1}) of zinc by giving it an average amounted to (46.22 root.plant^{-1}) compared to the control plants which gave an average amounted to (42.41 root.plant^{-1}). As for bi-interaction between the Moringa leaves extract and the soaking extract of the Fenugreek seeds, it was shown a significant effect on the number of roots amounted to (64.50 root.plant^{-1}) for the plants sprayed with Moringa leaves extract at a concentration of (10 g.L^{-1}) and the soaking extract of the Fenugreek seeds compared to the lowest number of roots amounted to 28.83 for the control plants. it was also shown significant superiority for the interaction between the Moringa leaves extract and zinc, where the plants that sprayed with a concentration of (10 g.L^{-1}) of the Moringa leaves extract only in the average number of roots amounted to (53.11 root.plant^{-1}) compared to the plants that sprayed with the same extract at a concentration of (5 g.L^{-1}) only which gave the lowest average number of roots amounted to (36.67 root.plant^{-1}). As for bi interaction between the soaking extract of the Fenugreek seeds and zinc, the same table showed plants that sprayed with the soaking extract of the Fenugreek only at a concentration of (6 g.L^{-1}) was significantly excelled in the number of roots by giving it the highest average amounted to (57.56 root.plants^{-1}) compared to the lowest number of roots amounted to (31.22 root.plants^{-1}) for the control plants. The triple interaction between the three factors of the experiment had a significant effect, where the highest average number of root amounted to (80.00 root.plants^{-1}) for the plants that were sprayed with Moringa leaves extract at concentration of (10 g.L^{-1}), the soaking extract of the Fenugreek seeds at concentration of (6 g.L^{-1}) and did not spray with zinc compared to the lowest average for the control plants which amounted to (20.00 root.plants^{-1}). Table (4) shows the spraying of plants with Moringa extract has a significant effect on the trait of the root length, where the plants that were sprayed with Moringa leaves at a concentration of (10, 5 g.L^{-1}) were significantly excelled by giving it an averages amounted to (38.42, 36.21 cm), respectively compared to the control plant which recorded the lowest average of root length amounted to (31.28 cm). At the same time, the sprayed plants with two concentrations differed significantly between them, where roots length increased with increasing the concentration of

extract. As for the effect of spraying factor with a soaking extract of Fenugreek seeds, where the plants that were sprayed at a concentration of (6 or 3 g.L^{-1}) showed a significant excelling in the trait of root length which amounted to (37.54, 35.59 cm), respectively, compared to the control plants, which gave an average amounted to (32.77 cm). As for the effect of spraying with zinc, where the plants that sprayed with a concentration of (60 mg.L^{-1}) of zinc was excelled in this traits by giving it an average amounted to (36.64 cm) compared to the control plants which gave an average amounted to (33.96 cm). Bi-interaction between the Moringa leaves extract and the soaking extract of the Fenugreek seeds had a significant effect on the length of the root, where the plants that sprayed with Moringa leaves extract at a concentration of (10 g.L^{-1}) was excelled by giving it an average amounted to (38.83 cm) compared to the control plants which gave the lowest average amounted to (25.55 cm). The results of the same table showed that the bi-interaction between the spraying factors (Moringa leaves extract and zinc) has a significant effect in the lengths of the roots, where the plants that sprayed with Moringa leaves extract at a concentration of (10 g.L^{-1}) and zinc at concentration of (60 g.L^{-1}) was excelled by giving the highest length of roots amounted to (39.27 cm) compared to the control plants which amounted to (29.30 cm). The bi-interaction between the soaking extract of the Fenugreek seeds and zinc has a significant effect on the trait of roots length, where the plants that sprayed with the soaking extract of the Fenugreek at a concentration of (6 g.L^{-1}) and zinc at a concentration of (6 g.L^{-1}) was significantly excelled in the length of root by giving it the highest average amounted to (38.31 cm) compared to the lowest root length amounted to (29.67 cm) for the control plants. The triple interaction between the three factors of the experiment had a significant effect, where the plants that sprayed with Moringa leaves extract at a concentration of (10 g.L^{-1}) and spraying with zinc at a concentration of (60 g.L^{-1}) was excelled by giving it the highest average amounted to (41.37 cm) compared to the lowest average for the control plants which amounted to (19.27 cm).

Table (5) shows the spraying of plants with Moringa extract has a significant effect, where the plants that sprayed with Moringa leaves at a concentration of (10 or 5 g.L^{-1}) were excelled by giving it an average number of Rhizomes amounted to (3.89, 2.78 Rhizome.plant^{-1}) compared to the control plant which gave an average amounted to (2.22 Rhizome.plant^{-1}). As for the effect of spraying with a soaking extract of Fenugreek seeds has shown a significant effect in this trait, where the plants that sprayed with a soaking extract of Fenugreek seeds at a concentration of (3 g.L^{-1}) was excelled by giving it an average amounted to (3.39 Rhizome.plant^{-1}), compared to the plants that sprayed with a soaking extract of Fenugreek seeds at a concentration of (6 g.L^{-1}) which gave an average amounted to (2.67 Rhizome.plant^{-1}). The control plants were also excelled by giving it an average amounted to (2.83 Rhizome.plant^{-1}). As for the effect of spraying with zinc, the results of the same table showed that there was no significant effect on this trait. As for bi-interaction between the Moringa leaves extract and the soaking extract of the Fenugreek seeds, it was shown a significant effect on the number of Rhizomes, where the plants that sprayed with the Moringa leaves extract only at a concentration of (10 g.L^{-1}) and the plants that sprayed with Moringa leaves extract at a concentration of (10 g.L^{-1}) and the soaking extract of Fenugreek seeds at a concentration of (3 g.L^{-1}) gave the highest number of Rhizomes amounted to (4.33 Rhizomes.plant^{-1}) for both concentrations, compared to the control plant which gave the lowest number of Rhizomes amounted to (1.83 Rhizomes.plant^{-1}). The results of the table showed that the bi-interaction between the Moringa leaves extract and the zinc was significantly excelled in these traits, where the highest average of Rhizomes amounted to (4.00 Rhizomes.plant^{-1}) for the plants that sprayed with Moringa leaves extract at concentrated of (10 g.L^{-1}) and zinc at concentrated of (60 g.L^{-1}) compared to the control plant which gave the lowest average amounted to (2.00 Rhizomes.plant^{-1}). The bi-interaction between the two spraying factors with the soaking extract of Fenugreek seeds and the zinc has a significant effect on the number of Rhizomes. The plants that sprayed with a soaking extract of Fenugreek seeds at a concentration of (3 g.L^{-1}) only gave the highest average number of Rhizomes amounted to (3.78 Rhizomes.plant^{-1}) compared to the lowest average amounted to (2.11 Rhizomes.plant^{-1}) was for the plants that sprayed with the same extract at a concentration of (3 g.L^{-1}) only. The triple interaction between the three factors of the experiment had a significant effect, where the plants that sprayed with Moringa leaves extract at a concentration of (10 g.L^{-1}) and spraying with soaking extract of Fenugreek seeds at a concentration of (3 g.L^{-1}) was excelled by giving it the highest average amounted to (4.67 Rhizomes.plant^{-1}) compared to the lowest average for the control plants which amounted to (1.33 Rhizomes.plant^{-1}). Table (5) shows the spraying of plants with Moringa extract has a significant effect on the percentage of dry matter in root system, where the plants that sprayed with Moringa leaves at a concentration of (10, 5 g.L^{-1}) were significantly excelled by giving it an averages amounted to (36.49, 33.77 %), respectively compared to the control plant which recorded the lowest average percentage amounted to (28.51 %), while the same table showed that spraying with a soaking extract of Fenugreek seeds did not have a significant effect on the percentage of dry matter in the root system. The spraying with zinc has significant effect on the percentage of dry matter in the root system, where the plants that sprayed with a concentration of (60 mg.L^{-1}) of zinc was excelled in this traits by giving it an average amounted to (33.41 %) compared to the control plants which gave an average amounted to (32.43 %). The Bi-interaction between the Moringa leaves extract and the soaking extract of the Fenugreek seeds had a significant effect on the percentage of dry matter in the root system, where the plants that sprayed with Moringa leaves extract at a concentration of (5 g.L-1) was excelled by giving it an average amounted to (50.17 %) compared to the control plants which gave the lowest average amounted to (24.48 %). The results of the same table showed that The Bi-interaction between the Moringa leaves extract and the zinc had a significant effect on the percentage of dry matter in the root system, where the plants that sprayed with Moringa leaves extract at a concentration of (10 g.L^{-1}) only gave 40.80% compared to the lowest average amounted to (27.32 %) for the treated plants with the same extract but at a concentration of (5 g.L^{-1}). The interaction between the two study factors (the soaking extract of the Fenugreek seeds and the zinc) had a significant effect, where the treatment with a concentration of (60 mg.L^{-1}) of zinc only recorded the highest percentage of dry matter in the root system amounted

to (45.30%) compared to the lowest percentage amounted to (23.44%) for the plant treated with the soaking extract of the Fenugreek seeds at concentration of (3 $g.L^{-1}$) and zinc at concentration of (60 $mg.L^{-1}$). While the same table showed that the triple interaction between the three factors of the experiment had a significant effect, where the plants that sprayed with Moringa leaves extract at a concentration of (5 $g.L^{-1}$) and spraying with zinc at a concentration of (60 $g.L^{-1}$) was excelled by giving it the highest average amounted to (69.71 %) compared to the lowest average for the control plants which amounted to (18.18 %). A significant excelling in root growth indicators when sprayed with Moringa leaves extract may be attributed to the role of this extract in increasing photosynthesis activity due to increase number of leaves, increasing leaf area and the leaves content of total chlorophyll as shown in Table (6), Which ensures the presence of new quantities of photosynthesis products to conducting bio-activities in the plant, thus increasing the growth of roots and Rhizomes (Prabhu *et al.*, 2010). This is reflected positively on the significant increase in the number of roots, their lengths and the percentage of dry matter. This result agrees with (Hegazi *et al.*, 2015) n their study on the garlic plant. The increase in the number of roots and their lengths when spraying with the soaking extract of Fenugreek seeds may be due to the strength of vegetative growth and increase the efficiency of photosynthesis and manufacturing the nutrients and its accumulation and transfer to the root system, therefore increased the growth of stem cells and their division and extension, resulting in an increase in this trait (Minkle and Kirby, 2000). The results showed a significant increase in the traits of the root growth when spraying with zinc, where the number of roots and their length and the percentage of dry matter increased. It is due to the fact that zinc has an important role in the synthesis of the growth regulator (indole acetic acid (IAA)). It plays an important role directly or indirectly in the photosynthesis process, respiration, and chlorophyll's bio-metabolism and growth regulation (Imadi, 1991) and that IAA is necessary for the expansion and elongation of plant cells (Awad and Atawia, 1995). This result agrees with (Al-Ali, 2011) in their study on the Dahlia plant.

Chemical traits

Table (6) shows the spraying of plants with Moringa leaves extract has a significant effect on the leaves content of total Soluble carbohydrate, where the plants that sprayed with Moringa leaves extract at a concentration of (10 or 5 $g.L^{-1}$) were excelled by giving it the highest content of total Soluble carbohydrate in leaves amounted to (50.08, 44.93 $mg.g^{-1}$) compared to the control plant which gave the lowest content amounted to (43.66 $mg.g^{-1}$). As for the effect of spraying with a soaking extract of Fenugreek seeds has shown a significant effect in this trait, where the plants that sprayed with a soaking extract of Fenugreek seeds at a concentration of (3 $g.L^{-1}$) was excelled by giving it the highest content of total Soluble carbohydrate in leaves amounted to (47.50 $mg.g^{-1}$), compared to the plants that sprayed with the same extract but at a concentration of (6 $g.L^{-1}$) and control plant which their values amounted to (45.47, 45.70 $mg.g^{-1}$), respectively which did not differ with each other in this trait. As for the spraying of plants with zinc, it had a significant effect in this trait, where the plants that sprayed with a concentration of (60 $mg.L^{-1}$) of zinc were excelled by giving it the highest content of total Soluble carbohydrate in leaves amounted to (47.19 $mg.g^{-1}$) compared to the lowest content of total Soluble carbohydrate in leaves amounted to (45.26 $mg.g^{-1}$) For the control plants. As for bi-interaction between the Moringa leaves extract and the soaking extract of the Fenugreek seeds, it was shown a significant effect on the leaves content of total Soluble carbohydrate, where the plants that sprayed with the Moringa leaves extract only at a concentration of (10 $g.L^{-1}$) were excelled by giving it the highest content of total Soluble carbohydrate in leaves amounted to (54.03 $mg.g^{-1}$) compared to the lowest content amounted to (37.71 $mg.g^{-1}$) for the control plants. The effect of the interaction between the two spraying factors with the Moringa leaves extract and zinc was significant in this trait, where the plants treated with a concentration of (10 $g.L^{-1}$) of Moringa leaves extract were significantly excelled by giving it the highest carbohydrate content amounted to (51.59 $mg.g^{-1}$) compared to the lowest carbohydrate content amounted to (41.48 $mg.g^{-1}$) for the control plants. The bi-interaction between the two spraying factors with the soaking extract of the Fenugreek seeds and the zinc had a significant effect on the leaves content of total Soluble carbohydrate, where the plants treated with (3 $g.L^{-1}$) of the soaking extract of the Fenugreek seeds and (60 $mg.L^{-1}$) of zinc were significantly excelled by giving it the highest carbohydrate content amounted to (49.48 $mg.g^{-1}$) compared to the control plants which gave the lowest content amounted to (44.96 $mg.g^{-1}$). As for the triple interaction between the three factors of the experiment had a significant effect, it is noted from the same table that the plants that sprayed with Moringa leaves extract at a concentration of (10 $g.L^{-1}$) recorded the highest content of carbohydrates in their leaves amounted to (58.49 $mg.g^{-1}$) compared to the lowest content amounted to (31.08 $mg.g^{-1}$) for the control plants. Table (6) shows the spraying of plants with Moringa extract has a significant effect on the leaves content of chlorophyll, where the plants that sprayed with Moringa leaves at a concentration of (10, 5 $g.L^{-1}$) were significantly excelled by giving it the highest content of chlorophyll amounted to (93.28, 90.82 mg.100 g^{-1} fresh weight), respectively compared to the control plant which recorded the lowest content of chlorophyll amounted to (83.20 mg.100 g^{-1} fresh weight). From the same table, the plants that sprayed with the soaking extract of the Fenugreek seeds at a concentration of (6 $g.L^{-1}$) were significantly excelled in the leaves content of chlorophyll, which amounted to (91.97 mg.100 g^{-1}) compared to the control plants where their leaves content of chlorophyll amounted to (88.98 mg.100 g^{-1}). The spraying with zinc has no significant effect on the leaves content of chlorophyll. The Bi-interaction between the Moringa leaves extract and the soaking extract of the Fenugreek seeds had a significant effect on the leaves content of chlorophyll, where the plants that sprayed with Moringa leaves extract at a concentration of (5 $g.L^{-1}$) was excelled by giving it the highest content amounted to (99.34 mg.100 g^{-1} fresh weight) compared to the control plants which gave the lowest content amounted to (73.05 mg.100 g^{-1} fresh weight). The results of the same table showed that The Bi-interaction between the Moringa leaves extract and the zinc had a significant effect on the leaves content of chlorophyll, where the plants that sprayed with Moringa leaves extract at a concentration of (10 $g.L^{-1}$) were excelled by giving it the highest content amounted to (95.92 mg.100 g^{-1} fresh weight) compared to the lowest content amounted to (82.93 mg.100 g^{-1} fresh weight) for the control plants. The table showed a significant effect for the bi-

interaction between the spraying with the soaking extract of the Fenugreek seeds and the zinc, where the plants that sprayed with the soaking extract of the Fenugreek seeds at a concentration of (6 g.L^{-1}) and zinc at a concentration of (60 mg.L^{-1}) were characterized by giving it the highest content amounted to (92.61 mg.100 g^{-1} fresh weight) compared to the plants that were sprayed with the soaking extract of the Fenugreek seeds at a concentration of (3 g.L^{-1}) and zinc at a concentration of (60 mg.L^{-1}) which gave (81.16 mg.100 g^{-1} fresh weight). As for the triple interaction between the three factors of the experiment, it had a significant effect, where the plants that sprayed with Moringa leaves extract at a concentration of (10 g.L^{-1}) was excelled by giving it the highest content amounted to (106.56 mg.100 g^{-1} fresh weight) compared to the lowest content for the control plants which amounted to (57.44 mg.100 g^{-1} fresh weight).

Table (7) shows the spraying of plants with Moringa extract has a significant effect on the leaves content of zinc, where the plants that sprayed with Moringa leaves at a concentration of (10 or 5 g.L^{-1}) were excelled by giving it the highest content of zinc in leaves amounted to (140.41, 132.15 mg.kg^{-1}) compared to the control plant which gave the lowest content amounted to (115.16 mg.kg^{-1}). As for the effect of spraying with a soaking extract of Fenugreek seeds has not shown a significant effect in this trait. As for the spraying of plants with zinc, it had a significant effect in this trait, where the plants that sprayed with a concentration of (60 mg.L^{-1}) of zinc were excelled by giving it the highest content of zinc in leaves amounted to (146.95 mg.kg^{-1}) compared to the lowest content of zinc in leaves amounted to (45.26 mg.kg^{-1}) For the control plants. As for bi-interaction between the Moringa leaves extract and the soaking extract of the Fenugreek seeds, it was shown a significant effect on the leaves content of zinc, where the plants that sprayed with the Moringa leaves extract only at a concentration of (10 g.L^{-1}) were excelled by giving it the highest content of zinc in leaves amounted to (154.62 mg.kg^{-1}) compared to the lowest content amounted to (109.68 mg.kg^{-1}) for the control plants. The effect of the bi-interaction between the two spraying factors with the Moringa leaves extract and zinc was significant in this trait, where the plants treated with a concentration of (5 g.L^{-1}) for Moringa leaves extract and zinc with a concentration of (60 mg.L^{-1}) were significantly excelled by giving it the highest content amounted to (171.40 mg.kg^{-1}) compared to the lowest content amounted to (92.90 mg.kg^{-1}) for the control plants. The bi-interaction between the two spraying factors with the soaking extract of the Fenugreek seeds and the zinc had a significant effect on the leaves content of zinc, where the plants treated with (3 g.L^{-1}) of the soaking extract of the Fenugreek seeds and (60 mg.L^{-1}) of zinc were significantly excelled by giving it the highest content amounted to (147.56 mg.kg^{-1}) compared to the lowest content amounted to (96.38 mg.kg^{-1}) for the plants treated with (3 g.L^{-1}) of the soaking extract of the Fenugreek seeds only. As for the triple interaction between the three factors of the experiment had a significant effect, it is noted from the same table that the plants sprayed with Moringa leave extract at a concentration of (5 g.L^{-1}), spraying with the soaking extract of the Fenugreek seeds at a concentration of (6 g.L^{-1}) and spraying with zinc at a concentration of (60 g.L^{-1}) were excelled by recording it the highest content of zinc in their leaves amounted to (192.50 mg.kg^{-1}) compared to the lowest content amounted to (79.23 mg.kg^{-1}) for the control plants. Table (7) shows the spraying of plants with Moringa extract has a significant effect on the Percentage of nitrogen in its leaves, where the plants that sprayed with Moringa leaves at a concentration of (10, 5 g.L^{-1}) were significantly excelled by giving it the highest Percentage of nitrogen amounted to (3.309, 3.288 %), respectively compared to the control plant which recorded the lowest Percentage of nitrogen amounted to (3.119 %). From the same table, the plants that sprayed with the soaking extract of the Fenugreek seeds at a concentration of (6, 3 g.L^{-1}) were significantly excelled in the Percentage of nitrogen, which amounted to (3.428, 3.236 %) compared to the control plants where their Percentage of nitrogen amounted to (3.053 %). The percentage was increased by increasing the concentration of the soaking extract of the Fenugreek seeds. The results of Table (7) show that spraying with zinc at a concentration of (60 mg.L^{-1}) was excelled by giving it the highest Percentage of nitrogen amounted to (3.359 %) compared to the control plants which gave the lowest Percentage of nitrogen amounted to (3.119 %). The Bi-interaction between the Moringa leaves extract and the soaking extract of the Fenugreek seeds had a significant effect on the Percentage of nitrogen, where the plants that sprayed with Moringa leaves extract at a concentration of (5 g.L^{-1}) and the soaking extract of the Fenugreek seeds at a concentration of (6 g.L^{-1}) were excelled by giving it the highest Percentage of nitrogen amounted to (3.495 %) compared to the control plants which gave the lowest Percentage of nitrogen amounted to (2.928 %). The results of the same table showed that The Bi-interaction between the Moringa leaves extract and the zinc had a significant effect on the Percentage of nitrogen, where the plants that sprayed with Moringa leaves extract at a concentration of (10 g.L^{-1}) and zinc with concentration of (60 mg.L^{-1}) were excelled by giving it the highest percentage amounted to (3.408 %) compared to the lowest percentage amounted to (2.887 %) for the control plants. The table showed a significant effect for the bi-interaction between the spraying with the soaking extract of the Fenugreek seeds and the zinc, where the plants that sprayed with the soaking extract of the Fenugreek seeds at a concentration of (6 g.L^{-1}) and zinc at a concentration of (60 mg.L-1) were characterized by giving it the highest percentage amounted to (3.563 %) compared to the control plants which gave the lowest percentage amounted to (2.983 %). As for the triple interaction between the three factors of the experiment, it had a significant effect, where the plants sprayed with Moringa leaves extract at a concentration of (10 g.L^{-1}), spraying with the soaking extract of the Fenugreek seeds at a concentration of (6 g.L^{-1}) and spraying with zinc at a concentration of (60 g.L^{-1}) were excelled by recording it the highest percentage amounted to (3.630 %) compared to the lowest percentage amounted to (2.790 %) for the control plants.

Table (8) shows the spraying of plants with Moringa extract has a significant effect on the Percentage of phosphorus in leaves, where the plants that sprayed with Moringa leaves at a concentration of (10 or 5 g.L^{-1}) were excelled by giving it the highest content of zinc in leaves amounted to (0.206, 0.193 %) compared to the control plant which gave the lowest content amounted to (0.157 %). Plants that were sprayed with the Moringa leaves extract at a concentration of (10 g.L^{-1}) were significantly excelled in the percentage of phosphorus in their leaves compared to the plants sprayed with the same extract but at a concentration of

(5 g.L^{-1}). From the same table, the plants that sprayed with the soaking extract of the Fenugreek seeds at a concentration of (6, 3 g.L^{-1}) were significantly excelled in the Percentage of phosphorus, which amounted to (0.195, 0.186 %) compared to the control plants where their Percentage of phosphorus amounted to (0.175 %), The percentage was increased by increasing the concentration of the soaking extract of the Fenugreek seeds. The results of Table (8) show that spraying with zinc at a concentration of (60 mg.L^{-1}) was excelled by giving it the highest Percentage of phosphorus amounted to (0.186 %) compared to the control plants which gave the lowest Percentage of phosphorus amounted to (0.185 %). The Bi-interaction between the Moringa leaves extract and the soaking extract of the Fenugreek seeds had a significant effect on the Percentage of phosphorus, where the plants that sprayed with Moringa leaves extract at a concentration of (10 g.L^{-1}) and the soaking extract of the Fenugreek seeds at a concentration of (3 g.L^{-1}) were excelled by giving it the highest Percentage of phosphorus amounted to (0.209 %) compared to the control plants which gave the lowest Percentage of phosphorus amounted to (0.134 %). As for the Bi-interaction between the Moringa leaves extract and the zinc had a significant effect on the Percentage of phosphorus, where the plants that sprayed with Moringa leaves extract at a concentration of (10 g.L^{-1}) and zinc with concentration of (60 mg.L^{-1}) were excelled by giving it the highest percentage amounted to (0.209 %) compared to the lowest percentage amounted to (0.162 %) for the control plants. The table showed a significant effect for the bi-interaction between the spraying with the soaking extract of the Fenugreek seeds and the zinc, where the plants that sprayed with the soaking extract of the Fenugreek seeds at a concentration of (6 g.L^{-1}) only were characterized by giving it the highest percentage amounted to (0.200 %) compared to the control plants which gave the lowest percentage amounted to (0.170 %). As for the triple interaction between the three factors of the experiment, it had a significant effect, where the plants sprayed with Moringa leaves extract at a concentration of (10 g.L^{-1}), spraying with the soaking extract of the Fenugreek seeds at a concentration of (3 g.L^{-1}) and spraying with zinc at a concentration of (60 g.L^{-1}) were excelled by recording it the highest percentage amounted to (0.212 %) compared to the lowest percentage amounted to (0.129 %) for the control plants. Table (8) shows the spraying of plants with Moringa extract has a significant effect on the Percentage of potassium in its leaves, where the plants that sprayed with Moringa leaves at a concentration of (10, 5 g.L^{-1}) were significantly excelled by giving it the highest Percentage of potassium amounted to (2.290, 1.882 %), respectively compared to the control plant which recorded the lowest Percentage of potassium amounted to (1.611 %). The effect was increased with increasing the concentration of Moringa extract. From the same table, the plants that sprayed with the soaking extract of the Fenugreek seeds at a concentration of (6, 3 g.L^{-1}) were significantly excelled in the Percentage of potassium, which amounted to (2.116, 1.974 %), respectively compared to the control plants. The results of Table (7) show that spraying with zinc at a concentration of (60 mg.L^{-1}) was excelled by giving it the highest Percentage of potassium amounted to (1.945 %) compared to the control plants which gave the lowest Percentage of nitrogen amounted to (1.910 %). The Bi-interaction between the Moringa leaves extract and the soaking extract of the Fenugreek seeds had a significant effect on the Percentage of nitrogen, where the plants that sprayed with Moringa leaves extract at a concentration of (6 g.L^{-1}) and the soaking extract of the Fenugreek seeds at a concentration of (6 g.L^{-1}) were excelled by giving it the highest Percentage of potassium amounted to (2.582 %) compared to the control plants which gave the lowest Percentage of potassium amounted to (1.430 %). The results of the same table showed that The Bi-interaction between the Moringa leaves extract and the zinc had a significant effect on the Percentage of nitrogen, where the plants that sprayed with Moringa leaves extract at a concentration of (10 g.L^{-1}) and zinc with concentration of (60 mg.L^{-1}) were excelled by giving it the highest percentage amounted to (2.307%) compared to the lowest percentage amounted to (1.569%) for the control plants. The table showed a significant effect for the bi-interaction between the spraying with the soaking extract of the Fenugreek seeds and the zinc, where the plants that sprayed with the soaking extract of the Fenugreek seeds at a concentration of (6 g.L^{-1}) were characterized by giving it the highest percentage amounted to (2.207 %) compared to the control plants which gave the lowest percentage amounted to (1.681%). As for the triple interaction between the three factors of the experiment, it had a significant effect, where the plants sprayed with Moringa leaves extract at a concentration of (10 g.L^{-1}), spraying with the soaking extract of the Fenugreek seeds at a concentration of (6 g.L^{-1}) and did not spray with zinc were excelled by recording it the highest percentage amounted to (2.907%) compared to the lowest percentage amounted to (1.330 %) for the control plants.

The increase in the leaves content of total Soluble carbohydrate when sprayed with Moringa leaves extract is due to its positive effect on vegetative growth indicators represented by increasing the number of leaves, increasing the leaf area and the percentage of dry matter for the total vegetative as well as the significant increase in the number and length of roots as shown in Table (4). All this together positively reflected on the increasing efficiency of photosynthesis and then increasing the number of manufactured nutrients in leaves which meant an increase in the number of manufactured carbohydrates (Abdelkader *et al.*, 1982). Also, the reason for the superiority of plants in the leaves content of the chlorophyll when treated with the extract of Moringa leaves extract is to contain this extract on the nutrients, including the magnesium component, which has a role in the photosynthesis process and enters the synthesis of chlorophyll, representing the center of the chlorophyll molecule (Al-Sahaf, 1989). Any factor increases the leaves content of the chlorophyll will result in increasing the accumulation of carbohydrates (Imadi, 1991). The reason for the increase in nutrient content (nitrogen, phosphorus, and potassium) when spraying plants with Moringa leaves extract is due to the fact that the extract contains many important nutrients in plant nutrition (Menkele and Kirby, 2000). Absorption of elements by plant and accumulation in leaves (Hamadi and Abbas, 2012). The reason for the significant increase in the content of zinc in the leaves when spraying the plants with the element of zinc may be due to increasing the absorption of this element by the plant and increasing its concentration in the spraying solution to the plant's need for more of this element due to insufficient soil processing which causes the plant to absorb as much as possible Of the added zinc by spraying it on the total vegetative with increasing concentration in the spraying solution (Khan and Jamil,

1998). This result agrees with (Elkafie *et al.*, 2016) in their study on the Coriander plant. As for the positive effect of the soaking extract of the Fenugreek seeds on the chemical properties of the herb may be due to its containment of organic compounds and mineral elements such as phosphorus, potassium, magnesium and micronutrients such as iron, zinc, copper, manganese, etc. as shown in Table (2). These elements play a role in activating the enzymes of various growth activities, including photosynthesis, as well as the entry of metal elements into the synthesis of nucleic acids (RNA, DNA) necessary for cell division (Moussa *et al.*, 1999). The reason for the increase in the leaves content of total chlorophyll when spraying the plants with the soaking extract of the Fenugreek seeds is due to the inclusion of this extract on magnesium and iron, which are essential elements in the formation of chlorophyll pigment (Moussa *et al.*, 1999). This result agrees with (Al-Mohammadi, 2011) in their study on Caraway plant. The increase in the leaves content of carbohydrates when spraying it with zinc element may be due to its role in increasing the efficiency of the photosynthesis process, thus increase the formation of manufactured materials represented by carbohydrates and fats and the group of vitamins B, C (Abu Dhahi and Al-Yunis, 1988; Imadi, 1991). This result agrees with (Abdel-Wahid, 2014) in his study on the Geranium plant. The increase in the percentage of nitrogen in the leaves when spraying plants with zinc and the appropriate concentrations leads to absorption the nitrogen in the soil, thus increasing its absorption, which increases the concentration of the nitrogen element in the leaves (Mohammed and Al-Riss, 1984). These results agree with (Khalife *et al.*, 2011) in their study on the iris plant. The increase in the percentage of phosphorus is due to the activity of vegetative growth for the plants when spraying plants with the element of zinc, which requires the withdrawal of the largest amount of phosphorus to meet the need of the plant in the formation of cellular membranes such as plasma membrane and Mitochondria and Chloroplast as well as entering the composition of energy-rich compounds that work on Auxiliary factors for enzymes (Abu Dhahi and Al-Yunis, 1988). This result agrees with (Abdel-Abbas *et al.*, 2017) in their study on *Jasminum sambac* plant. The increase in the percentage of potassium when spraying plants with the zinc element may have increased the withdrawal of potassium from the soil through its effect in the activation of chlorophyll and proteins in the photosynthesis process, which led to increasing absorption of potassium to meet the need of the plant, which is an ionic regulator of many of the phylogenetic processes (Devlin and Wyattam, 1985). This result agrees with (Al-Ali, 2011) in his study on Dahlia's bulbs. The reason for increasing the percentage of zinc in the leaves when spraying plants with this element is due to increase absorption of zinc by the plant with increasing its concentration in the spraying solution to the need of the plant to the more zinc element due to insufficient supplied zinc by soil, which prompted the plants to absorb as much as possible Of the added zinc by spraying on the total vegetative with increasing its concentration in the spraying solution (Mohamed and Elriss, 1984), this result agrees with (Hammadi, 2009) in his study on the Spanish Iris.

Table 4: Effect of spraying with Moringa leaves extract and the soaking extract of the Fenugreek seeds and the zinc and their interactions in the number of roots (root.plant^{-1}) and root length (cm) for the Gerbera plant.

Moringa leaves extract (g.L^{-1})	Fenugreek seeds extract (g.L^{-1})	The number of roots (root.plant^{-1})			Root length (cm)		
		Zinc (mg.L^{-1})		Moringa × Fenugreek seeds	Zinc (mg.L^{-1})		Moringa × Fenugreek seeds
		0	60		0	60	
0	0	20.00	37.67	28.83	19.27	31.83	25.55
	3	41.67	43.00	42.33	33.00	29.63	31.32
	6	50.67	68.33	59.50	35.63	38.30	36.97
5	0	32.00	44.67	38.33	33.43	34.40	33.92
	3	36.00	43.33	39.67	34.03	40.27	37.15
	6	42.00	46.67	44.33	37.53	37.57	37.55
10	0	41.67	46.33	44.00	36.30	41.37	38.83
	3	37.67	37.00	37.33	39.23	37.37	38.30
	6	80.00	49.00	64.50	37.17	39.07	38.12
				Average effect Moringa			Average effect Moringa
Interaction between Moringa and zinc	0	37.44	49.67	43.56	29.30	33.26	31.28
	5	36.67	44.89	40.78	35.00	37.41	36.21
	10	53.11	44.11	48.61	37.57	39.27	38.42
				Average effect Fenugreek seeds			Average effect Fenugreek seeds
Interaction between Fenugreek seeds and zinc	0	31.22	42.89	37.06	29.67	35.87	32.77
	3	38.44	41.11	39.78	35.42	35.76	35.59
	6	57.56	54.67	56.11	36.78	38.31	37.54
Average effect zinc		42.41	46.22		33.96	36.64	
L.S.D.0.05							
Trait	Moringa	Fenugreek seeds	zinc	Moringa × Fenugreek seeds	Moringa × zinc	Fenugreek seeds × zinc	Moringa × Fenugreek seeds × zinc
number of roots	2.09	2.09	1.70	3.61	2.95	2.95	5.11
Root length	2.19	2.19	1.79	3.79	3.10	3.10	5.36

Table 5: Effect of spraying with Moringa leaves extract and the soaking extract of the Fenugreek seeds and the zinc and their interactions in the number of Rhizomes (Rhizomes.plant^{-1}) and percentage of dry matter in the root system (%) for the Gerbera plant.

Moringa leaves extract (g.L^{-1})	Fenugreek seeds extract (g.L^{-1})	The number of Rhizomes (Rhizomes.plant^{-1})			Percentage of dry matter in the root system (%)		
		Zinc (mg.L^{-1})		Moringa × Fenugreek seeds	Zinc (mg.L^{-1})		Moringa × Fenugreek seeds
		0	60		0	60	
0	0	1.33	2.33	1.83	18.18	30.77	24.48
	3	3.00	2.33	2.67	35.38	27.24	31.31
	6	1.67	2.67	2.17	33.96	25.52	29.74
5	0	2.33	2.33	2.33	30.63	69.71	50.17
	3	3.67	2.67	3.17	26.63	21.35	23.99
	6	2.33	3.33	2.83	24.70	29.58	27.14
10	0	4.33	4.33	4.33	43.63	35.43	39.53
	3	4.67	4.00	4.33	43.35	21.73	32.54
	6	2.33	3.67	3.00	35.43	39.39	37.41
				Average effect Moringa			**Average effect Moringa**
Interaction between Moringa and zinc	**0**	2.00	2.44	2.22	29.18	27.84	28.51
	5	2.78	2.78	2.78	27.32	40.21	33.77
	10	3.78	4.00	3.89	40.80	32.18	36.49
				Average effect Fenugreek seeds			**Average effect Fenugreek seeds**
Interaction between Fenugreek seeds and zinc	**0**	2.67	3.00	2.83	30.82	45.30	38.06
	3	3.78	3.00	3.39	35.12	23.44	29.28
	6	2.11	3.22	2.67	31.36	31.50	31.43
Average effect zinc		2.85	3.07		32.43	33.41	
L.S.D.0.05							
Trait	**Moringa**	**Fenugreek seeds**	**zinc**	**Moringa × Fenugreek seeds**	**Moringa × zinc**	**Fenugreek seeds × zinc**	**Moringa × Fenugreek seeds × zinc**
Number of Rhizomes	0.49	0.49	NS	0.84	0.69	0.69	1.19

Table 6: Effect of spraying with Moringa leaves extract and the soaking extract of the Fenugreek seeds and the zinc and their interactions in the leaves content of total Soluble carbohydrate (mg.g^{-1}) and the leaves content of chlorophyll (mg.100 g^{-1} fresh weight) for the Gerbera plant.

Moringa leaves extract (g.L^{-1})	Fenugreek seeds extract (g.L^{-1})	The leaves content of total Soluble carbohydrate (mg.g^{-1})			The leaves content of chlorophyll (mg.100 g^{-1} fresh weight)		
		Zinc (mg.L^{-1})		Moringa × Fenugreek seeds	Zinc (mg.L^{-1})		Moringa × Fenugreek seeds
		0	60		0	60	
0	0	31.08	44.34	37.71	57.44	88.66	73.05
	3	44.59	49.40	47.00	93.28	77.85	85.56
	6	48.79	43.76	46.27	98.07	83.91	90.99
5	0	45.32	45.39	45.35	96.29	92.80	94.55
	3	44.40	50.34	47.37	87.66	90.84	89.25
	6	38.39	45.75	42.07	88.41	88.89	88.65
10	0	58.49	49.57	54.03	106.56	92.12	99.34
	3	47.57	48.68	48.12	93.69	74.78	84.24
	6	48.70	47.46	48.08	87.51	105.02	96.26
				Average effect Moringa			**Average effect Moringa**
Interaction between Moringa and zinc	**0**	41.48	45.83	43.66	82.93	83.47	83.20
	5	42.70	47.16	44.93	90.79	90.84	90.82
	10	51.59	48.57	50.08	95.92	90.64	93.28
				Average effect Fenugreek seeds			**Average effect Fenugreek seeds**
Interaction between Fenugreek seeds and zinc	**0**	44.96	46.43	45.70	86.76	91.19	88.98
	3	45.52	49.48	47.50	91.54	81.16	86.35
	6	45.29	45.66	45.47	91.33	92.61	91.97
Average effect zinc		45.26	47.19		89.88	88.32	
L.S.D.0.05							
Trait	**Moringa**	**Fenugreek seeds**	**zinc**	**Moringa x Fenugreek seeds**	**Moringa x zinc**	**Fenugreek seeds x zinc**	**Moringa x Fenugreek seeds x zinc**
Carbohydrate	**0.65**	**0.65**	**0.53**	**1.13**	**0.92**	**0.92**	**1.60**
Chlorophyll	**1.71**	**1.71**	**NS**	**2.96**	**2.42**	**2.42**	**4.19**

Table 7: Effect of spraying with Moringa leaves extract and the soaking extract of the Fenugreek seeds and the zinc and their interactions in the leaves content of zinc (mg.kg^{-1}) and the Percentage of nitrogen (%) for the Gerbera plant.

Moringa leaves extract (g.L^{-1})	Fenugreek seeds extract (g.L^{-1})	The leaves content of zinc (mg.kg^{-1})			The Percentage of nitrogen (%)		
		Zinc (mg.L^{-1})		Moringa × Fenugreek seeds	Zinc (mg.L^{-1})		Moringa × Fenugreek seeds
		0	60		0	60	
0	0	79.95	139.40	109.68	2.790	3.067	2.928
	3	90.40	130.59	110.50	2.810	3.360	3.085
	6	131.53	119.10	125.32	3.060	3.630	3.345
5	0	109.22	180.03	144.62	3.087	3.150	3.118
	3	79.23	141.66	110.45	3.263	3.363	3.313
	6	90.24	192.50	141.37	3.553	3.437	3.495
10	0	190.68	118.57	154.62	3.073	3.150	3.112
	3	119.50	170.44	144.97	3.167	3.450	3.308
	6	113.02	130.22	121.62	3.263	3.623	3.443
				Average effect Moringa			**Average effect Moringa**
Interaction between Moringa and zinc	**0**	100.63	129.70	115.16	2.887	3.352	3.119
	5	92.90	171.40	132.15	3.301	3.317	3.309
	10	141.07	139.74	140.41	3.168	3.408	3.288
				Average effect Fenugreek seeds			**Average effect Fenugreek seeds**
Interaction between Fenugreek seeds and zinc	**0**	126.61	146.00	136.31	2.983	3.122	3.053
	3	96.38	147.56	121.97	3.080	3.391	3.236
	6	111.60	147.27	129.44	3.292	3.563	3.428
Average effect zinc		111.53	146.95		3.119	3.359	
L.S.D.0.05							
Trait	**Moringa**	**Fenugreek seeds**	**zinc**	**Moringa × Fenugreek seeds**	**Moringa × zinc**	**Fenugreek seeds × zinc**	**Moringa × Fenugreek seeds × zinc**
Zinc	0.54	NS	0.44	0.93	0.76	0.76	1.31
Nitrogen	0.016	0.016	0.013	0.027	0.022	0.022	0.038

Table 8: Effect of spraying with Moringa leaves extract and the soaking extract of the Fenugreek seeds and the zinc and their interactions in the Percentage of phosphorus (%) and the Percentage of potassium (%) for the Gerbera plant.

Moringa leaves extract (g.L^{-1})	Fenugreek seeds extract (g.L^{-1})	The Percentage of phosphorus (%)			The Percentage of potassium (%)		
		Zinc (mg.L^{-1})		Moringa × Fenugreek seeds	Zinc (mg.L^{-1})		Moringa × Fenugreek seeds
		0	60		0	60	
0	0	0.129	0.140	0.134	1.330	1.530	1.430
	3	0.165	0.144	0.154	1.630	1.637	1.633
	6	0.192	0.175	0.183	1.747	1.790	1.768
5	0	0.180	0.195	0.187	1.760	1.643	1.702
	3	0.185	0.205	0.195	1.940	1.953	1.947
	6	0.205	0.186	0.195	1.967	2.030	1.998
10	0	0.201	0.207	0.204	1.953	1.940	1.947
	3	0.206	0.212	0.209	1.960	2.723	2.342
	6	0.205	0.208	0.206	2.907	2.257	2.582
				Average effect Moringa			**Average effect Moringa**
Interaction between Moringa and zinc	**0**	0.162	0.153	0.157	1.569	1.652	1.611
	5	0.190	0.195	0.193	1.889	1.876	1.882
	10	0.204	0.209	0.206	2.273	2.307	2.290
				Average effect Fenugreek seeds			**Average effect Fenugreek seeds**
Interaction between Fenugreek seeds and zinc	**0**	0.170	0.181	0.175	1.681	1.704	1.693
	3	0.185	0.187	0.186	1.843	2.104	1.974
	6	0.200	0.189	0.195	2.207	2.026	2.116
Average effect zinc		0.185	0.186		1.910	1.945	
L.S.D.0.05							
Trait	**Moringa**	**Fenugreek seeds**	**zinc**	**Moringa × Fenugreek seeds**	**Moringa × zinc**	**Fenugreek seeds × zinc**	**Moringa × Fenugreek seeds × zinc**
Phosphorus	0.001	0.001	0.001	0.002	0.002	0.002	0.003
Potassium	0.017	0.017	0.014	0.029	0.024	0.024	0.041

References

Abu, D.; Yousef, M. and Muayad, A.Y. (1988). Guide to Plant Nutrition, Dar Al Kutab for Printing and Publishing, University of Baghdad, Ministry of Higher Education and Scientific Research, Iraq.

Abu, D. and Yousef, M. (1993). Effect of the adding method of nutrients to the soil directly in the form of salts and foliar nutrition by spraying in the quantity and quality of wheat (Abu Ghraib cultivar). Iraqi Journal of Agricultural Sciences 24(2): 227-233.

Al-Rawi, K.M. and Abdul, A.M.K.A. (1980). Design and analysis of agricultural experiments. Dar Al Kuttab Publishing & Publishing, Mosul University. Iraq.

Al-Sultan, S.M.; Talal, M.A. and Mohammed, D.A. (1992). Ornamental. University of Mosul - Iraq.

Al-Sahaf, F.H. (1989). Applied Plant Nutrition. Dar Al Hekma for Printing and Publishing, Ministry of Higher Education and Scientific Research, University of Baghdad. Iraq.

Al-Ali, F.A.A.A. (2011). Effect of bunching and Spraying with Vitamin C and B3 and iron and zinc elements in the growth and flowering of Dahlia plant (*Dahlia varabilis* L.). Ph.D. thesis, College of Agriculture. University of Basra - Iraq.

Al-Mohammadi, A.F. (2011). Effect of the planting dates, Gibberellin, plant extracts and vitamins in the growth and yield of two cultivars of Caraway (*Carum carvi* L.). Ph.D. thesis. College of Agriculture, University of Baghdad, Iraq.

Hammadi, M.T. (2009). Effect of spraying with zinc and roots licorice extract in the growth and flowering of the Spanish Iris bulbs. Master Thesis. College of Agriculture. University of Kufa. Iraq.

Hammadi, M.T. and Jamal, A.A. (2012). Effect of Spraying Zinc and Liquorice (*Glycyrrhiza glabra*) Root Extract on Growth and Flower of Spanish Iris (*Iris xiphium* L.) Bulbs. 8(1): 127-137.

Devlin, R.M. and Francis, H. (1985). Plant Physiology, Translation of Mohamed Fawzi Abdel Hamid, Mohamed Sharaki, Abdel Hadi Khadr, Nadia Kamel, and Ali Saad El-Din Salameh, Al-Dar Al-Arabia Publishing and Printing House of the Arab Republic of Egypt.

Abdul, A.; Fakhria, A.; Al-Shwilly, A.N. and Al-Maliky, H.M.H. (2017). Effect of Spraying with Zinc and Liquid sulfur Zolfast on Vegetative Growth and Flowering of *Jasminum sambas* L. The Egyptian Arabic Republic. 48(3): 97-111.

Abdul, Q.F.; Fahima, A.L.; Ahmed, S.; Abbas, A.T. and Ghassan, K. (1982). Plant Physiology. University of Mosul. Iraq.

Abdel, W. and Nour, Y. (2014). Effect of pinching and spraying with gibberellic acid and zinc on growth flower and pigments of plant *Geranium pelargonium hortorum* L. Master degree, College of Agriculture. University of Basra. Iraq.

Imadi, T.H. (1991). Micro-nutrients in agriculture. Ministry of Higher Education and Scientific Research, Faculty of Agriculture, University of Baghdad Iraq.

Omran, W.H.H. (2004). Effect of some plant extracts on the growth and yield of cucumber plant (*Cucumis sativum* L.) heated greenhouses. Master Thesis, College of Agriculture, University of Baghdad, Iraq: 100 pages.

Lazim, Z.S.; Jasim, S.N. and Jannour, A.A. (2013). Effect of spraying with licorice and Fenugreek extracts in vegetative and flowering growth of *Antirrhinum majus* L. plant. Al-Furat Journal of Agricultural Sciences 5 (1): 8-17.

Mohammed, A.A. and Abdul, H.A. (1984). Plant Physiology. The first and second part, Dar al-Kitab for printing and publishing, University of Mosul - Iraq.

Mahmoud, M.K. and Sami, K.A. (1989). Ornamental and Landscape Gardening. Ministry of Higher Education and Scientific Research, Technical Institutes Authority Technical House Iraq.

Musa, T.N.; Hana, S.A. and Faiq, H.M. (1999). Evaluating the level of some nutrient components for the seeds of Fenugreek plant. Journal of Agricultural Sciences Volume 30 First Issue (Appendix).

Minkel, K. and Kirby, Y. (2000). Principles of Plant Nutrition. Translation of Saadullah Najem Abdullah Al-Nuaimi, Directorate of Dar al-Kutub for printing and Publishing, Mosul University - Iraq.

AL-battal, N. (2005). The Production of Ornamental Plants Protected. Damascus University, Faculty of Agricultural Engineering. 374.

Awad, M.M. and Atawia, R.A. (1995). Effect of foliar sprays with some micronutrients on 'Le- cont' Pear trees, I: tree growth and leaf mineral content. Annals Agric. Sci ., 40(1): 359-367.

Bermejo, H. and Leon, J. (1994). Plant Production and Protection Series. FAO, Rome, Italy. 26: 273-288.

Cockshull, K.E. (1985). Gerbera, I Harvey, A.H., (eds.) Hand book of Flowering, Vol.3. CRC Press. Inc. The USA.

Cresser, M.S. and Parsons, J.W. (1979). Sulphuric-perchloric acid digestion of plant material for the determination of nitrogen, phosphorus, potassium, calcium, and magnesium. Analytical Chemical Material Acta, 109: 431 – 436.

Dobois, M.K.; Crilles, K.A.; Hamiltor, J.K.; Robers, D.A. and Smith, F. (1956). Colorimetric method for determination of sugars and related-substance. Anal. Chem., 28: 350 – 365.

Elkafie, O.M.A.; Mahassen, M.S.; Kasem, M.M. and Shaimaa, M.A. (2016). Improving the Vegetative Growth and chemical Contents of Coriandr (*Coriandrum sativum* L.) Plant dy using Moringa Leaf Extract.J. plant production Mansoura Univ., 7(12): 1357-1363.

Grimstad, S.O. (1995). Low temperature plus effects growth and development of young cucumber and tomato plant, J. Hort. Sci. 70(1) : 75-80.

Hegazi, A.Z.; Ismaiel, A.Y. and Anany, T.G. (2015). Improving Growth and Seed Yield of Squash by Foliar Applications with Moringa Leaf Extract, Ascorbic Acid or Benzyladenine. Egypt. J. Hort., 42(1): 579–590.

Johnson, I. (2002). *Gerbera jamesonii* Adlam. Natal National Botanical Garden. September.

Kanwar, J.K. and Kumar, S. (2008). In vitro propagation of Gerbera- A Review, Hort. Sci. (Prague) 35(1): 35-44.

Kassel, C. (2006). Strawberry diagnostic workshops: Nutrition. Ministry of Agriculture, Food and Rural Affairs.

Kessler, J.R. (2006). Greenhouse Production of Gerbera Daisies, Alabama Cooperative Extension System. ACES Publications: ANR-1144.

Khalifa, R.K.M.; Shaaban, H.A. and Rawia, A. (2011). Effect of Foliar application of zinc sulfate and boric acid on growth, yield and chemical constituents of iris plants. Ozean Journal of Applied Sciences, 4 (2): 129-144.

Khan, M.Q. and Jamil, I.M. (1998). Effect of trace elements on their concentration in soil and wheat leaves. Sarhad. J. Agric., (Pakistan)., 14(2): 121 – 125. (C.F. Al-Taher, F. M.M., 2005. Effect of foliar feeding of Iron, Zinc, and Potassium on growth and yield of wheat *Triticum aestivum* L. (In Arabic).

Mansour, E.H. and El-Adawy, T.A. (1994). Nutritional potential and functional properties of heat-treated and germinated fenugreek seeds Lebensmittel-Wissenschaft und-Technologie, 27(6): 568-572.

Michael, S.R. (2004). Produce Facts Gerbra , Transvaal Daisy. Recommendations for maintaining postharvest quality. University of California, Davis.

Murphy, T. and Riley, J.R. (1962). A modified single solution method for the determination of phosphate in natural water. Analytica Chemical Acta, 27: 31 – 36.

Page, A.L.; Miller, R.H. and Keeney, D.R. (1982). Methods of Soil Analysis Part 2, 2nd Ed. Madison Son, Wisconson, U.S.A., 1159.

Pattanashetti, C.N. (2009). Evaluation of Gerbera Cultivars Under Protected Conditions. M.Sc. Thesis, Depart. Hort. University of Agricultural Sciences, Dharwad.

Prabhu, M.; Kumar, A.R. and Rajamani, K. (2010). Influence of Different Organic Substances on Growth and Herb Yield of Sacred Basil (*Ocimum sanctum* L.). Indian J. Agric. Res., 44(1): 48–52.

United States Department of Agriculture (USDA). (2016). Agricultural Research Service. National Nutrient Database for Standard Reference Release 28 slightly revised May 2016

Walsh, L.M. and Beaton, J.D. (1973). Soil testing and plant analysis. Madison, Wis. : Soil Science Society of America, Inc., 512.