



## Effect of spraying with some plant extracts on vegetative growth characteristics and mineral content of local mulberry seedling leaves *Morus sp*

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### Abstract

The College of Agriculture's Department of Horticulture and Landscape Engineering is a greenhouse where the research was carried out during the 2023-2024 growing season. The research investigated spraying three different doses of licorice root extract and moringa leaf extract, at 0, 4, and 6 mg L<sup>-1</sup>. The seedlings used in the experiment were one year old. The results revealed that the licorice extract had the highest benefits, with a dosage of 6 mg L<sup>-1</sup> outperformed Moringa leaf extract at a concentration of 6 mg in terms of vegetative and chemical moisture (plant height, diameter, number of branches, number of leaves, chlorophyll leaves, total soluble carbohydrates, nitrogen, phosphorus, and potassium), with values of (142.48, 13.85, 4.33, 81.55, 88.70, 68.74, 67.11, 4.30, 0.38, and 1.25), respectively. L<sup>-1</sup> had a significant impact on the vegetative and chemical temperatures of mulberry seedlings. The plants' height, diameter, number of branches, number of leaves, free space, leaf chlorophyll content, total soluble carbohydrates, nitrogen, phosphorus, and potassium were all measured (124.52, 12.93, 4.44, 80.54, 88.07, 8.88, 69.92, 4.41, 0.44, and 0.73). The bulk of accuracy investigations revealed a significant two-way interaction between the two factors.

**Keywords:** Mulberry seedlings. Licorice production. Moringa leaf production.

### Introduction

*Morus spp.* is a deciduous fruit tree that requires a certain temperature in winter and may thrive in practically any soil type. Mulberries are members of the Moraceae family and may be found across Asia, Europe, America, and certain portions of Africa [1] report that at least 100 species are known. Natural extracts are mineral compounds that have helped many plants grow successfully. red mulberry is one of the varieties rich in juice, which is suitable for making juices and jams, while the local white mulberry is characterized by its high content of sugars, total soluble solids and ash, and thus it is useful in cases of anemia, treatment of constipation and fresh consumption [2].

One of these significant plant extracts is licorice juice. Licorice is a perennial plant found across the globe, including Syria, Egypt, Turkey, Central Asia, and Europe [3]. The recreational extract of licorice roots includes a variety of elements, including phosphorus, potassium, calcium, and magnesium, as well as developed iron and manganese. It is one of the most critical components for activating enzymes involved in many growth processes, including photosynthesis, DNA and RNA synthesis, and cell division [4]. The extract also contains various growth stimulants, including as thymine, riboflavin, niacin, vitamin B12, and folic acid, as well as growth regulators like auxins, gibberellins, and cytokinins. Moringa leaves are a natural aqueous extract rich in antioxidants and flavonoid groups as

quercetin, moringa leaf extract is also high in protein, with 19-29% amino acids and vitamins, as well as elevated calcium, copper, and iron levels [5].

Due to a lack of info on mulberry trees and the fact that they are one of the easiest plants to grow in Basra Governorate orchards, the goal of this study was to discover how licorice and Moringa affect mulberry seedling development and the amount of minerals they contain.

## Materials and Methods

### A- Experimental Site

The experiment was conducted up under the plant canopy of the College of Agriculture at the University of Basra during the 2023-2024 season. They spraying licorice root extract and moringa extract on local mulberry seedlings that were over one year old and similar in length. The concentrations were 0, 4, and 6 g L<sup>-1</sup> of both the extracts (Table 1).

Table 1. Some physical and chemical properties of the culture medium sample used in the experiment.

Physical and chemical properties	values
N mg kg <sup>-1</sup>	80.31
P mg kg <sup>-1</sup>	15.00
K mg kg <sup>-1</sup>	112.7
Calcium (mmol L <sup>-1</sup> )	4.32
Organic Matters mg kg <sup>-1</sup>	2.00
Ec (ds m <sup>-1</sup> )	1.55
Ph	7.42
soil separators	
(Clay (g. kg <sup>-1</sup> ))	10.6
(Sand (g. kg <sup>-1</sup> ))	82.4
silt	7.00
soil texture	sandy mix

Source: Own authorship.

### B- Extract Preparation

#### Preparation of Licorice Root Extract

The licorice roots were washed with water, cut into small pieces, and then dried at 65°C until the weight was constant. The pieces were then sieved and the powder was taken to prepare the required concentrations. The concentrations were prepared by dissolving (0, 4, 6) grams in a liter of distilled water at 50°C for 24 hours. Then, a fine-mesh cloth was utilized to filter the extract so that it was able to use in spraying (Table 2).

Table 2. Some components of the licorice roots used in the experiment.

Mineral elements (mg.g <sup>-1</sup> )	Amino acids (mg Kg <sup>-1</sup> )	Other ingredients(%)
N	21.22	Lysine 5.82 Gleiser Heisen 4.00
P	21.30	Phenyl alanine 20.00 Sucrose 1.55
K	46.80	Methionine 4.21 Glucose 3.82
Mg	2.13	Cysteine 22.11 Gebrline 0.64
Fe	0.033	Glycine 7.84 Tannin 3.65
Zn	51.10	Glutamic acid 21.70 Protein 24.40

Cu	5.02	Aspartic acid	17.01	Oils	5.25
selenium	7.82	Hisitidine	6.93		
Co	0.60	Threonine	14.40		
Mn	4.89	Argenine	1.25		

Source: Own authorship.

### Preparation of Moringa Leaf Extract

The Moringa leaf extract was prepared by taking 4g and 6g of dry Moringa leaf powder, according to experimental parameters, and placing it in a 2000 cm<sup>3</sup> conical flask filled with distilled water. The plant material was mixed with the water using an electric mixer for half an hour at laboratory temperature. The mixture was then filtered through a piece of gauze to remove plant residues. It was then placed in a centrifuge at 3000 rpm for 15 minutes to obtain the extract [6], according to Table 3.

Table 3. Some minerals and vitamins in dried Moringa tree leaves [7].

Mineral elements mg 100g <sup>-1</sup> dry weight	Vitamins mg. 100g <sup>-1</sup> dry weight		
Fe	29.1	Vitamin A	19.00
Mg	357	Thiamine (Vitamin B1)	2.65
P	200	Riboflavin (Vitamin B2)	20.5
K	1.322	Niacin (Vitamin B2)	8.3
Zn	3.30	Vitamin C	17.2
Cu	0.55	Other	100g-1 dry weight
Ca	2.00	carbohydrate	39.3

Source: Own authorship.

### C- Concentrations and Spraying Times

Raspberry seedlings were sprayed with concentrations of (0, 4, and 6%) licorice root extract and Moringa leaf extract. The spraying process was carried out in the early morning. The first spraying was on October 30, 2023, the second on November 15, 2023, the third on November 25, 2023, and the fourth on December 4, 2023.

### D- Plant Traits Studied

#### Vegetative Measurements

Vegetative measurements were taken at end of it. Some of the measurements included: - Plant Height (cm). A metric scale was applied to measure the height of the plant from when it grasped the ground to the end of the main stem.

-Stem Diameter (mm)

A Vernier caliper was used to measure stem diameter at the end of the experiment, 5 cm above the soil surface.

-Number of main stem branches

The number of branches was counted manually at the end of the experiment.

-Number of leaves

The number of leaves on the plant stem was counted manually.

-Area estimation (cm<sup>2</sup>).

Leaf area was calculated using a scanner [8]. A

computer and scanner were used, along with the Digimizer program, which measures the area of the leaf image, converts it to a digital image, and then determines its area.

**Chemical measurements**

**A-Nutrient estimation (NPK)**

**Sample Digestion**

Dry and ground plant samples were digested using the [9] technique 200 mg of the samples were put in special volumetric glass flasks for digestion. 5 mL of 98% pure sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) was added to the flask. The samples were incubated in the digestion system at 120°C for 30 minutes. The samples were then chilled before being treated with 3 mL of an acidic mixture made up of 96% concentrated sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) and 4% perchloric acid (HCl<sub>4</sub>). The materials were then fed into the digestion system at 350°C until a clear, transparent solution was formed. The solution was then chilled and transferred to a 50 ml volumetric flask. The amount was then increased to 50 ml with distilled water. This produced samples that were ready for analysis and elemental determination. - Nitrogen Content in Leave (%). The proportion of total nitrogen in seedling leaves was determined using a microkjeldahl equipment, as reported by [10].

- Calculating Phosphorus in Leaves (%)

The amount of phosphorus in mulberry seedling leaves was determined using the yellow color technique, as reported by [11].

- Estimating Phosphorus in Leaves (%)

Phosphorus was determined using a flame-photometer, as reported by [10].

-Estimation of Chlorophyll pigment in mulberry seedling leaves (mg/100g fresh weight).

Chlorophyll content in the fifth leaf from the growing tip at the end of the treatment period was estimated using the method of [12].

- Estimation of total soluble carbohydrates in leaves.

It was calculated this using [13]. modified phenol sulfuric acid and colorimetric method (PSA CM).

**Experiment design and statistical analysis**

The experiment was designed as a factorial with two factors: spraying licorice root extract at three concentrations (0, 4, and 6 g L<sup>-1</sup>) and Moringa leaf extract at three doses (0, 4, and 6 g L<sup>-1</sup>). Three random repetitions. The experiment used a Randomized Complete Block Design (RCBD). The data were statistically analyzed using the digital statistical program Genstat (2012) in accordance with the design provided. The coefficient averages are checked using the least significant difference (LSD, p≤0.05) at the probability level [14].

**Results and Discussion**

**Vegetative Traits Results**

Table 4 shows the impact of spraying licorice root extract and Moringa extract on seedling height. They found that spraying with plant extracts significantly boosted the height of mulberry seedlings. The 6 mg. L-1 licorice root treatment resulted in the biggest increase in seedling height, reaching 124.48 cm, whereas the control treatment resulted in the shortest seedling height, 109.43 cm. The results also demonstrate that spraying with Moringa extract increases seedling height. The 6 mg. L-1 Moringa treatment resulted in the tallest seedlings, reaching 124.32 cm. The two-way interaction was significant, with the interaction treatment of 6 mg. L-1 licorice root and 6 mg. L-1 Moringa yielding the greatest outcomes, reaching 151.47 cm. The results in Table 5 reveal that spraying with extracts had an important effect on the diameter of the seedling's main stem as the extract concentration increased. The levels of 6 mg. L<sup>-1</sup> licorice and Moringa showed the largest increase, measuring 13.85 mm and 12.93 mm, respectively. The interaction of the two extracts had a beneficial effect on increasing stem diameter, with the combination of 6 mg. L<sup>-1</sup> licorice and 6 mg. L<sup>-1</sup> Moringa producing the highest values (14.63 mm).

Table 6 shows the plant extracts' continual help of enhancing attributes. The two spray treatments with 6 mg. L<sup>-1</sup> licorice and Moringa generated the most branches per seedling, reaching 4.33 and 4.44, respectively. The two-way interaction gave the best outcomes, with a treatment dose of 6 mg. L<sup>-1</sup>. 1 liter of licorice root and 6 milligrams of Moringa oleifera produced the greatest results, with seedlings having up to 5 branches apiece.

Table 4. Effect of spraying with plant extracts on plant height (cm) of mulberry seedlings.

licorice extract / Moringa extract	0	4	6	The effect of Moringa
0	109.43	119.71	124.52	109.43
4	138.24	127.19	148.78	119.71
6	142.10	133.87	151.47	124.52
The effect of licorice	117.89	138.07	142.48	--
LSD	Moringa 1.85	licorice 1.85		Interference 3.20

Source: Own authorship.

Table 5. The effect of spraying with plant extracts on the stem diameter (mm) of berry seedlings.

licorice extract / Moringa extract	0	4	6	The effect of Moringa
0	6.37	8.42	11.44	12.16
4	13.79	9.59	12.72	9.54
6	16.32	10.62	14.63	12.93
The effect of licorice	8.74	12.03	13.85	--
LSD	Moringa 0.49	licorice 0.49		Interference 0.85

Source: Own authorship.

Table 6. The effect of spraying with plant extracts on the number of branches (branch/seedling) of mulberry seedlings.

licorice extract / Moringa extract	0	4	6	The effect of Moringa
0	2.33	3.33	4.00	3.11
4	3.00	4.00	4.33	3.77
6	4.00	4.00	5.00	4.44
The effect of licorice	3.22	3.77	4.44	--
LSD	Moringa 0.330	licorice 0.330		Interference 0.571

Source: Own authorship.

The results of Table 7 also show that spraying with extracts has a good impact in increasing the number of leaves in seedlings. The spraying treatment's dosage is 6 mg. L-1 licorice and Moringa remained the most effective in increasing the number of leaves in seedlings, with rates of 81.55 and 80.54 leaves/seedling, respectively, and an interaction treatment of 6 mg. L-1 licorice contains 6 mg. L-1 Moringa generated the best results, with an average of 85.11 leaves per seedling.

Table 7. The effect of spraying with plant extracts on the number of leaves (leaf/seedling) of mulberry seedlings.

licorice extract / Moringa extract	0	4	6	The effect of Moringa
0	65.03	71.19	75.67	75.40
4	78.57	72.66	80.84	74.59
6	82.60	76.93	85.11	80.54
The effect of licorice	70.63	77.36	81.55	--
LSD	Moringa 1.186	licorice 1.186		Interference 2.054

Source: Own authorship.

The results of Table 8 showed the increase in leaf area with increasing concentrations of extracts, as the treatment of 6 mg. L-1 licorice and moringa was superior in this trait as well, and gave the best results, reaching 88.70 and 88.07 cm<sup>2</sup>, respectively. The treatment of the two-way interaction of 6 mg. L-1 licorice and 6 mg. L-1 moringa extract recorded the highest significant increase in leaf area, reaching 93.35 cm<sup>2</sup>.

Table 8. The effect of spraying with plant extracts on estimating the leaf area (cm<sup>2</sup>) of mulberry seedlings.

licorice extract / Moringa extract	0	4	6	The effect of Moringa
0	55.30	78.48	78.98	6880
4	66.53	84.76	91.86	83.81
6	84.57	88.19	93.35	88.07
The effect of licorice	70.92	81.05	88.70	--
LSD	Moringa 0.326	licorice 0.326		Interference 0.565

Source: Own authorship.

Like gibberellins (GA3), licorice extract acts as a growth stimulant, according to the results in the tables above. The high concentration of mevalonic acid, which promotes cell division and elongation while raising vegetative growth metrics (seedling height,

stem diameter, number of branches, number of leaves, and leaf area), is most likely what makes it successful [15]. In addition to its sugar and nutritional content, licorice extract also boosts the activity of several growth-stimulating enzymes, which are readily absorbed by the leaves when sprayed, particularly at high concentrations [15,16]. Elevated doses of Moringa leaf extract improved vegetative growth attributes. This could be as a result of the extract's presence of zeatin, a well-known cytokinin molecule that promotes cell elongation and division, is antioxidant, and controls and distributes the products of photosynthesis and the absorption of nutrients [17]. The extract also includes gibberellic acid, auxins, and the amino acid tryptophan, which serves as a precursor for indole butyric acid synthesis. These hormones increase the development of vegetative components' characteristics by improving the efficiency of their food supply [18].

Results of Chemical Characteristics Table 9 illustrates the impact of applying licorice and Moringa extracts on the total chlorophyll content in the leaves of mulberry seedlings. The highest chlorophyll content (0.74 mg L<sup>-1</sup> per 100 g fresh weight) was obtained by spraying licorice extract at a dosage of 6 mg L<sup>-1</sup>, according to the findings. In this regard, the 6 mg L<sup>-1</sup> remedy of Moringa leaf extract is similarly beneficial, with a maximum value of 8.88 mg L<sup>-1</sup> per 100 g fresh weight. The bidirectional interaction was substantial, with the amalgamation of 6 mg L<sup>-1</sup> licorice and 6 mg L<sup>-1</sup> Moringa producing the highest percentage of total chlorophyll in the leaves (10.05 mg L<sup>-1</sup> per 100 g fresh weight).

The results in Table 10 indicate that the 6 mg L<sup>-1</sup> treatment with 1 mg L<sup>-1</sup> licorice surpassed the other therapies, yielding the highest increase in total soluble carbs, measuring 67.11 mg per 100 grams of dry weight. With 69.92 mg per 100 g dry weight, the 6 mg L<sup>-1</sup> dose of Moringa leaf extract demonstrated the best effectiveness. The interaction was notable, as the combination of 6 mg L-1 licorice and 6 mg L<sup>-1</sup> Moringa yielded the highest total soluble carbohydrate content, measuring 100.60 mg per 100 grams of dry weight.

Tables 11-13 show the impact of licorice extract and Moringa leaves on the leaf levels of NPK, revealing that the 6 mg L-1 treatment outperformed the leaf content of elements, achieving (1.25, 0.38, and 4.30)% for the NPK elements, respectively. The Moringa leaf extract treatment significantly increased the leaf content of elements in correlation with increasing concentration, with the 6 mg L<sup>-1</sup> treatment exhibiting the most substantial increase, reaching 0.73, 0.44, and 4.41 percent for the three NPK components, respectively. The interaction was significant, with the

6 mg L<sup>-1</sup> Moringa treatment resulting in a major increase (1.74%, 0.51%, and 4.54%) in the NPK components.

Table 9. The effect of spraying with plant extracts on the chlorophyll content of leaves (mg/100g/L fresh weight) of mulberry seedlings.

licorice extract / Moringa extract	0	4	6	The effect of Moringa
0	6.81	7.25	7.35	7.49
4	7.57	8.02	9.86	7.79
6	8.09	8.09	10.05	8.88
The effect of licorice	7.14	8.28	8.74	--
LSD	Moringa 0.105	licorice 0.105		Interference 0.182

Source: Own authorship.

Table 10. The effect of spraying with plant extracts on the total soluble carbohydrate content (mg/100g/dry weight) of berry seedlings.

licorice extract / Moringa extract	0	4	6	The effect of Moringa
0	28.38	35.40	37.06	33.83
4	34.01	45.60	72.09	47.54
6	39.11	61.61	100.60	69.92
The effect of licorice	33.61	50.57	67.11	--
LSD	Moringa 0.816	licorice 0.816		Interference 1.413

Source: Own authorship.

Table 11. The effect of spraying with plant extracts on the leaf content of nitrogen (N%) for berry seedlings.

licorice extract / Moringa extract	0	4	6	The effect of Moringa
0	2.86	4.05	4.24	3.72
4	3.89	3.83	4.44	3.95
6	4.40	3.97	4.54	4.41
The effect of licorice	3.71	4.05	4.30	--
LSD	Moringa 0.0558	licorice 0.0558		Interference 0.0966

Source: Own authorship.

Table 12. The effect of spraying with plant extracts on the leaf content of phosphorus element P% for berry seedlings.

licorice extract / Moringa extract	0	4	6	The effect of Moringa
0	0.11	0.35	0.36	0.25
4	0.26	0.25	0.47	0.28
6	0.39	0.24	0.51	0.44
The effect of licorice	0.27	0.32	0.38	--
LSD	Moringa 0.004	licorice 0.004		Interference 0.007

Source: Own authorship.

Table 13. The effect of spraying with plant extracts on the leaf content of potassium (K%) for raspberry seedlings.

licorice extract / Moringa extract	0	4	6	The effect of Moringa
0	0.15	1.86	0.28	0.19
4	0.20	1.92	0.18	1.32
6	0.23	0.20	1.74	0.73
The effect of licorice	0.28	0.76	1.25	--
LSD	Moringa 0.019	licorice 0.019		Interference 0.033

Source: Own authorship.

Tables 9-13 may be used to analyze the results, that show that licorice extract and Moringa leaves have

greater concentration coefficients. The high concentration of minerals, organic acids, and protein in licorice extract could boost leaf life, enhance photosynthetic efficiency, and enhance carbohydrate storage in the leaves [2,19]. The extracts' high level of minerals (nitrogen, phosphorus, and potassium) was due to a lack of nutrients, amino acids, and enzymes that break down complex molecules into simpler forms. Moringa leaf extract, with its high zeathin and purine contents, is one of the most effective organic growth regulators. Zeathin improves the activity of a few antioxidant enzymes, aids cells from aging, raises the production of chlorophyll efficiency, improves photosynthetic efficacy, and boosts leaf carbohydrate content. Moringa leaves include copper, potassium, iron, zinc, phosphorus, and nitrogen. The addition of these nutrients to the extract boosts their concentration in the seedling leaves [20-22].

### Limitation

Limitation includes low sample size due to the new established center.

### Conclusion

The results revealed that the licorice extract had the highest benefits, with a dosage of 6 mg L<sup>-1</sup> outperformed Moringa leaf extract at a concentration of 6 mg in terms of vegetative and chemical moisture (plant height, diameter, number of branches, number of leaves, chlorophyll leaves, total soluble carbohydrates, nitrogen, phosphorus, and potassium), with values of (142.48, 13.85, 4.33, 81.55, 88.70, 68.74, 67.11, 4.30, 0.38, and 1.25), respectively. L-1 had a significant impact on the vegetative and chemical temperatures of mulberry seedlings. The plants' height, diameter, number of branches, number of leaves, free space, leaf chlorophyll content, total soluble carbohydrates, nitrogen, phosphorus, and potassium were all measured (124.52, 12.93, 4.44, 80.54, 88.07, 8.88, 69.92, 4.41, 0.44, and 0.73). The bulk of accuracy investigations revealed a significant two-way interaction between the two factors.

### CRedit

**Author contributions:** Conceptualization; Data curation; Formal Analysis; Investigation; Methodology; Project administration; Supervision; Writing - original draft, and Writing-review & editing- All authors.

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### Conflict of Interest

The authors declare no conflict of interest.

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### Application of Artificial Intelligence (AI)

Not applicable.

### Peer Review Process

It was performed.

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