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ORIGINAL ARTICLE

EFFECT OF EARRING OF THE GROWING TOP AND SPRAYED WITH MAGNESIUM ON THE MORPHOLOGICAL AND FRUITING CHARACTERISTICS OF EGGPLANT (*SOLANUM MELONGENA* L.)

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Abstract: A field experiment was carried out during the 2020 - 2021 agricultural season in the Sub district, east of Samawa city, on the eggplant (*Sulanum melongena* L.) to study the effect of the process of pinching the growing top of the plant, which was given the symbols P_1 and P_0, respectively. The magnesium element was sprayed at four concentrations (0, 0.50, 1.00 and 1.50 $g.L^{-1}$) and the symbols (Mg_0, Mg_1, Mg_2 and Mg_3) were taken respectively. A factorial experiment was applied according to a randomized complete block design (RCBD) with three replications. It was clear from the results that the process of pinching the growing top (P_1) led to a significant increase in the studied traits (number of branches, leaf area, stem diameter, number of fruits and yield of a single plant) in comparison with the control treatment. Increasing the concentration of the magnesium element in the spray solution (1.50 $g.L^{-1}$) when treated with Mg_3 led to an increase in the studied traits in the above, compared to the Mg_0 no-spray treatment. The bilateral interaction between the treatment of the process of earring then growing apex and spraying of magnesium had a significant effect on all studied traits when the treatment P_1Mg_3.

***Key words*:** Pinching the growing top of the plant, Magnesium, Morphological characteristics, Eggplant.

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1. Introduction

Eggplant (*Solanum melongena* L.) belongs to the Solanaceae family. It is one of the main summer vegetable crops, and it is found in the tropical and temperate regions of the world, and its original home is India and China, and then its cultivation spread in the Mediterranean region, North Africa and Spain. Eggplant has an important nutritional value, as each 100 mg of fresh fruits contains 24 calories, 92.7% water, 4.0 g carbohydrates, 1.4 g protein, 0.3 g fat, 1.3 g fiber, 124.0 IU vitamin A, 0.4 mg vitamin B_1, 0.11 mg vitamin B_2, 34.0 mg vitamin B_9, 12.0 mg vitamin C, 18.0 oxalic acid. In addition to mineral salts such as: Potassium, phosphorous, magnesium, calcium, iron, zinc, sodium, sulfur and copper, because of the importance of the eggplant crop, which is one of the soil stressful crops due to the length of its growing season, it was necessary to think about using the foliar feeding technique, and the need to increase crop productivity was one of the main motives for the use of foliar feeding, and here it is necessary to refer to the role and importance of nutrients in plant growth and completion its life cycle. Nutrients, including magnesium, are necessary for biochemical processes, and their deficiency causes physiological damage. Therefore, foliar feeding is one of the most efficient fertilization methods to meet the preparation of the plant's nutrients [Al-Bayati *et al*. (2020)]. In view of the economic importance occupied by the eggplant crop, this study aims to know the effect of the process of pinching the growing top of the plant and the positive role of foliar feeding on the growth and yield of eggplant.

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2. Materials and Methods

A field experiment was carried out in the Super district, east of the city of Samawa, during the agricultural season 2020-2021 on eggplant (*Solanum melongena* L.), where the seeds were sown in cork germination trays on 29 / 9 / 2020, and after the seedlings grew and two pairs of real leaves were formed, the plants were transferred to the plastic house, On 5/11/ 2020 and planted in the form of lines. The distance between a line and another is 75 cm, and between plants is 45 cm. The experimental unit contained 10 plants. A factorial experiment was carried out using a Randomized complete block design (RCBD) with three replications. The study included two factors, the first is the lack of earring the growing apex of the plant (P_0), and the second factor is the lack of earring the growing top of the plant (P_1). The process of spraying the magnesium element was carried out at four levels (0, 0.50, 1.00 and 1.50 g. L^{-1}) and the following symbols were taken (Mg_0, Mg_1, Mg_2 and Mg_3), respectively, after 3 weeks of transferring the plants to the greenhouse. All agricultural operations of the crop were carried out during the growing season. Some morphological and fruiting characteristics were studied, including the number of branches (branch. $Plant^{-1}$), leaf area (dm^2), stem diameter (cm), number of fruits (fruit. $Plant^{-1}$) and the yield of a single plant (kg).

3. Results and Discussion

3.1 Number of branches (branch. $Plant^{-1}$)

The results of Table 1 showed a significant increase in the average number of branches when treating the earring P_1, reaching 6.79 (branch.$Plant^{-1}$) compared to the treatment of no earring P_0, which recorded the lowest mean number of branches, which was 3.95 (branch.$Plant^{-1}$), with a relative increase of 71.95%. The reason for this increase in the number of branches may be attributed to the physiological effects of the process of pinching the developing apex, which led to the encouragement of lateral branching as a result of breaking the phenomenon of apical dominance by stopping the production of auxin hormone in the terminal bud of the plant [Bouras *et al*. (2011), Alnaimi (2011)]. The results of the same table also showed an increase in the number of side branches with an increase in the concentration of magnesium in the spray solution, where the Mg_3 treatment (spraying magnesium at a concentration of 1.50 g. L^{-1}) gave the highest number of side branches, which reached 7.02 (branch. $Plant^{-1}$) compared with the comparison treatment Mg_0, which recorded the lowest number of branches, which amounted to 4.07 (branch.$Plant^{-1}$) with an increase of 72.50%. The increase in the number of branches may be attributed to the main role of the magnesium element increasing the vital activity of the plant, as magnesium enters the formation of the chlorophyll molecule and other auxiliary pigments such as xanthophylls and carotene, which contribute to increasing the absorption of sunlight and improving the efficiency of the photosynthesis process, which leads to an increase in processed carbohydrates in addition, magnesium activates a number of enzymes and coenzymes involved in carbohydrate metabolism and increases plant growth characteristics, including the number of branches [Al-Gburi *et al.* (2019)]. The bilateral interaction between the treatment of earring of the growing top and spraying with magnesium had a significant effect on the character of the number of branches when the treatment P_1Mg_3 which recorded the highest number of branches reached 8.80 (branch.$Plant^{-1}$).

3.2 Leaf area (dm^2)

The results in Table 2 showed that the treatment of the growing top earring increased to a significant level in the characteristic of leaf area. The earring

Table 1: Effect of earring of the growing top, sprayed the magnesium and their interaction on number of branches per plant.

Treatment	Living of spraying magnesium				Rate of treatment
	Mg_0	Mg_1	Mg_2	Mg_3	
P_0	3.34	3.41	3.80	5.23	3.95
P_1	4.80	5.87	7.71	8.80	6.79
Rate of magnesium	4.07	4.64	5.76	7.02	
$L.S.D._{0.05}$	P = 0.573		Mg = 0.810		PMg = 1.146

Table 2: Effect of earring of the growing top, sprayed the magnesium and their interaction on leaves area (dm^2).

Treatment	Living of spraying magnesium				Rate of treatment
	Mg_0	Mg_1	Mg_2	Mg_3	
P_0	43.68	57.03	54.31	70.10	56.28
P_1	65.21	73.78	98.01	119.05	89.01
Rate of magnesium	54.44	65.41	76.16	94.58	
$L.S.D._{0.05}$	P = 6.169		Mg = 8.724		PMg = 12.337

treatment (P_1) recorded the largest average leaf area of (89.01 dm^2), while the non- earring treatment (P_0) gave the smallest average leaf area amounted to (56.28 dm^2) with a relative increase of 58.16%. This increase is attributed to the process of earring the growing top, which encouraged an increase in the number of lateral branches (Table 1), as well as an increase in the number of leaves carried by those branches, which led to an increase in the area of the leaves and this was confirmed by Abed Al- Hussain and Muhammad (2016). From the same table, we note the superiority of spraying with magnesium in the above characteristic. The Mg_3 treatment recorded the largest leaf area of (94.58 dm^2) compared to the Mg_0 treatment, which gave the lowest leaf area of (54.44 dm^2) with relative difference of 73.73%. The reason for this may be due to the contribution of magnesium to the formation of chlorophyll pigment and auxiliary pigments such as carotene and xanthophylls that contribute to trapping light waves and transferring them to chlorophyll, which made the photosynthesis process more efficient in increasing the manufacture of bitter carbohydrates, which reflected positively on the growth of vegetative plants including increasing the leaves area. The results of the bilateral interaction between the treatment of earring the growing top and spraying with magnesium showed a significant effect on the character of leaf area when the treatment P_1Mg_3, where the largest leaf area was recorded at (119.05 dm^2).

3.3 Stem Diameter (cm)

The results in Table 3 showed significant differences in the characteristics of stem diameter of eggplant with the earring of the growing top (P_1) treatment, which gave the largest mean of stem diameter of (2.32 cm), while the treatment of no earring (P_0) recorded the lowest mean of (1.69 cm) and a significant increase of 37.28%. The reason for this increase may be due to the effect of the process of pinching the stem of the plant and stimulating the process of plant cell division and elongation through the renewal of the juvenile stage in the plant and thus increasing the diameter of the stem and this is what was indicated by Cakmak and Yazici (2010) and Slomy *et al*. (2019). In general, the process of tying the developing apex of the main stalk leads to overcoming the phenomenon of apical dominance and giving a strong shape and a solid stalk. From the same table, a significant increase in stem diameter is observed with an increase in the concentration of magnesium in the spray solution. Where the Mg_3 treatment recorded the highest value in this trait, which was (2.45 cm), compared with the Mg_0 treatment, which gave the lowest value for the stem diameter, which was (1.73 cm), with a relative difference of 41.62%. This is attributed to the role of magnesium in the synthesis of many plant compounds such as sugars, proteins, oils and fats. In addition, magnesium contributes to carbohydrate metabolism and transport, as well as helps activate many enzymes, including Carboxylase, Dehydrogenases and Transphosphorylass [Gransee and Fuhrs (2013)], and all this is due to the improvement of vegetative growth characteristics, including increasing the diameter of the stem. The results showed a significant effect of the bilateral interaction between the treatment of earring the growing top of the plant and spraying with magnesium element, as the interaction treatment P_1Mg_3 recorded the highest value of the stem diameter amounted to (2.88 cm).

3.4 Number of fruits (fruit. Plant^{-1})

The results of Table 4 showed that the treatment of earring of the growing top of the plant (P_1) was significantly superior to the characteristic of the number of fruits per plant. The highest number of fruits was recorded (19.74 fruit. Plant^{-1}) compared to the treatment

Table 3: Effect of earring of the growing top, sprayed the magnesium and their interaction on stem diameter (cm).

Treatment	Living of spraying magnesium				Rate of treatment
	Mg_0	Mg_1	Mg_2	Mg_3	
P_0	1.48	1.59	1.68	2.02	1.69
P_1	1.98	2.10	2.33	2.88	2.32
Rate of magnesium	1.73	1.85	2.01	2.45	
$L.S.D._{0.05}$	P = 0.097		Mg = 0.137		PMg = 0.193

Table 4: Effect of earring of the growing top, sprayed the magnesium and their interaction on fruits number of per plant.

Treatment	Living of spraying magnesium				Rate of treatment
	Mg_0	Mg_1	Mg_2	Mg_3	
P_0	11.11	13.89	13.96	15.30	13.56
P_1	17.08	19.25	21.25	21.36	19.74
Rate of magnesium	14.09	16.57	17.60	18.33	
$L.S.D._{0.05}$	P = 1.695		Mg = 2.397		PMg = NS

of no earring (P_0), which gave the lowest number of fruits amounted to (15.56 fruit. Plant^{-1}) with an increase rate of 26.86%. The reason for this increase may be due to the process of pinching the developing apex, which leads to an increase in the number of secondary branches in the plant (Table 1), and thus an increase in the number of fruits carried on these branches, and this is what was indicated by Tripathi *et al*. (2013) and Reda and Muhammed (2016). The same table indicates an increase in the number of fruits of a single plant with an increase in the concentration of magnesium in the spray solution, where the Mg_3 treatment (magnesium spray at a concentration of 1.50 mg.L^{-1}) gave the largest number of fruits amounting to (18.33 fruit. Plant^{-1}) while the comparison treatment recorded the lowest number of fruits reached (14.09 fruit. Plant^{-1}) with a relative difference of 30.10%. This may be attributed to the increase in the leaf area (Table 2) and its role in intercepting and absorbing the largest amount of light energy and converting it into chemical energy through the process of photosynthesis and the production of carbohydrates and their transfer to the knotted fruits. There is no addition to the entry of the magnesium element into the formation of chlorophyll pigment and its auxiliary pigments such as carotene and xanthophyll [Masuda (2008)]. There were no significant effects of the study variables overlap in the number of fruits.

3.5 Plant yield (Kg)

The process of pinching the growing top of the plant significantly affected the trait of the yield of the single plant, as treatment P_1 gave the highest mean of plant yield of 5.586 (Kg. plant^{-1}), while treatment P_0 (not pinching the top) recorded the lowest mean of plant yield of 3.060 (Kg. plant^{-1}) with an increase of 82.55%. The reason for this may be attributed to the increase in the number of fruits (Table 4) as aresult of the process of earring the growing top (Table 5). This is what everyone referred to Reda and Muhammed (2016) and Ghurbat and Abdul Jebbar (2020).

The results of the Table 5 indicate an increase in the yield of single plant with an increase in the concentration of the magnesium element in the spray solution, where the Mg_3 treatment (magnesium spray at a concentration of 1.50 mg.L^{-1}) significantly outperformed all other treatments and recorded the highest average yield of a single plant of 5.691 (Kg. plant^{-1}) with a relative increase of 69.83% compared to the control treatment Mg_0, which gave the lowest average for this trait amounted to 3.351 (Kg. plant^{-1}). This increase may be due to the contribution of magnesium to increasing the activity of the enzyme Ribuluse-1,5 biphosphat carboxylase (Rubisco) and the enzyme Oxygenase, which leads to the formation of the Rubisco activate compound [Masuda (2008)], which increases the efficiency of the carbohydrate manufacturing process by increasing the activity of the photosynthesis process and the transfer of these manufactured materials from the source (leaves) to the downstream (fruits) and increasing the yield of the individual plant. It is noted from the same table that the binary interaction between the study variables did not rise to the level of significance in the trait of the single plant yield.

Table 5: Effect of earring of the growing top, sprayed the magnesium and their interaction on singular plant yield (Kg) of eggplant.

Treatment	Living of spraying magnesium				Rate of treatment
	Mg_0	Mg_1	Mg_2	Mg_3	
P_0	2.060	2.755	3.231	4.192	3.060
P_1	4.642	4.769	5.744	7.190	5.586
Rate of magnesium	3.351	3.762	4.488	5.691	
L.S.D.$_{0.05}$	P = 0.502		Mg = 0.709		PMg = NS

4. Conclusion

The results of the search indicate the possibility of using earring of the growing top of the plant plus the concentration magnesium (1.50 mg.L^{-1}) where gave the results beneficial in increasing attribute the vegetative growth and yield of eggplant.

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