

Impact of GROW MORE Fertilizer and BioHealth Biostimulant on *Mirabilis jalapa* L. Growth and Flowerin

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Summary

The experiment was conducted in the shade of the College of Agriculture at the University of Basra during the 2025-2026 agricultural season to investigate Impact of GROW MORE fertilizer and BioHealth biostimulant,, on the Growth and flowerin of *Mirabilis jalapa* L. The treatments were designated in a factorial experiment using a completely randomized block design with three replications, and the means were analyzed using the least significant difference test at a significance level of 0.05. The findings indicated a substantial impact of applying the compound fertilizer Grow More at a concentration of 4 g/L on all examined characteristics, including plant height, stem diameter, leaves.plant⁻¹, flower. Plant⁻¹, branches .plant⁻¹, leaves chlorophyll content, and leaves carotene content. The optimal values for the examined features were 56.19 cm, 2.07 mm, 124.00 leaf . plant⁻¹, 22.33 flower .plant⁻¹, 20.89 branches . plant⁻¹, 14.02 mg per 100g, and 1.599 mg per 100g, respectively. The application of the Biohealth biostimulant on the plants at a dosage of 6 ml/L led to a substantial enhancement in all examined characteristics, achieving peak values of 55.79 cm, 2.05 mm, 124.33 leaf . plant⁻¹, 22 flower . plant⁻¹, 20.02 branches . plant⁻¹, 14.47 mg/100g, and 1.569 mg/100g, respectively. The interaction between the two experimental variables significantly influenced all examined attributes.

Keywords: Grow more fertilizer, Biohealth biostimulant, *Mirabilis jalapa* .

Introduction

The plant *Mirabilis jalapa* (Lalla Abbas) belongs to the Nyctaginaceae family. Native to the southern United States, Mexico, and Peru, it is referred to a "four o'clock plant" for it blooming after 4:00 PM in the summer. It is a perennial plant that can reach a height of over half a meter. Its roots are taproots, and its leaves are green, ovate, opposite, and pointed. The small, Trumpet-shaped flower show a mix of color, including white, purple, and yellow, the latter being the most common in Iraq. Sometimes, its seeds produce plants with flowers of a different color than the parent plant, and a single flower may even have two colors due to cross-pollination by

insects. The plant tolerates high temperatures and drought. It produces spherical, wrinkled, black seeds that fall from the plant over maturity to then germinate into new plants. The plant propagates by seed in the spring and is fast-growing and easy to care for [2]. This plant is an excellent diuretic ;it promotes increased urin production, giving the leaf juice to patients suffering from bladder inflammation and urinary retention . The leaf juice is directly applied to the skin to treat infections like rashes or boils to promote fast healing .it is also used to treat wounds and cuts on the skin, The root of plant has diuretic, anti-inflammatory, anti-tumor, laxative, and anti-poison properties[25]

Compound chemical fertilizers (NPK) play an important role for plants as they provide the elements necessary for growth and production. Nitrogen promotes vegetative growth, while phosphorus is a key component of energy compounds, nucleic acids, phospholipids, and coenzymes. Potassium increases plant resistance to diseases and prevents excessive water loss[14]. [16,3] indicated that adding NPK compound fertilizer at a rate of 0, 25, 50, and 100% to the soil resulted in the highest values for vegetative growth characteristics (plant height, number of leaves, number of branches, leaf area, and leaf dry weight) and the highest total chlorophyll content in basil (*Ocimum basilicum* L.). [6] also demonstrated that adding NPK fertilizer at a rate of 8 g/pot significantly affected plant height, number of secondary branches, total leaf chlorophyll content, percentage of vegetative dry weight, flower number, and flower diameter in *Tagetes erecta*. Furthermore, the microorganisms in the biostimulant improve soil properties through their metabolic and biological activity, as well as by increasing the availability of nutrients to the plant [20]. Humic acids also increases plant growth and facilitates the ,such as Nitrogen and Phosphor .furthermor, it serves as acomplementary source of polyphenols during the early stages of plant development[23]. It has a positive effect on plant growth, such as cell elongation, increased cell membrane permeability, improved cell division, increased production of plant enzymes, and stimulation of intracellular enzymatic reactions. [22,24] It was determined that the application of humic acid at concentrations of 0, 2, 3, and 4 mg/L to *Dahlia hyprida* plants resulted in a notable enhancement in plant height, leaf count, leaf area, and number of vegetative branches, particularly at the 4 mg/L concentration. Additionally, [9]it was observed that the application of the

biostimulant BioHealth to *Tecoma stans* L. at a concentration of 5 g/L significantly improved all vegetative and floral attributes.. The soil application method yielded better results than the spraying method. Given the importance of *Mirabilis jalapa* L. as an ornamental plant due to its numerous and beautiful flowers and its use in medicinal treatments, The study was performed to determine the effect of spraying with the GROW MORE compound fertilizer and the biostimulant BioHealth, identify the optimal concentrations for improving vegetative and floral growth characteristics, and understand the effect of their interaction in enhancing these characteristics.

Materials and Methods

The experiment was carried out in the greenhouse of the College of Agriculture, University of Basra, during the 2025-2026 growing season. Seeds were sown on January 3, 2025, in 209-cell Styrofoam trays filled with a 1:1 growing medium consisting of river sand and peat moss. Seedlings were transplanted after developing two pairs of true leaves into 25 cm diameter pots. Table(1) shows the fertilizer's components.

The factorial experiment (3×3) involved spraying the plants with GROW MORE compound fertilizer, a 20-20-20 neutral NPK fertilizer manufactured in the USA. Table (2) shows physical and chemical properties of peat moss used as a growing medium,.product by substrate 1 (SAB) of Germany. The concentrations used in the experiment were 0, 2, and 4 g/L in three applications, with the first application on March 5, 2025. The plants were also sprayed with the biostimulant BioHealth in three applications at concentrations of 0, 3, and 6 ml/L, with the first application on March 7,

2025. The interval between applications was 10 days. The plants were fully treated in the early morning. The control treatment was sprayed with distilled water only. The experiment was conducted according to a

Table (1) shows some of the components of GROW MORE fertilizer used in the experiment

S.No	Chemical substance	Concentration
1	Boron(B)	0%
2	Copper(Cu) Chelated Copper	0.5% 0.05%
3	Total nittogen Ammonical Nitrogen Urea Nitrogen Nitrate Nitrogen	20.00% 3.9% 10.2% 5.9%
4	Available phosphate(p_2O_5)	20.00%
5	Chelated iron Manganese(Mn)	0.10% 0.05%
6	Iron(fe)	0.10%
7	Chelated Mangnese Molybdenum(Mo) Zinc(zn)	0.05% 0.0005% 0.05%
8	Chelated Zinc Soluble potash(k_2O)	0.05% 20.00%
9	Calcium(Ca)	0.05%
10	Magnesium(Mg) Chlated Magnesium	0.10% 0.10%
11	Sulfur(S) combined	0.20%

Randomized Complete Block Design (RCBD) with three replications. Means were compared using the Revised Least Significant Differences (R.L.S.D) method at a probability level of 0.05 [8].

Table(2)shows physical and chemical properties of peat moss used as a growing medium.

Attributes of agrowth medium	Value (reading)
PH	5.7-6.5
Salt content $mg.L^{-1}$ (	0.7-0.9
N($mg.L^{-1}$)	70.160
P($mg.L^{-1}$)	70.180
K($mg.L^{-1}$)	80-190
Organic Matter%	0.7-0.9

Studied Characteristics

1- Plant Height (cm)

The plant height was assessed from the soil surface to the apex of the plant with a measuring tape.

2-Stem Diameter (mm)

The stem diameter of the plants was measured using a vernier caliper.

3- leaves . $plant^{-1}$:the total number of leaves for each experimental unit was computed and its averaged was recorded.

4- flowers. $plant^{-1}$:

The number of flowers for each plant in the experimental unit was calculated and averaged.

5- Branches. $plant^{-1}$

The total number of branches for each plant was calculated and averaged.

6- Chlorophyll a, chlorophyll b, total chlorophyll and carotenoids in the leaves were measured according to [21], where 0.5 g was incubated with 10 ml of acetone at a ratio of 80% overnight at a temperature of 4 degrees Celsius. The following day, it was filtered and the volume was increased to 30 ml. It was measured at specified wavelengths of 663, 645, and 452 nanometers. The pigment concentrations were calculated according to [4]. using the following equations:

$$\text{Chlorophyll a (mg/100g)} = (10.3 \times A_{663} - 0.92 \times A_{645}) / 1000 \times 30 / 0.5 \times 100$$

$$\text{Chlorophyll b (mg/100g)} = (19.7 \times A_{645} - 3.87 \times A_{663}) / 1000 \times 30 / 0.5 \times 100$$

$$\text{Total chlorophyll (mg/100g)} = \text{Chlorophyll a} + \text{Chlorophyll b} [11]$$

$$\text{Carotenoids (mg/100g)} = (4.2 \times A_{452}) - (0.026 \times \text{Chlorophyll a}) + (0.426 \times \text{Chlorophyll b}) / 1000 \times 30 / 0.5 \times 100$$

Results and Discussion

1- Plant Height (cm)

Table (3) shows that spraying plants with the compound fertilizer Grow more had a significant effect on plant height, giving the highest plant height of 56.19 cm at a concentration of 4 g/L, while The control treatment was the lowest average plant

height of 45.74 cm. This may be due to nitrogen's role in increasing nucleic acid synthesis, the synthesis of proteins that stimulate cell division, and the increase in leaf primordia [12]. Potassium also plays a significant role in activating enzymes involved in carbohydrate synthesis [18]. This is consistent with the findings of [6], on the Jaafari plant, As for spraying plants with the biostimulant Biohealth, it had a significant effect on plant height, giving the highest height of 55.79 cm at a concentration of 6 ml/L, while the control treatment gave the lowest height of 47.86 cm. The reason for the increase in plant height is attributed to the fact that the humic acid in humic acid is rich in nitrogen, which is involved in the building of proteins, nucleic acids (DNA, RNA), and coenzymes that contribute to activating vital activities within plant tissues, which is reflected positively in increasing plant height [7]. These results are consistent with [5] on pepper plants (*Capsicum annuum* L.). The relation between the two factors significantly influenced the usage of the compound fertilizer Grow More at a concentration of 4 g/L and the biostimulant Biohealth at a level of 6 ml/L, giving an average height of 64.25 cm.

Table (3) show Impact of GROW MORE fertilizer and BioHealth Biostimulant on plant height (cm) of the *Mirabilis jalapa*.

Gro.mo Bio ml/l	0	2	4	Average Bio
0	41.34	43.90	58.36	47.86
3	45.77	65.12	45.97	52.28
6	50.11	53.01	64.25	55.79

Average of Gro.mo	45.74	51.01	56.19	
L.S.D	Gro.mo= 1.54	Bio= 1.54	overlap 2.31=	

2- Stem Diameter (mm)

Table (4) indicates that the application of the Grow More compound fertilizer at a concentration of 4 g l⁻¹ produced the largest average stem diameter of 2.07 mm, exhibiting a significant difference. The control treatment yielded the smallest stem diameter at 1.26 mm. This is consistent with the results of [3] on tulip plants. The number further demonstrates those plants administered Biohealth at a dose of 6 ml/L

had the greatest stem diameter, measuring 2.05 mm. The control treatment had the smallest diameter at 1.28 mm. The interaction between the two experimental factors significantly influenced this trait, leading to an increase in stem diameter of 2.46 mm at both the 4 g/L concentration of Grow more and the 6 ml/L concentration of Biohealth. The combined effect of the two experimental factors was significant in this characteristic.

Table (4) show Impact of GROW MORE fertilizer and BioHealth Biostimulant on the stem diameter (mm) of the *Mirabilis jalapa*.

Gro.mo Bio ml/l / gm/l	0	2	4	Average Bio
0	0.96	1.33	1.57	1.28
3	1.32	2.02	2.18	1.84
6	1.52	2.17	2.46	2.05
Average Gro.mo	1.26	1.84	2.07	
L.S.D	Gro.mo= 0.11	Bio=0.11	Overlap 0.21=	

3- leaves.plant⁻¹

Table (5) shows significant rise in leaves number when plants were treated with the compound fertilizer Grow More at a level of 4 g/L reaching 124.00 leaf.plant⁻¹. In contrast, the control treatment yielded the minimum level of leaves, in 84.33 leaves.-1 plant. Spraying the biostimulant Biohealth to the plants at a concentration of 6 ml/L

also resulted in a significant increase in the number of leaves, reaching 124.33 leaf.plant⁻¹, compared to the lowest value given by the control treatment, which was 85 leaf.plant⁻¹. The interplay between the two experimental variables significantly influenced The increase in leaf growth seen in plants treated with the compound fertilizer Grow More at a level of 4 g/L and

the biostimulant Biohealth at a maximum of 142 leaves per plant. concentration of 6 ml/L, yielded a Table (5) show Impact of GROW MORE fertilizer and BioHealth Biostimulant on the leaves.plant⁻¹ of the *Mirabilis jalapa*.

Gro.mo Bio ml/l	0	2	4	Average Bio
0	76	84	95	85
3	82	124	135	113.66
6	95	136	142	124.33
Avarage of Gro.mo	84.33	114.66	124.00	
L.S.D	Gro.mo= 3.63	Bio=3.63	Overlap 4.52=	

4- flowers.plant⁻¹

The results in Table (6) indicates a substantial increase in the number of blooms produced in plants treated with compound fertilizer. Increase growth. The largest number of flowers was obtained at a concentration of 4 g/L, at 22.33 flowers.plant⁻¹. The control treatment yielded the lowest blossom count, with 12.33 blossoms per plant. This is due to the function of nitrogen in the formation of amino acids, particularly tryptophan, which is the primary precursor in auxin production. This may induce a hormonal equilibrium that enhances cellular division and elongation activity. Moreover, nitrogen contributes to establishing equilibrium between

synthesized carbohydrates and assimilated nitrogen, facilitating the formation and growth of flower buds, shown by an increase in bloom quantity [1]. This aligns with the findings presented in [10]. In the Lalla Abbas plant, application of the biostimulant Biohealth at a concentration of 6 ml/L yielded the maximum flower count, totaling 22 blossoms per plant, while the control treatment resulted in the minimum, with 13.33 flowers per plant. The interaction between the compound fertilizer Grow More at a dosage of 4 g/L and The biostimulant Biohealth, at a concentration of 6 mL/L, also had a substantial impact on the number of flowers, with the highest rate of 26 flowers per plant.

Table (6) show Impact of GROW MORE fertilizer and BioHealth Biostimulant on the flowers.plant⁻¹ of the *Mirabilis jalapa*.

Gro.mo gm/ Bio ml/l	0	2	4	Average of Bio
0	9.00	13	18	13.33
3	12	22	23	19
6	16	24	26	22
Avarage of Gro.mo	12.33	19.66	22.33	
L.S.D	Gro.mo= 2.31	Bio=2.31	Overlap 3.11	=

5- branches .plant⁻¹

Table (7) indicates a significant effect when the compound fertilizer is applied to plants Grow more. which yielded the maximum result in the number of branches at a concentration of 4 g/L, reaching 20.89 branches. Plant⁻¹. The control treatment, on the other hand, gave the lowest value in the number of branches, averaging 16.47 branches. Plant⁻¹. These results are consistent with the findings of [17].on mustard plants, *Brassica albal* L. Plants treated with the biostimulant Biohealth at a concentration of 6 ml/L showed superior branch formation, yielding an optimum value of 20.02 branches .plant⁻¹, while the control treatment produced a minimal number of branches, averaging 17.67

Table (7) shows Impact of GROW MORE fertilizer and BioHealth Biostimulant on the branches.plant⁻¹ of the *Mirabilis jalapa*.

branches .plant⁻¹. The reason for the increase in the number of branches is attributed to the increased humic acid content, which enhances the plant's biological activity by stimulating enzyme systems and increasing the formation of nucleic acids (DNA, RNA, and TRNA), which in turn stimulate the formation of new growth. Cytokinins stimulate rapid cell division, which in turn encourages the formation of lateral shoots [19]. The interaction between the two experimental elements significantly influenced this feature when treated with the compound fertilizer Grow More at a dose of 4 g/L and the biostimulant Biohealth at a concentration of 6 mL/L, yielding 23.65 branches .plant⁻¹.

Gro.mo Bio ml/l	0	2	4	Average of Bio
0	9.34	21.65	22.04	17.67

3	19.77	20.02	16.98	18.92
6	20.30	16.11	23.65	20.02
Average of Gro.mo	16.47	19.26	20.89	
L.S.D	Gro.mo= 1.56	Bio= 1.56	Overlap 2.72=	

6- Total chlorophyll content in leaves (mg/100g)

Table (8) indicates an elevation in total chlorophyll content in leaves after treatment with the compound fertilizer Grow More at a dosage of 4 g/L. The maximum concentration was 14.02 mg/100g, while the control treatment resulted in the lowest total chlorophyll content of 10.84 mg/100g. This may be due to the role of nitrogen, which is involved in the synthesis of porphyrins, an important component in chlorophyll production [13]. The same data indicates an elevation in the overall chlorophyll content of leaves subjected to the Biohealth biostimulant at a concentration of 6 ml/L, yielding the highest value of 14.47 mg/100g compared to the lowest control value of 11.32 mg/100g. This is attributed to the humic acid present in the biostimulant,

which increases the permeability of cell membranes, thus facilitating the passage of elements, including nitrogen, which is involved in the synthesis of the four porphyrin groups that make up chlorophyll, and manganese, which aids in chlorophyll synthesis by reducing nitrates within the plant through its action as an enzyme modifier for nitrite reductase and hydroxylamin reductase. This ensures the availability of adequate quantities of nitrogen, the main component of the chlorophyll molecule. Regarding [15]. The interaction among the experimental parameters significantly influenced the total leaf chlorophyll content when treated with the compound fertilizer Grow More at a dosage of 4 g/L and the biostimulant Biohealth at a concentration of 6 ml/L, achieving 15.67 mg/100 g.

Table (8) shows Impact of GROW MORE fertilizer and BioHealth Biostimulant on the total leaves chlorophyll content of the *Mirabilis jalapa*.

Cro.mo Bio ml/l / gm/l	0	2	4	Average of Bio
0	8.97	11.98	13.01	11.32
3	10.41	12.51	13.39	12.10
6	13.15	14.59	15.67	14.47

Avarage of Gro.mo	10.84	13.02	14.02	
L.S.D	Gro.mo= 0.91	Bio= 0.91	Overlap 1.21=	

6- Leaves Carotene Content (mg/100g)
Table (9) indicates that the application of the compound fertilizer Grow More at a concentration of 4 g/L significantly enhanced leaves carotene content, yielding a peak value of 1.599 mg/100g. In contrast, the control therapy had the lowest outcome of 0.868 mg/100g. At a level of 6 ml/g, the biostimulant Biohealth resulted in an increase in the carotene content of the foliage of plants. achieving a

maximum average of 1.569 mg/100g, while the control treatment produced the lowest average of 0.879 mg/100g. The interaction effect of the experimental variables on this characteristic was significant between the treatment with Grow More at a dosage of 4 g/L and therapy with Biohealth at a concentration of 6 ml/L. with the highest average recorded for the latter. 1.988 milligrams per 100 grams.

Table(9)show Impact of GROW MORE fertilizer and BioHealth Biostimulant on the leaf carotene content of the *Mirabilis jalapa* L..

Gro.mo Bio ml/ l	0	2	4	Average of Bio
0	0.786	0.887	0.964	0.879
3	0.885	1.346	1.845	1.358
6	0.933	1.787	1.988	1.569
Avarage of Gro.mo	0.868	1.34	1.599	
L.S.D	Gro.mo= 0.10	Bio= 0.10	Overlap 0.16=	

Conclusion:

This research found that utilizing Growmore fertilizer at a dosage of 4gm/l and BioHealth Biostimulant at a concentration of 6ml/l increased vegetative and blooming of the plant.

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