

THE EFFECT OF BIOFERTILIZER AND COMPOST ON THE GROWTH OF ROSEMARY PLANTS

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Abstract. *The research was conducted in the Hussainiya Holy Shrine nursery to find out the effect of organic and biological mixtures on the growth of rosemary plants, as two factors were used in the experiment (Compost and Biohelth) and each factor had four levels. The second Biohelth (5, 10 and 15) g.l-1 in addition to the control treatment. The experiment was designed according to a completely randomized C.R.D design and for three replicates, each replicate contained three plastic pots and one plant per pot. The L.S.D test was adopted to determine the level of significance among the experimental treatments. The results showed that the interaction between compost + Biohealth treatment was superior to all treatments if the treatment gave 30% compost + Biohealth 10 g.l-1 the highest significant increase for plant height, number of leaves, number of vegetative branches, dry weight of vegetative total, root length and number of roots (64.67cm, 31.33 leaf, 25.88 branch, 6.67 gm, 19.3 cm, 53.00root respectively).*

Keywords: *Rosemary, Compost, Biohealth*

1.INTRODUCTION

Rosemary is one of the plants belonging to the Lamiaceae family. It is a shrubby or herbaceous perennial plant with a height of approximately 1-2 m, Its stems branch from the base from directly above the ground, evergreen, woody with a thin cylindrical diameter. The plant bears bisexual flowers of pale blue color, and some of them are colored, They are white and are all small in size with a beautiful aromatic and distinctive smell, as these flowers are located on cluster inflorescences either terminal or side, and the leaves of the plant are in the form of groups distributed on the stem, as each group contains three leaflets

perpendicular or opposite on the branch, The Mediterranean and southern Europe is the original home of the plant, and its cultivation extended from those areas to the rest of the world [1]. It is one of the most effective medicinal plants because of its many benefits, so that it was named the herb of the year 2001 by the International Herbal Association, as it prevents memory loss and treats cases of indigestion and circulatory disorders. It is considered a sedative for joint pain, a diuretic, treats headaches, calms nerves and resists bad breath and stomach disorders, etc [2]. The use of alternative safe sources, including organic and biological fertilization, by staying away as much as possible from chemical fertilizers and the harm they cause to the environment, humans and soil, in addition to using these safe alternatives for the purpose of producing safe crops free of chemical pollutants, especially since the living organisms used in composting have an effective role in eliminating organisms. The pathogenic microflora makes the plant resist stress conditions, in addition to improving the properties of the soil and making it cheaper[[3,4]. In addition to the major role in improving soil quality and developing agricultural production levels[5]. The study aimed to expand the cultivation of the plant rosemary due to its aesthetic, medical and industrial importance, in addition to enhancing the role of safe alternative fertilizers and avoiding chemical fertilization and trying to create a biological organic mixture and studying its impact on growth.

2. MATERIALS AND METHODS

2.1 MATERIALS

The factorial experiment was conducted according to Randomized Complete Blocks Design (R.C.B.D) in This experiment was conducted in a house covered with a layer of saran allocated for the purpose of studying the effect of adding organic and biological fertilizers and their interaction on the growth of rosemary plants. Small after preparing the cultivation medium and bio-fertilizer. On August 12, 2021, the seedlings were separated and transferred to plastic pots with a diameter of 28 cm, with one plant per pot, and the soil pressure was well taken into account when transferring the seedlings to prevent the seedling from moving, taking into account the conduct of all service operations that were applied during the experiment period.

2.1.1 COMPOST OF PREPARATION

Different levels of compost were used, which is the remnants of palm fronds prepared in the organic fertilizer preparation project of one of the organic farming centers in the province of Babylon by three levels were used, which are (10, 20 and 30) % of the weight of potting soil, and addition to the control treatment.

2.1.2 .BIOHEALTH FERTILIZER PREPARATION

The used in experiment of study the ready-made biofertilizer were prepared, which is a powder of German origin in a plastic bottle of 1 Kg and it is a group of micro-organisms present in an inactive form, the biological preparation was dissolved in water The chlorine-free distiller is completely dissolved with the addition of a spoonful of molasses per liter for the purpose of providing the energy needed by the microorganisms after taking the required weights of the preparation and then preparing the four concentrations (5, 10 and 15) g liter⁻¹, specifically on 8/8/2021, and then put In sealed plastic containers, even before adding them to the planting medium, 3 additions were added to the potted soil during the experiment period, the difference between one addition and another followed by 21 days and according to the fertilizer recommendations of the manufacturer. The powder content the Bacteria of *Bacillus* spp. and *Trichoderma* spp. fungi and supplemented with some nutrients.

2.1.3 TREATMENTS AND EXPERIMENTAL DESIGN

A factorial experiment (4×4) was carried out according to the C.R.D design. And with three replicates, each replicate contained three pots with one plant per pot, such as the first factor compost (30,20,10,0% of the weight of the anvil) and the second factor Biohelth (15,10,5,0) g.l-1, The data were analyzed according to GenStat 2008 program and the averages were compared according to the least significant difference (LSD). At the 0.05% probability level[6].

2.2 METHODS

2.2.1 PLANT HEIGHT (CM)

Measure from the point of contact of the plant with the potting soil to the top of the plant for each plant and then extract the average.

2.2.2 NUMBER OF LEAVES (LEAF/PLANT⁻¹)

The number of leaves for each plant was calculated from the frequency and then the average was extracted.

2.2.3 NUMBER OF VEGETATIVE BRANCHES (BRANCH / PLANT⁻¹)

The number of branches for each plant was calculated from the frequency and then the average was extracted.

2.2.4 THE DRY WEIGHT OF THE VEGETATIVE GROUP (GM)

one plant was taken from each repetition at random and the root system was separated from it, and after washing it well with water to remove dust, the wet weight was measured, and then dried in the electric oven (Oven) at a temperature of 70 ° C until the weight was stable, then Measure the dry weight of each plant with a sensitive scale and extract the average.

2.2.5 MAIN ROOT LENGTH (CM)

This trait was measured after the end of the research experiment, specifically on 10/4/2022, as the plants were removed from the pot after selecting one plant from each repetition of each treatment at random, then the plants were washed well with water to remove dust and plankton, then Measurement was carried out with a metric tape from the crown region to the terminal end of the root.

2.2.6 NUMBER OF ROOTS (ROOT-PLANT⁻¹)

The number of sub-roots of each plant in the repetition was calculated and then the average was extracted.

3.RESULTS AND DISCUSSION

3.1 RESULTS

3.1.1 PLANT HEIGHT (cm):

The characteristic of the height of the plant is an important characteristic as it is one of the distinctive indicators that express the strength of vegetative growth, which is related to the strength of cell division and its elongation, which in turn is affected by the quality and quantity of nutrients absorbed by the plant. The height of the plants treated with compost organic fertilizer, as the plants treated with

compost outperformed 30% of all treatments significantly and gave the highest rate of 44.08 cm, while the comparison treatment gave the lowest rate of 35.42 cm, and the treatment of the plant with Biohealth resulted in significant differences for the same aforementioned trait, where the treated plants outperformed Biohealth 10 gm on all treatments except for treatment 15 gm, which gave an average of 40.41 cm, as there were no significant differences between them, while treatment (10) gm gave the highest average, which amounted to 42.00 cm, while the comparison treatment gave the lowest average of 36.17 cm. As for the interaction of the two factors of the study, Compost + Biohealth, the results of the same table showed that the overlap treatment 30% compost + 10 gm. Biohealth over all the interaction treatments, as it gave the highest rate of 53.00 cm, while the comparison treatment gave the lowest rate of 34.33 cm.

Table 1. The effect of Biohealth fertilizer and compost and their interaction on the height of rosemary plants (cm)

compost (%)	Biohealth (mg.L ⁻¹)				compost rate
	0	5	10	15	
0.0	34.33	35.67	35.33	36.33	35.42
10	35.33	36.67	38.33	38.33	37.25
20	37.33	37.33	41.00	43.33	39.75
30	37.67	42.00	53.00	43.76	44.08
Average Biohealth	36.17	37.92	42.00	40.41	---
L.S.D 0.05	compost	Biohealth	interaction		---
	2.506	2.506	5.012		---

3.1.2 NUMBER OF LEAVES (LEAF⁻¹)

It is evident from Table No. (2) that the treatment of the plant with compost had a significant effect on the number of leaves of the rosemary plant, as the plants treated with compost reached 30%, the highest rate of 555.0 leaves, and thus significantly outperformed all treatments, while the comparison treatment gave the lowest average of 426.9 leaves, as well as the effect The addition of Biohealth to the planting medium was significant in the same trait, so the plants of the 10 gm treatment achieved the highest rate of 522.1 leaves, outperforming all treatments except for the 15 gm plants of Biohealth, which achieved an average of 509.6 leaves, as no significant differences were recorded between them, while the comparison treatment recorded The lowest rate was 382.4 sheets.

Regarding the interaction between the two research factors, Compost + Biohealth, the overlap treatment 30% compost + 10 gm Biohealth achieved the highest average of 719.3 sheets of paper, outperforming all treatments, while the comparison treatment gave the lowest average of 329.0 sheets.

Table (2) The effect of Biohealth fertilizer and compost and their interaction on the number of leaves of rosemary plants (leaf¹)

compost (%)	Biohealth (mg.L ⁻¹)				compost rate
	0	5	10	15	
0.0	329.0	418.7	420.0	540.0	426.9
10	413.3	426.7	424.7	393.3	414.3
20	392.0	500.0	525.0	568.3	496.3
30	395.3	568.7	719.3	536.7	555.0
Average Biohealth	382.4	478.5	522.1	509.6	---
L.S.D 0.05	compost	Biohealth	interaction		---
	20.21	20.21	40.41		---

3.1.3 NUMBER OF VEGETATIVE BRANCHES (PLANT⁻¹ BRANCH)

It is evident from Table No. (3) that the treatment of the plant with compost had a significant effect on the number of vegetative branches of rosemary, as the plant treated with compost reached 30%, the highest rate of 5.33 branches, and thus significantly superior to all treatments, while the comparison treatment recorded the lowest rate of 4.00 branches Whereas, adding biohealth to the cultivation medium had a significant effect on the number of branches, as the treatment plant 10 gm achieved the highest rate of 5.17 branches, outperforming all treatments, while the comparison treatment recorded the lowest rate of 3.83 branches.

The effect of the interaction between the two factors of the study, Compost + Biohealth, significantly in the characteristic of the number of vegetative branches. The intervention treatment achieved 30%, Compost + 10 gm Biohealth, the highest rate for the aforementioned trait, which amounted to 6.67 branches, thus outperforming all treatments. The lowest rate for this trait was recorded among the comparison plants, at a rate of 2.67 branches.

Table (3) The effect of Biohealth fertilizer and compost and their interaction on the number of vegetative branches of rosemary plants (Plant⁻¹)

compost (%)	Biohealth (mg.L ⁻¹)				compost rate
	0	5	10	15	
0.0	2.67	3.67	4.33	5.33	4.00
10	3.67	4.33	5.33	4.33	4.42
20	4.33	4.67	4.33	5.00	4.58
30	4.67	4.67	6.67	5.33	5.33
average Biohealth	3.83	4.33	5.17	5.00	---
L.S.D 0.05	compost	Biohealth	interaction		---
	0.657	0.657	1.315		---

3.1.4 VEGETATIVE DRY WEIGHT (gm):

The results in the statistical analysis presented in Table (4) indicate that there are significant differences for the dry weight characteristic of the vegetative group treated with compost, as 30% of the plants treated with compost outperformed all treatments significantly, giving the highest rate of 21.96 g, while the comparison treatment gave the lowest rate of 15.20 g. The treatment of the plant with Biohealth also led to significant differences for the same trait referred to, where the plants treated Biohealth (15) gm. outperformed all treatments at a rate of 20.87 g, while the comparison treatment gave the lowest rate of 11.67 gm.

As for the interaction between the two factors of the study, Compost + Biohealth, the results of the same table showed that the overlap treatment 30% Compost + 10 gm. Biohealth over all the interaction treatments, as it gave the highest rate of 25.88 g, while the comparison treatment gave the lowest rate of 8.50 g.

Table (4) The effect of Biohealth fertilizer and compost and their interaction on the dry weight of the vegetative mass of rosemary plants (gm.)

compost (%)	Biohealth (mg.L ⁻¹)				compost rate
	0	5	10	15	
0.0	8.50	4.59	14.59	23.10	15.20
10	14.34	14.90	14.88	14.00	14.53
20	8.70	22.70	23.00	23.45	19.46
30	15.13	23.90	25.88	22.92	21.96
average Biohealth	11.67	19.02	19.59	20.87	---
L.S.D 0.05	compost	Biohealth	Interaction		---
	1.020	1.020	2.041		---

3.1.5 ROOT LENGTH (cm):

The results in the statistical analysis presented in Table (5) indicate that there are significant differences for the root length of the plant treated with compost, as 30% of the plants treated with compost outperformed all treatments significantly, giving the highest rate of 27.42 cm, while the comparison treatment recorded the lowest rate of 20.92 cm. The treatment of the plant with Biohealth also led to significant differences for the same trait referred to, as the plants treated Biohealth (15) gm outperformed all treatments at a rate of 25.92 cm, except for the treatment of Biohealth 10 gm, which gave an average of 25.17 cm. No significant differences were recorded between them, while the comparison treatment gave Minimum average 20.75 cm.

As for the interaction between the two factors of the study, Compost + Biohealth, the results of the same table showed that the overlap treatment 30% Compost + 10 gm Biohealth over all the interaction treatments at a rate of 31.33 cm, while the comparison treatment gave the lowest rate of 17.67 cm.

Table (5) Effect of Biohealth Fertilizer and Compost and their Interference on Root Length of Rosemary Plants (cm)

compost (%)	Biohealth (mg.L ⁻¹)				Compost rate
	0	5	10	15	
0.0	17.67	20.33	21.33	24.33	20.92
10	20.67	22.33	24.33	25.67	23.25
20	21.33	23.67	23.67	25.33	23.50
30	23.33	26.67	31.33	28.33	27.42
average Biohealth	20.75	23.25	25.17	25.92	---
L.S.D 0.05	compost	Biohealth	interaction		---
	1.719	1.719	3.437		---

3.1.6 NUMBER OF ROOTS (ROOT⁻¹)

It is evident from the results of Table No. (6) that the treatment of the plant with compost had a significant effect on the number of roots of the rosemary plant, as the plants treated with compost reached 30%, the highest rate of 56.58 roots, and thus significantly outperformed all the treatments, while the comparison treatment recorded the lowest rate of 37.58 roots, and The effect of adding Biohealth to the cultivation medium was significant in the same trait, so the plants of the 15 gm treatment achieved the highest rate of 50.00 roots, outperforming all treatments except for the 10 gm plants of Biohealth which achieved a rate of 47.17 roots, as no significant differences were recorded between them, while the treatment recorded Compare the lowest rate of 40.17 root.

As for the interaction between the two research factors, Compost + Biohealth, the intervention treatment 30% Compost + 10 gm Biohealth achieved the highest rate for the number of roots, which amounted to 64.67 roots, outperforming all treatments except for the treatment of 30% Compost + 15 gm Biohealth, which reached an average of 59.33 roots. There were significant differences between them, while the comparison treatment gave the lowest average of 32.67 roots.

Table (6) The effect of Biohealth fertilizer and compost and their interaction on the number of roots of rosemary plants (root⁻¹)

compost (%)	Biohealth (mg.L ⁻¹)				Compost rate
	0	5	10	15	
0.0	32.67	32.33	36.00	49.33	37.58
10	38.00	39.67	42.67	42.67	40.75
20	41.67	42.67	45.33	48.67	44.58
30	48.33	54.00	64.67	59.33	56.58
average Biohealth	40.17	42.17	47.17	50.00	---
L.S.D 0.05	compost	Biohealth	interaction		---
	3.265	3.265	6.530		---

3.2 Discussion

The significant increase in the characteristics of vegetative growth achieved in Table (1-6) may be due to the organic matter represented by the compost, which works to chelate most nutrients, especially the small elements that stimulate the enzymes necessary for the formation of gibberellins and auxins, which later become centers of attraction for nutrients that work on Stimulating the division of cambium cells and increasing their size[7]. This is reflected positively in most growth characteristics such as number of leaves, plant height and number of branches[8]. in addition to the concentration of N, P, K elements within the organic matter, which is positively reflected in improving soil properties, providing elements and raising its readiness for absorption by plants, which Positively affects various vital activities such as elongation and division of meristematic cells and building proteins in addition to the formation of nucleic acids[9]. The organic matter contains a high percentage of major elements such as nitrogen, in addition to its work in cell division and elongation, and this is positively reflected in the increase in the percentage of dry matter[10]. as shown in Table (4).

Organic matter also has a large and effective role in increasing the activity of microorganisms, which in turn works to prepare the soil and plants with some necessary enzymes, including Protease and Phosphatase, which improve plant growth and increase the activity of roots to absorb nutrients from the soil, and also works on the formation of carbonic acid resulting from its decomposition. It works to reduce the soil pH and thus increase its micro-elements[11]. In addition to the role of organic matter in helping the root system to grow by improving the chemical and physical properties of the soil, increasing the availability of the necessary nutrients and providing a suitable environment[12].[13]. explained that the organic matter supplies the planting medium with nitrogen necessary for the metabolism of hormones and proteins, as it is mainly included in their composition and also works to raise the plant's content of amino acids, which is positively reflected on the increase in growth and the national division of root cells, as in Tables (5 and 6).

The significant increase that was recorded in the above characteristics when adding Biohealth to the plant may be due to the effectiveness of Trichoderma mushroom in analyzing organic matter and

forming organic mineral complexes with micro-elements that raised its readiness, or to the mushroom's role in analyzing organic matter and liberating chitin by the enzyme chitin. Which in turn leads to the release of a high percentage of nitrogen, which positively affects the root and vegetative growth and raises the ability of the root system to absorb [14]. Research also indicates that there is a close relationship between the accumulation of nitrogen amounts in the dry matter and the plant's content of chlorophyll, as the latter is an indicator of the extent of nitrogen absorption from the soil [15]. The noticeable increase in vegetative growth is largely due to the readiness of the elements, including the microelements Zn, Fe and others, as a result of lowering the soil pH due to the secretions of living organisms of a number of organic compounds and acids. Unready phosphorous into ready-made forms by manufacturing different types of acids, including citric and oxalic acid, whose role is to dissolve insoluble phosphorous compounds [16].

As for the moral differences that occurred as a result of the overlapping of the factors of the two factors of the study, it may be attributed to the joint positive effect between the two research workers, since the organic matter increases the activity of microorganisms and their numbers, whose secretions participate in supplying the root area with some nutrients that it needs to promote growth [17]. Or that the amount of organic matter levels and the concentration of the bio-fertilizer may be appropriate to produce the best growth needed by the plant according to the conditions of the experiment.

4. CONCLUSIONS

In view of the results obtained, we can conclude All growth traits had a significant effect on growth parameters, Addition of bio-fertilizer Biohealth at a concentration of 10 g, interfering with 30% of organic compost, had a significant effect on all studied traits, and this indicates the great importance of using environment-friendly fertilizers and their effective results in most growth indicators.

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