

Effect of Ground Addition of Seaweed Extract and NPK Fertilizer on the Some Active Substances of Aloe vera L.

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Abstract. The experiment was carried out at the College of Agriculture / University of Kerbala in the wooden canopy of the Department of Horticulture and Garden Engineering for the agricultural season (2021-2022) to study the effect of ground addition of seaweed extract and NPK fertilizer on some chemical growth characteristics of Aloe vera plants, and the experiment was conducted with two factors by comparing the use of An environmentally friendly nutritional program by adding seaweed extract and the chemical program by adding NPK fertilizer neutralized 20:20:20, as the first factor was the addition of seaweed extract, the first factor in three concentrations 3,1.5,0 g.l⁻¹ and the second factor was the addition of fertilizer For NPK neutralized with three concentrations (4,2,0) g.l⁻¹, the experiment was conducted as a factorial experiment according to the system of randomized complete block design (RCBD) and the plants were planted with 24 cm diameter anvils filled with a ratio of 3:1 with moss and sand and distributed in three replications, each replicate contains 9 Experimental units and each experimental unit includes 5 plants, and the comparison was made through the averages of the treatments using the (L.S.D) test, the least significant difference at the probability level of 5%, where the results showed that adding seaweed extract and NPK fertilizer to the plant Aloe vera has led to a significant increase in the specific growth of the plant, especially in the concentration of T₃N₄. The ground addition of seaweed extract of Aloe vera plant significantly increased most of the chemical properties and active compounds when T3 was treated with concentration (3g.l⁻¹) (percentage of chlorophyll 34.25%, aloin 194.53 µg.gm⁻¹, Aloe-emodin 98.9 µg. g⁻¹, salicylic acid 12.54 mcg.g⁻¹, cinnamic acid 12.77 mcg.g⁻¹). The addition of neutral NPK fertilizer to the aloe vera plant at a concentration (4 g / liter⁻¹) when treated showed significant differences in most of the chemical properties and active compounds (percentage of chlorophyll 33.53%, Aloin 178.19 µg.gm⁻¹, Aloe emodin 96.2 mcg.gm⁻¹, salicylic acid 11.15mcg.gm⁻¹, cinnamic acid 12.46 mcg.gm⁻¹).

Keywords. Aloe vera, NPK, Seaweed extract, Aloin, Aloe emodin.

Introduction

Aloe vera plant L. belongs to the cactus family Asphodelaceae [1]. The aloe vera plant is one of the oldest medicinal plants used for medicinal purposes, and historical manuscripts referred to its use in the treatment of some diseases more than 6000 years ago, according to what was written on clay tablets. In the Mesopotamian Civilization [2], Aloe vera is

one of the most widely used plants in the treatment of many diseases. It is used as juices, tea for drinking, creams, powder and capsules [3], where the leaves are the active part from which the gel is extracted, which contains the compounds Anthraquinins, which include glycosides with a medicinal effect, including Aloin and Emodin-Aloe glycosides. , [4] and [5]. Aloe vera is a succulent plant that contains 96-99.5% water and the

remainder is a solid substance containing more than 75 different compounds including sugars, anthraquinones, phenolic compounds, vitamins, minerals, soaps, sterols, amino acids, and salicylic acid [6].

The global trend is towards the use of organic materials with animal or plant origin as a source of fertilizer for the purpose of reducing the pollution of the environment and agricultural soils with chemical, and the production of agricultural crops safe for humans and animals and compensation of organic matter [7], which loses soil as a result of intensive agriculture. Organic fertilizers additionally enhance soil physical and compound properties and decrease the requirements for mineral composts, which is reflected in the increase of vegetative growth and yield of plants [8].

The most important organic sources used in the agricultural field are considered complementary to chemical fertilizers and not a substitute for them. Studies have shown that the addition of marine algae extract led to a positive effect on the plant's nutrient content. The reason is due to the extract's role in increasing nutrient absorption in addition to the contents of amino acids and nutrients and containing some substances that are a source of the formation of elements such as betaine, which is a source of nitrogen [9]. Biostimulants are natural or artificial components used for seeds, plants, and soil [10].

The marine algae extract also has an important role in providing the plant's needs of these elements by increasing the efficiency of the root system of the plant, which has a role in increasing the plant's absorption of nutrients and their entry into the plant's machine [11]. It has been shown [12] that the addition of NPK fertilizer to aloe vera plants led to a significant increase in the leaves content of chlorophyll a and b and total chlorophyll. He also noted that measuring chlorophyll in spring and autumn is better than measuring it in summer or winter due to a change in temperature in these two seasons. This was

supported by [13], as they showed that nitrogen fertilizer is important in the synthesis of chlorophyll and that its decrease causes a decrease in the efficiency of photosynthesis and that nitrogen fertilizer has increased total chlorophyll and chlorophyll a, b.

Materials and Methods

Research on the impact of seaweed extract and NPK fertilizer on certain aspects of Aloe vera's vegetative growth was conducted in the wooden canopy of the Department of Horticulture and Garden Engineering at the College of Agriculture/University of Karbala during the 2021–2022 agricultural season. Plants were set in place with anvils measuring 24 cm in diameter and were a year old when the experiment began. The aloe vera plants were planted with three replicates, and each replicate contains (9) experimental units, and each experimental unit contains (5) plants. The service operations were conducted periodically.

Transactions and Design

The search included the following transactions:

- Addition of seaweed extract, ground addition, in three concentrations (0, 1.5, 3) g.L⁻¹.
- Adding fertilizer for NPK (neutral) adding ground fertilizer in three concentrations (0, 2, 4) g.L⁻¹.

The experiment was carried out as a factorial experiment according to the system of randomized complete block design (RCBD) and the plants were planted with anvils with a diameter of 24 cm filled with a ratio of 3:1 with moss and sand and distributed in three replications, each replicate comprising 9 experimental units and each experimental unit comprising 5 plants. (L.S.D) test the least significant difference at the 5% probability level.

Studied Traits

The percentage of chlorophyll; Aloin content, Aloe –emodin content, salicylic acid content, Cinnamic acid.

Results Discussion

The percentage of chlorophyll

It is clear from the results of Table (1) that there is a significant difference that occurred as a result of fertilizing with NPK fertilizer and marine algae in the percentage of chlorophyll, as the highest percentage was when the fertilization level was 4 g / liter, reaching 33.53, while the lowest percentage of chlorophyll at the fertilization level was 0 g / l

Table 1. Effect of ground application of seaweed extract and NPK fertilizer on the percentage of chlorophyll in aloe vera leaves %.

algae g.L ⁻¹	NPK g.L ⁻¹			Average algae
	0	2	4	
0	16.06	20.05	28.77	21.63
1.5	18.10	21.77	32.09	23.99
3	26.05	36.99	39.71	34.25
averageNPK	20.07	26.27	33.53	
LS D 0.05	algae	NPK	overlap	
		1.32	0.76	0.76

The Amount of Aloin in the Leaves of the Aloe Vera Plant. Microgram.g⁻¹

It is clear from the results of Table (2) that there is a significant difference obtained as a result of fertilizing with NPK fertilizer and seaweed in the character of leuen, as the highest percentage was when the fertilization level was 4 g / liter, it amounted to 178.19 mcg. The comparison treatment amounted to 163.06 micrograms.g. As for seaweed fertilization, the highest percentage of win

(comparison treatment). It reached 20.07, while for marine algae fertilization, the highest percentage of chlorophyll was at the level of 3 g / l when fertilizing treatment, it reached 34.25, while it was lower when the comparison treatment level was 0 g / l, reaching 21.63, as for the interaction, the highest level of chlorophyll was at the level of 4 g / l. 1 NPK and 3 g / l marine algae, which amounted to 39.71, and the lowest length was the level of 0 g / l NPK and 0 g / l marine algae, which amounted to 16.06.

when the fertilization treated the level of 3 g / liter was 194.53 micrograms. g, while the lowest percentage when the comparison treatment was at the level of 0 g / liter, which amounted to 147.05 micrograms.gm, As for the interference, the highest percentage of win was at the level of 4 g / l NPK and 3 g / l marine algae, which amounted to 203.29 mcg. gm, and the lowest percentage was the level of 0 g / l NPK and 0 g / l marine algae, which amounted to 123.41 mcg. gm.

Table 2. Effect of ground application of seaweed extract and NPK fertilizer on the amount of Aloin mg. g⁻¹ in Aloe vera leaves% .

algae g.L ⁻¹	NPK g.L ⁻¹			average algae
	0	2	4	
0	123.41	146.47	171.25	147.05
1.5	180.05	130.40	160.02	156.83
3	185.70	194.61	203.29	194.53
averageNPK	163.06	157.16	178.19	
LS D 0.05	algae	NPK	overlap	
		0.69	0.40	0.40

The Amount of Aloe-Emodin in the Leaves. Mg.g⁻¹

It is evident from the results of Table (3) that there is a significant difference that occurred as a result of fertilizing with NPK and seaweed fertilizers in the amount of the compound waimodin, as the highest amount of the compound when the fertilization level was 4 g / liter, which amounted to 96.2 micrograms. / liter (comparison treatment) which amounted to 86.3 micrograms. g. As for

seaweed fertilization, the highest amount of the compound when fertilizing was 3 g / liter, it amounted to 98.9 micrograms. g, while the lowest amount of the compound when compared treatment was 0 g / liter, reaching 76.5 As for the interaction, the highest amount of wiemodin was at the level of 4 g/L NPK and 3 g/L seaweed, which amounted to 119.7 µg.gm, and the lowest percentage was the level of 0 g/L NPK and 0 g/L seaweed, which amounted to 65.9 mg.g⁻¹

Table 3. Effect of ground application of seaweed extract and NPK fertilizer on the amount of Aloe-emodin mg.g⁻¹ in Aloe vera leaves %.

algae g.L ⁻¹	NPK g.L ⁻¹			average algae
	0	2	4	
0	65.9	75.7	87.8	76.5
1.5	93.1	70.0	81.3	81.5
3	100.0	77.0	119.7	98.9
averageNPK	86.3	74.3	96.2	
LS D 0.05	algae	NPK	overlap	
	32.83	18.95	18.95	

The Amount of Salicylic Acid in the Leaves. Mg.g⁻¹

Through the results of the statistical analysis of Table (4), it was found that there were clear positive effects in the leaves content of salicylic acid when adding seaweed extract at a concentration of 3 µg l⁻¹, as it gave the highest content of salicylic acid when T3 was treated, which amounted to 12.54 µg l⁻¹, with a significant difference with the control treatment that recorded a lower content of acid, which amounted to 8.76, while the treatment of adding NPK fertilizer with a concentration of 4(N4) gave a higher content of salicylic acid that amounted to 11.15 µg l⁻¹,

and a significant difference with the treatment of The comparison that recorded the lowest value for this trait amounted to 10.00 µg l⁻¹, where the binary interaction of the study factors between the addition of seaweed extract and NPK fertilizer showed significant differences in the plant content of salicylic acid, as it was significantly superior to the treatment of the two interactions (T3N4) at a concentration of (3 g.l. -1,4 gm l⁻¹ recorded the highest content of salicylic acid and it was 13.11 mcg l⁻¹ compared to the control treatment which recorded the lowest content of 6.80 mg.L⁻¹ .

Table 4. Effect of ground addition of seaweed extract and NPK fertilizer on the amount of salicylic acid mg.g^{-1} in aloe vera leaves %.

algae g.L^{-1}	NPK g.L^{-1}			average algae
	0	2	4	
0	6.800	8.563	10.943	8.769
1.5	11.300	7.303	9.403	9.336
3	11,920	12,603	13.113	12.546
averageNPK	10.07	9,490	11.153	
LS D 0.05	algae	NPK	overlap	
	0.1306	0.0754	0.0754	

The Amount of Cinnamon Acid in the Leaves. Mg.L^{-1}

It is clear from the results of Table (5) that there is a significant difference that occurred as a result of fertilizing with NPK and seaweed fertilizers in the amount of cinnamic $\mu\text{g.gm}$, as the highest amount of cinnamic lion when the fertilization treatment was at a level of 4g/l, it amounted to 12.46 $\mu\text{g.gm}$, while the

lowest amount was at the level of fertilization 0 g / liter (the comparison treatment), which amounted to 11.47 micrograms. It amounted to 10.63 mcg.g. As for the interaction, the highest amount of the compound was at the level of 4 g/L NPK and 3 g/L seaweed, which amounted to 13.63 mcg.gm, and the lowest was the level of 0 g/L NPK and 0 g/L seaweed, which amounted to 9.90 mg.g^{-1} .

Table 5. Effect of ground application of seaweed extract and NPK fertilizer on the amount of cinnamin acid mg.g^{-1} in aloe vera leaves %.

algae g.L^{-1}	NPK g.L^{-1}			average algae
	0	2	4	
0	9.9033	10.6033	11.4033	10.6367
1.5	10.2400	11.0000	12.3600	11.2000
3	11.8800	12.8100	13.6333	12.7744
averageNPK	10.6744	11.4711	12.4656	
LS D 0.05	algae	NPK	overlap	
	0.04886	0.02821	0.02821	

Discussion

It is noted from the above tables Table No. (1) the percentage of chlorophyll and Table No. (2) the amount of aloin and Table No. (3) the amount of emodin and Table No. (4) the amount of salicylic acid and Table No. (5) the amount of cinnamic acid. Positive effect of plants for which marine algae extract was used in the characteristic of increasing leaves of total carbohydrate content, which were

recorded with higher concentrations than zero treatment. The leaves increased the content of chlorophyll with quality A, B and total chlorophyll. The addition of algae had an effective role in increasing the number of leaves of the plant and improving the content of these leaves from plant pigments and biochemical growth indicators [14]. If the effect of nitrogen is a positive effect on the concentration of medically active substances

in the leaves, the treatment of plants with nitrogen causes an increase in vegetative growth. The number of leaves, their width and thickness, which leads to an increase in carbon manufacturing, and then an increase in the production of secondary compounds within the plant, as nitrogen enters its composition. Or it may work to increase the construction of some enzymes responsible for the formation of these compounds, where these results agreed with what was reached by [15] when treating the gujarat plant with nitrogen if there was a significant increase in the plant content of active substances. The secondary metabolism compounds were significantly affected by organic fertilizers and mineral elements, and the reason may be due to the role of these treatments in increasing plant growth for their role in increasing cell division and the moral and positive reflection and its efficiency in the process of photosynthesis [16;17], and thus helps to increase the primary synthetic materials. The secondary ones are glycosides, as the effect of organic compounds in increasing glycosides may be due to the stimulation of hormones entering the plant such as cytokinins [18], and the reason for the increase in medicinal compounds is due to the organic fertilizers containing many mineral elements, including nitrogen, which has an important role in increasing the vegetative growth and the number, thickness and width of leaves, which in turn leads to an increase in the photosynthesis process and then an increase in the production of secondary compounds within the plant [19].

Conclusions

- The response of the aloe vera plant to fertilization with terrestrial marine algae extract at a concentration of 3 g / liter plant in all the medically active ingredients.
- Ground fertilization with NPK at a concentration of 4 g/plant had a positive effect on the medicinally active ingredients of the aloe vera plant.

- The interaction between terrestrial algae extract and NPK had a significant effect in increasing the active ingredients of aloe vera

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