Effect of some plant organic residues, biofertilizers and foliar spraying with seaweed extract on the growth of Sharabi apple seedlings.

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Abstract

This study was conducted in the Najaf Specialized Nursery of the Ministry of Agriculture / Najaf province for the period from September 2021 to June 2022. To study the effect of plant residues, biofertilizers and foliar spraying with seaweed extract on some vegetative, root and leaf content of growth regulators for apple seedlings, Sharabi cultivar, one and a half years age, which were planted in the nursery ground. 324 seedlings were selected with homogeneous growth and size as much as possible and it was implemented as a factorial experiment (4 * 3 * 3) by designing randomized complete block design with three replications. Each replicate includes 108 seedlings, with 3 seedlings for each experimental unit and with three factors if the first factor includes: Four ground additions of organic plant residues, which included (palm fronds residues at an average of 1 kg. seedlings^{-1}, rice residues at an average of 1 kg. seedlings^{-1}, a mixture of palm fronds residues and rice residues at a rate of 1 kg. seedlings^{-1} in addition to the control treatment (no addition) .As for the second factor, it is the ground addition of biofertilizers and with three additions (the control treatment (non-addition), a mixture of three types of bacteria (Azotobacter, Bacillus and Pseudomonas at a rate of 10 ml. seedlings $^{-1}$, Mycorrhiza 10 g. seedlings $^{-1}$). While the third factor included three concentrations of foliar spray with seaweed extract (0, 2, 4 ml. L^{-1}), and the service operations were conducted equally for all treatments. The results were as follows:.

. The results of the statistical analysis of the least significant difference (L.S.D) at the probability level of 0.05 showed that the triple interaction treatment was significantly excelled on all treatments between (ground addition of palm fronds residues with rice at a rate of 1 kg. seedlings $^{-1}$and the ground application between Mycorrhizae at an average of 10 g. seedlings^{-1} and foliar spraying with seaweed extract at a concentration of 4 ml. L^{-1} in all the studied traits represented by (plant height, leaf area, Dry weight of vegetative growth , dry weight of root system, leaf content of growth regulators (auxins, cytokines, gibberellins), which gave (145.2 cm, 34.29 cm, 140.20 g, 38.33 g, 34.33 ng. g^{-1}, 32.60 ng. g^{-1} , 21.42 ng. g^{-1}) respectively Compared to the control treatment, which recorded the lowest average for these traits, it was (4.85 cm, 20.36 cm, 2, 65.20 g, 19.57 g, 16.23 ng. g^{-1}, 19.64 ng. g^{-1},13.20 ng. g^{-1}) respectively.

key words :. Palm fronds, rice residues, apples, bacteria, auxins, foliar spraying, growth regulators

Introduction:

The apple (Malus domestica (Apple) is one of the deciduous fruit trees, and its cultivation is one of the oldest existing crops in the world. It has been known to man since ancient times. It is believed that its original home is the Caucasus, Central Asia and western China [1]. In Mesopotamia, its cultivation has been known since the beginning of human settlement at the end of the fifth millennium BC and during successive generations, and it was not given importance in its cultivation except in the sixties of the last century. As some foreign varieties were imported and multiplied in the country[2] .The apple occupies an advanced rank in the global ranking in fruit production, as its fruits are of high nutritional value, where they are rich in carbohydrates, protein and minerals. The fruits are used fresh or in the food industry, [3] Fertilizers are added to plants naturally or synthetically to the soil or directly in order to provide the plant with one or more nutrients necessary for the growth and development of the plant. Plant waste is

among the most important waste that has received wide attention in recent research because it is cheap and environmentally friendly compared to mineral fertilizers. It plays an important role in feeding the plant and supplying it with the important elements for the growth and development of the plant. The organic matter in the soil acts as a source of nutrients, improves the structure of the soil, and provides a source of food for microorganisms. It provides them with the energy and materials needed to build their bodies[4,5] . Adding organic matter to the soil improves its ability to hold water and increases the efficiency of the microorganisms present in it. Over time, the organic matter will provide the soil with the nutrients necessary for the plant's needs. Thus, it will reduce the need for fertilizing[6,7] , In a study,[8] found that by adding palm and wheat fronds residues to Helwani cultivar grape trees a significant increase in the studied traits represented by (plant height, leaf area, leaf content of regulators (auxins, cytokines, gibberellins). As for bio-fertilizers, they play a fundamental and important role in stabilizing some nutrients important for plant growth and development, including nitrogen, as well as increasing the absorption of phosphorous from the soil. These fertilizers are Azotobacter, Bacillus and Pseudomonas bacteria, as well as mycorrhiza fungi, which are obtained from isolation and multiplication of microorganisms in suitable farms, then they are kept in suitable conditions until they are used to pollute the roots or the soil[9] . In another study, [10] noticed when adding Mycorrhiza and Azotobacter bacteria to the roots of orange seedlings, a significant increase in the rate of the studied and represented traits, and marine algae extracts are considered important additions to plant nutrition because these extracts contain macro and micro elements in addition to auxins, cytokines and gibberellins and when sprayed On plants, it increases the vegetative and root system [11] It also works to increase the efficiency of the photosynthesis process, and these extracts contain betaine, which is a good and important source of nitrogen in its low concentrations, in addition to being a regulator of osmosis in high concentrations, which increases the plant's resistance to salinity and drought. Among these extracts is the extract of aljarayn, which contains macro and micro nutrients, auxins, cytokines and amino acids, which are available and easily absorbed by the plant (Stirk et al., 2003), In a study, [12] found a significant increase in the studied traits when spraying fig seedlings of Aswed Diyala cultivar with Algazone seaweed extract at three concentrations (8,6,4 ml. l-1).Given the importance of these factors and their important role in plant growth and development, this study came with the aim of knowing the response of apple cultivar Sharabi seedlings to some biofertilizers, organic plant residues and foliar fertilization with seaweed extract.

Materials and methods:

The study was conducted in Al-Najaf Al-Ashraf Governorate (Al-Najaf Model Nursery) affiliated to the Ministry of Agriculture during the growing season 2021-2022. The experiment was conducted on seedlings of apple cultivar Al-Sharabi planted in the nursery at the age of one and a half years and planted in the soil of the field, 324 seedlings were selected of homogeneous growth and size as much as possible. The service operations were conducted equally for all transactions, and the soil was analyzed in Table (1), A factorial experiment with three factors (4 * 3 * 3) was carried out by designing randomized complete block design and with three replications, as each iterator includes 108 seedlings with 3 seedlings for each experimental unit, and the first factor included organic plant residues (palm fronds and rice residues). The rice residues were obtained from the Organic Agriculture Center in Najaf, affiliated to the Ministry of Agriculture. As for the remnants of palm fronds, they were obtained from the Organic Agriculture Center in Babylon and were analyzed in Table (2), which included four ground additions: (control treatment, palm fronds residues at a rate of 1 kg. seedling^{-1}, rice residues at a rate of 1 kg. seedlings^{-1}, a mixture of palm fronds residues and rice

residues at a rate of 1 kg. seedlings^{-1}.As for the second factor, it included biological fertilization with fungi and bacteria, which included three ground additives: (the control treatment.

A bacterial mixture that includes three types of bacteria: Azotobacter, Bacillus and Pseudomonas at a rate of 10 ml. 1 seedlings

, Biofertilization with MYCORRHIZA fungus at a rate of 10 g. seedlings $^{-1}$). As for the third factor, it included:. Spraying with marine algae extract in three concentrations: (control treatment, 2 ml. L^{-1}., 4 ml. L^{-1}).

Table (1): Some chemical and physical characteristics of the soil in which seedlings grow

values	units	separated
740	g.kg^{-1} soil	sand
180	g.kg^{-1} soil	silt
80	g.kg^{-1} soil	Clay
sandy	--------	texture
2.24	Ds.m^{-1}	Electrical conductivity (Ec)
7.12	---------	pH
	mg.kg^{-1}	available nitrogen
	mg.kg^{-1}	available phosphorous
	mg.kg^{-1}	available potassium

Table (2): Some traits of the plant organic residues used in the experiment

units	rice residue	Palm fronds	traits
dSm-1	3.24	2.97	EC . electrical conductivity
-----	6.33	5.87	pH
gm kg-1			nitrogen
gm kg-1			phosphorous
gm kg-1			potassium
gm kg-1			organic carbon
gm kg-1			Organic matter
-----			N/C . ratio
-----			P/C . ratio

Table (3) shows the symbols used in the experiment

Treatments	Treatments symbol	Type of treatments
Organic waste (plant)	E0	control treatment (without adding ground)
	E1	Rice residues at an average of 1 kg. Seedlings -1
	E2	Palm fronds residues at an average of 1 kg. seedlings -1
	E3	Rice residues with palm fronds at an average of 1 kg. seedlings -1
biofertilizers	B0	control treatment (without adding ground)
	B1	Add bacteria at an average of 10 ml. seedlings-1
	B2	Add mycorrhiza at an average of 10 g. seedlings -1
Foliar spray with seaweed extract	A0	control treatment (without foliar spray)
	A1	Foliar spray at a concentration of 2 ml. L-1.
	A2	Foliar spray at a concentration of 4 ml. L-1.

The mycorrhizal fungus (G. mosseae) inoculum 50×10-8 was used, which was obtained from (Biofertilizers Laboratory in the Agricultural Research Department), which consisted of (spores + infected mycorrhizal roots + dry soil),The inoculum was tested to ensure the presence of pure spores by wet sieving and decanting, and it was added to the soil after placing it near the roots of the apple seedlings, according to the method suggested by (Gerdmann and Nicolson, 1963).As for the bacterial vaccine, a vaccine of three types was used: Azotobacter, Bacillus and Pseudomonas in liquid form, which was obtained from the (Bio-Fertilizer Laboratory in the Agricultural Research Department). It was added to the soil after placing it near the roots of apple seedlings. As for the spraying process with seaweed extract, it was sprayed with three times, where the first spray was tried on 3/15/2022, the second spray was on 1/4/2022 and the third spray was applied on 4/15/2022. Compared to distilled water only, A 20-liter hand sprayer was used, and the spraying process was carried out in the morning until the seedlings were completely wet. The watering process was conducted for the seedlings one day before the spraying process to increase the efficiency of the plants in absorbing the sprayed substance. Moisture has a role in the process of swelling the guard cells and opening stomata, in addition to the fact that watering before spraying reduces the concentration of solutes in the leaf cells, thus increasing the penetration of the ions of the spray solution into the leaf cells [13]

The measurements were taken on 06/15/2022.

Studied traits:

1- Plant height (cm):. The height of seedlings was measured by metric tape.

2- The leaf area (cm 2):. The leaf area was measured by (PLANIMETER) device and nine whole leaves were taken from different places of one plant and the leaf area was measured and the average was calculated for each seedling and then the average was calculated for each experimental unit.

3- The dry weight of vegetative growth (g):. The seedlings were uprooted, the root system separated from the shoot, and the shoots were placed in perforated paper bags and dried in an electric oven (Oven) for the purpose of getting rid of moisture at a temperature of 70 degrees Celsius for 48 hours until the weight was stabilized and the dry weight was taken using a sensitive electric scale[14]

4- The dry weight of the root total (g):. The rootstock was cut from the bottom of the stem of the original and then placed in perforated paper bags in an electric oven (Oven) for the purpose of getting rid of moisture at a temperature of 70 degrees Celsius for 48 hours until the weight was stabilized and the dry weight was taken using a sensitive electric balance

5- Leaves content of auxins, cytokines and gibberellins (ng.g-1): The process of estimation of auxins and gibberellins was conducted by taking a sample of leaves weighing 1 g and adding to it 12 ml methanol, 5 ml chloroform and 3 ml ammonium hydroxide.Then the volume was completed to 25 ml by adding distilled water and the acidity of the solution was adjusted to pH 2.5 by using drops of hydrochloric acid (1 N).The samples were read using a spectrophotometer at wavelengths (254 and 222 nanometers) for gibberellin and auxin, then the standard curve for these two hormones was made separately if the readings fell on the curve and the results were extracted. In the case of the cytokine, it was obtained by filtering the plank sample, 0.75 of ethyl acetate was added to it, then the lower layer of the mixture was taken (12 ml methanol, 5 ml chloroform and 3 ml ammonium hydroxide) and the pH was adjusted to 7 and the cytokine was measured along a wavelength 269[15]

Results:

1- Plant height (cm):.

The results in Table (4) show that there are significant differences between the organic fertilizer treatments in the average of plant height, where the treatment (E3) gave a significant effect of 133.3 cm compared to control treatment (E0), which recorded the lowest average of 92.8 cm, and it is noted from the same table that the ground addition Biofertilizers gave a significant increase for the same trait . The treatment with Mycorrhiza (B2) excelled by giving it the highest average of 115.0 cm compared to the control treatment (B0), which gave the lowest average of 107.8 cm.As for the spraying treatment with seaweed extract, treatment (A2) recorded an increase in the plant height average of 114.4 cm, while the control treatment (A0) gave the lowest rate of 110.7 cm.As for the binary interaction, the results of the table show that there are significant differences between the treatment of organic fertilization and biofertilizers. The treatment (E3B2) recorded a significant effect of 139.9 cm compared to treatment (E0B0), which gave 87.7 cm.As for the interaction between organic fertilization and foliar spraying with marine algae extract, the treatment (E3A2) recorded the highest rate in plant height of 136.0 cm, while the control treatment (E0A1) gave the lowest rate of 91.4 cm.We note from the same table that the bi-interaction between biofertilizers and foliar spray with seaweed extract gave an increase for the same traits, where the treatment (B2A2) gave the highest rate of 119.5 cm compared to the control treatment (B0A0), which gave a clear decrease of 105.9.As for the triple interaction (EBA), we notice from the same table a significant effect on the rate of plant height, the treatment (E3B2A2) gave the highest rate of 145.2 cm compared to treatment (E0B0A0), which gave the lowest average of 85.4 cm.

Table (4) Effect of organic fertilization with plant residues, biological fertilization with some biofertilizers and foliar spraying with seaweed extract (aljarayn) and the interaction between them on the rate of plant height (cm) for Sharabi apple seedlings

treatments						
B * A	Organic Fertilizer (plant) (E)				A . fertilization levels	fertilizing levels B
	E3	E2	E1	E0		
105.9	126.5	112.4	99.4	85.4	A0	B0
107.7	128.0	114.4	101.1	87.4	A1	
109.8	128.8	117.6	102.2	90.3	A2	
111.1	130.0	119.1	102.9	92.3	A0	B1
112.5	132.5	120.1	105.0	92.6	A1	
113.9	134.0	122.2	105.5	94.1	A2	
115.2	135.2	122.5	106.8	96.4	A0	B2
116.7	139.4	123.0	107.3	97.1	A1	
119.0	145.2	125.1	109.2	98.6	A2	
	133.3	118.9	104.4	92.8	effect E	
107.8	127.8	114.8	100.9	87.7	B0	B * E
112.5	132.2	120.5	104.4	93.0	B1	
115.0	139.9	123.5	107.8	88.7	B2	
effect A						
110.7	130.6	118.0	103.0	91.4	A0	A * E
112.6	133.3	119.2	104.5	93.7	A1	
114.4	136.0	121.7	105.6	94.4	A2	

B * A * E	B * A	A * E	B * E	A	B	E	LSD 0.05
23.06	11.53	13.31	13.31	6.66	6.66	7.69	

2- Average leaf area(cm^2):.

The results in Table (5) show that there are significant differences between the organic fertilizer treatments in the average leaf area cm2 where the treatment (E3) gave a significant effect of 32.42 cm^2 compared to the control treatment (E0), which was recorded the lowest rate of 22.01 cm^2. It is noted from the same table that the ground application of biofertilizers gave a significant increase for the same trait, where the mycorrhizal treatment (B2) excelled it by giving it the highest rate of 28.70 cm^2 compared to the control treatment (B0), which gave the lowest rate of 26.31 cm^2. As for the spraying treatment with seaweed extract, treatment (A2) recorded an increase in the average leaf area amounted to 27.82 cm^2, while the control treatment (A0) gave the lowest rate of 27.02 cm^2, as for the bi-interaction. The results of the table show that there are significant differences between the treatment of organic fertilization and biofertilizers. The treatment (E3B2) recorded a significant effect of 33.50 cm^2 compared to treatment (E0B0), which gave 020.7 cm^2. As for the interaction between organic fertilization and foliar spraying with seaweed extract, treatment (E3A2) recorded the highest average leaf area of 32.92 cm^2, while the control treatment (E0A0) gave the lowest rate of 21.65 cm^2. We note from the same table that the bi-interaction between biofertilizers and foliar spraying with seaweed extract gave an increase for the same treatments. The treatment (B3A2) gave the highest rate of 29.15 cm^2 compared to the control treatment (B0A0), which gave a clear decrease of 25.96 cm^2.As for the triple interference (EBA), we notice from the same table a significant effect on the average leaf area, as the treatment E3B3A2) gave the highest rate of 34.29 cm^2 compared to the treatment of E0B0A0), which gave the lowest average of 20.36 cm^2.

The average dry weight of vegetative growth (g)

The results in Table (6) show that there are significant differences between the organic fertilizer treatments in the average dry weight of the vegetative total in the plant . The treatment (E3) had a significant effect of 135.1 gm compared to the control treatment (E0), which recorded the lowest average of 75.2 gm. It is noted from the same table that the ground addition of biofertilizers gave a significant increase for the same trait, where the mycorrhizal treatment (B2) excelled it by giving it the highest rate of 116.6 g compared to the control treatment (B0), which gave the lowest rate of 103.8 g . As for the spraying treatment with seaweed extract, treatment (A2) recorded an increase in the average dry weight of the plant, which amounted to 134.7 g, while the control treatment (A0) gave the lowest rate of 108.3 g. As for the bi-interaction, the results of the table show that there are significant differences between the treatment of organic fertilization and biofertilizers. The treatment (E3B2) recorded a significant effect of 226.8 g compared to treatment (E0B0), which gave 72.3 g, As for the interaction between organic fertilization and foliar spraying with marine algae extract, treatment (E3A2) recorded the highest rate of dry weight in the plant amounted to 137.5 g, while the control treatment (E0A0) gave the lowest rate of 69.0 g, and we note from the same table that the bi-interaction between biofertilizers and spraying The foliar extract of seaweed gave an increase for the same trait, where the treatment (B3A2) gave the highest average of 118.4 gm.Compared to the control treatment (B0A0), which gave a clear decrease of 101.0 g. As for the triple interaction (EBA), we notice from the same table a significant effect on the average dry weight in the plant. The treatment E3B3A2) gave the highest average of 140.2 g compared to the treatment of E0B0A0)), which gave the lowest average of 65.2 g, As for the triple interaction between the experimental treatments (E*A*B), where there was a significant effect of the interaction of these factors, where the treatment (E3B2A2) gave the highest rate of the nitrogen content of the leaves amounting to 49.37% Whereas, the control treatment (E0B0A0) recorded the lowest value of 31.20%.

Table (3) The effect of organic fertilization with plant residues, biofertilization with some biofertilizers and foliar spraying with seaweed extract (aljarayn) and the interaction between them on the average leaf area (cm2) for apple seedlings

treatments						
B * A	Organic Fertilizer (plant) (E)				A . fertilization levels	fertilizing levels B
	E3	E2	E1	E0		
25.96	31.30	27.90	24.30	20.36	A0	B0
26.31	31.54	28.33	24.71	20.67	A1	
26.66	31.76	28.46	25.30	21.11	A2	
26.90	31.81	28.81	25.71	21.27	A0	B1
27.32	32.21	29.60	25.97	21.52	A1	
27.64	32.70	29.73	26.13	22.02	A2	
28.20	33.06	30.00	26.42	23.33	A0	B2
28.74	33.14	30.51	27.51	23.82	A1	
29.15	34.29	30.72	27.66	23.95	A2	
	32.42	29.34	25.97	22.01	effect E	
effect B						
26.31	31.53	28.23	24.77	20.71	B0	B * E
27.29	32.24	29.38	25.94	21.60	B1	
28.70	33.50	30.41	27.20	23.70	B2	
effect A						
27.02	32.06	28.90	25.48	21.65	A0	A * E
27.46	32.30	29.48	26.06	22.00	A1	
27.82	32.92	29.64	26.36	22.36	A2	

B * A * E	B *A	A * E	B * E	A	B	E 2.755	LSD 0.05
8.265	4.133	4.772	4.772	2.386	2.386	2.775	

Table (6) Effect of organic fertilization with plant residues and biofertilization with some biofertilizers and foliar spraying with seaweed extract (aljarayn) and the interaction between them on the dry weight of the vegetative total (gm) of apple seedlings

treatments						
B * A	Organic Fertilizer (plant) (E)				A . fertilization levels	fertilizing levels B
	E3	E2	E1	E0		
101.2	131.9	120.3	87.2	65.2	A0	B0
103.8	132.3	122.0	91.6	69.4	A1	
106.5	134.0	125.5	94.1	72.3	A2	
108.1	134.7	127.8	97.3	72.8	A0	B1
110.3	135.0	127.9	101.1	77.3	A1	
111.6	135.5	128.7	104.2	78.0	A2	
115.6	135.9	129.3	118.2	78.9	A0	B2
115.9	136.5	129.8	117.3	80.1	A1	
118.4	140.2	131.7	118.6	83.2	A2	
	135.1	127.0	103.3	75.2	effect E	
effect B						
103.8	132.7	122.6	91.0	69.0	B0	B * E
110.1	135.3	128.2	100.9	76.0	B1	
116.6	137.5	130.3	118.0	80.7	B2	
effect A						
108.3	134.2	125.8	100.9	72.3	A0	A * E
110.0	134.6	126.6	103.4	75.6	A1	
112.2	136.8	128.6	105.7	77.8	A2	

B * A * E	B *A	A * E	B * E	A	B	E	LSD 0.05
127.70	63.85	73.73	73.73	36.86	36.86	42.57	

- Dry weight of the root total (g):.

The results inTable (7) show that there are significant differences between the organic fertilizer treatments in the dry weight rate of the roots, where the treatment (E3) gave a significant effect of 38.33 compared to the control treatment (E0), Which recorded the lowest rate of 19.57 g,It is noted from the same table that the ground addition of biofertilizers gave a significant increase for the same trait, where the treatment with Mycorrhiza (B2) excelled by giving it the highest rate of 33.07 g compared to the control treatment (B0), which gave the lowest rate of 29.71 g. As for the spraying treatment with marine algae extract.Treatment (A2) recorded

an increase in the rate of dry weight of roots in the plant amounting to 31.93 g, while the control treatment treatment (A0) gave the lowest average of 30.78 g. As for the bi-interaction, the results of the table show significant differences between the treatment of organic fertilization and biofertilizers, the treatment recorded (E3B2) had a significant effect of 39.27 g, compared to treatment (E0B0), which gave 20.12 g,As for the interaction between organic fertilization and foliar spraying with seaweed extract, treatment (E3A2) recorded the highest dry weight rate of roots in the plant, which was 38.77 g, while the control treatment (E0A0) gave the lowest rate of 22.27 g. We note from the same table that the bi- interaction between biofertilizers and foliar spray with seaweed extract gave an increase for the same traits , where the treatment (B3A2) gave the highest rate of 33.74 g compared to the control treatment (B0A0), which gave a clear decrease of 29.03 g.As for the triple interaction (EBA), we notice from the same table a significant effect on the rate of dry weight of the roots. Treatment (E3B3A2)) gave the highest rate of 40.19 g compared to treatment E0B0A0), which gave the lowest rate of 19.57 g.

5- Auxin content of leaves (ng.g^{-1}):.

The results in Table (19) show that there are significant differences between the organic fertilization treatments in the rate of auxin in the plant, where the treatment (E3) gave a significant effect of 34.78 ng.g^{-1}compared to the control treatment (E0), which recorded the lowest rate of 9.11 ng.g^{-1}, It is noted from the same table that the ground addition of biofertilizers gave a significant increase for the same trait, as the treatment with Mycorrhiza (B2) was excelled by giving it the highest rate of 28.60 ng.g^{-1}compared to the control treatment (B0), which gave the lowest rate of 25.05 ng.g^{-1}.As for the spraying treatment with seaweed extract, treatment (A2) recorded an increase in the auxin rate in the plant amounted to 27.60 ng.g^{-1}, while the control treatment (A0) gave the lowest average of 26.30 ng.g^{-1}.As for the bi-interaction, the results of the table show that there are significant differences between the treatment of organic fertilization and biofertilizers. The treatment (E3B2) recorded a significant effect of 37.19 ng.g^{-1}compared to treatment (E0B0), which gave 17.22 ng.g^{-1}, as for the interaction between the fertilization Organic and foliar spraying with seaweed extract, the treatment (E3A2) recorded the highest auxin rate in the plant, which was 35.72 ng.g^{-1}While the control treatment (E0A0) gave the lowest average of 18.53 ng.gm-1, and we note from the same table that the bilateral interaction between biofertilizers and foliar spray with seaweed extract gave an increase for the same traits.The treatment (B3A2) gave the highest rate of 29.32 ng.g^{-1}compared to the control treatment (B0A0), which gave a clear decrease of 24.24 ng.gm-1.As for the triple interaction (EBA), we notice from the same table a significant effect on the auxin rate in the plant. Treatment (E3B3A2)) gave the highest rate of 38.38 ng.g^{-1}compared to treatment (E0B0A0)), which gave the lowest rate of 16.23 ng.g^{-1}.

Table (7) The effect of organic fertilization with plant residues, biofertilization with some biofertilizers and foliar spraying with seaweed extract (aljarayn), and the interaction between them on the dry weight of the root system (gm) of apple seedlings

treatments						
B * A	Organic Fertilizer (plant) (E)				A . fertilization levels	fertilizing levels B
	E3	E2	E1	E0		
29.03	37.41	32.25	26.90	19.57	A0	B0
29.89	37.65	33.19	28.46	20.27	A1	
30.20	37.84	33.67	28.79	20.51	A2	
30.69	37.92	34.18	29.06	21.62	A0	B1
31.53	38.11	34.70	30.18	23.15	A1	
31.84	38.27	35.07	30.24	23.77	A2	
32.61	38.62	35.86	30.33	25.63	A0	B2
32.86	39.00	36.17	30.45	25.84	A1	
33.74	40.19	36.91	31.16	26.71	A2	
	38.33	34.67	29.51	23.01	effect E	
effect B						
29.71	37.63	33.04	28.05	20.12	B0	B * E
31.36	38.10	34.65	29.83	22.85	B1	
33.07	39.27	36.31	30.65	26.06	B2	
effect A						
30.78	37.98	34.10	28.76	22.27	A0	A * E
31.43	38.25	34.69	29.70	23.09	A1	
31.93	38.77	38.77	30.06	23.66	A2	

B * A * E	B *A	A * E	B * E	A	B	E	LSD 0.05
9.188	4.594	5.305	5.305	2.652	2.652	3.063	

Table (8) Effect of organic fertilization with plant residues, biological fertilization with some biofertilizers and foliar spraying with seaweed extract (aljarayn) and the interaction between them on the auxin content of leaves (ng.g-1) of apple seedlings

treatments						
B * A	Organic Fertilizer (plant) (E)				A . fertilization levels	fertilizing levels B
	E3	E2	E1	E0		
24.24	31.09	27.51	22.13	16.23	A0	B0
25.14	32.34	27 .82	23.02	17.40	A1	
25.77	33.08	28.34	23.63	18.03	A2	
26.64	34.07	29.18	24.07	19.23	A0	B1
27.22	35.20	29.22	24.84	19.62	A1	
27.71	35.69	30.01	25.37	19.76	A2	
28.03	36.11	30.17	25.71	20.12	A0	B2
28.46	37.07	30.33	26.02	20.44	A1	
29.32	38.38	30.79	26.92	21.19	A2	
	34.78	29.26	24.63	19.11	effect E	
effect B						
25.05	32.17	27.89	22.93	17.22	B0	B * E
27.19	34.99	29.47	24.76	19.54	B1	
28.60	37.19	30.43	26.22	20.58	B2	
effect A						
26.30	33.76	28.95	23.97	18.53	A0	A * E
26.94	34.87	29.12	24.63	19.15	A1	
27.60	35.72	29.71	25.31	19.66	A2	

B * A * E	B * A	A * E	B * E	A	B	E	
6.226	3.113	3.595	3.595	1.797	1.797	2.075 2.075	LSD 0.05

7- The content of the leaves of cytokinin (ng.gm^{-1}):.

The results in Table (9) show that there are significant differences between the organic fertilization treatments in the level of cytokinin in the plant, where the treatment (E3) gave a significant effect of 32.60 ng.gm^{-1} compared to the control treatment (E0) which recorded the lowest rate of 21.40 ng.gm^{-1}, It is noted from the same table that the ground addition of biofertilizers gave a significant increase for the same trait, where the treatment

with Mycorrhiza (B2) was superior by giving it the highest rate of 28.88 ng.gm^{-1} compared to the control treatment (B0), which gave the lowest rate of 26.42 ng.gm^{-1}. As for the spraying treatment with seaweed extract, treatment (A2) recorded an increase in the rate of cytokinin in the plant amounting to 28.04 ng.gm^{-1}, while the control treatment (A0) gave the lowest rate of 27.22 ng.gm^{-1}.,As for the bi-interaction, the results of the table show that there are significant differences between the treatment of organic fertilization and biofertilizers. The treatment (E3B2) recorded a significant effect of 33.87 ng.gm^{-1} compared to the treatment (E0B0), which gave 19.85 ng.gm^{-1},As for the interaction between organic fertilization and foliar spraying with seaweed extract, treatment (E3A2) recorded the highest rate of cytokinin in the plant, which was 33.16 ng.gm^{-1}, while the control treatment (E0A0) gave the lowest rate of 20.94 ng.gm^{-1}.

We note from the same table that the bi-interaction between biofertilizers and foliar spray with seaweed extract gave an increase for the same traits, where the treatment (B3A2) gave the highest rate of 29.45 ng.gm^{-1} compared to the control treatment (B0A0), which gave a clear decrease of 26.12 ng.gm -1, As for the triple interaction (EBA), we notice from the same table a significant effect on the rate of gibberellin in the plant. Treatment (E3B3A2)) gave the highest rate of 34.94 ng.gm^{-1} compared to treatment (E0B0A0)), which gave the lowest rate of 19.64 ng.gm^{-1} .

The content of the leaves of gibberellin (ng.gm^{-1}):.

The results in Table (10) show that there are significant differences between the organic fertilization treatments in the rate of gibberellin in the plant, where the treatment (E3) gave a significant effect of 21.42 ng.gm^{-1} compared to the control treatment (E0), which recorded the lowest rate of 15.08 ng.g^{-1}, It is noted from the same table that the ground addition of biofertilizers gave a significant increase for the same trait, where the mycorrhiza (B2) treatment was excelled by giving it the highest rate of 19.64 ng.gm^{-1} compared to the control treatment (B0), which gave the lowest rate of 17.88 ng.gm^{-1}, either Spraying with seaweed extract, treatment (A2) recorded an increase in the rate of gibberellin in the plant amounted to 18.98 ng.gm^{-1}, while the control treatment (A0) gave the lowest rate of 18.48 ng.gm^{-1}.As for the bi- interaction, the results of the table show that there are significant differences between the organic fertilization treatment and the biofertilizers. The treatment (E3B2) recorded a significant effect of 22.31 ng.gm-1 compared to the treatment (E0B0), which gave 13.61 ng.gm^{-1}, as for the interaction between the fertilization Organic and foliar spray with seaweed extract Treatment (E3A2) recorded the highest rate of gibberellin in the plant reached 21.79 ng.gm^{-1}, while the control treatment (E0A0) gave the lowest rate of 14.74ng.gm-1, and we note from the same table that the bi-interaction between biofertilizers and foliar spray with seaweed extract It gave an increase for the same trait, where the treatment (B3A2) gave the highest rate of 19.93 ng.gm^{-1} Compared to the control treatment (B0A0), which gave a clear decrease of 17.64 ng.gm^{-1}.As for the triple interaction (EBA), we notice from the same table a significant effect on the rate of gibberellin in the plant. Treatment (E3B3A2)) gave the highest rate of 23.00 ng.gm^{-1} compared to treatment (E0B0A0)), which gave the lowest rate of 13.20 ng.gm^{-1} .

Table (9): Effect of organic and bio-fertilization with some biofertilizers and foliar spraying with seaweed extract (Al-Jarain) and the interaction between them on cytokinin (ng.g-1) of apple seedlings

treatments						
B * A	Organic Fertilizer (plant) (E)				A . fertilization levels	fertilizing levels B
	E3	E2	E1	E0		
26.12	31.16	28.76	24.94	19.64	A0	B0
26.41	31.23	29.34	25.28	19.80	A1	
26.72	31.53	29.62	25.62	20.12	A2	
27.25	32.23	29.66	26.47	20.66	A0	B1
27.54	32.64	29.78	26.73	21.00	A1	
27.94	33.00	30.01	27.00	21.75	A2	
28.29	33.12	30.30	27.24	22.52	A0	B2
28.90	33.54	30.54	28.06	23.47	A1	
29.45	34.94	30.67	28.52	23.67	A2	
	32.60	29.85	26.65	21.40	effect E	
effect B						
26.42	31.31	29.24	25.28	19.85	B0	B * E
27.58	32.62	29.82	26.73	21.14	B1	
28.88	33.87	30.50	27.94	23.22	B2	
effect A						
27.22	32.17	29.57	26.22	20.94	A0	A * E
27.62	32.47	29.89	26.69	21.42	A1	
28.04	33.16	30.10	27.05	21.85	A2	

B * A * E	B * A	A * E	B * E	A	B	E	LSD 0.05
6.864	3.432	3.963	3.963	1.981	1.981	2.288	

Table (8) Effect of organic fertilization with plant residues and biofertilization with some biofertilizers and foliar spraying with seaweed extract (Al-Jarain) and the interaction between them on the iron content of leaves (mg.kg^{-1}) for apple seedlings

treatments						
B * A	Organic Fertilizer (plant) (E)				A . fertilization levels	fertilizing levels B
	E3	E2	E1	E0		
17.64	20.46	19.58	17.30	13.20	A0	B0
17.89	20.58	19.69	17.56	13.72	A1	
18.11	20.90	19.83	17.81	13.90	A2	
18.43	21.07	19.91	18.20	14.52	A0	B1
18.65	21.35	19.99	18.46	14.81	A1	
18.91	21.46	20.01	18.72	15.46	A2	
19.38	21.72	20.07	19.21	16.50	A0	B2
19.63	22.20	20.21	19.35	16.76	A1	
19.93	23.00	20.37	19.51	16.82	A2	
	21.42	19.96	18.46	15.08	effect E	
effect B						
17.88	20.65	19.70	17.56	13.61	B0	B * E
18.66	21.29	19.97	18.46	14.93	B1	
19.64	22.31	20.22	19.36	16.69	B2	
effect A						
18.48	21.08	19.85	18.24	14.74	A0	A * E
18.72	21.38	19.96	18.46	15.10	A1	
18.98	21.79	20.07	18.68	15.39	A2	

B * A * E	B * A	A * E	B * E	A	B	E	LSD 0.05
5.633	2.816	3.252	3.252	1.626	1.626	1.878	

Discussion :

The results in Tables (4-10) showed a significant increase in all studied traits represented by (plant height, leaf area, dry weight of the vegetative group, dry weight of the root system, leaf content of growth regulators (auxins, cytokines, gibberellins) when adding residues Plant (palm fronds and rice residues) and the reason for the increase when adding apple seedlings to the soil planted in it may be due to the role of these fertilizers, which work to increase its fertility and thus provide the necessary nutrients to the plant through its work in improving the physical properties and increasing the readiness of the macro and micro elements necessary to carry out the vital processes within The plant also that the fertilizer nutrients present in these wastes play an important role in the growth of the plant and the vital activities of the plant. Increasing plant growth[16] . In addition, the addition of compost to the soil may be possible The effect of increasing the activity and numbers of microorganisms in the soil that works to add nutrients to the soil continuously, which restores the balance of nutrients in it, which increases the absorption of elements for the plant and increases its concentration in it[17] as well as for the other elements found in these fertilizers, either As for the biological fertilizers, the reason for the increase may be due to the role of Mycorrhiza, Azotobacter, Bacillus and Pseudomonas bacteria when added to the soil. As well as the role of mycorrhiza fungi in improving the symbiotic relationship between plants and fungi and the role of these fungi in absorbing phosphorous element from the soil [18] and these fungi extend for several centimeters from the surface of the roots and work to withdraw nutrients from the outer area of the affected roots[19] These fungi also work to increase the area of absorption due to their hyphae as a result of the increase in the area of absorption They are superficial to the roots and thus secrete a good amount of growth regulators liberated in the growth medium (gibberellin, auxin and cytokinin), which increased the content of growth regulators in the leaves[20,21] that these secretions play an important role in the elongation of plant cells as a result of increased division Plant cells as well as stimulating root hairs, which positively affects the process of nutrient absorption and thus an increase in vegetative traits . As for the role of bacteria, their role does not differ from that of mycorrhizal fungi. The reason for the increase can be due to its role in increasing the absorption of nutrients such as nitrogen as a result of nitrogen fixation in a way Biologically alive, which plays an important role in cell division and the important physiological processes of roots in the soil, and that nitrogen is included in the construction of its chlorophyll molecule, as well as in the construction of nucleic acids RNA and DNA [22] .The symbiotic relationship and consequently an increase in the absorption of nutrients as a result of an increase in its availability in the growth medium[23] as for the nutrient The reason for the increase in the studied traits in plants treated with these extracts is due to its containment of biostimulants on amino acids and various plant hormones that work on the development of the vegetative and root system and increase the process of absorption of nutrients, as well as its role in increasing the resistance of the plant to stress The various environmental factors that increase the process of photosynthesis and thus increase the vegetative growth and the content of the leaves of nutrients[24] and the nutrients present in these extracts play an important role in the metabolism of the protein necessary for building cells, thus increasing the vegetative growth and the content of the leaves from carbohydrates and nutrients[25] As a result of the role of these plant organic residues, biofertilizers and marine algae extract, which contributed significantly to the absorption of nutrients from the growth medium to apple seedlings, and the overlap of these factors with each other contributed significantly to the absorption and accumulation of nutrients in the plant and thus reflected positively in improving Growth and development of these seedlings **Conclusions**:

We conclude from the study that the triple interaction was significantly excelled on the rest of the treatments, where the treatment of ground application with mycorrhizae at a rate of 10 g. seedlings $^{-1}$ and ground application of palm fronds residues with rice at a rate of 1 kg. seedlings $^{-1}$ and foliar spraying with seaweed extract at a concentration of 4 ml. L $^{-1}$ In all studied traits

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