THE EFFECT OF PLANTING MEDIA AND FOLIAR FEEDING WITH SEAWEED EXTRACT ON THE GROWTH OF PEPPER PLANTS

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ABSTRACTS

A pot experiment was conducted in one of private farms which is located in Baquba district of diyala Governorate with coordinates 33°44'41"N 44°38′37″E to study the effect of seaweed extract on the growth of pepper *Capsicum annuum* var. Crystal. The study included two factors: the planting media, which is peat moss medium and a mixture of peat moss and sand, and the second factor was seaweed extract at four levels 0, 2.5, 5, and 7.5 g l^{-1}. The experiment was conducted using the complete randomized block design (RCBD), and the experimental units were distributed randomly on three blocks, and plastic pots were used in the experiment. The seaweed extract was sprayed when the plants reaches the fourth fully mature leaf stage, and the second spray 30 days after the first spray. The results showed that the treatment of the peat moss media was significantly superior to the other media (mixture of peat moss and sand). The results also show that seaweed extract treatment was significantly superior to the concentration of 7.5 gm^{-1} over the rest of the treatments in the characteristics of plant height 35.00cm, number of leaves of 79.83 $leaf.plant^{-1}$, number of branches of 16 $breanch.plant^{-1}$, relative chlorophyll content of 56.31 spad, and leaf area of 268.21dm^2 , while the concentration of 5 gm^{-1} was superior in the fresh weight of 42.00 $gm.plant^{-1}$.

Keyword: PLANTING MEDIA, SEAWEED EXTRACT, PEAT MOAS, SAND

INTRODUCTION

Pepper L annuum Capsicum is a herbaceous plant of the Solanaceae family. It is native to Central and South America, and from there its cultivation moved to the rest of the world (14) . It is eaten fresh or in salads, and it is also used in pickling, stuffing, and sauce. Al contains 100 gr. Of its fresh fruits, it contains 8.4% carbohydrates and 2.1% protein, in addition to iron and potassium salts. And calcium, as well as fluorine, which prevents tooth decay (8)

Foliar feeding is an appropriate and necessary system for the plant to meet its requirements of the necessary nutrients through the leaves because transporting them through the roots requires a long time compared to spraying on the leaves and has a direct effect on many physiological processes affecting growth (9).

Farmers have increasingly used seaweed as a fertilizer. As marine algae extracts are commercially available. The effect of seaweed extract is due to the microelements and plant growth regulators such as the cytokinins present in it. The seaweed extract is used as a mixture added to the soil or sprayed foliarly on the plant, and the seeds are soaked in it before planting. Because it promotes seed germination, increases the absorption of plant nutrients, and gives plant resistance to frost and fungal diseases (15).

(4) obtained in their experiment when spraying sweet pepper plant with seaweed extract Basfolior Kelp, at a concentration of 6 ml l^{-1}, on significant differences in the vegetative traits represented by plant height, number of main branches, and dry weight of the shoot.

Taking care of the appropriate cradle is one of the important and defining matters for the growth of seedlings (2) Peat Moss is an organic material decomposed to varying degrees for aquatic plants in swamps and marshes, and is characterized by its high ability to retain water.

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This experiment aimed to:

1-Determine the best suitable medium for the growth of the sweet pepper plant.

2-Determine the best spray concentration of seaweed extract

3-Finding the best interaction between the agent of marine extracts and the agricultural media.

MATERIALS AND METHODS

The experiment was conducted During the spring agricultural season on11/3/2020 in the city of Baquba, and the experiment was conducted in pots to study the effect of the agricultural media and seaweed extract on the sweet pepper plant. in equal proportions (1:1) and gave them symbols, A_1 and A_2 respectively, and the second factor was sprayed with seaweed extract at four concentrations of 0, 2.5, 5, and 7.5 g l^{-1}, and symbols were given, B_1, B_2, B_3 and B_4 respectively.

The concentrations of seaweed extract (ts commercial name, Compe star, Which contains 35% seaweed and P_2O_2:5% and K_2O:10% ,Aliginic Acid:4%.) were prepared as follows:

1-Taking distilled water only, which is considered the control factor to obtain a concentration of 0 g $l^{-1.}$

2-Take 2.5 grams of seaweed in the form of dried powder, and dissolve in a liter of distilled water to obtain a concentration of 2.5 g l^{-1}.

3- Take 5 grams of seaweed powder and dissolve it in a liter of distilled water to get a concentration of 5 g l^{-1}.

4- Take 7.5 grams of seaweed powder and dissolve it in a liter of distilled water to get a concentration of 7.5 g l^{-1}.

The pots were prepared and filled with two types of agricultural media, the first is peat moss and the second is a mixture of peat Moss and sand soil with equal proportions 1:1.

The experiment was conducted using a randomized complete block design (RCBD) (2), and the experimental units were distributed randomly on three blocks, and plastic pots were used in the experiment. The seaweed extract was sprayed when the plants reached the fourth stage of and the second spray after 30 days of the first spray.

MEASURED TRAITS

Measurements were made on plants randomly and from all replicates for the following characteristics:

1 -Plant height (cm): The plant height was measured for three random plants from each replicate from the area of contact with the soil to the highest leaf in the plant by measuring tape and taking the average.

2-Stem diameter (cm): It was measured by the foot (Vernier) of five plants from each cultivar, and the average was taken in the field .

3 -Relative chlorophyll content (SPAD): Chlorophyll was measured with a chlorophyll meter as a percentage with a spade device

4-The number of total leaves / plant: The number of leaves of each plant was counted, all the leaves of the plant were counted, and the average was taken .

5- Number of branches (branch/plant): The number of branches for each plant was calculated and the average was taken.

6 -The wet weight of the plant (gm/plant): The wet weight of the shoot was measured with an electronic scale after cutting the plant from the stem-root connection area.

7- A digital planimeter was used to measure this characteristic in the laboratories of the College of Agriculture, Diyala University, in units poison2By taking four full leaves from the middle branch on the main stem of each seedling and for each treatment Its average was extracted and the total leaf area of the seedlings was calculated by multiplying the

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number of leaves of the seedlings by the area paper for that transaction.

RESULTS AND DISCUSSION

1-Plant height

Table No. 1 shows the effect of the agricultural media and the concentration of seaweed on the length of the pepper plant, where the treatment of the agricultural medium A1 was superior to the agricultural medium A2 in Plant height, reaching 34.80 cm, while the treatment of the mixture of A2 reached 31.50 cm. L-1 over the control treatment with an average Plant height of 35.00 cm. B4 gm treatment was superior. L-1 treatment was superior to B2 and B3 treatments, both of which reached 34.50 cm. From the same table, it is clear that treatment B2 and B3 outperformed the control treatment. The table also shows the effect of overlap coefficients on Plant height. The overlap treatment, B4 A1, was superior to the control treatment and to all other treatments, with an average Plant height of 37.00 cm. It is also noted that the treatment of Overlapping A1B2 and A1B3 over the rest of the overlapping treatments, as the plant height for both reached 35.33 cm. From the same table, it is noted that the treatment of A2B2 was superior to the treatment of A2B4, A2B3, and A1B1, with an average plant height of 33.66 cm, while the overlapping treatment of A2B4 was superior to the overlapping treatment of A2B3 and A1B1, with an average Plant height of 33.00 cm. From the same table, the overlap treatment A2B3 is superior to the two treatments A1B2 and A2B1 with a plant length of 32.66 cm. It is noted that the overlap treatment A1B1 is superior to the treatment A2B1 with a Plant height of 31.66 cm.

Table 1. Effect of planting media and seaweed on plant height (cm)

	Overlap between A&B Factors				
Factors A	**B4**	**B3**	**B2**	**B1**	
a34.8	**37.00a**	**35.33b**	**35.33b**	**31.66f**	**A1**
31.50 b	**33.00d**	**32.66e**	**33.66c**	**26.66g**	**A2**
	35.00a	**34.50b**	**34.50b**	**29.16c**	**Factors B**

Note: There are no significant differences between the values followed by the same letter according to Dunkin's multiple test.

2- The stem diameter

The results of Table No. 2 show that there is a significant effect of the agricultural medium and seaweed concentrations on stem diameter of the pepper plant, as the plants grown in the agricultural medium A1 excelled with a stem diameter of 0.50 cm, while stem diameter decreased to 0.46 cm for the treatment of A2. From the same table, the effect of the seaweed concentration is noted on stem diameter of a plant Pepper, as the B4 treatment plants outperformed the rest of the treatments, with a stem diameter of 0.53 cm, while the stem diameter of the control treatment was 0.41 cm, and for B2, B3, 0.50, and 0.48 cm. Through the results of the table, it is noted that treatment B2 was superior to treatment b3 and the control treatment with a stem diameter of 0.50. cm also outperformed B3 treatment The control treatment, as the thickness of the stem reached 0.48 cm. Through the results of the table, we also note that there is a significant effect of the interaction between the agricultural medium and the effect of seaweed. cm, and the overlap treatments A1B3 and A2B4 excelled with a stem thickness of 0.50 cm for both, while the stem diameter of A2B2

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and A2B3 treatments reached 0.46 cm. stem diameter decreased to 0.40 cm for A1B1 treatment

Table 2 Effect of planting media and seaweed on stem diameter (cm).

	Overlap between A&B Factors				
Factors A	**B4**	**B3**	**B2**	**B1**	
0.50a	**0.56a**	**0.50c**	**0.53b**	**0.40f**	**A1**
0.46b	**0.50c**	**0.46d**	**0.46d**	**0.43e**	**A2**
	0.53a	**0.48c**	**0.50b**	**0.41d**	**Factors B**

Note: There are no significant differences between the values followed by the same letter according to Dunkin's multiple test.

3- The relative content of chlorophyll in the leaves

The results of Table No. 3 show that there is a significant effect of the treatment of the agricultural medium on the relative content of chlorophyll of the leaves of the pepper plant, as the plants grown in the agricultural medium A2 excelled with the best relative content of chlorophyll amounting to 49.25%, and the concentration of seaweed had a significant effect on the relative content of chlorophyll, as the plants treated with different concentrations excelled over the control plants and distinguished from them B4 plants with the best relative content of chlorophyll amounted to 56.31%, and through the results of the table, it is noted that B2 plants outperformed B3 and B1 plants with a relative content of chlorophyll amounted to 48.91%.The results of the same table show that there is a significant effect of the overlap treatment between the agricultural medium and seaweed, as the plants of the overlap treatment A2B4 were characterized by the best relative content of chlorophyll amounted to 56.76%, while the overlap treatment A1B4 amounted to 55.86%. A1B2 over the rest of the treatments with a chlorophyll rate of 49.33%. Also, the overlap treatment A2B2 outperforms the overlap treatment A1B1 and a2b1 with a chlorophyll rate of 48.50%, while the overlap treatment A1B1 excels with a chlorophyll rate of 42.60%. It is noted that the relative content of chlorophyll of A2B1 chlorophyll reached 41.60%.

Table 3. Effect of planting media and seaweed on the relative chlorophyll content (SPAD) in the leaves.

	Overlap between A&B Factors				
Factors A	**B4**	**B3**	**B2**	**B1**	
47.76b	**55.86b**	**43.03f**	**49.33d**	**42.60g**	**A1**
49.25a	**56.76a**	**50.16c**	**48.50e**	**41.60h**	**A2**
	56.31a	**46.60c**	**48.91b**	**42.21d**	**Factors B**

Note: There are no significant differences between the values followed by the same letter according to Dunkin's multiple test.

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4- The number of leaves

The results of Table No. 4 show that there is a significant effect of the treatment of the agricultural medium of the pepper plant, as the A1 agricultural medium plants were characterized by the best number of leaves, reaching 72.58 leaves of plant^{-1}, while it decreased to 57.25 leaves of plant^{-1}. The concentration of seaweed affected the increase in the number of leaves, as the treated plant excelled in various treatments On the two comparison plants, the plants of the B4 treatment were characterized by the highest number of leaves, reaching 79.83 leaves of Plant^{-1}, while the number of leaves in the B3 treatment reached 66.66 leaves of Plant-1, which outperformed the B2B1 treatment, as the number of leaves reached 58.66 and 54.50 for each, respectively. It is noted from the same table the effect of the treatment Interaction between culture medium and seaweed In the number of leaves, the plants of the overlap treatment A1B4 gave the best number of leaves reaching 89.00 leaf plant^{-1}, and the overlap treatment A1B3 gave an average of leaves relative to the rest of the overlap treatments 71.00 leaf plant^{-1}. Also, the intervention treatment A2B4 outperformed the two overlap treatments A1B2 and a2b3 with a number of leaves of 70.66 leaf plant^{-1}While it is noted from the table that there were no significant differences between A1B2 and A2B3, the number of leaves for both reached 62.33 leaf plant^{-1}, and the overlap treatment affected A2B2 with a higher number of leaves than the intervention treatment A2B1, with a number of leaves of 55.00 leaf plant^{-1}, while the number of A2B1 leaves reached 41.00 leaf plant^{-1}

Table 4. Effect of the agricultural media and seaweed on the number of leaves per plant (leaf plant^{-1})

	Overlap between A&B Factors				
Factors A	**B4**	**B3**	**B2**	**B1**	
72.58a	**89.00a**	**71.00b**	**62.33e**	**68.00d**	**A1**
57.25b	**70.66c**	**62.33e**	**55.00f**	**41.00g**	**A2**
	79.83a	**66.66b**	**58.66c**	**54.50d**	**Factors B**

Note: There are no significant differences between the values followed by the same letter according to Dunkin's multiple test.

5- The number of branches of the plant

The results of Table No. 5 show that there is a significant effect of the treatment of the agricultural medium on the number of branches of the pepper plant, as the plants grown in the agricultural medium A1 gave the highest number of branches of 14 branches of plant^{-1}, while the number of branches decreased to 10 branches of plant $^{-1}$ in the treatment of A2 significantly and the effect of the concentration of seaweed Significantly in the number of branches, the plants treated with different concentrations outperformed the control plants, and the b4 plants were distinguished by the highest number of branches, reaching 16 branches of plant^{-1}, while the number of branches in the B3 treatment reached 14 branches of plant^{-1}, which was distinguished from B2 and B1, as the number of branches reached 12 and 8, respectively. Through the results of the table above, we notice that there is a significant effect of the interaction between the treatment of the agricultural medium and the seaweed

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extract The plants of the overlap treatment A1B4 excelled with the highest number of branches, reaching 20 branches of plant^{-1}, while the number of branches in the treatment of B3 A1 reached 16 branches of plant^{-1}, which outperformed the two overlap treatments over the treatments A1B2 and A2B3, as the number of branches reached 12 branches of plant $^{-1}$ for both of them, while the number of branches reached In the overlap treatment A2B2 and A2B4 11 branches of plant $^{-1}$, that is, there are no significant differences between them, as it is noted that they are superior to the two overlap treatments A1B1 and A2B1, as the number of branches reached 9 and 7 branch of plant $^{-1}$, respectively

Table 5 Effect of planting media and seaweed on the number of branches of the plant (branch plant^{-1})

	Overlap between A&B Factors				
Factors A	**B4**	**B3**	**B2**	**B1**	
a 14	**a 20**	**b16**	**c 12**	**9 e**	**A1**
b10	**d11**	**c12**	**d11**	**f7**	**A2**
	a16	**14B**	**c12**	**d8**	**FactorsB**

Note: There are no significant differences between the values followed by the same letter according to Dunkin's multiple test>

6- The wet weight of the shoot

The results of Table No. 6 show that there is a significant effect of the treatment of the media on the wet weight of the pepper plants, as the plants of the culture media A1 excelled with the highest wet weight of the shoot totaling 38.90 gm, while the wet weight decreased in the treatment of A2 to 23.08 gm. Also, seaweed treatments recorded significant effects, as the plants excelled Treatment B3 with the highest wet weight amounted to 42.00 gm, while the wet weight of the shoot of B1 treatment decreased to 16.60 gm, and the treatments B4 and B2 outperformed the B1 treatment with a wet weight of 37.50 and 27.83 gm, respectively. The agent A1B4 had the highest wet weight of 51.33 gm, and the wet weight in the overlap treatment A1B3 was 51.00 gm, which was superior to the overlap treatments A1B2, A2B4, A2B3 and A2B1

Table 6 Effect of planting media and seaweed on the wet weight of shoot (gm)

	Overlap between A&B Factors				
Factors A	**B4**	**B3**	**B2**	**B1**	
38.90a	**51.33a**	**51.00b**	**33.00c**	**19.33g**	**A1**
23.08b	**23.66e**	**32.00d**	**22.66f**	**14.00h**	**A2**
	37.50b	**42.00a**	**27.83c**	**16.60d**	**Factors B**

Note: There are no significant differences between the values followed by the same letter according to Dunkin's multiple test.

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7- The total leaf area

The results of Table No. 7 show that there is a significant effect of the media on the total leaf area of the pepper plant. The plants grown in the A1 culture media excelled with the highest total leaf area of 52.98 dm ^{2}, while the total leaf area decreased in the A2 treatment to 158.036 dm ^{2}; The concentration of seaweed had a significant effect, as the different plants treated with different concentrations outperformed the control plants, and the plants of B4 treatment excelled with the highest total leaf area amounting to 268.21 dm^2, and the total leaf area in the B3 treatment reached 251.66 dm^2, which outperformed the B1 and B2 treatments The total leaf area, respectively, was 199.25 and 103.56 dm^2. Through the same table, we notice a significant effect of the interaction of the agricultural medium and seaweed on the total leaf area of the pepper plant, as the two plants of the overlap treatment A1B4 were characterized by the highest total leaf area of 346.93 dm^2, while the total leaf area in the overlap treatment A1B3 was 327.96 dm^2, while the paper area in the overlap treatment A1B2 was 250.93 dm^2. It is also noted from the table that the paper area in the overlap treatment A2B4 was 189.50, which outperformed the overlap treatment A2B3 with a paper area of 175.36 dm^2, which outperformed the two overlap treatments A2B2 and A2B1, which amounted to 147.56 and 121.03 dm^2, respectively. While the total leaf area decreased to 86.10 dm ^{2} in the treatment of overlapping A1B1

Table 7 Effect of planting media and seaweed on total leaf area (dm^2)

	Overlap between A&B Factors				
Factors A	**B4**	**B3**	**B2**	**B1**	
252.98a	**346.93a**	**327.96b**	**250.93c**	**86.10h**	**A1**
158.36b	**189.50d**	**175.36e**	**147.56f**	**121.03g**	**A2**
	268.21a	**251.66b**	**199.25c**	**103.56d**	**FactorsB**

Note: There are no significant differences between the values followed by the same letter according to Dunkin's multiple test

Discussion

The increase in the vegetative growth characteristics of pepper may be attributed to what the seaweed extract (Seaforce and Seamino) contains of auxins, which have an effective role in increasing cell division and breadth, which leads to a larger vegetative size and an increase in plant height, branches, or insomnia and an increase in leaf area and plant weight (11). The reason may be due to the content of these seaweed extracts on many nutrients, both macro and micro, such as iron, which is important in activating oxidation-reduction enzymes in the electron transport chain in the respiration process and helping it build chlorophyll and store iron in chloroplasts in the form of phytoferritin, which leads to greater vegetative growth (4), also, the zinc element contained seaweed extracts contributes to the manufacture of the amino acid (Treptophan), which is the basic material in the manufacture of auxin (IAA) which is important in cell division and expansion, which leads to greater vegetative growth, as well as copper and boron found in seaweed extracts, which are important in transporting electrons and transporting sugars, which encourages photosynthesis and other growth processes and thus leads to greater growth (10) his can be attributed to the fact that the seaweed extract contains proteins, vitamins, sugars, and mineral elements such as potassium and magnesium, which play a role

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in the vital processes within the plant, such as photosynthesis, activating the work of some enzymes, and building proteins, calcium and magnesium are the largest percentage of the components of the middle plate, and the magnesium atom represents the center of the chlorophyll molecule (7).

In addition to the fact that seaweed extract contains amino acids that are essential precursors for the formation of phytohormones auxin, gibberellin, and cytokinin (12)(13). As for the effect of the culture medium on vegetative growth, the increase in vegetative growth characteristics and the superiority of peat moss may be attributed to the fact that house moss has the ability to retain water as well as provide sufficient oxygen for cell respiration during the rooting period Also, this medium has the ability to exchange positive ions and it was also found that peat moss contains the major elements NPK, Mg (11) (5)

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