EFFECT OF SOIL COVERAGE WITH ORGANIC MULCHING AND SPRAYING WITH SEAWEED EXTRACT ON SOME VEGETATIVE AND PRODUCTIVE TRAITS OF CUCUMBER GROWN IN GREENHOUSES

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ABSTRACT

The experiment was carried out to investigate the effect of soil coverage with organic mulching and spraying with seaweed extract in some vegetative and productive characteristics of Cucumber planted under plastic houses. The study was included two factors: the first factor was organic soil coverings which divided into Control: without coverage (M_0), Coverage of wheat straw (M_1), Coverage of Sawdust (M_2) and Coverage of Corn cobs (M_3) while the second factor was represented by three concentrations of seaweed extract (0, 1, 2) $g.L^{-1}$ (F_0, F_1, F_2 respectively). The experiment was Randomized Complete Block Design RCBD with three replicates as a factorial experiment (4 x 3). The experiment included 12 treatments and 36 units, each unit includes 8 plants. The obtained results were analyzed by SAS program and the averages were compared by the Duncan Multipliers test at a probability level of 5%. The present results showed that the Soil coverings with wheat straw (M1) recorded a significant increase in plant length, number of leaves, relative chlorophyll quantity, number of fruits, fruit weight, plant yield and total yield with mean values195.60 $cm/plant^{-1}$,47.89$leaf/plant^{-1}$, 41.19 SPAD,29.00 fruit,80.20$g/fruit^{-1}$, 2.320 $g/plant^{-1}$,3.897 $kg/plant^{-1}$ respectively. While the seaweed extract had a significant effect in most studied traits, spraying at (1 g/L^{-1}) F1 gave the highest rate of plant length, number of leaves, fruit weight, and total soluble solids content (T.S.S) was197.10 $cm/plant^{-1}$. 48.08 $leaf/plant^{-1}$. 71.30 $g/fruit^{-1}$, 3.300% respectively, the concentration of spray (2 g/ L^{-1}) F2 exceeded the number of fruits, plant yield, and total yield. Additionally, the interaction between spraying with a concentration of seaweed extract (1 g/ L^{-1}) F1 and soil cover with wheat straw (M1) significantly increased plant height, number of leaves, and relative amount of chlorophyll and fruit weight.

Keywords: Organic mulching, Seaweed extract, greenhouses, cucumber
*The research is part from high diploma thesis for the first researcher

تأثير تغطية التربة بالمغطيات العضوية والرش بمستخلص الاعشاب البحرية في بعض الصفات الخضرية والانتاجية للخيار المزروع في البيوت البلاستيكية غير المدفأة

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المستخلص

نفذت التجربة خلال الموسم الزراعي 2018- 2019 في احد البيوت البلاستيكية العائدة لمحطة الابحاث التابعة لقسم البستنة وهندسة الحدائق في كلية الزراعة جامعة ديالى وذلك بهدف دراسة اثر اغطية التربة العضوية والرش بمستخلص الاعشاب البحرية في نمو وانتاج الخيار المزروع داخل البيوت البلاستيكية تضمنت دراسة عاملين الاول اغطية التربة العضوية اذ استخدم انواع وهي: M_1 التغطية بقش الحنطة (التبن) ، M_2 التغطية بنشارة الخشب، M_3 التغطية بكوالح الذرة بالا ضافة الى معاملة المقارنة بدون تغطية M_0.والثاني ثلاثة تراكيز من مستخلص الاعشاب البحرية 0،1،2 غم. لتر$^{-1}$. نفذ البحث كتجربة عاملية بأستخدام تصميم القطاعات العشوائية الكاملة(R.C.B.D) وبثلاث مكررات وقد قورنت المتوسطات حسب اختبار دنكن متعدد الحدود عند مستوى احتمال 5% واظهرت النتائج على النحو الاتي: سجلت اغطية التربة بأستخدام قش الحنطة (التبن)M_1 زيادة معنوية في كل من طول النبات195.60سم. نبات$^{-1}$،عدد الاوراق47.89ورقة. نبات$^{-1}$، كمية الكلوروفيل النسبية 41.19 سباد، وزن الثمرة 80.20 غم. نبات$^{-1}$، حاصل النبات الواحد 2.320 كغم. نبات$^{-1}$، حاصل كلي 3.897 طن. بيت$^{-1}$ على التوالي. اما مستخلص الاعشاب البحرية فقد سجل تأثيرا معنويا في اغلب الصفات المدروسة، اذ تفوق الرش بتركيز1غم. لتر$^{-1}$ F1 بأعطاء اعلى معدل في طول النبات 197.10سم. نبات$^{-1}$، عدد الاوراق 48.08 ورقة. نبات$^{-1}$، وزن الثمرة 82.20 غم. نبات$^{-1}$ نسبة المواد الصلبة الذائبة الكلية T.S.S 3.300% على التوالي، بينما كان تركيز الرش 2غم. لتر$^{-1}$ F_2 متفوق في صفات عدد الثمار28.87 ثمرة. نبات$^{-1}$، حاصل النبات الواحد 1.964 كغم. نبات$^{-1}$، الحاصل الكلي 3.299 طن. بيت$^{-1}$. كما سجلت معاملة التداخل بين مستخلص الاعشاب البحرية بتركيز 1غم. لتر$^{-1}$ F_1 واغطية التربة بقش الحنطة (التبن) M_1 زيادة معنوية في طول النبات، عدد الاوراق، كمية الكلوروفيل السباد، وزن الثمرة.

الكلمات المفتاحية: الاغطية العضوية، مستخلص الاعشاب البحرية، الخيار، البيوت البلاستيكية.

INTRODUCTION

Cucumber (*Cucumis sativus* L.) is a plant of the Cucurbitaceae family, Containing 90 species and 750 varieties (Haifa and Group, 2014). Cucumbers' fruit is a poor source of some vitamins (A,B1,B2,C) and Niacin in addition to mineral elements, especially calcium, phosphorus potassium and iron (Papadopoulos,2003).It is believed the native country is India , where India exports large quantities of it, especially small fruits used in pickling (Mady and Derees ,2007).Cucumber was mentioned in the records of Sumerians and Babylonians about 3000 BC.It is one of the most important vegetable crops due

to its wide spread , rapid growth, early maturity, abundant production and its rapid development in the field of vegetable production in the world.The area planted in Iraq in 2017of the cucumber crop 3.156 thousand Hectares and the Ministry about Agriculture, 2018). average productivity of 897.9 tons.H^{-1} Modern research is now directed towards the use of plant and seaweed extracts as an alternative to growth regulators because they are natural substances and do not have an impact on humans and the environment as well as increasing the resistance of plants to diseases and insects. Foliar fertilization by using seaweed extract, which contains a lot of plant hormones such as Auxin ,Gibberellin, Cytokines and some major and minor nutrients, has proved effective in many horticultural crops. It is also one of the modern methods to increase agricultural production for its rapid impact on processing the plant with these requirements. Natural extracts have a direct role in inducing metabolic pathways leading to the construction of antioxidant molecules in the plant cell, which is lead to increasing plant resistance to a biotic stresses and diseases (Cardozo et al, 2007). Ali et al (2012) showed in a study the effect of spraying seaweeds extract ALTRA at two concentration of (0, 1.5 ml.L^{-1}) and Sea force at a concentration of (1.5 ml.L^{-1}) on the cucumber plant. The treatment of Sea force (1.5 ml.L^{-1}) was significantly superior in the plant height and the fresh and dry weight of plant exceeded control treatment. Al-Bayati (2011) indicated a significant response in the total yield characteristics, which included fruit length, fruit diameter, fruit number, fruit weight, fruit size and total yield when spraying cucumber plants with some seaweed extract ALGA 600 at a concentration of (3 ml. .L^{-1}) and seaweed extract TON ALGA (3 ml.L^{-1}) and interaction between the two extracts compared to the control treatment which gave the lowest rates. As for organic soil coverings, their effect on plant growth and productivity increased by affecting the physiological activities of the soil and its surrounding conditions (Zhang et al, 2007). Jafarnia and Homayi (2006) was reported that organic mulching is one of agricultural practices that aims to apply synthetic and organic materials on the soil to provide a more suitable environment for plant growth. Al-Mohammadi (2012) was found he was when using some local wastes (sawdust and corn cobs) and their effect on growth and yield of chili pepper the sawdust recoded highest value in plant height, leaf area and chlorophyll concentration in leaves. Based on the above and considering the importance of the cucumber crop, the research aim to improve and increase the vegetative and productive characteristics of the cucumber through the use of organic soil coverings and foliar spraying with seaweed extract and interaction between them

to determine the suitable cover type and the best spray concentration in greenhouse. .

MATERIALS AND METHODS

The experiment was carried out during the agricultural season of 2018-2019 in one of the greenhouses belongs to the research station of the Department of Horticulture and gardening landscape / college of Agriculture - Diyala University to study the effect of soil coverage with organic mulching and spraying with seaweed extract in some vegetative and productive traits of cucumber grown in greenhouses. The soil was prepared by a plow with a depth of about 40 cm. And then samples of soil from different areas with a depth of 30 cm were taken and analyzed at the Laboratory. Table (1) shows the physical and chemical properties of the experimental soil. Dab fertilizer (N46, P18) was added at a rate of 8 kg per to all the plastic house (504 m^2), (9 × 56 m) and the fertilizers was mixed with the soil, followed by soil smoothing, settling and then the house was divided into 12 line and the distance between the two lines was 75 cm . about the corridor was 30 cm between the two lines, drip irrigation pipes were extended on the planting lines. The distance between plants was 40 cm,The seeds of cucumber variety YEKT F1 produced by the Spanish company (Fito) were planted at 10/11/2018 in cork dishes 902 after filling with peatmoss as agricultural medium has been planted with one seed in each eye, the seedlings were transformed to the permanent field in the plastic house on 10/12/2018 After the appearance of two real leaves and a length of 12 cm. Recommended processing for planting including irrigation, weed control, insect and fungal infections control and crop harvesting were provided until the end of the season, And equally for all experimental units. .

EXPERIMENTALFACTORS

The experiment included two factors: The first factor was organic soil coverings which divided into Control: without coverage (M0), Coverage of wheat straw (M1), Coverage of Sawdust (M2) and Coverage of Corn cobs (M3) while the second factor was represented by three concentrations of seaweed extract (0, 1, 2) $g.L^{-1}$ (F_0, F_1, F_2 respectively). The experimental treatments involved T1: Control treatment (without coverage and spraying) M_0F_0, T2 :(Spray treatment with 1 g. L^{-1} + without coverage) M_0F_1, T3: (Spray treatment with 2 $g.L^{-1}$ + without coverage) M_0F_2, T4: (Coverage of wheat straw treatment without spraying) M_1F_0, T5:(Coverage of wheat straw treatment with spraying 1 g/L^{-1}) M_1F_1, T6: (Coverage of wheat straw treatment with spraying 2 $g.L^{-1}$) M_1F_2 , T7:(Coverage of Sawdust treatment without spraying) M_2F_0, T8:(Coverage of Sawdust treatment with spraying 1 g/L^{-1}) M_2F_1, T9:(Coverage

of Sawdust treatment with spraying 2 g/L $^{-1}$) M_2F_2, T10:(Coverage of Corn Cobs treatment without spraying) M_3F_0, T11:(Coverage of Corn Cobs treatment with spraying 1 g/L $^{-1}$) M_3F_1, T12:(Coverage of Corn Cobs treatment with spraying 2 g/L $^{-1}$) M_3F_2.The experiment was designed as Randomized Complete Block Design (RCBD) with three replicates as a factorial experiment (3 x 4) into 12 treatments and 36 units (each experimental unit involved 8 plants), the measurements were made for five plants from each unit. The statistical analysis of the studied traits was performed using the SAS program and Duncan Multiplicity test at a 5% probability level (AL-raawi and Khalaf Allah, 2000). Seaweeds extract (Juice weed sea) Table 2, was sprayed four times during the growing season, the first spraying was after a month of transferred to the permanent field in the plastic house,and continue spraying ever 15 day for four times.

Table 1. Physical and chemical properties of the soil before planting

Trait	Value	Unit
Organic Matter	1.19	%
$CaCO_3$	207.10	g/kg^{-1}
EC(1:1)	6.58	dsm^{-1}
1):Ph (1	7.82	
Elements availability		
Nitrogen	10.05	mg/kg^{-1}
Phosphorus	7.241	mg/kg^{-1}
Potassium	199.81	mg/kg^{-1}
Soil Particle Size		
Clay	216	g/kg^{-1}
Silt	232	g/kg^{-1}
Sand	552	g/kg^{-1}
Texture Class	Sandy loam	

Table 2. properties of the Seaweed Extract which used in the research

Trait	ratio
Organic Carbon	30%
Organic Matter	50%
small elements	16%
Other materials	4%

STUDY INDICATORS

-Studied indicators such as

Plant length (cm), **the number of leaves**, **Relative chlorophyll quantity in leaves** (SPAD unit).

The number of fruits (fruit/plant $^{-1}$):

The number of fruits in the experimental unit was calculated from the continued from of the harvest until the end of the growing season as follows:

Number of fruits = Total number of fruits in the experimental unit / number of plants in experimental unit.

Fruit weight (g):

The weight of fruit was calculated as follows:

The weight of fruit = the plant yield / the number of its fruits

The plant yield (kg/plant^{-1}):

The plant yield was caculated by multiplying the average of fruits number by the average of fruit weight per treatment.

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The total yield of the plastic house (ton.h^{-1}):

The total yield of the plastic house was determined by multiplying the plant yield by the total number of plants in the plastic house (1680 plant) for 12 lines, length 56m and 40cm the distance between the plant and another.

Total Soluble Solids (T.S.S):

T.S.S was measured by selected five fruits from each. The experimental unit.

Results and Discussion

-Vegetative growth parameters

Plant length (cm):

The results in Table 3 showed no significant differences between organic soil coverings M_1, M_2 and M_3 in plant length as the differences between coverings did not reach significant effect all these treatments outperformed on the Control treatment, which gave the minimum plant length of 163.30 cm/Plant^{-1}. The results also showed that there were significant differences in the treatments of spraying with seaweed extract of this characteristic, the treatment F_1 concentration of 1 g/ L^{-1} was superior which gave the highest length 197.10 cm/plant^{-1} compared Control treatment which gave the lowest length of 170.80 cm/ Plant^{-}.The interaction between the soil coverings and spraying with seaweed extract treatments had a significant effect in this characteristic. The M_1 F_1 and M_3F_1treatments were superior in giving the highest plant length as they did not differ significantly from each other and reached 201.70 cm/Plant $^{-1}$ for both of them, while the Control treatment recorded the lowest rate in this characteristic amounted 125.00 cm/ Plant^{-1}. This may be due to its large role in the supply of plants with the necessary elements N, P and K, which may affect the increased soil capability to catch water and elements as a result of the decrease in the

degree of soil interaction (Eifediy and Remison, 2010). This is consistent with the findings of Al-Mohammadi (2012), who indicated that the use of some local wastes had an effect on the growth and yield of chili pepper and its superiority in plant height. Or may be due to the extract containing a number of important nutrients, especially zinc, which affects the increase and improve the characteristics of vegetative growth and activation of many enzymes such as Protenase, Carbonic anhydrase with Ali et.al (2012), which indicated that there was a significant increase in plant length compared to the control treatment which gave the lowest results.

Table 3. Effect of the organic soil mulching, spraying with seaweed extract and their interaction on the Plant length (cm/plant^{-1}).

F / M	F_0	F_1	F_2	Organic mulching average
M_0	125.00 d	195.00 ab	170.00 c	163.30 B
M_1	193.30 ab	201.70 a	191.70 ab	195.60 A
M_2	181.70 bc	190.00 ab	196.70 ab	189.40 A
M_3	183.30 bc	201.70 a	193.30 ab	192.80 A
Concentrations average	170.80 C	197.10 A	187.90 B	

The values of similar letters are not significantly different from each other according to the Duncan test below the 5%
F: seaweed extract spraying concentration; M: Organic mulching.

The number of leaves:

Result in Table 4 shows the superiority of organic soil coverings M_1 and M_2 with the highest number of leaves of 47.89 and 48.44 leaf.Plant^{-1}, respectively, there were not significantly different between them compared to M_0 and M_3, which had the lowest rate of 44.33 and 44.17 leaves. Plant^{-1} respectively, As for the spraying treatments with seaweed extract, spraying treatments F_1 and F_2 were superior in number of leaves, which were not significantly different from each other (48.08 and 47.25 leaf.Plant^{-1}, respectively) compared to Control treatment which gave the lowest number of leaves, 43.29 leaf.Plant^{-1}.The interaction had a significant effect, The treatment of F_1M_1 exceeded the highest leaves number of 54.00 leaf.plant^{-1}, while The Control treatment recorded the lowest rate in this characteristic amounted to 40.00 leaf/Plant^{-1}. To explain these

results that may refer the effect of organic matter on plant growth and productivity through the influence of soil physiological activities (Zhang et al., 2007). This is consistent with the findings of Al- Hakim (2006) he pointed out that the use of organic soil cover has affected the production of cucumber and increased the soil temperature during the growth stages in the cold weather and get the best growth of the roots, which reflected on the increasing the strength and activity of vegetative growth of the number of leaves.

Table 4. Effect of the organic soil mulching, spraying with seaweed extract and their interaction on the number of leaves (leaf/plant^{-1}).

F / M	F_0	F_1	F_2	Organic mulching average
M_0	40.00 D	43.50 bcd	49.50 Ab	44.33 B
M_1	44.50 Bcd	54.00 A	45.17 Ab	47.89 A
M_2	46.67 Bc	49.50 ab	49.17 Ab	48.44 A
M_3	42.00 Cd	45.33 bcd	45.17 Bcd	44.17 B
Concentrations average	43.29 B	48.08 A	47.25 A	

The values of similar letters are not significantly different from each other according to the Duncan test below the 5%
F: seaweed extract spraying concentration; M: Organic mulching

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Relative chlorophyll quantity in leaves (SPAD unit):

Result in Table 5 indicated there were asignificant differences between organic soil coverings. The M_1 treatment was superior with the highest rate of relative chlorophyll in the leaves of 41.19 SPAD, superior the other treatments which recorded the lowest rate in this characteristic, but all superior the Control treatment which gave the lowest rate. As such, it reached 36.11 SPAD. As well as the results indicated that there were no significant differences between spraying treatments with seaweed extract in relative chlorophyll content in leaves. The interaction between the two factors resulted asignificant differences, F_0M_3, F_1M_1 and F_2M_1 treatments were recorded the highest relative chlorophyll content of 42.80, 42.10 and 41.23 SPAD respectively. this may be due to the extract containing a number of important nutrients, especially zinc who helps in the formation of the hormone IAA to drive the growth of seedling and growing plant tops, elongation and division of cells and the representation of nitrogen and photosynthesis , therefore increases the number of leaves and the relative content of chlorophyll and is associated with the role of iron, which preserves

the green matter inside the plant through its role as a mediator, catalyst and activator of green dye formation reactions through a series of compounds ending in the chlorophyll molecule leading to increased chlorophyll content. This is consistent with Bayoumi and Hafes (2006) they indicated a significant response to vegetative growth traits when they used the extract, this leads to the formation of a strong root system which gives the plant strength to grow and increase the absorption of nutrients leading to increased chlorophyll content. Cucumber's response to wheat straw coverage with this concentration may be attributed to the findings of Sabh and Shallan (2008) due to a significant increase in all vegetative growth Al-Hamzawi and Al-Zauobidy (2015) which showed the same results on cucumber yield.

Table 5. Effect of the organic soil mulching, spraying with seaweed extract and their interaction on the Relative chlorophyll quantity in leaves (SPAD unit)

F / M	F_0	F_1	F_2	Organic mulching average
M_0	33.37 c	36.13 bc	38.83 Ab	36.11 C
M_1	40.23 ab	42.10 A	41.23 A	41.19 A
M_2	36.30 bc	40.00 ab	38.37 Ab	38.22 BC
M_3	42.80 a	38.67 ab	39.20 Ab	44.17 B
Concentrations average	38.17 A	39.23 A	39.41 A	

The values of similar letters are not significantly different from each other according to the Duncan test below the 5%
F: seaweed extract spraying concentration; M: Organic mulching

CROP CHARACTERISTICS AND COMPONENTS

The number of fruits (fruit. Plant $^{-1}$)

The results of Table 6 show the superiority of M_1 and M_2 treatments in giving the highest number of fruits (29.00 and 29.81 fruit/Plant^{-1}, respectively) with not differ significantly from each other while M_3 and Control treatment gave the lowest number of fruits was 25.76 and 25.54 fruit/ Plant^{-1} respectively, which did not differ significantly from each other. Also, spraying with seaweed extract resulted in significant differences between them. F_2 gave the highest number of fruits reachedts 28.87 fruits.Plant^{-1}, thussuperior to F_1 and Control treatments, which were not significantly different from each other. The interaction between organic soil coverings and spraying with seaweed extract gave F_2M_1 treatment gave the highest number of fruits 32.83 fruit. Plant^{-1}, thus superior to all treatments that gave the lowest number of fruits, especially the

Control treatment respectively F_1M_0 and F_1M_3, where it reached 23.87, 25.62 and 25.46 fruit/Plant^{-1}. The reason may be due to the superiority in the characteristics of vegetative growth reflected positively in the qualities of the product and production. This is in agreement with Mohammed (2009) in his study when spraying cucumber with Seaforce2 extract at a concentration of 2 m/L^{-1} and on several sprinkles latest significant increase in the total yield and the number of fruits.

Table 6. Effect of the organic soil mulching, spraying with seaweed extract and their interaction on the number of fruits (fruit/plant $^{-1}$)

M \ F	F_0	F_1	F_2	Organic mulching average
M_0	23.87 e	25.62 E	27.12 Bcde	25.54 B
M_1	26.54 bcde	27.62 Bcde	32.83 A	29.00 A
M_2	29.58 abcd	30.16 Ab	29.68 Abc	29.81 A
M_3	26.00 cde	25.46 E	25.83 De	25.76 B
Concentrations average	26.90 B	26.78 B	28.87 A	

The values of similar letters are not significantly different from each other according to the Duncan test below the 5%
F: seaweed extract spraying concentration; M: Organic mulching

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Fruit weight (g)

The results in Table 7 indicate that there was a significant difference of soil coverings in the weight of the fruit; the highest weight was recorded in M_1 treatment of 80.20 g. compared to Control treatment which gave the lowest wejght of 54.20 g, while spraying with seaweed extract did not significantly affect fruit weight. The interaction between organic soil coverings and spraying with seaweed extract, the F_1M_1 treatment gave highest weight was recorded 82.20 g compared by Control treatment which gave the lowest rate of 41.60g.

Table 7. Effect of the organic soil mulching, spraying with seaweed extract and their interaction on the Fruit weight (g/plant^{-1})

F / M	F_0	F_1	F_2	Organic mulching average
M_0	41.60 d	69.20 Abc	51.70 Cd	54.20 C
M_1	81.60 a	82.20 a	76.80 Ab	80.20 A
M_2	65.70 abc	66.50 abc	72.50 Abc	68.20 B
M_3	58.20 bcd	67.30 abc	67.00 Abc	64.20 BC
Concentrations average	61.77 A	71.30 A	67.00 A	

The values of similar letters are not significantly different from each other according to the Duncan test below the 5%
F: seaweed extract spraying concentration; M: Organic mulching

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The plant yield (kg.plant^{-1})

The results in Table 8 showed a significant effect among organic soil coverings. M_1 treatment gave the highest plant yield of 2.320 kg. Plant^{-1} superior to all treatments, especially the Control treatment, which gave the lowest rate in this characteristic amounted to 1.298 kg. Plant^{-1}. The effect of spraying with seaweed extract resulted in spraying at a concentration of 2 g. L^{-1} F_2 to give the highest yield per plant 1.964 kg. Plant^{-1}, which did not differ significantly from treatment F_1, which gave a higher rate of Control treatment where the last one recorded the lowest yield per plant, was 1.669 kg.Plant^{-1}. As for the interaction, F_2M_1 achieved the highest rate of this trait, recording 2.531 kg.plant^{-1} outperforming all treatments, including Control treatment, which achieved the lowest rate gave 1.067 kg. Plant. To explain these results may refer to the extract contains the element potassium, which is absorbed by the plant in greater quantities than any other element and is the dominant cation in the plant and its great importance in the process of cell division and regulate the permeability of membranes in the plant and regulate the representation of carbon and transport of sugars and protein, which reflected positively on increasing the number of fruits and weight And then the yield of one plant and the total yield of cucumber

Table 8. Effect of the organic soil mulching, spraying with seaweed extract and their interaction on the plant yield (kg/plant^{-1})

F / M	F_0	F_1	F_2	Organic mulching average
M_0	1.067 f	1.402 ef	1.425 Ef	1.298 D
M_1	2.160 abc	2.268 Ab	2.531 A	2.320 A
M_2	1.939 abc	2.031 Abc	2.161 Abc	2.044 B
M_3	1.510 def	1.708 Cde	1.739 cde	1.653 C
Concentrations average	1.669 B	1.852 AB	1.964 A	

The values of similar letters are not significantly different from each other according to the Duncan test below the 5%
F: seaweed extract spraying concentration; M: Organic mulching

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The total yield of the plastic house (ton.h^{-1})

As shown in Table 9, the two treatments M_1 and M_2 were superior in giving the highest total yield as they did not differ significantly from each other (3.897 and 3.433 tons/house^{-1} respectively) compared to the Control treatment which recorded the lowest total yield of 2.180 tons/ House^{-1}. The same table shows that there were no significant differences between the two treatments of seaweed extract F_1 and F_2 in the total yield of the house as it reached 3.299 and 3.112 tons/ house $^{-1}$ respectively; surpassing the Control treatment which achieved the lowest total yield of 2.887 tons/House^{-1}. The effect of interaction was superior to the spray treatment at a concentration of 2 g/L^{-1} with wheat straw covered F_2M_1 giving the highest total production reached 4.252 tons/ house $^{-1}$, compared to the Control treatment which achieved the lowest production in the total yield of the house amounted to 1.792 tons/House $^{-1}$. This result may be due to the increase of vegetative growth, which led to an increase in the total yield as the organic covers create suitable conditions for plant growth, absorption of water and nutrients and improve the physical, chemical and biological properties of the soil and soil retention of water. This is consistent with the findings of Verma and Achary (1995) Matsi and Athanasios (2006) which indicated that the use of wheat straw in the cover led to increased soil moisture content and increased supplying of nutrients, especially nitrogen.

Table 9. Effect of the organic soil mulching, spraying with seaweed extract and their interaction on the total yield of the plastic house (ton.h^{-1})

F / M	F_0	F_1	F_2	Organic mulching average
M_0	1.792 d	2.355 cd	2.394 cd	2.180 C
M_1	3.629 ab	3.811 ab	4.252 a	3.897 A
M_2	3.258 bc	3.412 ab	3.630 ab	3.433 A
M_3	2.871 bc	2.870 bc	2.922 bc	2.888 B
Concentrations average	2.887 A	3.112 A	3.299 A	

The values of similar letters are not significantly different from each other according to the Duncan test below the 5%

F: seaweed extract spraying concentration; M: Organic mulching

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Total Soluble Solids (T.S.S):

In Table 10 there are no significant differences between treatments of organic soil coverings. As for the seaweed spraying treatments, F_1 spraying was superior to giving the highest percentage of total soluble solids 3.300% compared to the Control treatment which recorded the lowest percentage of 3.263%. While there were significant differences in the interaction treatments, F_1M_2 which gave the highest percentage of total soluble solids 3.313% compared to the Control treatment which recorded the lowest percentage of 3.260%. To explain these results that may be refer to the addition of wheat straw as an organic cover had a significant effect in T.S.S of the qualities of the product and its components. The reason is that organic matter is a source of energy for most soil organisms, When organic matter decomposes, the nutrients that the plant benefits from are released; Organic acids are also released, which help to take advantage of some elements not available to the plant, such as phosphorus and iron all these factors effect on T.S.S.

Table 10. Effect of the organic soil mulching, spraying with seaweed extract and their interaction on the total Soluble Solids (T.S.S)

M \ F	F_0	F_1	F_2	Organic mulching average
M_0	3.260 b	3.310 ab	3.280 ab	3.283 A
M_1	3.260 b	3.307 ab	3.290 ab	3.286 A
M_2	3.263 ab	3.313 a	3.270 ab	3.282 A
M_3	3.270 ab	3.270 ab	3.293 ab	3.278 A
Concentrations average	3.263 B	3.300 A	3.283 AB	

The values of similar letters are not significantly different from each other according to the Duncan test below the 5%
F: seaweed extract spraying concentration; M: Organic mulching

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