Effect of the Biofertilizers and the Methods of its Addition on the Growth and Yield of Eggplant (*Solanum melongena* L.) Under Greenhouse Conditions

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Abstract

Research was conducted at Al-latifia Research Station of Plant Breeding and Improvement Center, Agricultural Research Directorate, during spring season of year 2016 to study the effect of some biofertilizers on growth and yield of Eggplant plant under greenhouse conditions. A factorial experiment was designed in Randomized Complete Block Design with three replicates and the means of traits compared by L.S.D. at 5% level. The main factor included methods of adding biofertilizers to seeds (A1) and transplants (A2). The secondary factor was biofertilizers included: without adding any Biofertilizer (control) (T0), *Pseudomonas fluorescenc*e, (T1), *Azospirillum brasilense* (T2), *Bacillus subtilis* (T3) and *Azotobacter chroococcum* (T4). The results showed that *Azotobacter chroococcum* treatment significantly increased the plant height (87.70 cm) compared with (57.70 cm) in the control treatment. Moreover, *Azotobacter chroococcum* treatment showed significant increases the yield per plant and the total yield which were, (1000.00 $gm.plant^{-1}$ and 899.00 $Kg.greenhouse^{-1}$) respectively in comparison with the control treatment which were (553.00 $gm.plant^{-1}$) and (498.00 $Kg.greenhouse^{-1}$) respectively.

Key Words: *Azospirillum brasilense*, *Azotobacter chroococcum*, Transplants and Grow.

تأثير المخصبات الاحيائيه وطرق اضافتها في نمو وحاصل الباذنجان *Solanum melongena* L. تحت ظروف البيت البلاستيكي

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الخلاصــة

نفذ البحث في البيت البلاستيكي لمحطة ابحاث اللطيفية التابعة لمركز تربية وتحسين النبات للموسم الربيعي 2016 لدراسة تأثير بعض المخصبات الأحيائية في نمو وحاصل الباذنجان تحت ظروف البيت البلاستيكي و طبقت تجربه عامليه باستخدام تصميم القطاعات الكاملة المعشاة وبثلاث مكررات وقورنت المتوسطات الحسابيه للصفات المدروسه حسب أختبار LSD عند مستوى أحتمال 5 % اذ تضمن العامل الرئيسي طرق اضافة المخصبات للبذور(A1) وللشتلات (A2) وتضمن العامل الثانوي المخصبات الاحيائيه التي شملت:- بدون اضافة اي مخصب (المقارنة) (T0) *Pseudomonas fluorescence* (T1) *Azotobacter* (T4) *Azospirillum brasilense* (T2) *Bacillus subtilis* (T3) *chroococcum* أظهرت النتائج تفوق معاملة بكتريا ال*Azotobacter chroococcum* معنويا في صفة ارتفاع النبات بلغ (87.7 سم) قياساً بمعاملة المقارنة والتي بلغت (57.70 سم) علاوة على ان معاملة *Azotobacter chroococcum* اظهرت زيادة معنوية في حاصل النبات وحاصل بيت بلاستيكي مساحته 450 م^2 بلغ (1000.00 غم . نبات$^{-1}$) و (899.00 كغم. بيت$^{-1}$) بالتتابع قياسا بمعاملة المقارنة والتي أعطت (553.00 غم.نبات$^{-1}$) و(498.00 كغم.بيت$^{-1}$) بالتتابع.

الكلمات المفتاحية: *Azospirillum brasilense*، *Azotobacter chroococcum* ، شتلات والنمو

Introduction

Eggplant (*Solanum melongena* L) is one of the main summer vegetables. It is an important vegetable crop grown worldwide. So, cultivation has spread throughout the world, and planting in most areas of Iraq on fields and also grown in greenhouses and tunnels (Al-mohammadi, 1990). It is planted for its fruits, which is a popular food for most developing countries. It is used in cooking, pickles and canned. Also, it kept freezing and drying (Salloum, 2012). Crop service under greenhouse conditions requires chemical fertilizers either by adding to the soil or spraying on plants to obtain a high yield (Al-zehawi, 2007). Chemical fertilization rates for vegetables have been increased relative to other crops because they can be planted more than one season per year, which led to increase the harmful effects on health and environment, especially the residual effect of nitrates which is considered one of the most dangerous compounds for human health. Therefore, the world is turning to Biofertilizers instead of chemical fertilizers to reduce environmental pollution. Biofertilizers are environmentally safe alternatives and have a big impact to get high production and avoid chemical pollution (Al-haddad, 1989) Biofertilizer is a natural product carrying living microorganisms derived from the root or cultivated soil. So, they don’t have any ill effect on soil health and environment. Besides their role in atmospheric nitrogen fixation and phosphorous solubilization, these also help in stimulating the plant growth hormones providing better nutrient uptake and increased tolerance towards drought and moisture stress. (Anandaraj and Delapierre, 2010).

The beneficial effects of Biofertilizers such as *Azotobacter* and *Azospirillum* on plants are attributed mainly to an improvement in root development, an increase in the rate of water and minerals uptake by roots, displacement of fungi and plant pathogenic bacteria and to a lesser extent, biological nitrogen fixation (Meena, *et al*., 2017). Moreover, inhibit and stop the growth of harmful microorganisms and they have the ability to stimulate, increase roots and shoot growth, increase the absorption of essential nutrients and increase plant ability to resist unsuitable environmental conditions (Allawi, 2013) Biofertilizers input in soil activated appropriate microbiological processes which can be more and better uniform supply of plants with nitrogen, phosphorus and potassium, as well as some trace elements (Tosic, *et al*., 2016) (Al-dulaimi, *et al*., 2003) explained that the use of the *Pseudomonas fluorescence* has increased growth of tomato plants under greenhouse conditions. The addition of *Azospirillium* sp. to peas plant was observed in giving a significant increase in plant height and number of leaves compared with control treatment (Thenmozhi, *et al*., 2010). While the addition of Biofertilizers (*Azotobacter* and *Azosprillium*) on tomato plants led to increase in plant height, number of leaves, relative content of chlorophyll, number of fruits and plant yield (Ramakrishnam and Selvakumar, 2012). Whereas (Rao, *et al*., 2014) found the treatment of cabbage with *Azotobacter* and *Azosprillium* increased the yield under plastic house conditions. Moreover, using *Azotobacter* and *Bacillus* on lettuce gave the highest increase in plant yield (Tosic, *et al*., 2016).

In another study, using *Azospirillium* fertilizer with 25% FYM (Farm Yard Manure) gave increase in plant yield and total yield compared with control treatment (Meena, *et al*., 2017). The use of suitable combination of *Azotobacter* with 75% nitrogen fertilizer gave significant increases of plant height, number of branches and number of fruits and total yield of tomato plants (Shashi, *et al.*, 2018).The aim of this study is to determine the effect of biofertilizers on growth and development of eggplant in the greenhouses.

Materials and Methods

This experiment was carried out in the greenhouses at Al-latifia Research Station of Plant Breeding and Improvement Center, Agricultural Research Directorate during the Spring season of 2016 using Eggplant (Barcelona cv.).

Preparation of Seeds and Transplants

1. Treatment of Seeds

Seeds of eggplant were treated with biofertilizer by coating them with the bacterial suspension for 10 minutes and then let it to dry for 15 minutes. The treated and untreated seeds were planted on 7/10/2016 in transplanting trays which contain peat moss, and the trays were kept inside the green house for germination of seeds before transferring to the permanent place (Naeem, 2012).

2 - Treatment of Transplants

Seeds were sown in transplanting trays which contain peat moss on 7/10/2016. biofertilizers were added to eggplant seedlings when real leaf appeared at a rate of 5 ml of bacterial suspension for each transplant. The trays were placed in the green house until transferring to the permanent place (Naeem, 2012).

Preparing the Green House and Transplants

The green house was prepared with a distance of 9 * 50 m and solar sterilization was applied from 15 June until 1 September 2016 and then divided to five blocks (3 Blocks Were Used) with a length of 50 m and width of 0.80 m and a distance between raw and other 0.80 m with 1 m left on each side. Each block was divided to 9 sections of 5 m each experimental unit, Eggplant transplants were planted with a distance of 0.60 m between plants on 12/11/2016. Chemical fertilizer was added two times, the first was 14 days after transplanting and included 120Kg N ha^{-1} (Urea 46% N) and 160 Kg P ha^{-1} (Super Triphosphate 21%) and 120 Kg K ha^{-1}(Potassium Sulphate 46% K) and the same amount added after one month from the first treatment (Al-naimi, 1999). Chemical and physical analysis were carried out according to Richards (1954) as shown in Table (1).

Table (1) Chemical and Physical Properties of Soil

Properties		Standard Unit	Value
(1:1) pH		---	7.2
(1:1) Ec		dsm^{-1}	3.3
Organic Matter		gKg^{-1}	1.02
HCO_3		gKg-1	2.33
Available Nitrogen		$mgKg^{-1}$	60.5
Available Phosphorus		$mgKg^{-1}$	11.4
Available Potassium		$mgKg^{-1}$	156.3
Ions Soluble	Mg^{++}	mgL^{-1}	73.00
	Ca^{++}	mgL^{-1}	199.10
Silt		gKg^{-1}	465
Clay		gKg^{-1}	370
Sand		gKg^{-1}	165
Soil Mixture		Silty Clay	

The factorial experiment was laid out in Randomized Complete Block Design (R.C.B.D) with three replicates. Means of traits were compared by L.S.D. at level 5% (Al-Sahuki and Wahib, 1990) using Statistical Analysis System (SAS, 2001).

Table (2) Effect of Biofertilizers and Methods of Addition on the Plant Height and Stem Diameter of Eggplant under the Greenhouse Conditions

Method of Addition A / Bio Fertilizers T	Plant Height (cm)			Stem Diameter(cm)		
	Seeds A1	Transplant A2	Mean of Bio Fertilizers	Seeds A1	Transplant A2	Mean of Bio Fertilizers
T0	57.70	57.70	57.70	1.17	1.17	1.17
T1	75.30	96.00	85.70	1.45	1.52	1.48
T2	77.30	95.00	86.20	1.58	1.15	1.36
T3	79.00	93.00	86.00	1.58	1.61	1.59
T4	78.70	96.70	87.70	1.45	1.78	1.61
Mean of a Method of Addition	73.60	87.70		1.44	1.44	
L.S.D 0.05	Method of Addition	Bio Fertilizers	Method of Addition Bio Fertilizers	Method of Addition	Bio Fertilizers	Method of Addition Bio Fertilizers
	9.37	14.81	20.94	N.S	N.S	N.S

T0 control T1 *Pseudomonas fluorescence*
T2 *Azospirillum brasilense* T3 *Bacillus subtilis* T4 *Azotobacter chroococcum*

Biofertilizer Inoculation

Biofertilizers were obtained from Biotechnology Center/Agricultural Research Directorate.

Treatments Included

1- Methods of Addition inocula (A)

A1: Add the inocula to seeds.
A2: Add the inocula to the transplants.

2. The biofertilizer (T) included

T0: without Biofertilizer (Control)
T1: *Pseudomonas fluorescence*
T2: *Azospirillum brasilense*
T3: *Bacillus subtilis*
T4: *Azotobacter chroococcum*

Observation

The plant height, stem diameter (cm), average number of branches, fresh weight of plants and roots g, chlorophyll in the leaves was measured by Chlorophyll meter device type SPAD - 502 (Minnotti, *et al.*, 1994) and the leaf area was measured with the portable leaf area meter (USACI-202) (Tekalign & Hammes, 2005) were measured after 55 days for 5 plants from each treatment. Furthermore, number of fruits per plant, weight of fruits, yield per plant (gm), total yield (Kg), fruit diameter and length were calculated.

Results and Discussion

Plant Shoot Growth

The results in the Table (2) showed that methods of inocula addition were significantly differences in plant height, the transplants treatment (A2) gave the highest significant differences ($P<0.05$) in plant height at (87.70 cm) compared with (A1) the seed treatment which reached (73.60 cm). So, the biofertilizers treatments, results showed that the T4 treatment (*Azotobacter*) was significantly higher than (87.70 cm) and followed it by T2 treatment (*Azospirillum*) was (86.20 cm) compared with T0 treatment (without Bio-fertilizer), which gave (57.70 cm). The Interaction between the methods of adding (A) and (T) biofertilizers treatments had a significant effect with A2T4 (transplants + *Azotobacter*) treatment which gave of (96.70 cm), while A1T0 and A2T0 treatments gave (57.70 cm) for both.

Also, the results in the same Table showed non-significant differences between methods of addition biofertilizer and used biofertilizers and interaction between them in stem diameter.

Results in Table (3) indicated non-significant differences in the number of branches per plant due to methods of inocula addition and the biofertilizers used. The interaction between the methods of addition and biofertilizers treatments showed significant effect. The treatment combination of A2T2 gave the highest number of branches (9.67) while the lowest number of branches was recorded with A1T0 and A2T0 treatments which reached (4.33). The results also showed that non-significant effects were obtained from the methods of addition in shoot weight of plant. However, significant effect on shoot weight was found due to biofertilizers.

Table (3) Effect of Biofertilizers and Methods of Addition on the Number of Branches and Fresh Weight of Eggplant Shoots under the Greenhouse Conditions.

Method of Addition A / Bio Fertilizers T	No. of Branches			Fresh Weight of Shoot (g)		
	Seeds A1	Transplant A2	Mean of Bio Fertilizers	Seeds A1	Transplant A2	Mean of Bio Fertilizers
T0	4.33	4.33	4.33	195.00	195.00	195.00
T1	7.07	7.00	7.03	319.00	441.00	380.00
T2	8.67	9.67	9.17	303.00	434.00	369.00
T3	7.33	8.33	7.83	307.00	383.00	345.00
T4	8.67	9.00	8.83	427.00	571.00	499.00
Mean of a Method of Addition	7.21	7.67		310.00	405.00	
L.S.D 0.05	Method of Addition	Bio Fertilizers	Method of Addition Bio Fertilizers	Method of Addition	Bio Fertilizers	Method of Addition Bio Fertilizers
	N.S	N.S	4.68	N.S	178.70	252.70
T0 control T1 *Pseudomonas fluorescence* T2 *Azospirillum brasilense* T3 *Bacillus subtilis* T4 *Azotobacter chroococcum*						

T4 treatment recorded the highest shoot weight (499.00 gm) while T0 treatment gave the lowest shoot weight (195.00 gm). The interaction between the methods of addition and biofertilizers showed a significant effect with A2T4 treatment which gave (571.00 gm), while A1T0 and A2T0 treatments gave (195.00 gm). Data of Table (4) showed non-significant differences in the roots fresh weight between the two methods of inocula addition whereas, biofertilizer had a significant effect, with the highest rate of (42.90 gm) in the T4 treatment compared with 27.40 gm for T0 treatment.

The interaction between the methods of inocula addition and biofertilizer treatments had a significant effect in the highest weight reached (45.40 gm) with A2T4 treatment compared with the lowest weight of (27.40 gm) with A1T0 and A2T0 treatments. In addition to significant, the influence of methods of addition on chlorophyll content in leaves was recorded with transplants treatment A2 significantly superior which reached (47.39) SPAD units compared with the seeds treatment A1 which gave (44.86) SPAD units (Table 4).

Table (4) Effect of Biofertilizers and Methods of Addition on Fresh Weight of Roots and Relative Chlorophyll Content of Eggplant Shoots under the Greenhouse Conditions.

Method of Addition A / Bio Fertilizers T	Fresh Weight of Root (g)			Relative Chlorophyll Content		
	Seeds A1	**Transplant A2**	**Mean of Bio Fertilizers**	**Seeds A1**	**Transplant A2**	**Mean of Bio Fertilizers**
T0	27.40	27.40	27.40	44.00	44.00	44.00
T1	36.80	44.40	40.60	46.17	48.27	47.22
T2	37.70	44.70	41.20	44.73	49.00	46.87
T3	38.90	44.00	41.50	44.30	46.10	45.20
T4	40.50	45.40	42.90	45.10	49.60	47.35
Mean of a Method of Addition	36.30	41.20		44.86	47.39	
L.S.D 0.05	Method of Addition	Bio Fertilizers	Method of Addition Bio Fertilizers	Method of Addition	Bio Fertilizers	Method of Addition Bio Fertilizers
	N.S	11.82	16.72	1.39	2.21	3.12

T0 control T1 *Pseudomonas fluorescence*
T2 *Azospirillum brasilense* T3 *Bacillus subtilis* T4 *Azotobacter chroococcum*

Table (5) Effect of Biofertilizers and Methods of Addition on Leaf Area of Eggplant under the Greenhouse Conditions

Method of Addition A / Bio Fertilizer T	Leaf Area dcm^2		
	Seeds A1	**Transplant A2**	**Mean of Bio Fertilizers**
T0	45.50	45.90	45.70
T1	71.30	64.50	67.90
T2	71.10	56.70	63.90
T3	48.00	55.80	51.90
T4	55.30	56.60	56.00
Mean of a Method of Addition	58.20	55.90	
L.S.D 0.05	Method of Addition	Bio Fertilizers	Method of Addition Bio Fertilizers
	N.S	N.S	N.S

T0 control T1 *Pseudomonas fluorescence*
T2 *Azospirillum brasilense* T3 *Bacillus subtilis* T4 *Azotobacter chroococcum*

The results of the same Table also showed significant differences in effect of Bio- fertilizers on chlorophyll content where the T4 treatment was significantly superior which reached (47.35) SPAD units and reduced significantly in T0 treatment to 44.00 SPAD units. The interaction between the methods of inocula addition and biofertilizers treatments had a significant effect with A2T4 (transplants + *Azotobacter*) treatment gave the highest amount of chlorophyll (49.60) SPAD units, while A1T0 and A2T0 treatments gave (44.00) SPAD units.

The results of Table (5) showed non-significant differences between methods of addition and the biofertilizers used and the interaction between them on the leaf area/dcm^2. The increases in most shoot characteristics of plants with biofertilizers inoculation (*Azotobacter* and *Azospirillum*) attributed to the role of biofertilizers in the availability, absorption and concentration of nutrients such as nitrogen and phosphorus. biofertilizers also play a role in stimulating the production of growth regulators, which are positively reflected in increased division, elongation and expansion of cells, which reflected on shoot growth (Salhia, 2010; Allawi, 2013; Shashi, *et al*., 2018), and the availability of elements in the leaves lead to increase management and activity of photosynthesis, which leads to increase CO_2 in the leaves, which is the basic unit for building carbohydrates, protein's structure and amino acids and therefore increasing vegetative growth. The results of the present study were in agreement with (Islah and El-Sayed, 2011; Dharmendra, 2014; Saeed, 2015 and Meena, *et al*., 2017).

Yield and It's Component

Table (6) showed that the methods of inocula addition gave a significant difference in the number of fruits per plant. A significantly higher number of fruits per plant was recorded in transplants treatment A2 was (5.13) fruit while the seed treatment gave (4.18) fruits per plant. While biofertilizers varied significantly for the number of fruits per plant. biofertilizers application T2 and T4 treatments recorded higher fruits per plant reached (5.23 and 5.23) fruits respectively, compared with T0 treatment (without Biofertilizers) which gave (3.57) fruits. The interaction between the methods of inocula addition and biofertilizers application showed a significant effect with A2T2 and A2T4 treatments gave (5.69 and 5.81) fruits respectively, while A1T0 treatment gave (3.57) fruits. No significant differences in fruit weight were recorded among methods of inocula addition and biofertilizers and the interaction between them. The methods of inocula addition showed significant differences in plant yield Table (7). The highest value of plant yield was obtained from inocula treatments of transplant A2 which was (942.00 $gm.plant^{-1}$) and significantly higher than the seed treatment A1 which gave (734.00 $gm.plant^{-1}$). The results showed that biofertilizer treatments, T4 treatment (Azotobacter) were significantly higher than other treatments which reached (1000.00 gm) while the lowest was for the control treatment T0 which reached (553.00 $gm.plant^{-1}$).

The interaction between the methods of inocula addition and biofertilizer treatments was found to be significant with the highest value for treatment A2T4 (1116.00 $gm.plant^{-1}$) and the lowest plant yield was recorded for A1T0 treatments which reached (553.00 $gm.plant^{-1}$).

Moreover, the results of Table (7) showed a significant effect in the total yield of greenhouse according to the methods of inocula addition which reached (848.00 Kg) in the treatment of transplants A2 compared with the treatment of seeds A1 which gave (660.00 Kg). In addition, biofertilizers varied significantly for plant yield with T4 treatment (Azotobacter) gave a higher value than reached (899.00 Kg) compared with T0 treatment (without biofertilizers) which gave (498.00 Kg).

Table (6) Effect of Biofertilizers and Methods of Inocula Addition on Number of Fruits and Fruit Weight of Eggplant under the Greenhouse Conditions

Method of Addition A / Bio Fertilizers T	Number of Fruits			Fruit Weight(g)		
	Seeds A1	Transplant A2	Mean of Bio Fertilizers	Seeds A1	Transplant A2	Mean of Bio Fertilizers
T0	3.57	3.57	3.57	153.50	153.50	153.50
T1	4.11	5.39	4.75	185.80	186.50	186.10
T2	4.56	5.69	5.13	182.40	201.30	191.90
T3	4.00	5.18	4.59	173.60	186.10	179.80
Fertilizers T4	4.66	5.81	5.23	198.50	194.30	196.40
Mean of a Method of Addition	4.18	5.13		178.80	184.30	
L.S.D 0.05	Method of Addition	Bio Fertilizers	Method of Addition Bio Frtilizers	Method of Addition	Bio Fertilizers	Method of Addition Bio Frtilizers
	0.69	1.09	1.55	N.S	N.S	N.S
T0 control T1 *Pseudomonas fluorescence* T2 *Azospirillum brasilense* T3 *Bacillus subtilis* T4 *Azotobacter chroococcum*						

Table (7) Effect of Biofertilizers and Methods of Inocula Addition on Yield of Plant Height and Total Yield of House of Eggplant under the Greenhouse Conditions

Method of Addition A / Bio Fertilizers T	Yield of plant (g)			Total yield of house (Kg)		
	Seeds A1	**Transplant A2**	**Mean of Bio Fertilizers**	**Seeds A1**	**Transplant A2**	**Mean of Bio Fertilizers**
T0	553.00	553.00	553.00	498.00	498.00	498.00
T1	740.00	974.00	857.00	666.00	876.00	771.00
T2	848.00	1108.00	978.00	763.00	997.00	880.00
T3	647.00	958.00	802.00	582.00	862.00	722.00
T4	884.00	1116.00	1000.00	793.00	1005.00	899.00
Mean of a Method of addition	734.00	942.00		660.00	848.00	
L.S.D 0.05	Method of Addition	Bio Fertilizers	Method of Addition Bio Fertilizers	Method of Addition	Bio Fertilizers	Method of Addition Bio Fertilizers
	159.00	251.40	355.50	143.10	226.20	320.00

T0 control T1 *Pseudomonas fluorescence*
T2 *Azospirillum brasilense* T3 *Bacillus subtilis* T4 *Azotobacter chroococcum*

The Interaction between the methods of inocula addition and biofertilizer treatments found to be significant with the highest value recorded for treatment A2T4 which gave (1005.00 Kg) while the lowest yield was recorded by A1T0 and A2T0 treatments reached (498.00 Kg) for both of them.

The results of Table (8) showed significant differences in length of fruit by methods of inocula addition wherein the transplants treatment A2 reached (11.1 cm) compared with the seed treatment A1 which gave (8.9 cm), whereas biofertilizer had a significant effect, with the highest rate of (11.4 cm) was in the T4 treatment and the lowest was 7.3 cm in T0 treatment. The interaction between the methods of inocula addition and biofertilizer treatments showed a significant effect with A2T2 treatment gave (12.9 cm) while reduced to (7.3 cm) in A1T0 treatment. The diameter of fruit in Table (8) was significantly different depending on the methods of inocula Addition. was recorded in transplants treatment A2 reached (4.68 cm) compared with seeds treatment A1 which gave (4.40 cm). Also, biofertilizer treatments showed a significant effect on fruit diameter and the results showed that T4 treatment (Azotobacter) was the highest of (4.88 cm), while the lowest was in control treatment T0 of (3.81 cm).

The interaction between the methods of inocula addition and biofertilizer treatments showed a significant effect on fruit diameter in A2T4 treatment which gave the highest value of (5.06 cm) while the lowest value of (3.81 cm) in A1T0 treatment.

The inoculation of eggplant with biofertilizers led to stimulation and increase of growth through strategies which are used in this biological system, especially the availability of nutrients through phosphorus solubilization and nitrogen fixation in soil and increase resistance of plants to biotic and abiotic stresses and production of different growth regulators like IAA and GA3. All these factors contributed to increasing lengths and diameters of fruits, number of fruits and weight of fruit, which led to increasing of plant growth and total yield. (Saharan and Nehra, 2011, Dharmendra, 2014, Saeed, 2015 and Shashi, *et al*., 2018). The growth regulators also contribute to increasing shoot and root growth due to division and elongation of cells and tissues, which is reflected positively on the increment of lengths, diameters and weight of fruits (Islah and Ei-sayed, 2011, Doifode and Nandkar, 2014, Saeed *et al*, 2014 and Tosic, *et al*., 2016).

conclusion

In this study, biofertilizers showed a significant effect on most traits, Azotobacter and Azospirillum applications, and showed positive results in increasing the fruit yield of eggplant. Also, results showed that treatment of transplants with biofertilizers was superior on most traits compared with the treatment of seeds coating with biofertilizers.

Table (8) Effect of Biofertilizers and Methods of Addition on length and Dameter of Fruit of Eggplant under the Greenhouse Conditions

Method of Addition A / Bio Fertilizers T	**Length of Fruit(cm)**			Diameter **of Fruit(cm)**		
	Seeds A1	**Transplant A2**	**Mean of Bio Fertilizers**	**Seeds A1**	**Transplant A2**	**Mean of Bio Fertilizers**
T0	7.3	7.3	7.33	3.81	3.81	3.81
T1	7.3	11.6	9.50	4.39	4.63	4.51
T2	9.8	12.9	11.40	4.60	5.00	4.80
T3	9.8	11.3	10.58	4.50	4.93	4.71
T4	10.3	12.5	11.42	4.70	5.06	4.88
Mean of a Method of Addition	8.9	11.1		4.40	4.68	
L.S.D 0.05	Method of Addition	Bio Fertilizers	Method of Addition Bio Fertilizers	Method of Addition	Bio Fertilizers	Method of Addition Bio Fertilizers
	1.14	1.80	2.55	0.23	0.37	0.53
T0 control T1 *Pseudomonas fluorescence* T2 *Azospirillum brasilense* T3 *Bacillus subtilis* T4 *Azotobacter chroococcum*						

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