

Influence of seed and transplants inoculation with Bio-fertilizers on growth and yield of cucumber under greenhouse

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ABSTRACT

To study Influence of seed and transplants inoculation with some bio fertilizers on growth and yield of Cucumber crop under green house conditions. Experiment was laid out in Split-Split Plot Design with three replicates where biofertilizers was main plots and included (B0) without adding any Bio- fertilizer (control), (B1), Mix (B2), *Pseudomonas fluorescence* (B3)Mix + *Pseudomonas fluorescence* (B4)Mycorrhiza (B5)Mix + Mycorrhiza (B6), *Pseudomonas fluorescence*+Mycorrhiza (B7) and Mix + *Pseudomonas fluorescence* + Mycorrhiza (B8) and methods of adding Bio- fertilizers (A) was sub-plots and included seeds (A1) and transplants (A2) and varieties (V) was sub-sub-plots, included Sief (V1) Samar(V2) . The results showed that biofertilizers (B7) treatment significantly increased in plant height, yield.plant⁻¹ and yield.house⁻¹ reached 182.7cm, 2164 g and 3246 kg respectively . whereas , interaction between varieties and biofertilizers showed significant increase inV1B7 treatment which gave197.5 cm,2519 g and 3779 kg respectively .as well as, interaction among methods of adding ,varieties and biofertilizers showed significant increase in A2V1B7 treatment which gave 201.7 cm , 2788 g and 4183 kg respectively.

Introduction

Cucumber (*Cucumis sativus* L) is one of the main summer vegetables. It is an important vegetable crop growing worldwide So cultivation has spread throughout the world, and planting in most areas of Iraq on fields and also grown in green houses [1]. cucumber is planted for its fruits, it is widely consumed, either fresh or pickled, in salads and fast food , it is characterized by its nutritional and medical value because it contains the nutrients Ca, P, K, vitamins C, B1, B2 [2]. Crop service under greenhouse conditions requires chemical fertilizers either by adding to the soil or spraying on plants to obtain a high yield [3].

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 [4]. It is added in the form of an inocula to the soil, treated with seeds, or sprayed on the vegetative part of the plant. It improves the chemical, physical and biological properties of the soil as well as improving the nutritional status and secretion of plant hormones, which leads to increased growth and productivity of plants. [5]. [6] found the addition of Biofertilizers (*Azotobacter* and *Azospirillum*) on

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Tomato plants led to increase in plant height, number of leaves, relative content of chlorophyll, number of fruits and plant yield. Whereas, [7] found the using *Azotobacter* and *Bacillus* on lettuce gave the highest increase in plant yield.[8] found that the addition of biofertilizers on soil gave increasing in chlorophyll content, dry weight of vegetative and the total yield compared with control treatment of beans plant. In another study, using *Azospirillum* with 25% FYM (Farm Yard Manure) gave increasing in plant yield and total yield of tomato plant compared with control treatment [9]. [5] indicated that the use of biofertilizers *Pseudomonas fluorescence* and *Azotobacter chroococcum* on cucumbers gave the best values in plant height, leaf area, chlorophyll content and yield per plant compared with control treatment .

In another study, using 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 [10].

Therefore, this research aimed to evaluate the Influence of seed and transplants inoculation with Bio-fertilizers on growth and yield of cucumber under greenhouse conditions .

2 Materials and Methods

This experiment was carried out in the greenhouse at AL-Twaitha Research Station of Plant Breeding and Improvement Center, Agricultural Research Directorate during the Spring season of 2020 using Cucumber (Saif and Samar cv.).

2.1 Prepare seeds and transplants

2.1.1 Treatment of seeds

Cucumber seeds were treated with biofertilizer by coating them with the bacterial suspension for 10 minutes and then let to dry for 15 minutes (a gram of bacterial inocula contains 80-100 x 10³ cfu / gm inocula). The treated and untreated seeds were planted on 7/10/2020

in transplanting trays which contain peat moss and the trays were kept inside the greenhouse for germination before transferring to the permanent place [11].

2.1.2 Treatment of transplants

Cucumberr seeds were sown in transplanting trays that contain peat moss on 7/10/2020.

Biofertilizers were added to cucumber transplants when real leaf appeared on 31/10/ 2020 at a rate of 5 ml of the bacterial suspension for each transplant (a gram of bacterial inocula contains 80-100 x 10³ cfu / gm inocula). The trays were placed in the Greenhouse until transferring to the permanent place [11].

2.2 Preparing the Greenhouse

The greenhouse was prepared with a distance of 9 x 50 m and solar sterilization was applied from 15 June until 1 September 2020 and then divided into five rows with a length of 50 m and width of 0.80 m and a distance between row and other 0.80 m with 1 m left on each side. Each row was divided into 20 sections of 2.5 m each experimental unit, Cucumber transplants were planted with a distance of 0.4 m between plants on 20/11/ 2020.

Chemical fertilizers were added according to the recommended (N 120, P₂O₅ 160, K₂O 120 kg. ha⁻¹) Urea fertilizer was used as a source of nitrogen, triple superphosphate fertilizer as a source of phosphorous, and potassium sulfate fertilizer as a source of potassium [12].

The greenhouse soil has been characterized physically and chemically as shown in Table (1). The temperature and humidity were measured with a Thermo hygro graph, the temperature was ranged between 35-37 during the day and 10-midnight, and the humidity was between 80-85%. An experiment was applied using split-split plot design with three replications, where the parameters of inocula addition methods were distributed to the main plot. As for the cultivars' treatments, they were distributed on the sub-plot. As for the biological fertilizers, they were distributed on the sub-sub-plot.. Means of traits were compared by L.S.D. at level 5% [13]. The data were analyzed using Statistical Analysis System GenStat ed¹² [14].

Table 1. Physical and Chemical properties of Greenhouse Soil

properties	Standard unit	value
pH (1:1)	---	7.3
Ec (1:1)	dsm ⁻¹	3.9
Organic matter	gKg ⁻¹	0.85
HCO ₃	gKg ⁻¹	1.95
Available Nitrogen	mgKg ⁻¹	55.30
Available Phosphorus	mgKg ⁻¹	20.88
Available	mgKg ⁻¹	178.00

potassium			
Ions soluble	Mg ⁺⁺	mgL ⁻¹	23.77
	Ca ⁺⁺	mgL ⁻¹	120.9
silt		gKg ⁻¹	455
clay		gKg ⁻¹	175
sand		gKg ⁻¹	370
Soil mixture		Silty clay	

2.3 Biofertilizer inoculation

Biofertilizers were obtained from Biotechnology Center/Agricultural Researches Directorate.

2.4 Treatments included

2.4.1 Fertilizers (B) included:-

B0 without adding any fertilizers (control)

B1 MIX (contained the following fertilizers) (*Azotobacter chroococcum* + *Azospirillum brasilense* + *Bacillus subtilis* + *Rhizopium sp*)

B2 *Pseudomonas fluorescence*

B3 MIX + *Pseudomonas fluorescence*

B4 *Mycorrhiza* (*Glomus spp.*)

B5 Mix + *Mycorrhiza*

B6 *Mycorrhiza* + *Pseudomonas fluorescence*

B7 Mix + *Pseudomonas fluorescence* +
Mycorrhiza

2.4.2 Methods of Addition inocula (A)

(**A1**) Add the inocula to seeds

(A2) Add the inocula to the transplants

2.4.3 Varieties (V) and included

(V1) Saif

(V2) Samar

2.5 Parameters of vegetative growth and yield:

The effect of the research parameters was studied by taking 5 plants randomly in each treatment, and they measured the plant height (cm), chlorophyll content, which was measured by a SPAD-502 chlorophyll meter [15]. Leaf area (dcm^2) was measured with a Portable Leaf Area Meter (USACI-202) [16], and take the average number of fruits (fruit.plant^{-1}), average fruit weight (gm.fruit^{-1}) and the average yield per plant (kg). When calculating the yield of plastic house, the number of plants in the house was calculated multiplied by the yield of one plant and length, and diameter of fruit were taken to measure per plant.

3 Results and Discussions

Data represented in table (2) showed no significant differences between methods of inocula

addition (A) (seeds + seedlings), and indicated to superiority of the treatment of varieties (V) in the plant height (cm), as Seif variety (V1) was significantly superior to Samar variety (V2) which reached 180.7 and 154.2cm respectively .Biofertilizer treatments gave highest rate of plant height B2 (*Pseudomonas fluorescence*) treatment which reached 182.7 cm compared with for treatment B0 (without adding biofertilizers) which gave 126.2 cm. Interaction between methods of inocula addition and vareities showed significant effect between treatments A2V1 and A1V1 were gave 182.0 and 179.0 cm , respectively. Whereas, the interaction of vareity and biofertilizers, treatment of V1B7 showed that the highest value reached 197.5 cm. The plant height was affected as a result of interaction between methods of inocula addition and biofertilizers in the superiority of the treatment A2B7 significantly were gave 184.2 cm. As for triple interaction between biofertilizer (B) and the methods of adding (A) and the varieties (V), the results showed that A2V1B7 treatment was significantly superior in increasing plant height, which reached 201.7 cm compared to A1V2B0 treatment, which gave 106.7 cm

Table 2 Influence of Methods of Inocula Addition, Varieties and Biofertilizers on Plant Height of cucumber plant

B	V2		V1		Treatments								A x V
	A2	A1	A2	A1	Biofertilizers (B)								
					Method of Addition (A)								
126.2	121.7	106.7	143.3	133.3	B0								
175.0	161.7	160.00	190.0	188.0	B1								
167.5	155.0	158.3	190.0	166.7	B2								
167.5	158.3	158.3	186.7	166.7	B3								
174.6	163.3	158.3	186.7	190.0	B4								
172.5	160.0	155.0	181.7	193.3	B5								
174.6	160.0	158.3	183.3	196.7	B6								
182.7	166.7	165.0	201.7	197.5	B7								
	1558	1525	1829	1790									

				V x B		V
				V1		
				V2		
				114.2		138.3
				160.8		189.2
				156.7		178.3
				158.3		176.7
				160.8		188.3
				157.5		187.5
				159.2		190.0
				165.8		197.5
				A x B		A
				A1		
				120.0		
				174.2		
				162.5		
				162.5		
				174.2		
				174.2		
				177.5		
				179.2		
				169.4		
				A2		
				132.5		
				175.8		
				172.5		
				172.5		
				172.5		
				175.0		
				170.8		
				171.7		
				184.2		
				A x B		
				A x V		
				x B		
				39.44		

treatment compared with 24.94 SPAD units (B0) treatment .The interaction between methods of inocula addition and varieties treatments had a significant effect V_1A_2 treatment this gave highest amount of chlorophyll (32.02 SPAD units) compared with V_1A_1 was gave 23.50 SPAD units, while interaction between Varieties and Biofertilizers had recorded a significant increase V_1B_1 treatment reached 33.95 SPAD units. Whereas, interaction treatment between addition methods and biofertilizers showed significant effect the best treatments were A_2B_1 treatment which gave 31.98 SPAD unit.. And triple interaction between methods of inocula addition , varieties and biofertilizers treatment $A_2V_1B_1$ was significantly superior as it gave 37.67 SPAD units compared with $A_1V_1B_0$ treatment which recorded 22.50 SPAD units.

Table 4. Influence of Methods of Inocula Addition, varieties and Biofertilizers on Chlorophyll Content of Leaves (SPAD units) of Cucumber plant

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Table 5 indicated that the methods of inocula addition gave a significant difference in number of fruits per plant. A significantly higher number of fruits per plant was recorded in transplants treatment A2 was gave 26.43 fruit. Plant⁻¹ while seed treatment A1 gave (23.02 fruit Plant⁻¹). and showed to superiority of treatment of varieties (V), as the Seif variety (V1) was significantly superior which gave 27.42 fruit.plant⁻¹. Biofertilizer application B7 treatment recorded higher fruits which reached (28.42 fruits. Plant⁻¹) compared with the B0 treatment (without biofertilizers) which gave (17.25 fruit. Plant⁻¹). In the same table ,interaction between methods of inocula addition and vareity showed significant effect in A2V1 treatment which gave 28.92 fruit.plant⁻¹ , and interaction between varieties and biofertilizers had recorded a significant increase V1B7 treatment reached 31.83 fruit.plant⁻¹. Whereas, interaction treatment between addition methods and biofertilizers showed significant effect the best treatments were A2B7 treatment which gave 31.50 fruit.plant⁻¹ As for the triple interaction found to be significant with highest value recorded for treatment A2V1B7 which gave 35.00 fruit.plant⁻¹ compared with A1V2B0 treatment which reached 13.00 fruit.plant⁻¹.

Table 5. Influence of Methods of Inocula Addition, Varieties and Biofertilizers on Number of Fruits of Cucumber plant

Cucumber plant						
				Treatments		A x V
V2		V1		Biofertilizers (B)	Variev (V)	
					Method of Addition(A)	
A2	A1	A2	A1			
15.00	13.00	21.33	19.67		B0	
25.00	22.33	29.00	26.67		B1	
24.33	20.00	29.33	24.67		B2	
23.00	20.67	29.33	23.67		B3	
26.00	21.33	27.33	30.33		B4	
24.67	20.33	28.33	24.33	B5		
26.33	21.33	31.67	29.33	B6		
28.00	22.00	35.00	28.67	B7		
24.04	20.12	28.92	25.92			

LSD 0.05	A2		A x B				V x B	B
			A1	V2	V1			
A1) Add the inocula to seeds (A2) Add the inocula to the transplant (V1) Saif CV (V2) Samar B0 without adding any fertilizers (control) B1 MIX (contained the following fertilizers) (<i>Azotobacter chroococcum</i> + <i>Azospirillum brasilense</i> + <i>Bacillus subtilis</i> + <i>Rhizopium sp</i>) B2 <i>Pseudomonas fluorescense</i> B3 MIX + <i>Pseudomonas fluorescense</i> B4 <i>Mycorrhiza</i> (<i>Glomus spp.</i>)B5 Mix + <i>Mycorrhiza</i> B6 <i>Mycorrhiza</i> + <i>Pseudomonas fluorescense</i> B7 Mix + <i>Pseudomonas fluorescense</i> + <i>Mycorrhiza</i>	1.28	A	18.17	16.33	14.00	20.50	17.25	
	1.32	V	27.00	24.50	23.67	27.83	25.75	
	3.32	B	26.83	22.33	22.17	27.00	24.58	
	1.79	A xV	26.17	22.17	21.83	26.50	24.17	
	4.03	A xB	26.17	25.83	23.67	28.83	26.25	
	4.11	V xB	26.67	22.33	22.50	26.33	24.42	
	5.39	A x V x B	29.00	25.33	23.83	30.50	27.17	
		31.50	25.33	25.00	31.83	28.42		
							V	
							27.2	
							22.08	
							A	
							23.02	
							26.43	

The results in Table (6) showed a significant superiority for all treatments used in experiment. The fruit weight (g) increased in treatment of methods of inocula addition (A), varieties (V), and biofertilizers (B), which reached 72.79, 72.58, and 76.17 g in A2, V1, and B1 treatments . respectively compared with A1, V2 and B0, which gave 64.08, 64.29 and 48.68 g, respectively. Also, in the same table indicated to the interaction between the addition methods and the varieties to be significant with highest value recorded for treatment A2V1 which gave (76.96 g) . As for effect of interaction between the variety and biofertilizer, was significant highest value for V1B1 treatment was 82.50 g. The same table indicated that interaction treatment between addition methods and biofertilizer the A2B1

treatment was significantly superior, with the highest weight which reached 79.00 g. Regarding effect of triple interaction between the methods of addition, varieties and biofertilizer, found to be significant with highest value recorded for treatment A2V1B1 which gave 86.67 g, compared to lowest fruit weight in treatment of A1V2B0, which amounted to 44.33g..

Table 6. Influence of Methods of Inocula Addition, varieties and Biofertilizers on Fruit Weight (gm) of Cucumber plant

LSD 0.05		Treatments														A x V		
		A2		A x B		Biofertilizers (B)												
				A1		V2		V1		Method of Addition (A)								
						A2		A1										A2
5.85	A	49.83	79.00	46.33	73.33	44.67	69.83	51.50	82.50	48.08	76.17	45.00	71.33	44.33	68.33	54.67	78.33	B0
6.51	A x V	72.50	61.50	64.00	70.00	67.00	68.33	59.67	76.67	63.33	B3							
												18.40	A x B	77.50	64.17	67.50	74.17	70.83
16.14	V x B	76.33	67.83	66.50	77.67	72.08	73.00	60.00	79.67	75.67	B5							
												20.21	A x V x B	78.00	65.83	68.17	75.67	71.92
		75.83	74.17	71.67	78.33	75.00	73.33	70.00	78.33	78.33	B7							

A1) Add the inocula to seeds	A2) Add the inocula to the transplant
(V1) Saif CV	(V2) Samar
B0 without adding any fertilizers (control)	
B1 MIX (contained the following fertilizers) (<i>Azotobacter chroococcum</i> + <i>Azospirillum brasilense</i> + <i>Bacillus subtilis</i> + <i>Rhizopium sp</i>)	
B2 <i>Pseudomonas fluorescence</i>	B3 MIX + <i>Pseudomonas fluorescence</i>
B4 <i>Mycorrhiza</i> (<i>Glomus spp.</i>)	B5 Mix + <i>Mycorrhiza</i>
B6 <i>Mycorrhiza</i> + <i>Pseudomonas fluorescence</i>	B7 Mix + <i>Pseudomonas fluorescence</i> + <i>Mycorrhiza</i>

Data of Table 7 showed the effect of methods of inocula addition was significant differences in plant yield (g). Transplants treatment (A2) gave highest significant differences ($P < 0.05$) in plant yield reached (1968 g) compared with (A1) seed treatment which gave (1514 g) , in same table showed to superiority of treatment of varieties (V) in it that Seif variety V1 was significantly superior in yield which gave 2023 g compared with Samar Variety (V2) which gave 1460 g. Concerning biofertilizers treatments, the results showed that B7 treatment was significantly higher than other treatments in plant yield which reached (2164 gm). In same table ,interaction between methods of inocula addition and vareity showed significant effect in A2V1 which gave 2248. The plant yield was affected significantly as a result of the interaction between variety and biofertilizers in significantly superior of V1B7 treatment was reached 2519 g. As for interaction between the methods of inocula addition and biofertilizer treatments showed a significant effect on total yield A2B7 treatment gave highest yield 2433 g . As for triple interaction found to be significant with highest value recorded for treatment A2V1B7 which gave 2788 g.

Table 7. Influence of Methods of Inocula Addition, varieties and Biofertilizers on Yield of Plant (gm) of Cucumber plant

Cucumber plant											A x V
Treatments											
Variety (V)	Method of Addition (A)	Biofertilizers (B)									
		B0	B1	B2	B3	B4	B5	B6	B7		

LSD 0.05	A	A x B	A	A x B	V	V x B	B	V2		V1	
								A2	A1	A2	A1
168.5	A	929	748	626	1051	838	838	675	576	1182	920
151.2	V	2152	1827	1666	2313	1989	1989	1791	1540	2513	2113
468	B	1990	1360	1394	1957	1675	1675	1680	1107	2300	1613
219.7	A x V	1918	1407	1429	1895	1662	1662	1582	1277	2253	1537
554.6	A x B	2063	1675	1605	2133	1869	1869	1950	1260	2177	2090
541.1	V x B	2036	1527	1519	2044	1782	1782	1818	1220	2254	1835
686.2	A x V x B	2223	1677	1629	2271	1950	1950	1932	1327	2515	2027
		2433	1895	1809	2519	2164	2164	2078	1540	2788	2250
		1968	1514	1460	2023			1688	1231	2248	1798

A1) Add the inocula to seeds (A2) Add the inocula to the transplant
(V1) Saif CV (V2) Samar
B0 without adding any fertilizers (control)
B1 MIX (contained the following fertilizers)
(*Azotobacter chroococcum* + *Azospirillum brasilense* + *Bacillus subtilis* + *Rhizopium sp*)
B2 *Pseudomonas fluorescense* B3 MIX + *Pseudomonas fluorescense*
B4 *Mycorrhiza* (*Glomus spp.*) B5 Mix + *Mycorrhiza*
B6 *Mycorrhiza* + *Pseudomonas fluorescense*
B7 Mix + *Pseudomonas fluorescense* + *Mycorrhiza*

The methods of inocula addition showed significant differences in total yield (Table 8). The highest value of plant yield was obtained from inocula treatments of transplant (A2) which reached (2952 kg) while (A1) treatment gave (2272 kg) and in the same table showed to superiority treatment of varieties (V) while that Seif variety V1 was significantly superior in yield which gave 3033 kg. In addition, significant differences were found

among treatments for total yield, B7 treatment which gave highest value (3246 Kg) compared with B0 treatment (without biofertilizers) gave the lowest yield (1257 Kg). Interaction between methods of inocula addition and variety showed significant effect in A2V1 treatment was gave 3372 kg. The total yield was affected significantly as a result of the interaction between variety and biofertilizers in significantly superior of V1B7 treatment was reached 3779 kg. As for Interaction between methods of inocula addition and biofertilizer treatments showed a significant effect on total yield when treatment A2B7 gave the highest yield 3650 kg. As for triple interaction found to be significant with highest value recorded for treatment A2V1B7 which gave 4183 kg.

Table 8 Influence of Methods of Inocula Addition, varieties and Biofertilizers on Total yield of House (Kg) of Cucumber plant

Treatments											
V x B	V	B	V1	V2	A1	A2	B0	B1	B2	B3	B4
938	V2	1257	1773	865	1380	1773	1380	2310	2420	2313	3135
2498		2769	3770	2310	2310	3770	2310	3770	3450	3380	3265
2090		2513	3450	1661	2420	3450	2420	3450	3380	3265	3381
2144		2495	3380	1915	2313	3380	2313	3380	3265	3381	3265
2408		2804	3265	1890	3135	3265	3135	3265	3381	3265	3381
2278		2672	2752	1830	2752	2752	2752	2752	3381	3265	3381
2444		2925	3040	1990	3040	3040	3040	3040	3381	3265	3381
2714		3246	3375	2310	3375	3375	3375	3375	3381	3265	3381
2189	A		3372	1846	2591	3372	2591	3372	3372	3372	3372
3033				2532							

A x B	A1	1122	2740	2040	2114	2513	2291	2515	2842	2272
A2	1393	3228	2985	2876	3095	3054	3335	3650	2952	
LSD 0.05	A	V	B	AxV	AxB	VxB	A x V x B			
	252.4	226.8	701.5	329.3	831.2	811.3	1038.8			
A1) Add the inocula to seeds (A2) Add the inocula to the transplant (V1) Saif CV (V2) Samar B0 without adding any fertilizers (control) B1 MIX (contained the following fertilizers) (<i>Azotobacter chroococcum</i> + <i>Azospirillum brasilense</i> + <i>Bacillus subtilis</i> + <i>Rhizopium sp</i>) B2 <i>Pseudomonas fluorescense</i> B3 MIX + <i>Pseudomonas fluorescense</i> B4 <i>Mycorrhiza</i> (<i>Glomus spp.</i>) B5 Mix + <i>Mycorrhiza</i> B6 <i>Mycorrhiza</i> + <i>Pseudomonas fluorescense</i> B7 Mix + <i>Pseudomonas fluorescense</i> + <i>Mycorrhiza</i>										

The results of table 9 indicated no significant differences between methods of inocula addition (A) in length of fruit and showed superiority treatment of varieties (V) in it , as Seif variety (V1) was significantly superior compared with Samar Variety (V2) which reached 14.80 and 12.58 cm, respectively. Also, bio-fertilizers treatments showed a significant effect on length of fruit this results showed that B7 treatment was highest value (14.58 cm), while lowest was in control treatment (B0) reached 11.29 cm. Interaction between methods of inocula addition and vareity showed significant effect in A2V1 treatment which gave 15.29 cm. As for Interaction between methods of inocula addition and biofertilizer treatments showed a significant effect on fruit diameter A2B7 treatment gave highest value 14.83 cm. The length of fruit was affected significantly as a result of interaction between variety and biofertilizers in significantly superior of V1B7 treatment was reached 16.33cm. As for the triple interaction between methods of inocula addition (A) , varieties (V) and Biofertilizer (B) in length of Fruit, the results showed that A1V1B7 and A2V1B7 treatments were significantly superior were gave 16.33 cm for both treatments, and decreased to 9.67 cm in A1V2B0 treatment.

Table 9. Influence of Methods of Inocula Addition, varieties and Biofertilizers on Length of Fruit(cm) of Cucumber plant

Treatments										
Variety (V)	Method of Addition (A)	Biofertilizers (B)							AxV	
		B0	B1	B2	B3	B4	B5	B6	B7	
V1	A1	10.83	15.00	13.83	14.33	14.17	14.33	15.67	16.33	14.31
	A2	13.17	15.83	15.00	15.33	16.33	15.00	15.33	16.33	15.29
V2	A1	9.67	12.67	13.17	12.50	13.33	11.67	12.00	12.33	12.17
	A2	11.50	13.00	13.83	13.00	13.00	13.33	13.00	13.33	13.00
B		11.29	14.12	13.96	13.79	14.21	13.58	14.00	14.58	
										V
V x B		V1	12.00	15.42	14.42	14.83	15.25	14.67	15.50	16.33
		V2	10.58	12.83	13.50	12.75	13.17	12.50	12.50	12.83
										A
A x B	A1	10.25	13.83	13.50	13.42	13.75	13.00	13.83	14.33	13.24
	A2	12.33	14.42	14.42	14.17	14.67	14.17	14.17	14.83	14.15
LSD 0.05		A	N.S	0.740	1.046	1.041	1.805	1.762	A x V	
		V							x B	
		B								
		AxV								
		AxB								
A1) Add the inocula to seeds (A2) Add the inocula to the transplant (V1) Saif CV (V2) Samar B0 without adding any fertilizers (control) B1 MIX (contained the following fertilizers) (<i>Azotobacter chroococcum</i> + <i>Azospirillum brasilense</i> + <i>Bacillus subtilis</i> + <i>Rhizopium sp</i>) B2 <i>Pseudomonas fluorescense</i> B3 MIX + <i>Pseudomonas fluorescense</i> B4 <i>Mycorrhiza</i> (<i>Glomus spp.</i>) B5 Mix + <i>Mycorrhiza</i> B6 <i>Mycorrhiza</i> + <i>Pseudomonas fluorescense</i> B7 Mix + <i>Pseudomonas fluorescense</i> + <i>Mycorrhiza</i>										

Data of Table 10 showed no significant differences between methods of inocula addition (A) in diameter of fruit and indicated to superiority treatment of varieties (V) in it , as Seif variety (V1) was significantly superior compared with Samar Variety (V2) which reached 5.45 and 5.06 cm, respectively Also, biofertilizers treatments showed a significant effect on fruit diameter and results showed that B7 treatment was highest value (6.25 cm), while lowest fruit diameter was in control treatment (B0) 3.92 cm. Interaction between methods of inocula addition and vareities showed significant effect in A2V1 treatment was gave 5.94 cm. Interaction between methods of inocula addition and biofertilizer treatments showed a significant effect on fruit diameter A2B7 treatment gave highest value (6.67 cm) Whereas, interaction between vareity and biofertilizers, V1B7 treatment showed that highest value reached 6.67 cm. As for triple interaction between the methods of inocula addition (A) , varieties (V) and Biofertilizer (B) in Diameter of Fruit, the results showed that A2V1B7 treatment was significantly superior in increasing plant height, which reached 7.33 cm .

Table 10. Influence of Methods of Inocula Addition, varieties and Biofertilizers on Diameter of Fruit(cm) of Cucumber plant

Treatments										A x V		
B	V2		V1		Variev (V)	Biofertilizers (B)						
	A2	A1	A2	A1	Method of Addition (A)							
	3.92	4.33	3.67	4.00	3.67						B0	
	5.16	4.67	4.67	6.00	5.33						B1	
	4.88	4.67	5.00	5.17	4.67						B2	
	5.25	5.33	5.33	5.67	4.67						B3	
	5.66	5.67	5.33	6.33	5.33						B4	
	5.42	5.67	4.67	6.33	5.00						B5	
	5.50	5.67	4.67	6.67	5.00						B6	
	6.25	6.00	5.67	7.33	6.00						B7	
V		5.25	4.88	5.94	4.96							

LSD 0.05	A	N.S	A x B		V x B
			A1	V1	
A1) Add the inocula to seeds (A2) Add the inocula to the transplant (V1) Saif CV (V2) Samar B0 without adding any fertilizers (control) B1 MIX (contained the following fertilizers) (Azotobacter chroococcum + Azospirillum brasilience + Bacillus subtilus + Rhizopium sp) B2 Pseudomonas fluorescenseB3 MIX + Pseudomonas fluorescense B4 Mycorrhiza (Glomus spp.)B5 Mix + Mycorrhiza B6 Mycorrhiza + Pseudomonas fluorescense B7 Mix + Pseudomonas fluorescense + Mycorrhiza	A	N.S	A1	V1	V x B
	A	0.26	4.17	4.00	3.83
	V	0.70	5.33	4.67	5.67
	B	0.34	4.92	4.83	4.92
	A x V	0.81	5.50	5.33	5.17
	A x B	0.84	6.00	5.50	5.83
	V x B	1.06	6.00	5.17	5.67
	A x V x B		6.17	5.17	5.83
			6.67	5.83	6.67

The inoculation of seeds and seedlings of the cucumber plant with biofertilizers leads to encouraging and increase of growth indicators through strategies which are used in this biological system , especially availability of nutrients through phosphorus soluble and nitrogen fixation in soil and increase the resistance of plants to biotic and abiotic stresses and production of different growth regulators like IAA and GA3(contribute to increasing vegetative and root growth as a result of the division and elongation of cells and tissues) All these factors contributed to increasing lengths and diameters of fruits, number of fruits, and weight of fruit, which lead to increased plant growth and total yield. [7,10,17,22,23,24,25]. The reason may be due to that characteristics of yield are controlled by variety through the dominance of genetic facters between varieties and ability of each variety to gave a yield, as well as, leaf area is one of positive effects on yield because it is a function of absorption of nutrients and photosynthesis this results to increasing

fruit length ,diameter , plant yield and total yield [20,26,27].

4 The conclusion

In this study, methods of inocula addition, varieties and biofertilizers, showed significant effect on most traits, and showed positive results in increasing the plant growth and refelects its on fruit yield of Cucumber.

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تأثير تلقيح البذور والشتلات بالمخصبات الحيوية في نمو وحاصل الخيار تحت ظروف البيوت البلاستيكية

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الخلاصة:

لدراسة تأثير تلقيح البذور والشتلات ببعض المخصبات الاحيائية في نمو وحاصل الخيار تحت ظروف البيت البلاستيكي و طبقت تجربته باستخدام تصميم القطع المنشقة – المنشقة split – split plot design بثلاث مكررات اذ تضمن العامل الرئيسي المخصبات الاحيائية (B) وشملت (B0 بدون اضافة اي مخصبات (المقارنة) (B1 MIX ، Pseudomonas fluorescence (B2) ، Pseudomonas fluorescence + Mycorrhiza (B3) ، Mycorrhiza (B4) ، Mix + Mycorrhiza (B5) ، Pseudomonas fluorescence + Mycorrhiza (B6) ، Mix + Pseudomonas fluorescence + Mycorrhiza (B7) and (A2) وتضمن العامل تحت الثانوي الاصناف (V) صنف سيف (V1) صنف سمار (V2). اظهرت النتائج تفوق معاملة المخصبات الاحيائية في صفة ارتفاع النبات وحاصل. نبات⁻¹ وحاصل الكلي. بيت⁻¹ اذ تفوقت معاملة اللقاح الخليط (B7) باعطائها اعلى زيادة بلغت 182.7 سم و 2164 غم و 3246 كغم على الترتيب. كما اظهر التداخل بين الاصناف والمخصبات تفوق معاملة V1B7 في اعطاءها ارتفاع نبات وحاصل. نبات⁻¹ وحاصل. بيت⁻¹ بلغ 197.5 سم و 2519 غم و 3779 كغم بالتتابع. وكذلك تفوقت معاملة التداخل بين طرق الاضافة والصنف والمخصبات A2V1B7 باعطائها اعلى ارتفاع وحاصل. نبات⁻¹ وحاصل. بيت⁻¹ بلغ 201.7 سم و 2788 غم و 4183 كغم بالتتابع.

الكلمات المفتاحية: مساحة ورقية، كلوروفيل، قطر وطول الثمرة.