P- ISSN 1991-8941 E-ISSN 2706-6703 *Journal of University of Anbar for Pure Science (JUAPS)* Open Access
2023,(17), (1):29 – 41

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

Samer M. Ahmed[1], Mustafa M. Mohammed[2], Amira S. Mohammed[3*], Abdulrahman K. .Suhail[1] and Hassen Y. Jaber[1]

[1]Breeding and improvement plant center, Agricultural Research Directorate, Ministry of Science and Technology ;Baghdad, Iraq.
[2]College of Education for pure Science, University of Anbar ;Ramadi,Iraq ,
[3] Department of Chemistry, College of Science, University of Anbar Ramadi, Anbar, Iraq.

ARTICLE INFO

Received: 25 / 02 /2023
Accepted: 30 / 03/ 2023
Available online: 06/ 06 / 2023

DOI: 10.37652/juaps.2023.178809

Keywords:
Leafarea,
Chlorophyell,
Length and Diameter of fruits,

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 fluorescenc*e (B3)*Mix* + *Pseudomonas fluorescenc*e (B4)Mycorrhiza (B5)Mix + Mycorrhiza (B6), *Pseudomonas fluorescenc*e+Mycorrhiza (B7) and Mix + *Pseudomonas fluorescenc*e + 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 (*Cucumus 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].

*Corresponding author at Department of Chemistry, College of Science, University of Anbar Ramadi, Anbar, Iraq; ORCID:https://orcid.org/0000-0000-00000- ; Tel:+9647734982227
E-mail address: samaf-88@hotmail.com

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 *Azosprillium*) on

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 *Azospirillium* 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 incoula contains 80-100 x 103 cfu / gm incoula). 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 incoula contains 80-100 x 103 cfu / gm incoula). 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 raws 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 raw 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, P_2O_5 160, K_2O 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 ed ^{12} [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 + Azospirillim brasilience + Bacillus subtillus + 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

Treatments										
Variey (V)	Method of Addition (A)	Biofertilizers (B)								A xV
		B0	B1	B2	B3	B4	B5	B6	B7	
V1	A1	133.3	188.0	166.7	166.7	190.0	193.3	196.7	197.5	179.0
	A2	143.3	190.0	190.0	186.7	186.7	181.7	183.3	201.7	182.9
V2	A1	106.7	160.00	158.3	158.3	158.3	155.0	158.3	165.0	152.5
	A2	121.7	161.7	155.0	158.3	163.3	160.0	160.0	166.7	155.8
B		126.2	175.0	167.5	167.5	174.6	172.5	174.6	182.7	

											V
V x B	V1	138.3	189.2	178.3	176.7	188.3	187.5	190.0	197.5	180.7	
	V2	114.2	160.8	156.7	158.3	160.8	157.5	159.2	165.8	154.2	
										A	
A x B	A1	120.0	174.2	162.5	162.5	174.2	174.2	177.5	179.2	165.5	
	A2	132.5	175.8	172.5	172.5	175.0	170.8	171.7	184.2	169.4	
LSD 0.05		A	V	B	AxV	AxB	VxB	A x V x B			
		N.S	8.82	25.25	13.35	31.55	29.87	39.44			

(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 subtillus* + *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*

The results of Table (3) found no significant differences for treatment of methods of inocula addintion and variety in leaf area, while treatment of biofertilizers (B4) was significantly superior in increasing which reached 55.80 dcm^2. Also, there was no significant superiority in the interaction treatment between the addition methods (A) and (V) variety, while interaction treatment between variety and biofertilizer V1B1was recorded 56.70 dcm ^{2} .Interaction between addition methods (A) and biofertilizer (B). A2B7 treatment was significantly superior which reached 57.40 dcm^2.The triple interaction treatment (A2V1B7) was significantly superior which gave 61.60 dcm2.

Table 3 Influence of Methods of Inocula Addition, varieties and Biofertilizers on Leaf Area(dcm^2) of cucumber plant

Variey (V)	Method of Addition (A)	Biofertilizers (B)								AxV
		B0	B1	B2	B3	B4	B5	B6	B7	
V1	A1	41.20	55.600	52.00	48.70	54.90	53.30	53.10	51.10	51.24
	A2	41.80	57.80	54.10	55.40	55.40	54.80	59.00	61.60	55.00
V2	A1	32.90	53.10	51.80	52.90	59.70	54.20	53.20	52.90	51.34
	A2	41.60	49.30	54.60	53.20	53.20	52.70	51.80	53.10	51.20
B		39.40	53.90	53.15	52.60	55.80	53.75	54.30	54.70	
										V
V x B	V1	41.50	56.70	53.00	52.10	55.20	54.00	56.00	56.30	53.10
	V2	37.20	51.20	53.20	53.00	56.40	53.40	52.50	53.00	51.30
										A
A x B	A1	37.00	54.30	51.90	50.80	57.30	53.70	53.20	52.00	51.30
	A2	41.70	53.50	54.40	54.30	54.30	53.70	55.40	57.40	53.10
LSD 0.05		A	V	B	AxV	AxB	VxB	A x V x B		
		N.S	N.S	14.53	N.S	17.77	18.17	22.76		

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 subtillus* + *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*

The table (4) showed non-significant differences between methods of inocula addition and variety. Whereas, biofertilizer had a significant effect, with highest rate of 31.11 SPAD units in (B1)

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 V1B1 treatment reached 33.95 SPAD units. Whereas, interaction treatment between addition methods and biofertilizers showed significant effect the best treatments were A2B1 treatment which gave 31.98 SPAD unit.. And triple interaction between methods of inocula addition , varieties and biofertilizers treatment A2V1B1 was significantly superior as it gave 37.67 SPAD units compared with A1V1B0 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

Treatments											
Variety (V)	Method of Addition (A)	Biofertilizers (B)									AxV
		B0	B1	B2	B3	B4	B5	B6	B7		
V1	A1	22.50	30.32	29.83	24.53	25.10	25.00	23.67	27.03	23.50	
	A2	28.67	37.67	33.67	34.07	31.67	29.87	29.90	30.63	32.02	
V2	A1	23.27	30.17	23.97	23.63	28.33	26.13	26.13	27.90	26.19	
	A2	25.33	26.30	26.37	28.67	26.93	27.33	26.50	32.00	27.43	
B		24.94	31.11	28.47	27.72	28.01	27.08	26.55	29.39		
											V
V x B	V1	25.58	33.95	31.77	29.30	28.38	27.43	26.78	28.83	29.00	
	V2	24.30	28.23	25.17	26.15	27.63	26.73	26.32	29.95	26.81	
											A

A x B	A1	22.88	30.20	26.92	24.08	26.72	25.57	24.90	27.47	26.09
	A2	27.00	31.98	30.02	31.37	29.30	28.60	28.20	31.32	29.72
LSD 0.05		A	V	B	AxV	AxB	VxB	A x V x B		
		N.S	N.S	3.35	2.94	5.15	5.36	7.19		

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* + *Azospirillim brasilience* + *Bacillus subtillus* + *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*

These results confirmed the efficiency of biological fertilization in increasing plant height, leaf area, and leaf chlorophyll content as important indicators of vegetative growth that express the strength of plant growth, due to increase in the availability of nutrients in the soil and the increase in total content of nutrients in plant, and this is confirmed by [17]. The results agreement with [18] . The increase in most shoot characteristics of plants with biofertilizers inoculation (*Azotobacter* and *Azospirillum*) attributed to role of biofertilizers in availability, absorption, and concentration of nutrients such as nitrogen and phosphorus. Biofertilizers also play a role in stimulating production of growth regulators, which are positively reflected in the increased division, elongation, and expansion of cells, which reflected on shoot growth [10,19], This results may be due to the dominance of the genetic factors of the varieties in their response to biofertilizers in increasing or decreasing vegetative growth or reason may be that superior Saif variety is one of medium late varieties, which means that it stays for a longer period on field until harvest, which allows a longer period of time to benefit from Biofertilizers, which positively affects vegetative growth, and this is agreement with many papers [9,17,20,21,22,23].

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

Treatments											
Variey (V)	Method of Addition(A)	Biofertilizers (B)									AxV
		B0	B1	B2	B3	B4	B5	B6	B7		
V1	A1	19.67	26.67	24.67	23.67	30.33	24.33	29.33	28.67	25.92	
	A2	21.33	29.00	29.33	29.33	27.33	28.33	31.67	35.00	28.92	
V2	A1	13.00	22.33	20.00	20.67	21.33	20.33	21.33	22.00	20.12	
	A2	15.00	25.00	24.33	23.00	26.00	24.67	26.33	28.00	24.04	
B		17.25	25.75	24.58	24.17	26.25	24.42	27.17	28.42		
											V
V x B	V1	20.50	27.83	27.00	26.50	28.83	26.33	30.50	31.83	27.42	
	V2	14.00	23.67	22.17	21.83	23.67	22.50	23.83	25.00	22.08	
											A
A x B	A1	16.33	24.50	22.33	22.17	25.83	22.33	25.33	25.33	23.02	
	A2	18.17	27.00	26.83	26.17	26.17	26.67	29.00	31.50	26.43	
LSD 0.05		A	V	B	A xV	A xB	V xB	A x V x B			
		1.28	1.32	3.32	1.79	4.03	4.11	5.39			

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* + *Azospirillim brasilience* + *Bacillus subtillus* + *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*

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

Treatments														
Variety (V)		Method of Addition (A)	Biofertilizers (B)								AxV
			B0	B1	B2	B3	B4	B5	B6	B7	
V1		A1	48.33	78.33	63.33	63.33	68.33	75.67	70.00	78.33	68.21
		A2	54.67	86.67	78.33	76.67	80.00	79.67	81.33	78.33	76.96
V2		A1	44.33	68.33	55.67	59.67	60.00	60.00	61.67	70.00	59.96
		A2	45.00	71.33	68.33	68.33	75.00	73.00	74.67	73.33	68.63
B			48.08	76.17	66.42	67.00	70.83	72.08	71.92	75.00	
											V
V x B		V1	51.50	82.50	70.83	70.00	74.17	77.67	75.67	78.33	72.58
		V2	44.67	69.83	62.00	64.00	67.50	66.50	68.17	71.67	64.29
											A
A x B		A1	46.33	73.33	59.50	61.50	64.17	67.83	65.83	74.17	64.08
		A2	49.83	79.00	73.33	72.50	77.50	76.33	78.00	75.83	72.79
LSD 0.05		A	V	B	AxV	AxB	VxB	A x V x B			
		5.85	3.17	15.17	6.51	18.40	16.14	20.21			

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 + Azospirillim brasilience + Bacillus subtillus + 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*

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

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

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

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* + *Azospirillim brasilience* + *Bacillus subtillus* + *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*

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 vareity 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														
Variety (V)	Method of Addition (A)	Biofertilizers (B)												AxV
			B0	B1	B2	B3	B4	B5	B6	B7				
V1	A1		1380	2310	2420	2313	3135	2752	3040	3375	2591			
	A2		1773	3770	3450	3380	3265	3381	3772	4183	3372			
V2	A1		865	2310	1661	1915	1890	1830	1990	2310	1846			
	A2		1012	2686	2520	2372	2925	2727	2898	3118	2532			
B			1257	2769	2513	2495	2804	2672	2925	3246				
												V		
V x B	V1		1557	3470	2935	2847	3200	3067	3406	3779	3033			
	V2		938	2498	2090	2144	2408	2278	2444	2714	2189			
														A

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) (*Azotobacter chroococcum* + *Azospirillim brasilience* + *Bacillus subtillus* + *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*

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**			**14.80**
	V2	**10.58**	**12.83**	**13.50**	**12.75**	**13.17**	**12.50**	**12.50**	**12.83**			**12.58**
												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**	**V**	**B**	**AxV**	**AxB**	**VxB**	**A x V x B**					
	N.S	**0.740**	**1.046**	**1.041**	**1.805**	**1.762**	**2.708**					

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* + *Azospirillim brasilience* + *Bacillus subtillus* + *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*

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

V x B										
	V1	3.83	5.67	4.92	5.17	5.83	5.67	5.83	6.67	5.45
	V2	4.00	4.67	4.83	5.33	5.50	5.17	5.17	5.83	5.06
										A
A x B	A1	3.67	5.00	4.83	5.00	5.33	4.83	4.83	5.83	
	A2	4.17	5.33	4.92	5.50	6.00	6.00	6.17	6.67	
LSD 0.05	A	V	B	AxV	AxB	VxB	A x V x B			
	N.S	0.26	0.70	0.34	0.81	0.84	1.06			

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* + *Azospirillim brasilience* + *Bacillus subtillus* + *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*

The inoculation of seeds and seedlings of the cucumber plant with biofertilizers leds 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.

5 References

[1] Hussein, W, A . The effect of extracts of garlic, licorice roots, and urea on the vegetative growth, flowering, yield, and specific characteristics of cucumber plants. (*Cucumis sativus*) . Master's thesis - Department of Horticulture and Landscape Engineering - College of Agriculture - University of Baghdad .(2002).p:76.

[2] Arnaout, M, E. Medicinal herbs and plants as food and medicine. The Egyptian Lebanese Dar of Egyptian Lebanese for Publishing and Distribution, Beirut, Lebanon.(1980).

[3] Al-Zehawi, S, M, A. Effect of Manures and Mulching on growth, yield and quality of potato *(Solanum tuberosum* L.*)* MSc Thesis . Department of Horticulture. College of Agriculture . University of Baghdad. (2007) p:69.

[4] Al- Haddad, M, E. M. The role of Biofertilizers on reducing agricultural costs,reducing environmental pollution and increasing crop production. National Training Course on the Production and use of Biological Fertilizers. College of Agriculture, Ain Shams University. Egypt.(1989).

[5] Hassan , K, D. Hadi M. Aboud Falih H. Saeed.Effect of bio-fertilizer and genotype on Cucumber growth and their productivity. Anbar Journal of Agricultural Sciences. Volume 15 (a special issue for the conference): (2017) P. 208-317.

[6] Ramakrishnan, K and G. Selvakumar. Effect of biofertilizers on enhancement of growth and yield on Tomato (*Lycopersicum esculentum* Mill.) International Journal of Research in Botany 2(4): (2012) p.20-23.

[7] Tosic ,I; Z. Golic and A. Radosavac. Effects of the application of biofertilizers on the microflora and yield of lettuce (*Lactuca sativa* L.*) Acta Agriculturae Serbica*, Vol. 21(42) : (2014) p 91-98 .

[8] Alwan , U. A., M. A. Hadi and H. M. Bayan. Effect of biofertilizers and salicylic acid on availability of some nutrients in soil and plant and som vegetative and production quality of beans irrigated with saline water .*Iraqi Journal of Agricultural Sciences*.47(1): (2016) p.291 - 302.

[9] Meena; M,L. V.S. Gehlot, D.C. Meena, S. Kishor, S. Kishor, S. Kumar and J.K.Meena.2017. Impact of biofertilizers on growth, yield and quality of tomato (*Lycopersicon esculentum* Mill.) cv. Pusa Sheetal. Journal of Pharmacognosy and Phytochemistry . 6(4): 1579-1583.

[10] Shashi, K; M .Kumar . R. kumar and M. Raghav. Effect of Biofertilizers on Growth and Yield of Tomato (Lycopersicon esculentum Mill). International Journal of Current Microbiology and Applied Sciences 7 (2):(2018).p 2542- 2545.

[11] Deiab , N. S. Utilization of Rock and Super Phosphate and Addition of Fungal and Bacterial Bio-fertilizer on Growth and Yield Potato. PhD Thesis Horticulture and Gardening Engineering Department / College of Agriculture - University of Baghdad. Iraq . (2012) p.150.

[12] Al-Naimi, S, N, A.1999. Fertilizers and soil fertility. Dar Al Kutub For Printing & Publishing. University of Al Mosul. Ministry of Higher Education and Scientific Research. Iraq.

[13] Al-Sahuki, M. M and K. Wahib .Applications in the Design and Analysis of Experiments. Dar Al Hekma for Printing & Publishing. Mosul. University of Al Mosul. Ministry of Higher Education and Scientific Research. Iraq.(1990)

[14] Glaser .A and C. Biggs. An Introduction to Statistical Methods in GenStat. VSN International, Hemel Hempstead, UK.(2010)

[15] Minnotti, P.L.; D.E. Halseth and J.B. Sieczka. 1994. Chlorophyll measurement to assess the nitrogen status of potat varieties. Hortscience. 29(12): (1994). 1497-1500.

[16] Tekalign, T and S.P. Hammes . Growth and biomass production in potato grown in the hot tropics as influenced by paclobut razel . Plant Growth Regulation. Springer Netherland 45(1): (2005) 37- 46.

[17] Saeed, F. H. Integrated management of chemical, organic and biochemical fertilizers and their impact on the growth and productivity of some genotypes of cucumber plant. PhD thesis. Horticulture and Gardening Engineering Department / College of Agriculture - University of Baghdad. Iraq . (2015) .p 138.

[18] Isfahani, M. and H. Besharati. Effect of biofertilizers on yield and yield components of cucumber. J. of. B. &Earh S. 2(2): (2012) p 87-92.

[19] Allawi, M. M. Impact of bio,organic and chemical fertilization on the roots architectural and growth and yield of pepper plant (Capsicum annuum L.) Ph.D . Thesis. Horticulture and Landscape Department .College of Agriculture., University of Baghdad, Iraq .(2013) p:168

[20] Al- Qaisy ,Sh, A . Effect of Nitrogen Fertilizer on the Growth and some Quantity and Quality Characters and Accumulation of Total Steroidal Alkaloids in Some Potato Cultivars . Master Thesis. Department of Horticultural Sciences, College of Agriculture, University of Baghdad.(2010) Page 115.

[21] Fawzy , Z.F., A.M. El-Bassiony., L. Yunsheng ., O. Zhu and A.A. Ghoname . Effect of mineral, organic and bio-N fertilizers on growth , yield and fruit quality of sweet pepper. *Journal of Applied Sciences Research* . 8 (8): (2012) 3921-3922

[22] Dharmendra; S. Effect of Organic Manures and Bio fertilizers on Growth, Yield and Quality of tomato (*Solanum lycopersicum* L.) .Degree of Master of Science(Agriculture) . Department of Horticulture, College of Agriculture. Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur.India.(2014).139.

[23] Saeed, F H, Hadi M A and Kazem D H. The detection of Auxin and cytokine hormons in leachate growth of some biogenic fertilizers. Women's Scientific Conference (Special Issue): (2014) .pp. 186-192.

[24] Islah ;M, M ,El-Hifny and El-Sayed, M.A.M. Response of Sweet Pepper plant Growth and Productivity to Application of Ascorbic Acid and Biofertilizers under Saline Conditions. Australian Journal of Basic and Applied Sciences, 5(6): (2011) .1273-1283.

[25] Doifode, V.D and P.B. Nandkar. Influence of Biofertilizers on the Growth, Yield and Quality of Brinjal Crop. Int. J. of Life Sciences .Special Issue A2 :(2014) .17 -20.

[26] Eifediyi, E. K, and Remison, S. U. Growth and yield of cucumber (*Cucumis sativus* L,) as influenced by farmyard manure and fertilizer, Journal of Plant Breeding and Crop Science. 2 (7):(2010) 216-220.

[27] Sabo M. U., M.A. Wailare ., S. Jari. and Y.M.Shuaibu . Effect of NPK fertilizer and spacing on growth and yield of watermelon (*Citrillus lanatus L.*) in Kaltungo Local Government Area of Gombe State, Nigeria, Scholarly Journal of Agricultural Science Vol, 3(8) : (2013) 325-330.

P- ISSN 1991-8941 E-ISSN 2706-6703 *Journal of University of Anbar for Pure Science (JUAPS)* Open Access
2023,(17), (1):29 – 41

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

سمير محمد احمد[1] ، مصطفى مزبان محمد[2] ، اميرة سمير محمد[3]* ، عبد الرحمن خماس سهيل[1] ، حسن يوسف جابر[1]

[1]وزارة العلوم والتكنولوجيا – دائرة البحوث الزراعية – مركز تربية وتحسين النبات
[2] جامعة الانبار , كلية التربية للعلوم الصرفة
[3] جامعة الانبار , كلية العلوم , قسم الكيمياء
.samaf-88@hotmail.com
Mostafamizban71@uoanbar.edu.iq
Mostafamizban71@uoanbar.edu.iq

الخلاصة:

لدراسة تأثير تلقيح البذور والشتلات ببعض المخصبات الاحيائيه في نمو وحاصل الخيار تحت ظروف البيت البلاستيكي و طبقت تجربه باستخدام تصميم القطع المنشقة – المنشقة split – split plot design بثلاث مكررات اذ تضمن العامل الرئيسي المخصبات الاحيائيه (B) وشملت (B0بدون اضافة اي مخصبات (المقارنة) *MIX* (B1) ، *Pseudomonas fluorescence* (B2) ، *Mix + Pseudomonas fluorescence* (B3) ، *Mycorrhiza* (B4) ، *Mix + Mycorrhiza* (B5) ، *Pseudomonas fluorescence + Mycorrhiza* (B6) ، *Mix + Pseudomonas fluorescence + Mycorrhiza* (B7) *and* . و العامل الثانوي طرق اضافة المخصبات (A) للبذور(A1) وللشتلات (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 باعطاءها 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.*