



## The Role of BioFertilizer in Reduction of Irrigation Periods for the Yield and Components of Mung Bean

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### Abstract

A field study has been conducted during autumn season of 2016 at Karbala province of Hindia by mung bean plant *Vigna radiate* L. is a local category to study the interrelated effect of both the Mycorrhiza fungi (*Glomus mosseae*) and the Rhizobia bacteria (*R.leguminosarum*) Under levels of water stress. Three treatments of irrigation are used ; (S1 irrigation every 5 days and S2 irrigation every 10 days and S3 irrigation every 15 days) and four levels of Bio fertilizer are used (without inoculation) (C<sub>0</sub>) and (*Rhizobium* inoculation) (R) and (mycorrhiza inoculation)(M) and (the interaction between mycorrhiza and *Rhizobium*) (M+R). A split plot in randomized complete block design is used with three replications to do this experiment. Treatments of irrigation are used as main plots while Bio fertilizer levels are used as sub-plot. Least significant difference (LSD) at 5% probability is used to compare between the means.

The results showed irrigation every 5 days (S1) was superior in having the highest average of (The dry weight of the root, number of pod per plant, number of seeds per pod ,100 seeds weight ,seed yield , Biological yield) Amount (0.78 gm. Plant<sup>-1</sup>, 31.33 pods. Plant<sup>-1</sup>, 8.45 seed .pod<sup>-1</sup>, 3.82 gm , 3.77 tan .ha<sup>-1</sup>, 7.37 tan .ha<sup>-1</sup>) respectively. without significant difference between them treatment of irrigation 10 days (S2) in 100-seed weight 3.50 gm. Moreover treatment Bio fertilizer (R+M) significantly gives the highest means for yield and yield components (0.89 gm. Plant<sup>-1</sup>, 33.64 pods. Plant<sup>-1</sup>, 8.42 seed .pod<sup>-1</sup>, 4.10 gm , 4.00 tan .ha<sup>-1</sup>, 7.70 tan .ha<sup>-1</sup>) respectively. The interaction among (R+M)S1,(R+M)S2 and(M)S1 significantly give the highest means for all plant characteristics.

### Introduction:

Mung bean *Vigna radiata* L. is a summer crop belonging to the fabaceae family, a herbaceous or semi-existing herbaceous plant (25-125 cm), covered with foliage. Its leaves are three-component and have a life span of 70-90 days And is relatively drought tolerant (1 and 2 ), It is cultivated in Iraq in most governorates the total area planted with livestock is estimated at 33027 dunums with a production rate of 383.8 kg / dunum<sup>-1</sup> (3), and its seeds are used as a cheap source of protein The percentage of seeds in the seeds (19-29)%.

Biotechnological technologies in modern advanced agriculture rely on the addition of the biological vaccine to the center of plant growth, which contributes to the sustainability and improvement of the cultivation of different crops through the conservation of biomes to benefit the plant from its effectiveness and activity and thus increase the quality of high (4). The interest in bio-fertilization technology and the attempt to vaccinate plants with microorganisms, especially those that stabilize nitrogen, are being used to solve the problem of providing the nitrogen element of the plants,



filling in the shortage in part and using the minimum mineral nitrogen fertilizers. Another problem is the rate of movement of the nitrogen element in the complex soil system(5).

Water stress is one of the most environmental stresses affecting low crop yields (6). Water affects the vital processes in the plant as well as the nutrient uptake of the plant. (7) found significant differences between the various genotypes of the mung bean in the traits of growth and the extent of their response to the effect of water stress. (8) explained that the spacing of irrigation periods for grass plants led to a decrease in the soft and dry weight of plants (9) Repeat irrigation of every 2,4 and 6 days on soybean plants resulted in dry and soft weight differences. Irrigation every 6 days significantly reduced dry weight compared with irrigation every two days. (10) noted that the restriction of irrigation on 20-day grass plants led to a decrease in plant height compared with irrigation every 10 days, and between (8and 11) Number of pod . plants and number of seeds / pod and weight of 100 seeds. (12) And (13) showed that during the flowering period, plantation of soybean was a significant increasing in the number of pod / plants, number of seeds / pod, 1000 seed weight and total plant yield compared to non-irrigated plants.

### Materials and Methods :

A field experiment was carried out in a loam soil to cultivate the *Vigna radiate* L. crop during the autumn 2016 agricultural season on a farm located in the province of Karbala / district of Al. Hindiyah, located within 33.15° north and 44.07°east. The site of topographic Previously agriculture with a crop *Zea mays*,

Analyzes and measurements of the physical, chemical and biological properties of soil in the pre-agriculture field were conducted in the laboratories of the faculty of agriculture/ Al-Qadisiyah university and the department of agricultural research / ministry of science and technology. The sample of the study soil was taken from the surface horizon (0-30cm) well to form a representative soil model of the field, the soil was air dry and then grinded and sifted through a 2 mm diameter sieve.

### Experimental Design and Transaction Distribution:

Three irrigation parameters were used for irrigation (5, 10, 15) days. And four levels of bio-fertilization, treated without control (C<sub>0</sub>), rhizobia (R) and Mycorrhiza (M), and interaction between rhizobia and Mycorrhiza (M + R) and three replicates. The experiment was designed according to the split plot design according to the design of the RCBD and three replicates. The water stress factors were distributed on the main boards at random while the biological fertilization of the secondary plates was taken. The most important factor is the biological vaccines in the secondary plates, the least significant factor is the water stress factor in the main panels. The field is divided into three main replicates with 36 experimental units each , Repeated 12 experimental units within the single repeater. The area of the experimental unit is 4 x 2 m and the dimensions are 2 × 2 m. As well as major transactions, and 2 m intervals were left between secondary transactions for irrigation control. The experimental unit includes five lines of length of each line 2 m, the distance between line 0.30 m and the distance between the plant and the last 0.25 m.

Table (1) Some chemical, physical and biological characteristics of soil study before planting

Adjective	Value	Measuring unit
pH	7.4	
EC	3.6	dSm <sup>-1</sup>
CEC	26.73	cmol.kg <sup>-1</sup> soil
O.M	3.4	gm.kg <sup>-1</sup>
Available N	46.10	mg.kg <sup>-1</sup>
Available P	6.34	
Available K	73.76	



Clay	276	gm.kg <sup>-1</sup>
Silt	370	
Sand	354	
Soil Texture	loam	
Total bacteria	1.59 *10 <sup>7</sup>	gm <sup>-1</sup> soil . C.F.U
Total fungi	2.20 *10 <sup>3</sup>	

Seeds and vaccine used in the study:  
seeds are used Mung bean plant *Vigna radiate* L. (leaf of dicotyledonous) Class local (Khadrawi) (Wilczek) in order to be used in the field experiment, as well as the use of vaccine fungi Mycorrhiza (VAM) in this study, consisting of ( endospore + infected roots + dry soil) were obtained spores mushrooms *Glomus mosseae* from the Department of Agricultural research / Ministry of Science and Technology / Zaafaraniya for the purpose of use as a vaccine in the field experiment, the use of bacteria Rhizobium (*R.leguminosarum*) where he was isolated for vaccine Rhizobia collection plant roots Albaqlae *Vicia faba* L. from different agricultural fields in the district of Al. Hindiyah.

Preparation of Rhizophytic Plant Rationale:  
The liquid extract medium was used for the preparation of Rhizobia bacteria. This medium was prepared by dissolving the following substances in a liter of distilled water: 10 g mannitol, 0.5gm monohydrate potassium phosphate K<sub>2</sub>HPO<sub>4</sub>, 0.1 g magnesium sulphate MgSO<sub>4</sub>.7H<sub>2</sub>O, 0.2 g salt Sodium chloride NaCl and 0.5 g yeast powder, pH control at number 7 and sterilized at the temperature of 121 ° C and pressure of 15 lb-2 and stored in the refrigerator until use. For the purpose of isolation and development of root nodules in different experiments, Agar is 15 grams (14).

Isolation of Rhizobia bacteria :  
Bacterial isolations were carried out in the laboratories of the agricultural research department / ministry of science and technology / Zaafaranyah. The method described by (14) was followed by isolating the bacteria from the root nodes by separating the root nodes using a razor blade, taking into consideration the cutting of part of the root of the contract. After washing with sterilization

water several times, it was immersed in HgCl<sub>2</sub> solution concentration 0.1% for 5 minutes and then in 95% ethyl alcohol for 3 minutes. After that, it was washed several times in sterile distilled water and the last time left the node inside a sterile petri dish A small amount of distilled water Then, under the sterilization conditions, the node was crushed into the dish by a tablespoon of weight. Using the pollination loop, a portion of the crushed root node suspension was transferred under sterilization conditions and spread on the surface of Petri dishes containing the YEMA extract using the Streaking method.

Seed inoculation, agriculture and fertilization:  
The total area of the field (600 m<sup>2</sup>) was prepared from plowing, tilling and settling. The vaccine was distributed under the seeds with a width of 5 cm and a thickness of 5 cm. The addition was 300 gm for each treatment, 10 gm of the Mycorrhiza vaccine was added in one Joura , In addition, that the seeds of the crop were vaccinated with the root nodule vaccine one hour before planting. It contained the pregnant 5.8 x10<sup>8</sup> bacterial cells. And the addition of 10% sucrose to increase the vitality and efficiency of the bacteria in the formation of the contract, and added 40% of the gum arabic to ensure the adhesion of the largest number of cells of the bacteria Streptococcus with Seed. The seed of the mung bean crop was planted in the field on 18/7/2016 with three to five seeds per unit. The distance between Joura and the other 0.25 m for plant density was 133333 plants. After a week of emergence, the plants were reduced to one plant in Joura. At the same time, the failed jaws were perfected after 75% of the seedlings appeared. The plant was harvested on different dates according to "irrigation coefficients from 14/10 to 25/10/2016 in the season" The data were collected and statistically analyzed by the



statistical program of the least significant difference (LSD) Level of 0.05.

Studied attributes:

Ten plants were taken randomly from the center lines and each experimental unit. The following characteristics were measured:

1. Calculate the dry weight of the total root (gm. Plant<sup>-1</sup>): The dry root weights of the samples taken after the vegetative cutting of the samples were calculated by extracting the total root of these plants, The roots were then washed under a steady stream of water, and they were well settled. The roots were then placed in paper bags, dried in the electric oven, dry root weights were calculated, and the average weights were extracted on a per plant basis in grams.
2. Number of pod per.Plant<sup>-1</sup>: Five plant samples were taken randomly for each experimental unit after total maturity, according to the number of pod<sup>-1</sup> in all studied plants, and the average was extracted on a plant<sup>-1</sup> based basis.
- 3 - Number of seeds in Pod<sup>-1</sup>: The number of seeds in Pod<sup>-1</sup> Calculated according to the following equation: Number of seeds per plant = Number of seeds in Pod<sup>-1</sup> × Number of pods.
- 4 - weight of 100 seeds (gm): After mixing the seeds of harvested plants took 100 seeds at random and then weighed.
- 5 - Seed yield (Tan.ha<sup>-1</sup>): was calculated by taking the product of the rest of the plants in the experimental unit and add to the total of the ten plants used in the study of previous qualities and extracted on the basis of experimental unit area and then around the output to a Tan.ha<sup>-1</sup>.
- 6- The biological yield (Tan.ha<sup>-1</sup>): according to the average dry weight of the sample harvested for each experimental unit after drying for 48 hours in the oven at a temperature of 70 m , as weighed the air parts and seeds and take the average and then hit the plant density to convert to a Tan.ha<sup>-1</sup> (15).

### Results and discussion:

The dry weight of the total root (gm. Plant<sup>-1</sup>). The results in table (2) showed that the addition of bio fertilizer lead to significant increase in the dry weight of the root mass from the measurement treatment (C0), with the plants fertilized with Mycorrhiza and rhizobia together (M + R) the highest mean root weight 0.89gm. Which differed significantly from the treatment of Mycorrhiza (M) and the treatment of rhizobia (R) 0.69 and 0.66 gm<sup>-1</sup>, with increase of 28.98 and 34.84%, respectively. The lowest mean root weight was 0.43 gm Plant<sup>-1</sup> with a decrease of 51.68% compared to the treatment of the interaction between Mycorrhiza and rhizobia (M + R). Note that the dry weight response of the root mass of the interaction between Mycorrhiza and rhizobia infection is largely due to the dry weight response of the vegetative group. The significant increase in dry weight due to Mycorrhiza and rhesophagee vaccine concur with the findings of the researchers (16 and 17).

The results showed that the behavior of the dry weight of the roots was increased and was similar to the length of the roots. The irrigation spacing increased the dryness stress at the irrigation treatment every 15 days (S3) lead to significant decrease of the root dry weight of 0.58 gm. Plant<sup>-1</sup> compared to the treatment of water stress 5 days (S1) 0.78 gm And 25.64%. On irrigation treatment every 10 days (S2), the dry weight of the root increased by 0.64 gm. Plant<sup>-1</sup> Which did not differ significantly compared to the treatment of stress, which is irrigation every 15 days (S3) and increased by 10.34%. The reason for the low dry weight of the root was due to the decrease in root length due to the severity of the stress and its attainment of Severe Stress, which stimulated the production of oxidizing enzymes and increased the accumulation of abyssic acid and the reduction of cytokines (18 and 19). The results are consistent with both (20) on soybean and planters, (21) on Mung bean plant.



Table (2) Effect of bio fertilizers and Water Stress and their interaction in the dry weight of the total root (gm. Plant<sup>-1</sup>)

Bio-fertilizer transactions (B)	(S) Water stress coefficients			Average
	Irrigation every 5 days (S1)	Irrigation every 10 days (S2)	Irrigation every 15 days (S3)	
Without fertilization (C <sub>0</sub> )	0.54	0.42	0.33	0.43
(R) Rhizobia	0.76	0.64	0.58	0.66
(M) Mycorrhiza	0.79	0.65	0.65	0.69
Rhizobia + Mycorrhiza (M+R)	1.06	0.87	0.75	0.89
Average	0.78	0.64	0.58	(B) 0.15
L.S.D (0.05)	(S) 0.12		(SB) 0.25	

Number of pod per (pod . plants<sup>-1</sup>).  
The results indicated in table (3) that there was a significant effect of bio-fertilization treatments on the increase of the number of pod<sup>-1</sup>. The fertilized treatment of Mycorrhiza and Rhizobia (M + R) was higher by giving them the highest mean number of 33.64 pod.plante<sup>-1</sup> 31.16 pod.plante<sup>-1</sup> and Rhizobia (R) 28.00 pod.Plants<sup>-1</sup> with increase of 7.95 and 20.14%, respectively, compared with the lowest number of corns given by the measurement treatment (C<sub>0</sub>) 17.42 pod.plante<sup>-1</sup>. The increase was attributed to the effect of inoculation fungi Mycorrhiza, and caused by stimulation of growth and increase in the number of chloroplasts with an important role in increasing photosynthesis, and this is reflected in the winning and its components and that agreement with the results of (22), as well as the composition Rhizobia and Mycorrhiza system bilateral plant equipped with both elemental nitrogen and phosphorus, as the bacteria root nodes lead directly, or indirectly by increasing the viability of the plant to absorb nitrogen mediated by fungi

Mycorrhiza (23), and the processing of the element phosphorus-borne fungus to the plant as both (24). This is consistent with the results of (17) and with (25).

Results showed a table (3) also water stress irrigation periods spacing significant effect in reducing the average number of pod per plant from 31.33 pod. plant<sup>-1</sup> for the treatment of irrigation every five days (S1) to 23.98 pod. plant<sup>-1</sup> for the treatment of irrigation every 15 days (S3), a decline 24.41%, while the treatment of irrigation every 10 days (S2) decreased the average number of pod per plant reached 27.35 pod. plant<sup>-1</sup>, down by 12.70% compared to the treatment of water stress (S1), attributed the reason for the low number of pod per to a lack of relative water content and low content of chlorophyll and reduced vegetative growth and the number of leaves, leading to inhibition of photosynthesis and low installation and lack of CO<sub>2</sub> in dry matter accumulated (26 and 27). The results are consistent with the findings of both (8 and 28) and (29) on Mung bean, beans and chickpeas, respectively.



Table (3) Effect of bio fertilizers and Water Stress and their Interaction in the number of pod (pod . plants<sup>-1</sup>).

Bio-fertilizer transactions (B)	(S) Water stress coefficients			Average
	Irrigation every 5 days (S1)	Irrigation every 10 days (S2)	Irrigation every 15 days (S3)	
Without fertilization (C <sub>0</sub> )	19.60	17.33	15.33	17.42
(R) Rhizobia	32.53	27.40	24.07	28.00
(M) Mycorrhiza	35.40	30.40	27.67	31.16
Rhizobia + Mycorrhiza (M+R)	37.80	34.27	28.87	33.64
Average	31.33	27.35	23.98	(B) 0.83
L.S.D (0.05)	(SB) 1.37		(S) 0.81	

Number of seeds in Pod-1 (Seed. Pod-1). It is noted from table (4) that the effect of the treatments of the biological fertilizers continued to be treated with the interaction of Mycorrhiza and rhizobia (M + R) with a moral superiority in the number of seeds 8.42 seed. Pod, which differed from the treatment of Mycorrhiza (M) 7.02 seeds. (C<sub>0</sub>) with the lowest number of seeds in Pod 5.40 seed. The treatment of the interaction between the Mycorrhiza and Rhizobia bacteria is attributed to the increase in the number of pod and seeds in Pod. The positive relationship between fungi and bacteria has been enhanced by their presence in the same environment. The microorganisms work to release the carbon compounds produced by photosynthesis , Which increases the sources of energy and carbon for Rhizobia bacteria, which increased the growth of plants by increasing the concentration of nitrogen and phosphorus in the plant tissues, which in turn reflected the increase in the number of seeds per pod, and

these results agree with the findings of to him (30 and 31) in his study on soybean yield. The effect of water stress coefficients increased by 5 days per day (S1) significantly in the number of seeds in Pod with 8.45 seeds. Pod, while the treatment was given every 10 days (S2) 6.55 seeds. Pod increased by 29.00% The treatment is 15 weeks (S3). The average number of seeds is 5.60 seeds. The seed weight is 33.72% compared to the highest value of the irrigation treatment every 5 days (S1). The decrease in the number of seeds in Pod is due to the decrease in the relative water content and the low dry weight, and the drought disrupts the distribution of water in Pod and the imbalance in the protein structure and the failure of the growth of Pod and seeds, which leads to the separation of seeds from pod contact and reduction of growth (32) The results are consistent with the findings of with ( 33) on soybean plants and (34 and 35) on the Mung bean.



Table (4) Effect of bio fertilizers and Water Stress and their Interaction in the number of seeds in Pod (Seed. Pod<sup>-1</sup>).

Bio-fertilizer transactions (B)	(S) Water stress coefficients			Average
	Irrigation every 5 days (S1)	Irrigation every 10 days (S2)	Irrigation every 15 days (S3)	
Without fertilization (C <sub>0</sub> )	6.53	5.13	4.53	5.40
(R) Rhizobia	8.33	6.27	5.27	6.62
(M) Mycorrhiza	8.47	7.00	5.60	7.02
Rhizobia + Mycorrhiza (M+R)	10.47	7.80	7.00	8.42
Average	8.45	6.55	5.60	(B) 0.59
L.S.D (0.05)	(S) 0.45		(SB) 0.94	

Weight 100 seed (gm).

Table (5) indicates significant differences between the mean weight of 100 seeds at the effect of the biological vaccines. The interaction between the Mycorrhiza and Rhizobia (R + M) recorded the highest mean weight of 100 seeds of 4.10 gm Which differed significantly from the treatment of Mycorrhiza (M) 3.36 gm and Rhizobia (R) 3.33 gm and the measurement treatment (C<sub>0</sub>) 2.98 gm, with an increase of 22.02, 23.12 and 37.58%, respectively. The increase may be attributed to the positive effect of root contract formation, which in turn provided the plant with sufficient nitrogen, which was reflected in improved growth, And then on the number of pod in the plant and the weight of 100 seeds, as (36) have shown in their study on the Mung bean yield, the efficacy of the microorganism vaccine and the cycle of increased nutrient uptake and absorption, especially phosphorus. This is

confirmed by (36), and these results are consistent with the findings of (37 and 38). in their study on the yield of cattle and elbows respectively, and the results showed the effect of water stress on the weight of 100 seeds. (S1) irrigation every 5 days above the average 3.82 gm which was significantly higher on the treatment (S3) irrigation every 15 days 3.01 gm and an increase of 26.91%. the decrease in water and nutrient uptake during the full grain filling period causes shrinkage, small size and low weight (39 and 40). Water shortage also plays a role in the migration of calcium and magnesium and the disappearance of Pectin Methylated pectin To the separation of the area of contact with the pod and abortion (41 and 42). The results are consistent with the statements of (34) and (43). (44). On the plants of beans, chickpeas and Mung bean respectively.



Table (5) Effect of bio fertilizers and Water Stress and their interaction in the weight 100 seed (gm).

Bio-fertilizer transactions (B)	(S) Water stress coefficients			Average
	Irrigation every 5 days (S1)	Irrigation every 10 days (S2)	Irrigation every 15 days (S3)	
Without fertilization (C <sub>0</sub> )	3.23	3.13	2.60	2.98
(R) Rhizobia	3.73	3.31	2.95	3.33
(M) Mycorrhiza	3.73	3.40	2.96	3.36
Rhizobia + Mycorrhiza (M+R)	4.61	4.16	3.53	4.10
Average	3.82	3.50	3.01	(B) 0.16
L.S.D (0.05)	(S) 0.45		(SB) 0.45	

fungi Mycorrhiza in the winning ingredients has been reflected on the quotient of seeds, as well as (46 and 47), Who showed that soybean seed yields increased when pollinated with Mycorrhiza.. The table showed that there was a significant decrease in seed yield with increased water stress. The irrigation treatment (S1) was given every 5 days at an average of 3.77 tans. An increase of 32.74%. While irrigation treatment (S3) irrigation was given every 15 days with a mean average of 2.41 tan.ha<sup>-1</sup> and a decrease of 36.07% for irrigation treatment (S1). The decrease in the number of pod (Table 3), the number of seeds in Pod (Table 4), and the weight of 100 seeds (Table 5) have been attributed to a decrease in seed yield (48 and 49) It is believed that high temperatures and low relative humidity associated with drought play a role in drought of pod and seeds and that extreme drought leads to a reduction in rainfall (50). The results are consistent with the findings of (51 and 12) and (44) on the plants of cattle and Mung bean, respectively.

Total seed yield (Tan.ha<sup>-1</sup>).

The results of table (6) showed that the overlap of the pollinated by Rhizobia and Mycorrhiza had a significant effect on the total seed yield.( M + R) gave the highest average total seed yield of 4.00 Tan.ha<sup>-1</sup>), Production decreased significantly in the Mycorrhiza (M) and Rhizobia (R) and (C<sub>0</sub>) (2.92), 2.85, and 2.25 (tan.ha<sup>-1</sup>) with a decrease of 27.00, 28.75 and 43.75%, respectively.

Attributed this increase in the sum of seeds to the efficiency of bio-fertilizers through the formation of the root nodes that play a major role in increasing the efficiency of biological nitrogen fixation process, and then increase the amount of nitrogen uptake, which in turn is reflected in the increased protein synthesis within the various parts of the plant, and then had this effect proteins accumulated a significant increase in plant growth and development quotient and its components, these findings are consistent with the findings of (45), as well as the effect of inoculation



Table (6) Effect of bio fertilizers and water Stress and their interaction in the total seed yield (Ton.ha<sup>-1</sup>).

Bio-fertilizer transactions (B)	(S) Water stress coefficients			Average
	Irrigation every 5 days (S1)	Irrigation every 10 days (S2)	Irrigation every 15 days (S3)	
Without fertilization (C <sub>0</sub> )	2.51	2.28	1.97	2.25
(R) Rhizobia	3.73	2.48	2.35	2.85
(M) Mycorrhiza	3.76	2.61	2.41	2.92
Rhizobia + Mycorrhiza (M+R)	5.11	3.97	2.92	4.00
Average	3.77	2.84	2.41	(B) 0.24
L.S.D (0.05)	(S) 0.29		(SB) 0.42	

treatment (5 days) (S1) 7.37 tons.ha<sup>-1</sup>, which differed significantly from irrigation treatment every 10 days (S2) 5.98 and irrigation treatment every 15 days (S3) 5.16 tons.ha<sup>-1</sup>, And the ratio of treatment (S3) for treatment (S2) and (S1) was 13.71 and 29.98%, respectively. The reason for the lack of biological yield of the number of riyals is due to the decrease in the values of dry matter components such as number of pod, number of seeds in Pod<sup>-1</sup> and seed yield (Table 3, 4, 6). The results came in support of (11 and 52). Those who reached the low biological yield of the plant under the conditions of water stress and attributed to the decline in plant height and the number of leaves and paper area, as well as water stress reduces the growth of roots and the ability of the plant to absorb water and nutrients reduced vital activities in the total vegetative.

Biological yield (Tan.ha<sup>-1</sup>).

The results of the statistical analysis table (7) showed a significant effect of bio fertilizers in the increase of the biological yield of the Mung bean. The effect of the treatment of the interaction between Mycorrhiza and Rhizobia (M + R) was significant in increasing the biological yield by the highest value of 7.70 tons.ha<sup>-1</sup>, while the value of the biological yield was significantly decreased in the coefficients of Mycorrhiza (M), Rhizobia (R) and comparison (C<sub>0</sub>) 6.32, 5.91 and 4.76 tons respectively. The increase in biological yield may be due to an increase in the number of corns (Table 3), as well as the increase in the weight of 100 seeds (Table 5) and grain yield (Table 6) for the treatment of biological fertilization (M + R).

As for the water stress factors, the highest value of the biological yield was for irrigation



Table (7) Effect of Bio fertilizers and Water Stress and their Interaction in the Biological yield (Tan.ha<sup>-1</sup>).

Bio-fertilizer transactions (B)	(S) Water stress coefficients			Average
	Irrigation every 5 days (S1)	Irrigation every 10 days (S2)	Irrigation every 15 days (S3)	
Without fertilization (C <sub>0</sub> )	5.64	4.78	3.86	4.76
(R) Rhizobia	7.02	5.59	5.12	5.91
(M) Mycorrhiza	7.57	5.99	5.39	6.32
Rhizobia + Mycorrhiza (M+R)	9.26	7.57	6.28	7.70
Average	7.37	5.98	5.16	(B) 0.37
L.S.D (0.05)	(S) 0.30		(SB) 0.59	

References :

1. Ali, Hamid Glob; Issa, student Ahmed and Jadan, Hamid Mahmoud (1990). Pulses crops. Higher Education Press, University of Mosul. 259 p.
2. Pandey , P. (2009) . A text book of botany angiosperms . S.Chand and Company , Ramangar , New Delhi : 329 P.
3. Directorate of Agricultural Statistics in the Central Organization for Statistics and Information Technology. Crop and Vegetable Production Report. 2016. Ministry of Agriculture - Iraq.
4. Al-Rawi, Dyna T. Hmodii. 2009. Preparation Bradyrhizobium japonicum Inoculum's tolerance the salinity and develop suitable carrier material. Master Thesis .College of Agriculture/ University of Al- Anbar.
5. Angus, J.F. 2001. Nitrogen supply and demand in australian agriculture .Australian Journal of Experimental Agriculture 41,277-288.
6. Lambers ,H. ; Stuart ,F.; Chapin and Thijs, L. .(2008) . Plant physiological Ecology . second edition .Springer +Business Media.
7. Hossain, M., M. Rahman, M. Rahman, A. Anwar and A. Hossen. 2010. Effects of water stress on yield attributes and yield of different mungbean genotypes. Int. J. Sustain. Crop Prod. 5(1)19-24.
8. Sheteawi , S. A. and Tawfik , K. M. (2007) . Interaction effect of some biofertilizers and irrigation water regime on mung bean (*Vigna radiata*) growth and yield . J. Apli. Sci. Res. , 3(3):251-262.
9. Lobato , A. K. S. ; Neto , C. F. O. ; Filho , B. G. S. ; Costa , R. C. L. ; Cruz , F. J. R. ; Neves , K. B. and Lopes , M. J. S. (2008) . Physiological and biochemical behavior in Soybean(*Glycine max. c.v. sambaiba*) . plants under water deficit . Austral. J. Crop Sci. , 2(1):25-32.
10. Gallab , K. H. ; Megawer , E. A. ; Afiah , S. A. and Ahmed , S. M. (2007) . Characterization of some superior mung bean genotypes on agronomic and biochemical genetic levels . Egyptian J. Desert , Res., 57(2):1-12.



11. Tawfik , K. M. (2008) . Effect of water stress in addition to ptassium application of mung bean . Austural. J. Bas. Sci. , 2(1) :42-52.
12. Asaduzzaman ; Karim , F. ; Ullah , J. and Hassanuzzaman , M. (2008). Response of mung bean (*Vigna radiata* L.) to nitrogen and irrigation management. American-Eurasian J. Sci. Res., 3(1):40-43.
13. Abdipur , M. ; Rezaee , A. H. ; Houshmand , S. Frad , B. G. (2008) . Evaluation of drought tolerance of indeterminate genotypes Soybean in flowering and seed filling stages. Res. Agric.; 4:140-150.
14. Beck, D.P. Materon, L.A. and Afandi, F.(1993). Practical Rhizobium Legume technology manual. Technical manual. No19. ICARDA.
15. Donald, C. and J. Hamblin. 1976. The biological yield and harvest index of cereals as agronomic and plant breeding criteria. Adv. Agro. 28:361-405.
16. Yousef, A.N., N.A. Ali, and B.H. Munem, (1993). Interaction effect of Rhizobia, VA - mycorrhiza and phosphorus on soybean plants grown in calcareous soil Iraqi. Journal of Agricultural Sci: 24 (1): 30 - 39.
17. Ani, Mahjeen Aziz Mustafa (1993). The role of life technology in the growth and yield of wheat and soybean crops using Mycorrhiza fungi. PhD thesis. College of Agriculture/ University of Mosul.
18. Al-Shahat, Nasr Abu Zaid. (2000). Plant Hormones and Agricultural Applications. The Arab House for Publishing and Distribution, Cairo.660p.
19. Hussain , S. S., Kayani , M. K. and Amjad , M. (2011). Transcription factor as tolls to engineer enhanced drought stress tolerance in plants. biotechnol. prog., 27(2) :247-306.
20. Nakayama , N. ; Saneoka , H. ; Moghaieb , R. E. A. ; Premachandra , G. S. and Fujita , K. (2007) . Response of growth, photosynthetic gas exchange, translocation of 13C-labelled photosynthate and N accumulation in two soybean(*Glycine max* L.) cultivars to drought stress . Food Pub., 9(5):669-674.
21. Al-Muntafji, Haider Nasser (2011). Effect of spraying with aspirin (acetyl salicylic acid) on the growth and yield of the plant *Vigna radiata* L, which is exposed to drought stress. Master Thesis . Faculty of Life Sciences. Baghdad University .
22. Young, C.C., T.C. Juang and C.C. Chao. (1988). Effects of Rhizobium and vesicular - arbuscular mycorrhiza inoculations on nodulation, symbiotic nitrogen fixation and soybean yield in subtropical-tropical fields. Biology and Fertility of Soils 6(2):165 - 169.
23. Barea, J.M., C. Azcon - Aguilar and R. Azcon (1988). The role of mycorrhiza in improving the establishment and function of the rhizobium - legume system. In: Nitrogen fixation by legumes in Mediterranean agriculture. Eds. D.P. Beck and L.A. Materon. PP. 153 - 162. ICARDA. Printed in the Netherlands.
24. Mosse, B. and D.S. Hayman. (1980). Mycorrhiza in agricultural plants. In: Tropical Mycorrhiza Research Ed. P. Mikola PP. 213 - 230. University Press, Oxford.
25. Tahir, M.M., M.K. Abbasi, N. Rahim, A. Khaliq and M.H. Kazmi. (2009). Effect of Rhizobium inoculation and NP fertilization on growth, yield and nodulation of soybean (*Glycine max* L.) in the sub-humid hilly region of Rawalakot Azad Jammu and ashmir, Pakistan. African Journal of Biotechnology Vol. 8 (22):6191- 6200.
26. Rao , K. V. M. ; Raghavendra , A. S. and Reddy , K. J. (2006). Physiology and molecular biology of stress tolerance in plants . Springer , Dordecht , Netherlands: 345 P.
27. Sadeghipour , O. (2008) . Effect of withholding irrigation at different growth stages on yield and yield components of mung bean (*Vigna*



- radiata* L. Wilczek) varieties. Amer. Euras. J. Agric. Environ. Sci. , 4(5):590-594.
28. EL- Noemani , A. A. ; EL-Zeiny , H. A. ; AL- Gindy A. ; AL- Shahhar E. A. and EL-Shawafy M. A. (2010). Performance of some bean (*Phaseolus vulgaris* L.) varieties under different Irrigation systems and regimes. Aust. J. Bas. Appli Sci., 4 (12): 6185 – 6196.
  29. Mafakheri , A. ; Siosemardeh , A. ; Struik , P. C. , and Shorabi , A. (2010) . Effect of drought stress on yield ,proline and chlorophyll contents in three chick pea cultivars .Asutral. J. Crop sci., 4(8):580-585.
  30. Singh, V.S., R.P. Singh, K.S. Panwar, S.M. Singh, and V. Singh, (1993). Effect of inoculation with Azotobacter on wheat (*Triticum aestivum*). Indian of Agronomy 38:648 - 650.
  31. Shahid, M.Q., M.F. Saleem, Z.K .Haroon and A.A. Shakeel. (2009). Performance of Soybean (*Glycine max* L.) Under Different phosphorus levels and inoculation. Pak. J. Agri. Sci., Vol. 46(4).
  32. Jaleel , C. A. ; Manivannan , P. ; Wahid , A. ; Farooq , M. ; Al-Juburi , H. J. ; Somasundaram , R. and Panneerselvam , R. (2009) . Drought stress in plants: a review on morphological characteristics and pigments composition. Int. J. Agric. Biol. , 11(1):100-105.
  33. Ohashi , Y. ; Nakayama , N. Saneoka , H. ; Mohaparta , P. K. and Fujita , K. (2009) . Difference in the responses of stem diameter and pod thickness to drought stress during the grain filling stage in soy bean plants. Acta. Physiol. Plant. , 31(2):271-277.
  34. Shaikh, and Rada Mohammed Sharif.(2004). Effect of Number of Irrigation and Spraying with Guillotine Extract in Plant Growth and Plant *Vigna radiata* L. Wilczek. Master Thesis . College of Science, University of Babylon, Iraq.
  35. Malik , A. ; Ul-Hassan , F. ; Waheed , A. ; Qader , G. and Asgltar , R. (2006). Interactive effect of Irrigation and phosphorus on greengram (*Vigna radiata* L.) Pak. J. Bot., 58(4): 1119-1126.
  36. Bhat, M.I., A. Rashid, Faisul – ur - Rasool, S.S. Mahdi, S.A. Haq and R.A. Bhat. (2010). Effect of Rhizobium and Vesicular arbuscular mycorrhizae Fungi on Green gram (*Vigna radiata* L. Wilczek) under Temperate Conditions. Research Journal of Agricultural Sciences, 1(2): 113 - 118.
  37. Hazarika, O.K., K.K. Das, L.N. Dubey, and A.K. Phookan, (2000). Effect of vesicular arbuscular mycorrhizae (VAM) fungi and Rhizobium on growth and yield of green gram (*Vigna radiata* L. Wilczek). Journal of Mycology and Plant Pathology. 30(3): 424 - 426.
  38. Mufti, Huda Farouk (2004). The effect of interstitial interstitial macrophages (*Glomus mosseae* and *Gigaspora* spp) and *Rhizobia* bacteria in *Vigna radiata* L and *Vicia faba* L. growing under different levels of phosphorus. Mustansiriya University.
  39. Mut , Z . ; Akay , H. and Aydin , N. (2010). Effect of seed size and drought stress on germination and seedling growth of some oat genotypes (*Avena sativa* L.). Afric. J. Agric. Res. 5(10): 1101-1107.
  40. Sadras , V. O. and Calderini , F. D. (2009) . Crop physiology . Elsevier Inc. Oxford .UK :580 P.
  41. Dasouki, Hishmat Suleiman Ahmed (2008). Fundamentals of Plant Physiology. Mansoura, Egypt.433p.
  42. Salloum, Mohamed Ghassan; Jamal, Mona and Maala, Abeer.(2011) . Plant physiology. Damascus University, Faculty of Science, Damascus. 238 p.
  43. Fang , X-W. ; Turner N.C. ; Li F-M. and Siddique , K. H. M. (2011) An early transient water deficit reduces flower number and pod production but increases seed size in chick pea (*Cicer vitinum* .a) Crop Pasture Sci. , 62: 481-487.



44. Al-Fahdawi, Walid Abdul Sattar (2015). Role of Potash Fertilization in Reduction of Water Stress in Growth and Yield of Mungbean (*Vigna radiata* L.). PhD thesis. College of Agriculture/ University of Baghdad.
45. Abbas, c. a. , Alaa . P. , Israa . a. A and Magd. K. M. (2004). Effect of bacterial inoculation and the amount of seed and spraying powder yeast in the growth of plants and holds livestock, Iraqi Journal of Agricultural Sciences. Volume 35 Issue (1): 69- 76.
46. Ashraf, M., Ali, S., Hassan, I. (2002). Interaction of Rhizobium japonicum strains and soybean genotypes. Pak. J. Soil Sci. 21: 49-54.
47. Abbasi, M.K., Majeed, A., Sadiq, A., Khan, S.R. (2008). Application of Bradyrhizobium japonicum and phosphorus fertilization improved growth, yield and nodulation of soybean in the sub-humid hilly region of Azad Jammu and Kashmir, Pakistan. Plant Prod. Sci. 58: 368 - 376.
48. Kole , J. (2011). Wild crop relatives genomic and breeding resources legume crops and forages . Springer ., Heidelberg , Berlin : 321 P.
49. Anjum , S. A. A. Xie , X. Y. ; Wang L. C. ; Saleem , M. F. ; Man , C. and Lei , W. (2011) . Morphological ,physiological and bio chemical responses of plant to drought stress . Afric. J. Agric. Res. , 6(9):2026-2032.
50. Hamayun , M. ; Khan, S. A. K. ; Shinwari , Z. K ; Khan , A. L. ; Ahmad , N. and Lee ; I. J. (2010) . Effect of poly ethylene glycol induced drought stress on physio-hormonal attributes of soybean. Pak. J. Bot. , 42(2):977-986.
51. Hamdani, Shamil Younis Hassan Mari (2005). Effect of supplemental irrigation and spraying of ABA acid in the growth of the productivity of some of the other varieties (*Vicia faba* L). PhD, Faculty of Agriculture and Forestry, University of Mosul, Iraq.
52. Anjum, N., S. Umar, I. Aref and M. Iqbal. (2015). Managing the pools of cellular redox buffers and the control of oxidative stress during the ontogeny of drought-exposed mung bean (*Vigna radiata* L.) - role of sulfur nutrition. Front. Environ. Sci., 2: 66. Pp: 1- 9

### دور التسميد الحيوي في تقليل فترات الري لحاصل ومكونات نبات الماش *Vigna radiate* L.

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#### المستخلص

أجريت تجربة حقلية في الموسم الخريفي لسنة (2016) في إحدى حقول محافظة كربلاء - قضاء الهندية لدراسة التأثير المتداخل لكل من فطريات المايكورايزا *Glomus mosseae* وبكتريا (الرايزوبيا) *R. leguminosarum* في صفات النمو لمحصول الماش *Vigna radiate* L. صنف محلي تحت مستويات من الاجهاد الامائي، استعملت في التجربة ثلاث معاملات للري هي: S1 الذي كل 5 ايام و S2 الذي كل 10 يوم و S3 الذي كل 15 يوم. وقد اجريت التجربة باربع مستويات من التسميد الحيوي هي معاملتي بدون تلقیح (CO) و (التلقیح بالرايزوبيا) (R) ، و (التلقیح بالمايكورايزا) (M) ، و (التداخل بين المايكورايزا والرايزوبيا) (M+R). طبقت التجربة بحسب ترتيب الالواح المنشقة Split Plot Design وفق تصميم القطاعات العشوائية الكاملة RCBD وثلاث مكررات. وزعت معاملات الري على الالواح الرئيسية عشوائيا، في حين وزعت معاملات التسميد الحيوي على الالواح الثانوية. وتمت المقارنة بين متوسطات المعاملات باستعمال اختبار اقل فرق معنوي L.S.D عند مستوى احتمال 5% .

اظهرت النتائج تفوق معاملة الري كل 5 يوم (S1) باعطائها اعلى متوسط لـ ( الوزن الجاف للمجموع الجذري، وعدد القرينات، وعدد البذور بالقرنة، ووزن 100 بذرة، وحاصل البذور، الحاصل البيولوجي) (0.78 غم. نبات<sup>-1</sup>، 31.33 قرنه نبات<sup>-1</sup> و 8.45 بذرة. قرنه<sup>-1</sup> و 3.82 غم و 3.77 طن. هـ<sup>-1</sup> و 7.37 طن. هـ<sup>-1</sup>) على التوالي، وبدون فرق معنوي بينها وبين معاملة الري كل 10 يوم (S2) في وزن 100 بذرة 3.50 غم. حققت معاملة التسميد الحيوي (M+R) اعلى القيم في الحاصل ومكوناته وبلغت (0.89 غم. نبات<sup>-1</sup> ، 33.64 قرنة نبات<sup>-1</sup> و 8.42 بذرة قرنه<sup>-1</sup> و 4.10 غم و 4.00 طن. هـ<sup>-1</sup> و 7.70 طن. هـ<sup>-1</sup>) على التوالي، واظهرت معاملات التداخل (R+M) S1 و S2 (R+M) و S1 (M) تفوقها في جميع الصفات قيد الدراسة .

الكلمات المفتاحية : محصول الماش ، فترات الري ، التسميد الحيوي .