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EFFECT OF BIO-FERTILIZERS, ORGANIC FERTILIZER AND IRRIGATION PERIODS IN THE TRAITS OF YIELD AND ITS COMPONENTS FOR RICE PLANT *ORYZA SATIVA* L. (ANBAR 33 CULTIVAR)

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Abstract

This study was conducted in the northern part of Babylon province, in order to determine the effect of bio-fertilizers, levels of organic fertilizer and irrigation periods in the traits of yield and its components for rice plant. The spilt-spilt plots were used according to the Randomized Complete Block Design (RCBD), with three replicates, where the treatments of irrigation periods (continuous irrigation, irrigation every 6 days) occupied the main plots, while the organic fertilizer (300: 150: 100 kg.ha^{-1}) NPK of the recommended quantity, 85% sheep manure: 15% poultry waste, 70% sheep manure: 30% poultry waste, 100% sheep manure) occupied sub-plots, while the bio-fertilization treatments (0, 83.33 g.ml^{-1}, 1.67 g.ml^{-1}, 10 ml.L^{-1} water) occupied sub-sub-plots. The results showed the following:

The superiority of bio-fertilizer significantly in the traits of the yield and its components (the number of panicles in m^2, the number of grains in the panicles, the weight of 1000 grains, the grain yield. The plants of treatment (C1) was excelled by giving it the highest average for the number of panicles in m^{2}amounted to (371.79 panicles), while plants of control treatment (C0) gave the lowest average amounted to (267.05, 285.71 panicles), for both seasons, respectively. The adding of the organic fertilizer in the increasing the traits of the yield and its components (number of panicles, the number of grain in the panicles, the weight of 1000 grain, the grain yield), The level of fertilizer (B3) was excelled by giving it the highest average for the grain yield of the plant which amounted to (5.05, 5.60 tons.ha^{-1}), and for both seasons, respectively, While the level of compost B0 achieved the lowest average of the plant grain yield amounted to (4.02, 4.24 tons.ha^{-1}) for both seasons, respectively. The irrigation treatment every 6 days (A2) was excelled in the traits of the number of grains (the number of panicles in m^2, the number of grains in the panicles, the weight of 1000 grains, the grain yield), where gave the highest average for the grains yield in plant amounted to (5.15, 5.44 tons.ha^{-1}) for the two seasons, respectively, while the treatment of continuous irrigation (A1) gave the lowest average amounted to (4.16.4.39 tons. ha^{-1}) for the two seasons, respectively. The triple interaction between the study factors showed a significant increase in most traits of the yield and its components, where the treatment of A2B3C1 was excelled by giving it the highest average for the grains yield in the plant amounted to (6.47, 7.21 tons.ha^{-1}), respectively. While the treatment A1B0C0 gave the lowest average amounted to (3.19, 3.52 tons.ha^{-1}) for both seasons, respectively.

Keywords : Bio-fertilizers, Organic fertilizers, Irrigation period, *Oryza sativa* L.

Introduction

Rice crop (*Oryza sativa* L.) is considered one of the most important grain crops in Iraq, comes third order in terms of the cultivated area after wheat and barley, despite the instability of the area planted with it and change it according to the abundance of water, but the production of rice in Iraq amounted to (4.788 thousand tons.ha^{-1}) (Ministry of Planning, Statistics Department, 2018).The local cultivar of Anbar 33 is known as the oldest cultivar that has been cultivated in Iraq, it is characterized by its flavor and aromatic smell. It belongs to the submerged rice group with water, Rice farmers in Iraq believe that the cultivation of this cultivar and other cultivars of rice cannot be successful without flooding the fields with water for the duration of the growth, while the global and local studies have shown the possibility of cultivating rice in an Alternative Irrigation method with good productivity in the unit area. Therefore, it is necessary to make accurate scientific work to increase productivity in the unit area through the addition of organic fertilizer in the fertilization of rice in addition to some other treatments, such as bio-fertilizers because of their distinctive and important role in improving the soil physical, chemical and biological traits and increase the efficiency of its preservation with water, Thus providing the plant needs with water and reducing the addition of chemical fertilizers to the soil, thereby reducing environmental pollution (Das and Puste, 2001). Bio-fertilizers are microorganisms (fungal or bacterial) that are living in the soil or when added to soil, increase the soil's ability

to retain water, It works to increase plant growth by increasing nutrient elements availability (Radwan *et al*., 2008).This study aims to:

The possibility of changing from flooding irrigation to drip irrigation to rice production, determining the best level of organic fertilizer in the growth and yield of rice plant, determining the best bio-fertilizer in the growth and yield of rice plant, Knowing the effect of the interaction of the study factors (bi-interaction and triple interaction) in the growth of the grain yield and its components and some specific traits.

Materials and Methods

Location of the Experiment

A field experiment was conducted during the two agricultural seasons, the first one in 2017 and the second one in 2018 in the field of one farmers in Abu Al-Jasim area which located in the north of Babylon province, In order to determine the effect of In order to determine the effect of bio-fertilizers, levels of bio-fertilizers and irrigation periods on the traits of the yield and its components for rice plant.

Soil Analysis

To identify some of the physical and chemical traits of the soil before cultivating, random samples were taken from different places of the soil field for both seasons and at a depth of 0-30 cm.

Table 1: Some chemical and physical traits of the field soil and for both seasons (2017, 2018).

pH	Electrical conduction ($ds.m^{-1}$)	Apparent density (%)	Porosity (%)	Organic matter (%)	Volumetric distribution for soil separates			Soil texture
					Clay (%)	Silt (%)	Sand (%)	
7.4	3.2	1.7	36	1.3	35.3	34.2	30.5	Clay loam

Experiment Design

The experiment was conducted for two seasons according to the order of split-split-plots using the Randomized Complete Block Design (RCBD), with three replicates. The irrigation treatments (continuous irrigation, irrigation every 6 days) occupied the main plots which are symbolized by (A1, A2), respectively, which applied directly after the seedling. While the levels of the organic fertilizer (15 $tons.ha^{-1}$) (85% sheep manure: 15% poultry waste, 70% sheep manure: 30% poultry waste, 100% sheep manure) occupied sub-plots, which is symbolized by (B0, B1, B2, B3), respectively. The control treatment was (300: 150: 100 $kg.ha^{-1}$) NPK of the recommended quantity, while the bio-fertilization treatments (0, 83.33 $g.ml^{-1}$, 1.67 $g.ml^{-1}$, 10 $ml.L^{-1}$ water) occupied sub-sub-plots, which is symbolized by (C0, C1, C2, C3), respectively. The area of experimental unit amounted to ($2 \times 3 = 6\ m^2$), Thus, the total experimental units was (2 x 4 x 4 x 3 = 96 experimental units).

Preparation of cultivation land

The land was prepared for cultivating through plowing it two perpendicular plowing by the moldboard plow, it was smoothed using the smoothing disk, and were divided according to the design used, with leaving 2 m space between the replicates, It was left the spaces (1.5 m) between the main units toward the plot to control the movement of water and leave spaces (1 m) between subplots and sub-sub plots, The plants were cultivated on 15/6/2017 for the first season and 20/6/2018 for the second season. After one month from the date of cultivating, the seedlings were transferred to the permanent field for cultivating. The cultivating was done by the seedlings. The plants were harvested on 27/11/2017 For the first season and 22/11/2018 for the second season, the following traits were measured (number of panicles in m^2, number of grains in panicle ($grain.panicle^{-1}$), the weight of 1000 grains (g), grain yield ($tons.ha^{-1}$).

Results

Number of panicles in m^2

Table (1) indicates to the excelling the plants of bio-fertilizers treatment (Mycorrhiza) C1 by giving it the highest average number of panicles amounted to (354.24, 371.79 $panicles.m^2$), for both seasons, respectively, While the plants of the treatment C0 gave the lowest average amounted to (267.05, 285.71 panicles m^2), the levels of organic fertilizer significantly affected the number of panicles in m^2 where the level of organic fertilizer (B3) gave the highest average number of panicles in m^2 amounted to (345.23, 354.19 $panicles.m^2$) for both seasons, respectively, While the plants of the treatment (B0) gave the lowest average number of panicles in m^2 amounted to (301.84, 302.13 $panicles.m^2$) for both seasons, respectively. Plants of the treatment with irrigation every 6 days (A2) excelled by giving it the highest average number of panicles in m^2 amounted to (332.96, 344.83 $panicles.m^2$) for both

seasons, respectively, while the plants of the continuous irrigation treatment (A1) gave the lowest average amounted to (308.52, 321.64 panicles.m^2) for both seasons, respectively, The effect of the interaction between the irrigation periods and bio-fertilizer was significantly affected, where the plants of the treatment A2 C1 in the first season, was excelled by giving it the highest average number of panicles in m^2 amounted to (374.76 panicles.m^2),In the second season, the plants of the treatment A2C2 was excelled by giving it the highest average number of panicles in m^2 amounted to (385.87 panicles.m^2), while the plants of the treatment A1C0 gave the lowest average number of panicles in m^2 (256.49, 279.08 panicles.m^2) for both seasons, respectively. The effect of the interaction between organic fertilizer and bio-fertilizer was significantly affected in the average number of panicles in m^2, where the plants of the treatment B3C2 in the first season was excelled by giving it the highest average number of panicles in m^2 amounted to (368.75 panicles.m^2). In the second season, the plants of the treatment B3C1 gave the lowest average number of panicles in m^2 amounted to (387.97 panicles.m^2), while the plants of the treatment B0 C0 gave the lowest average number of panicles in m^2 amounted to (228.91, 219.02 panicles.m^2) for both seasons, respectively. As for the interaction between organic fertilizer and irrigation periods, where the plants of the treatment A2B2 in the second season gave the highest average number of panicles in m^2 amounted to (374.21 panicles.m^2), while plants of the treatment A1B gave the lowest average number of panicles in m^2 amounted to (286.04 panicles.m^2). The results of the statistical analysis showed that there were significant differences between the three factors in this study. The plants of the treatment A2B0C1 in the second season recorded the highest average number of panicles in m^2 amounted to (393.24 panicles.m^2), while plants of the treatment A2B0C0 gave the lowest average amounted to (212.10 panicles.m^2).

Table 1: Effect of Bio-fertilizers, Organic Fertilizers, Irrigation periods and their interactions in the number of panicles in m^2 (panicles.m^2).

Irrigation periods (A)	Organic Fertilizers (B)	The first season 2017					The second season 2018				
		Bio-fertilizers (C)				Average AxB	Bio-fertilizers (C)				Average AxB
		C0	C1	C2	C 3		C0	C1	C2	C 3	
A1	**0**B	223.36	318.99	313.69	289.87	286.48	225.94	324.13	314.43	279.65	286.04
	1B	236.51	326.65	319.93	300.41	295.88	229.24	381.37	372.65	295.40	319.67
	2B	260.59	341.81	340.19	321.50	316.02	318.70	338.55	328.24	314.81	325.07
	B 3	305.50	347.43	356.03	333.92	335.72	342.45	387.22	385.50	307.97	355.79
A2	**0**B	234.47	371.65	358.18	304.52	317.20	212.10	393.24	390.18	277.40	318.23
	1B	241.81	368.93	352.66	281.36	311.19	275.00	382.35	384.16	295.63	334.29
	2B	318.83	375.33	374.46	326.21	348.71	369.42	378.72	383.51	365.19	374.21
	B 3	315.36	383.15	381.46	339.00	354.74	312.86	388.73	385.63	323.13	352.59
L.S.D 0.05		**(A×B×C)= N.S**				**N.S**	**(A×B×C)= 24.227**				**10.735**
Irrigation periods × Bio-fertilizers						A	Irrigation periods × Bio-fertilizers				A
Interaction AxC	A1	256.49	333.72	332.46	311.42	308.52	279.08	357.82	350.21	299.46	321.64
	A2	277.62	374.76	366.69	312.77	332.96	292.34	385.76	385.87	315.34	344.83
L.S.D 0.05		**14.568**				**9.170**	**12.114**				**12.194**
Organic Fertilizers × Bio-fertilizers						B	Organic Fertilizers × Bio-fertilizers				B
Interaction BxC	**0**B	228.91	345.32	335.94	297.19	301.84	219.02	358.69	352.31	278.53	302.13
	1B	239.16	347.79	336.30	290.89	303.53	252.12	381.86	378.41	295.52	326.98
	2B	289.71	358.57	357.33	323.85	332.36	344.06	358.64	355.88	340.00	349.64
	B 3	310.43	365.29	368.75	336.46	345.23	327.65	387.97	385.57	315.55	354.19
L.S.D 0.05		**20.602**				**11.146**	**17.131**				**8.765**
Bio-fertilizers (C)		267.05	354.24	349.58	312.10		285.71	371.79	368.04	307.40	
L.S.D 0.05		**10.301**					**8.566**				

Number of grains in panicle

Table (2) indicates to the excelling the plants of bio-fertilizers treatment (Mycorrhiza) C1 by giving it the highest average number of grain in panicle amounted to (166.85 and 159.19 grains.panicle^{-1}) for both seasons, respectively, While the plants of the treatment C0 gave the lowest average amounted to

(143.13, 142.27 grains.panicle^{-1}) for both seasons, respectively, the levels of organic fertilizer significantly affected the number of grains in panicle, where the level of organic fertilizer (B3) gave the highest average number of grains in panicle amounted to (166.41,165.11 grains.panicle^{-1}) for both seasons, respectively, While the plants of the treatment (B0) gave the lowest average number of grains in panicle amounted to (142.22, 137.91 grains.panicle^{-1}) for both seasons, respectively. Plants of the treatment with irrigation every 6 days (A2) excelled by giving it the highest average number of grains in panicle amounted to (156.99, 157.44 grains.panicle^{-1}) for both seasons, respectively, while the plants of the continuous irrigation treatment (A1) gave the lowest average amounted to (153.30, 147.96 grains.panicle^{-1}) for both seasons, respectively. The effect of the interaction between the irrigation periods and bio-fertilizer was significantly affected, where the plants of the treatment A2 C1 in the first season, was excelled by giving it the highest average number of grains in panicle amounted to (168.00 grains.panicle^{-1}), In the second season, the plants of the treatment A2C2 was excelled by giving it the highest average number of grains in panicle amounted to (140.59 grains.panicle^{-1}),while the plants of the treatment A1C0 gave the lowest average number of grains in panicle amounted to (140.59 grains.panicle^{-1}).The interaction between organic fertilizer and bio-fertilizer was significantly affected in the average number of grains in panicle, where the plants of the treatment B3C1 in the first season was excelled by giving it the highest average number of grains in panicle amounted to (171.71 grains.panicle^{-1}). In the second season, the plants of the treatment B3C1 gave the lowest average number of grains in panicle amounted to (171.45 grains.panicle^{-1}), while the plants of the treatment B0C0 gave the lowest average number of grains in panicle amounted to (122.41, 127.60grains.panicle^{-1}) for both seasons, respectively. As for the interaction between organic fertilizer and irrigation periods, where the plants of the treatment A2B3 in the second season gave the highest average number of grains in panicle amounted to (167.22 grains.panicle^{-1}), while plants of the control treatment A1B0 gave the lowest average number of grains in panicles amounted to (134.93 grains.panicle^{-1}).Triple interaction showed a significant effect in this trait, where the plants of the treatment A2 B3 C1 in the first season was excelled by giving it the highest average amounted to (171.77grains.panicle^{-1}), while the plants of the treatment A2 B0 C0 gave the lowest average amounted to (121.36 grains.panicle^{-1}).

Table 2: Effect of Bio-fertilizers, Organic Fertilizers, Irrigation periods and their interactions in the number of grains in the panicles (grains.panicle^{-1}).

Irrigation periods (A)	**Organic Fertilizers (B)**	**The first season 2017**					**The second season 2018**				
		Bio-fertilizers (C)				**Average AxB**	**Bio-fertilizers (C)**				**Average AxB**
		C0	C1	C2	C 3		C0	C1	C2	C 3	
A1	**0**B	123.45	146.83	138.10	131.32	134.93	122.88	142.49	139.46	133.54	134.59
	1B	124.01	172.59	163.76	136.03	149.10	130.28	144.49	144.08	141.25	140.03
	2B	154.00	171.71	167.77	160.86	163.59	139.55	165.73	168.05	149.50	155.71
	B 3	160.92	171.64	163.67	166.19	165.60	159.45	165.75	162.66	158.14	161.50
A2	**0**B	121.36	171.29	169.48	135.93	149.52	132.31	148.86	146.13	137.63	141.23
	1B	131.54	159.61	160.67	134.52	146.58	139.05	153.90	160.53	151.31	151.20
	2B	169.38	169.32	167.46	152.38	164.64	154.92	176.81	174.85	167.83	168.60
	B 3	160.36	171.77	169.27	167.46	167.22	159.71	175.50	171.52	168.15	168.72
L.S.D 0.05		**(A×B×C)= 9.568**				**4.669**	**(A×B×C)= N.S**				**N.S**
Irrigation periods × Bio-fertilizers						A	Irrigation periods x Bio-fertilizers				A
Interaction AxC	A1	140.59	165.70	158.32	148.60	153.30	138.04	154.61	153.56	145.61	147.96
	A2	145.66	168.00	166.72	147.57	156.99	146.50	163.77	163.26	156.23	157.44
L.S.D 0.05		**4.784**				**3.626**	N.S				**0.931**
Organic Fertilizers × Bio-fertilizers						B	Organic Fertilizers × Bio-fertilizers				B
Interaction BxC	**0**B	122.41	159.06	153.79	133.62	142.22	127.60	145.67	142.79	135.59	137.91
	1B	127.77	166.10	162.21	135.27	147.84	134.67	149.19	152.31	146.28	145.61
	2B	161.69	170.52	167.61	156.62	164.11	147.23	171.27	171.45	158.67	162.15
	B 3	160.64	171.71	166.47	166.83	166.41	159.58	170.63	167.09	163.15	165.11
L.S.D 0.05		**6.766**				**3.812**	**4.812**				**4.147**
Bio-fertilizers (C)		143.13	166.85	162.52	148.09		142.27	159.19	158.41	150.92	
L.S.D 0.05		**3.383**					**2.406**				

The weight of 1000 grains

Table (3) indicates to the excelling the plants of bio-fertilizers treatment (Mycorrhiza) C1 by giving it the highest average weight of 1000 grains amounted to (20.27, 21.76 g) for both seasons, respectively, While the plants of the treatment C0 gave the lowest average amounted to (20.27, 21.76 g) for both seasons, respectively, the levels of organic fertilizer significantly affected the weight of 1000 grains, where the level of organic fertilizer (B3) gave the highest average weight of 1000 grains amounted to (22.56 g) for both seasons, respectively, While the plants of the treatment (B0) gave the lowest average weight of 1000 grains amounted to (20.51, 21.37 g) for both seasons, respectively. Plants of the treatment with irrigation every 6 days (A2) excelled by giving it the highest average weight of 1000 grains amounted to (22.27, 23.81 g) for both seasons, respectively, while the plants of the continuous irrigation treatment (A1) gave the lowest average amounted to (20.70, 21.57 g) for both seasons, respectively. The effect of the interaction between the irrigation periods and bio-fertilizer was significantly affected, where the plants of the treatment A2 C1 in the first season, was excelled by giving it the highest average weight of 1000 grains amounted to (24.63, 25.25 g), while the plants of the treatment A1C0 gave the lowest average weight of 1000 grains amounted to (19.99, 21.09 g). The interaction between organic fertilizer and bio-fertilizer was significantly affected in the average weight of 1000 grains, where the plants of the treatment B3C1 in the first season was excelled by giving it the highest average weight of 1000 grains amounted to (24.27 g), while the plants of the treatment B0C0 gave the lowest average weight of 1000 grains amounted to (18.65 g). As for the interaction between organic fertilizer and irrigation periods, where the plants of the treatment A2B3 in the second season gave the highest average weight of 1000 grains amounted to (23.84, 25.71 g) for both seasons, respectively, while plants of the control treatment A1B0 gave the lowest average weight of 1000 grains amounted to (43.19, 20.99 g) for both seasons, respectively.

Table 3: Effect of Bio-fertilizers, Organic Fertilizers, Irrigation periods and their interactions in the weight of 1000 grains (g).

Irrigation periods (A)	**Organic Fertilizers (B)**	**The first season 2017**					**The second season 2018**				
		Bio-fertilizers (C)				**Average AxB**	**Bio-fertilizers (C)**				**Average AxB**
		C0	C1	C2	C 3		C0	C1	C2	C 3	
A1	**0**B	18.03	19.50	19.93	20.27	19.43	20.16	20.74	21.89	21.15	20.99
	1B	18.87	22.50	20.49	20.12	20.50	21.52	22.81	21.54	19.95	21.46
	2B	22.24	22.14	21.87	20.10	21.59	21.71	22.94	22.86	21.75	22.31
	B 3	20.83	22.45	21.38	20.46	21.28	20.99	22.65	20.62	21.92	21.54
A2	**0**B	18.46	23.97	23.80	20.10	21.58	20.77	23.12	21.77	21.34	21.75
	1B	19.62	23.87	21.95	21.44	21.72	22.10	23.84	22.88	21.91	22.68
	2B	22.24	24.60	24.67	21.01	23.13	23.33	26.88	25.69	24.41	25.08
	B 3	21.90	26.10	24.33	23.03	23.84	23.52	27.15	26.75	25.43	25.71
L.S.D 0.05		**(A×B×C)= N.S**				**0.598**	**(A×B×C)= N.S**				**1.014**
Irrigation periods × Bio-fertilizers						A	Irrigation periods × Bio-fertilizers				A
Interaction AxC	A1	19.99	21.65	20.92	20.24	20.70	21.09	22.29	21.73	21.19	21.57
	A2	20.56	24.63	23.69	21.40	22.57	22.43	25.25	24.27	23.27	23.81
L.S.D 0.05		**0.914**				**1.358**	**0.790**				**1.141**
Organic Fertilizers × Bio-fertilizers						B	Organic Fertilizers × Bio-fertilizers				B
Interaction BxC	**0**B	18.25	21.73	21.87	20.19	20.51	20.47	21.93	21.83	21.25	21.37
	1B	19.25	23.18	21.22	20.78	21.11	21.81	23.33	22.21	20.93	22.07
	2B	22.24	23.37	23.27	20.56	22.36	22.52	24.91	24.28	23.08	23.70
	B 3	21.37	24.27	22.86	21.75	22.56	22.25	24.90	23.68	23.68	23.63
L.S.D 0.05		1.293				0.488	N.S				0.828
Bio-fertilizers (C)		20.27	23.14	22.30	20.82		21.76	23.77	23.00	22.23	
L.S.D 0.05		**0.646**					**0.559**				

Grain yield for the plant

Table (4) indicates to the excelling the plants of bio-fertilizers treatment (Mycorrhiza) C1 by giving it the highest average grain yield for the plant amounted to (5.21, 5.55 tons.ha^{-1}) for both seasons, respectively, While the plants of the treatment C0 gave the lowest average amounted to (3.77, 3.95 tons.ha^{-1}) for both seasons, respectively, the levels of organic fertilizer significantly affected the grain yield for the plant, where the level of organic fertilizer (B3) gave the highest average grain yield for the plant amounted to (5.05, 5.60 tons.ha^{-1}) for both seasons, respectively, While the plants of the treatment (B0) gave the lowest average grain yield for the plant amounted to (4.02, 4.24 tons.ha^{-1}) for both seasons, respectively. Plants of the treatment with irrigation every 6 days (A2) excelled by giving it the highest average grain yield for the plant amounted to (5.15, 5.44 tons.ha^{-1}) for both seasons, respectively, while the plants of the continuous irrigation treatment (A1) gave the lowest average amounted to (4.16, 4.39 tons.ha^{-1}) for both seasons, respectively. The results of the statistical analysis showed that there were significant differences between the irrigation periods and bio-fertilizer, where the plants of the treatment A2C1 in the first season, was excelled by giving it the highest average grain yield for the plant amounted to (5.76, 6.18tons.ha^{-1}) for both seasons, respectively, while the plants of the treatment A1C0 gave the lowest average grain yield for the plant amounted to (3.50, 3.65tons. ha^{-1}) for both seasons, respectively. The interaction between organic fertilizer and bio-fertilizer was significantly affected in the average grain yield for the plant, where the plants of the treatment B3C1 in the first season was excelled by giving it the highest average grain yield for the plant amounted to (5.91, 6.49tons.ha^{-1}) for both seasons, respectively. While the plants of the treatment B0C0 gave the lowest average grain yield for the plant amounted to (3.48, 3.69tons.ha^{-1}) for both seasons, respectively. The interaction between organic fertilizer and bio-fertilizer was significantly affected in the average grain yield for the plant in the first season, where the plants of the treatment A2B2 in the first season was excelled by giving it the highest average amounted to (76.5 tons.ha^{-1}). As for the second season, where the plants of the treatment A2B3 in the second season gave the highest average grain yield for the plant amounted to (6.32tons.ha^{-1}), while plants of the control treatment A1B0 gave the lowest average grain yield for the plant amounted to (3.90, 4.07tons.ha^{-1}) for both seasons, respectively. Triple interaction showed a significant effect in this trait, where the plants of the treatment A2B3C1 in the first season was excelled by giving it the highest average amounted to (6.47, 7.21tons.ha^{-1}) for both seasons, respectively, while the plants of the treatment A2B0C0 gave the lowest average amounted to (3.19, 3.52tons.ha^{-1}) for both seasons, respectively.

Table 4: Effect of Bio-fertilizers, Organic Fertilizers, Irrigation periods and their interactions in the grain yield (tons.ha^{-1}).

Irrigation periods (A)	Organic Fertilizers (B)	The first season 2017					The second season 2018				
		Bio-fertilizers (C)				Average AxB	Bio-fertilizers (C)				Average AxB
		C0	C1	C2	C 3		C0	C1	C2	C 3	
A1	**0**B	3.19	4.45	4.45	3.51	3.90	3.52	4.62	4.62	3.54	4.07
	1B	3.51	4.35	4.45	3.97	4.07	3.60	4.50	4.69	4.00	4.20
	2B	3.60	4.55	4.43	4.57	4.29	3.70	4.83	4.62	4.45	4.40
	B 3	3.69	5.34	4.80	3.76	4.40	3.76	5.76	5.67	4.30	4.87
A2	**0**B	3.77	4.60	4.11	4.10	4.14	3.86	4.68	4.72	4.32	4.40
	1B	4.11	5.57	5.34	4.94	4.99	3.95	5.92	5.69	4.98	5.14
	2B	4.19	6.39	6.21	6.25	5.76	4.48	6.89	6.09	6.24	5.93
	B 3	4.13	6.47	6.09	6.15	5.71	4.74	7.21	6.56	6.76	6.32
L.S.D 0.05		**(A×B×C)= 0.514**				**0.307**	**(A×B×C)= 0.409**				**0.247**
Irrigation periods × Bio-fertilizers						A	Irrigation periods x Bio-fertilizers				A
Interaction AxC	A1	3.50	4.67	4.53	3.95	4.16	3.65	4.93	4.90	4.07	4.39
	A2	4.05	5.76	5.44	5.36	5.15	4.26	6.18	5.77	5.58	5.44
L.S.D 0.05		**0.257**				**0.305**	**0.204**				**0.200**
Organic Fertilizers × Bio-fertilizers						B	Organic Fertilizers xBio-fertilizers				B
Interaction BxC	**0**B	3.48	4.52	4.28	3.80	4.02	3.69	4.65	4.67	3.93	4.24
	1B	3.81	4.96	4.89	4.46	4.53	3.78	5.21	5.19	4.49	4.67
	2B	3.89	5.47	5.32	5.41	5.02	4.09	5.86	5.36	5.35	5.16
	B 3	3.91	5.91	5.45	4.96	5.05	4.25	6.49	6.12	5.53	5.60
L.S.D 0.05		**0.364**				**0.251**	**0.289**				**0.201**
Bio-fertilizers (C)		3.77	5.21	4.98	4.66		3.95	5.55	5.33	4.83	
L.S.D 0.05		**0.182**					**0.145**				

Discussion

1) The reason is due to the role of bio-fertilizers in the increase root growth and increase root hairs, which play a role in increasing the absorption nutrient and nutrient elements, which increases the availability of photosynthesis products and increases the effectiveness of bio-enzymes that stimulate the sink activity in receiving of manufactured materials, nutrients and nutrient elements, which was positively reflected in the increasing the yield components such as the number of panicles in m^2, the number of grains in the panicles, the weight of 1000 grains, the grain yield, These results agree with (Radwan *et al*., 2008; Oladele and Awodun 2014; Shahane *et al*., 2015; Naher *et al*., 2016).

2) The reason for the superiority of the organic fertilization treatment (100% sheep) in increasing the availability of nutrient elements and increase the photosynthesis process and nutrient transfer from the source to increase the efficiency of the plant in the conversion of the largest possible from the net of photosynthesis production to the stored dry matter and transferred to sink, which was positively reflected in the increasing the yield components such as the number of panicles in m^2, the number of grains in the panicles, the weight of 1000 grains, the grain yield, These results agree with (Siavoshi *et al*., 2011; Chhogyel *et al*., 2015; Solunke *et al*., 2006; Hassani, 2016).

3) The reason for the superiority of the plants of the irrigation treatment every 6 days to the growth of active and health roots due to good ventilation that led to occurring the cracks in the soil and the entry of oxygen to it when the use of irrigation intervals every (6) day, which contributed to the increase of microorganisms in the soil, This led to increasing nutrient elements and providing more nutrients for plants during the crop life cycle, which was positively reflected in the increasing the yield components such as the number of panicles in m^2, the number of grains in the panicles, the weight of 1000 grains, the grain yield, These results agree with (Hameed *et al*., 2013; Hassan *et al*., 2015; Al-Hassani, 2016).

The reason may be due to the role of bio-fertilizer in the secretion of cytokinin, which is a sink for receiving the potassium elements, which play an important role in increasing the plant's tolerance to water shortage, water stress, increasing the nutrient elements and its role in stimulating Carbon fixation, thus affecting the manufacture of Carbohydrate, which provided the necessary nutrition support for the growth and increasing the number of panicles in m^2, the number of grains in the panicles, the weight of 1000 grains, the grain yield, These results agree with (Barker and Tagu, 2000; Singh *et al*., 2015).

The reason for excelling the interaction (organic fertilizer and bio-fertilizer) may be due to the role of microorganisms contained in the microorganisms (Mycorrhiza) in the analysis of organic matter in the soil and the secretion it to the enzymes, proteins, and acids that lead to the release of nutrient elements, and the role of microorganisms in improving the growth of roots and activate its absorption for the mineral elements and their accumulation in the plant, which provided the necessary nutrition support for the growth and increasing the number of panicles in m^2, the number of grains in the panicles, the weight of 1000 grains, the grain yield, These results agree with (Dahiphale *et al*., 2003; Padmanaban, 2013; Malo *et al*., 2018).

The reason for excelling the interaction (organic fertilizer and the irrigation treatment every 6 days) may be due to the growth of roots when adding large amounts of organic fertilizers which contributed to reduce the impact of water stress due to the retention of soil water, which led to increase the growth of roots, Whenever its ability to absorb nutrients and water from the soil is high, which was positively reflected in the increasing the yield components such as the number of panicles in m2, the number of grains in the panicles, the weight of 1000 grains, the grain yield, These results agree with (Satyanayane *et al*., 2002; IRRI, 2009; Al-Hassani, 2016).

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