Journal of Kerbala for Agricultural Sciences Issue (2), Volume (7), (2020)

Effect of bio-fertilizer, organic manure, nano zinc oxide and the interaction on the growth parameters of sunflower plant *Helianthus annuus* L.

Ali Ahmed Hussein Al Myali*[1], Jassim Jawad Jader Alnuaimi[2], Madeha H. Hussain[3]

[1]Department of Biological Science, College of Sciences, University of Kerbala, Iraq.
[2]Departement of plant production Techniques, Al-Musaib Tech. Collage, Al-Furat Al-Awsat Technology University, Iraq.
[3]Department of Pharmacy, Medical Institute Tech, Mansour Technology University, Iraq.
***Corresponding author email:** Ali.hussien@uokerbala.edu.iq

Received:
March 20, 2020

Accepted:
April 27, 2020

Published:
June 01, 2020

Abstract

This study was conducted in the east part of Karbala/ Iraq to determine the effect of levels of organic manure and nano zinc oxide on the traits sunflower crop. The number of days from planting to 50% flowering, plant hight, number of days form planting to maturation, leaf area, number of leaves, leaves chlorophyll content and disk diameter for sunflower were inspected. The split-split plots were used according to the Randomized Complete Block Design (RCBD) with three replicates. The treatments of nano ZnO control and nano ZnO occupied the main plots (put here amount of Nano), while the organic manure control (50, 150 and 300 Kg.ha^{-1}) NPK, the poultry manure 15 ton.ha-1. the sheep manure 15 ton ha^{-1} and 1/2 amount of poultry manure and 1/2 amount the sheep manure occupied sub plots, while the bio-fertilization treatments (0, Mychorriza, Azospirillum (put here amount of biofertilizer) and 1/2 amount Mychorriza and 1/2 amount Azospirillum) were occupied sub-sub-plots. The results showed the following the superiority of bio-fertilizer significantly in the traits of the number of days from planting to 50% flowering, plant height, number of days form planting to maturation, leaf area, number of leaves, leaves chlorophyll content and disk diameter. The treatment Mychorriza (C1) was excelled by giving in the lowest average for number days for 50% flowering recorded 72.1 and 60.0 days for both season respectively and number days to maturation the plants treated with the Mychorriza recorded 101.6 days for spring season and the plants treated with Azospirillum recorded 91.7 days for autumn. However, the plants of control treatment (C0) gave the highest average of 50 % flowering and maturation period while the plants treated with the Mychorriza + Azospirillum was excelled by giving the highest average for plant height recorded (171.1 , 141.1) cm for two seasons respectively. Also, the highest average of leaves area recorded (8927 cm2 for autumn season the plant treated with the

Mychorriza was excelled giving the leaves chlorophyll content and highest average number of leaves the highest average recorder (50.5 , 52.43) SPAD unit and (15.37 , 17.9) leaves. Plants were treated with the (B1) showed the best average recorded (69.7 , 59.9) days, (176.8 , 144.3) cm, (8426 , 11640) cm^2, (52.46 , 54.46) SPAD unit and (16.9 , 19.21) leaves for the treat flowering beard, plant height, leaves area, leaves chlorophyll content and number of leaves foe both season respectively. On the other hand, the plant treated with the B2 was topped by providing the lowest average of the maturation period recorded (99.00 , 98.88) days for both season respectively. The plant treated with the nanoZnO supplied in the lowest average of flowering and maturation period. However, it presented the highest average of plant height, leaves area, leaves chlorophyll content, number of leaves of plant and disk diameter recorded (72.8 , 58.9) days, (103 , 89.95) days, (168.1 , 144.1) cm, (6259 , 8682) cm^2, (50.1 , 52.35) SPAD unit, (15.9 , 17.82) leaf and (17.6 , 22.67) cm for two seasons respectively. As well as be and triple interaction (put the triple treat-ment here) was significantly affected on some traits in the both on alone of seasons.

Keywords: Bio-fertilizer, organic manure, zinc oxide NPs of, sunflower

تاثير المخصبات الحيوية ، المخلفات العضوية ، مركب النانو ZnO وتداخلاتها في مؤشرات النمو لزهرة الشمس (*Helianthus annuus* L.)

علي احمد حسين الميالي[1] جاسم جواد جادر[2] مديحة حسين[3]

[1]جامعة كربلاء / كلية العلوم / قسم علوم الحياة

[2] جامعة الفرات الاوسط التقنية / الكلية التقنية في المسيب / قسم تقنيات الانتاج النباتي

[3] الجامعة التقنية الوسطى/ المعهد الطبي التقني المنصور / قسم الصيدلة

المستخلص:

اجريت هذه الدراسة في وسط العراق ، لتقدير تأثيرات المخصبات الحيوية ، مستويات المخلفات العضوية ، مركب النانو ZnO وتداخلاتها في الصفات عدد الايام من الزراعة حتى تزهير 50% من النباتات ، ارتفاع النبات ، عدد الايام من الزراعة الى النضج الفسلجي ، المساحة الورقية ، محتوى الاوراق من الكلوروفيل وقطر قرص لزهرة الشمس ، طبقت التجربة بترتيب الالواح المنشقة – المنشقة باستخدام تصميم القطاعات الكاملة المعشاة ، احتلت مركبات النانو الالواح الرئيسية وهي (المقارنة و اضافة ZnO) ، وشملت الالواح الثانوية المخلفات العضوية وهي (المقارنة ، 300 ، 150 ، 50 كغم هـ$^{-1}$ 15 , K.P.N طن هـ$^{-1}$ مخلفات دواجن ، 15 طن هـ$^{-1}$ مخلفات اغنام ، 7.5 طن هـ$^{-1}$ مخلفات الدواجن + 7.5 طن هـ$^{-1}$ مخلفات الاغنام ، في حين احتلت المخصبات الحيوية الالواح تحت الثانوية وهي (المقارنة ، المايكورايزا ، الايزوسبيريليم ، 1/2 كمية

المايكورايزا + 1/2 كمية الايزوسبيريليم) . تلخصت النتائج بالاتي : اثرت المخصبات الحيوية معنوياُ في الصفات ، عدد الايام من الزراعة الى تزهير 50% من النباتات ، ارتفاع النبات ، عدد الايام من الزراعة الى النضج الفسلجي ، المساحة الورقية ، محتوى الورقة من الكلوروفيل ، عدد الاوراق وقطر القرص ، تفوقت النباتات المعاملة بالمايكورايزا باعطاء اقل متوسط لعدد الايام من الزراعة حتى تزهير 50% من النباتات بلغ 72.1 و 60.0 يوماً لكلا الموسمين ، واقل عدد ايام من الزراعة حتى النضج الفسلجي بلغ 10.16 يوماً للموسم الربيعي ، واعطت النباتات المعاملة بالايزوسبيريليم اقل متوسط بلغ 91.7 يوماً في الموسم الخريفي ، في حين اعطت نباتات المقارنة اعلى متوسط لعدد الايام ، في حين اعطت النباتات المعاملة بالمايكورايزا + الايزوسبيريليم اعلى متوسط لعدد الايام من الزراعة حتى النضج الفسلجي بلغ 171.1 و 141.1 يوماً لكلا الموسمين بالتتابع ، واعلى متوسط للمساحة الورقية بلغ 8927 سم2 خلال الموسم الخريفي ، واعطت النباتات المعاملة بالمايكورايزا اعلى متوسط لمحتوى الورقة من الكلوروفيل بلغ 50.5 و 52.43 سباد ، 15.3 ، 17.9 ورقة ، ادت اضافة المخلفات العضوية الى حصول تاثيرات معنوية في الصفات المدروسة ، تفوقت النباتات المعاملة B1 في اعطاء افضل المتوسطات بلغ 69.7 و 59.9 يوماً 178.8 و 144.8 سم ، 8426 و 11640 سم2 ، 52.46 ، 54.46 سباد و 16.9 ، 19.21 ورقة للصفات عدد الايام من الزراعة حتى تزهير 50% من النباتات ، ارتفاع النبات ، المساحة الورقية ، محتوى الكلوروفيل للورقة ، عدد الاوراق نبات−1 لكلا الموسمين بالتتابع ، بينما اعطت النباتات المعاملة بالمايكورايزا اقل متوسط لعدد الايام من الزراعة الى النضج الفسلجي بلغ 99.00 ، 98.88 يوماً لكلا الموسمين ، واعطت النباتات المعاملة بالمركب النانوي ZnO اقل متوسط لعدد الايام من الزراعة حتى التزهير والنضج الفسلجي ، في حين اعطت اعلى المتوسطات للصفات ، ارتفاع النبات ، المساحة الورقية ، محتوى الورقة من الكلوروفيل ، عدد الاوراق نبات$^{-1}$ وقطر القرص بلغ 72.8 ، 58.9 يوماً 103.00 و 89.95 يوماً 168.1، 144.1 سم ، 6259 و 8682 سم^{2} ، 50.1 و 52.35 سباد ، 15.9 و 17.82 ورقة و 17.6 و 22.67 سم لكلا الموسمين بالتتابع ، كذلك كان للتداخلات الثنائية والتداخل الثلاثي تاثيرا معنويا في الصفات المدروسة في كلا الموسمين او احدهما.

Introduction

Sunflower is one the an important oil crop in the world and come second after soy-bean as for Iraq it is considered the first oil crop and it is considered among the best vegetable oils in the world, it is oil is distinguished by high levels unsaturated fatty acid such as linoleic acid, also used in making food and medicine. The production of Iraq for the year 2016 reached 0.9 thousand tons and the total cultivated area was 520 hectare (central statistical organization, 2018). Due to the cultivated area in Iraq did not rise to the required level, there for agricultural methods most be adopted to in-creasing production of sunflower, The most important of these methods are biofertilizers, organic manure and nano elements particles (Farina and Moayedi, 2014). The bio fertilizer was increased yield by in-creased he supply and availability the nutrient to absorbed by root system, as well as nonhazardous and non-toxic products (Basher

and et al , 2016). The organic manure is method more sustainable is that safer more productive and qualitative, as it improve soil characters and promotes the effectiveness of it is microorganisms and increased the prossing of nutrient for plant (AL-Sultani and Ha-shem, 2019). The nanoparticles of elements are a new method for fertilizer plant because it made an agriculture revolution (Hafize and Nasrin, 2018). The aim of study was to find the best bio fertilizer was, The best level of the organic manure in the yield its component and oil yield of sunflower were determining, nanoparticles ZnO and triple interaction between factors in the growth parameters of sunflower crop.

Material and Methods

Location of experiment

Afield of experiment was conducted during the two agricultural seasons, the first one in spring 2019 and the second in the autumn 2019 in the field are the located of the field , east of holly Karbala in Iraq. In order to determine the effect of levels of bio fertilizers, control, *Mychorriza* , Azosprilum, My+As. Organic manure. Control, chemical NPK, poultry manure, sheep manure and 1/2 amount poultry manure and sheep manure , and two levels zero application of Nanozinc oxide (ZnO) as control and nano ZnO on the vegetable growth traits of sunflower crop.

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 for both seasons and depth of 0- 30 cm

Table 1: Some chemical and physical traits of the field soil for both seasons (2019).

	pH	Electrical conduction ds.m^{-1}	Apparent density %	Porosity %	Organic matter %	Volumetric distribution for soil separates		
						clay%	Silt%	Sorel%
Spring	7.3	3.1	1.7	36	1.3	36.2	35.4	28.4
Autumn	7.1	2.9	1.6	34	1.5	35.9	34.6	28.5

Preparation of cultivation

The land was prepared for cultivating through plowing it two perpendicular plowing by the moldboard plow, it was smoothed using the smoothing desk, and were divided according to design used, with leave 2m space between the replicates, it was leave the spaces 2m between the main plots and leave spaces (1.5 m) between subplots and sub-subplots.

The experimental units were divided to rows the spaces 0.75 m between the rows and the row was divided to holes the space 0.25 m between the holes and other, the seeds of sunflower were cultivated with rated three seeds hole on 15/3/2019 for spring season and 15/8/2019 for the autumn season, The plants in the hole were

frightened to one plant in the hole before two weeks from seedling. The following traits were measured the number of days from planting to 50% flowering, plant height, number of days form planting to maturation, leaves area, number of leaves, leaf chlorophyll content and disk diameter for sunflower.

Experimental Design

The experiment was conducted for two season according to the order of split- split plots, using the randomized complete Block Design (RCBD) with three replicates.

The Nano Zinc Oxide, two treatments (zero and added ZNO near the roots of plant occupied the main plots (No and N_1) respectively, while the levels of the organic manure (control, NPK 300, 150 and 100 $Kg.ha^{-1}$, poultry waste, sheep manure 15 $ton.ha^{-1}$ and 7.5 $ton.ha^{-1}$ from both poultry waste and sheep manure occupied sub-plots which is symbolized by (B0, B1, B2, B3 and B4) respectively, while the biofertilization treatments (0, *Mychorriza* 10g , *Azosperillum* 10g and 1/2 (5g) *Mychorriza* , 1/2 (5g) *Azos.* occupied sub-sub-plots, which is symbolized by (C0, C1, C2 and C3) respectively . The area of experimental unit amounted to ($3 \times 4 = 12m^2$), Thus the total experimental units was $2 \times 5 \times 4 \times 3 = 120$ experimental units). The data were collected and analysis statistically of variance (ANOVA) by using Genstat2008 computer means comparison with L.S.D. probability level at 0.05 (steel and Torrie, 1980). After two week from emerged the seedling the plants were thinning to one on hole.

Results and discussion

Number of days from planting at flowering 50 % of plant

Table 2. Effect of biofertilizer , organic manure , Nano ZnO and interactions in the number of days from planting at flowering 50 % of plants

Nanomedicine	Organic waste	Spring agricultural season 2019				average N*B	Fall agricultural season 2019				average N*B
		Biofertilizers					Biofertilizers				
		C0	C1	C2	C3		C0	C1	C2	C3	
N0	b0	85	79	80.3	76	80.1	73.33	70.33	68.67	70.33	70.7
	b1	72	67	71	73.3	70.8	61.33	59.67	65.33	67.67	63.5
	b2	76	73.7	77	73.3	75	62.33	59.67	61	60	60.5
	b3	76	73.7	75	74	74.7	68.67	61.67	60.67	61.67	63.2
	b4	75.3	73	75.3	73.7	74.3	63.67	60.67	62	63.33	62.4
N1	b0	81.3	76.7	78.7	74.3	77.8	67.33	65	64.33	66.67	65.8
	b1	69.7	64.7	69.3	70.7	68.6	57	55.67	56	56.67	56.3
	b2	73.3	71.3	74.7	71	72.6	60.67	55.33	56	56.33	57.1
	b3	75.3	71.7	72.7	71.7	72.8	63.67	56.67	55.67	55.67	57.9
	b4	73.3	70.3	72.7	71.7	72	58.67	56	56.67	57.33	57.2
average		75.7	72.1	74.7	73		63.7	60.1	60.6	62.5	

L.S.D 0.05	A*B*C	0.6=C		n.s		n.s	0.63=C		1.78	0.47
	Nanomedicine	**Nanocomposite * bio-enriched**				**average**	**Nanocomposite * bio-enriched**			**average**
	N0	76.9	73.3	75.7	74.1	75	65.9	62.4	63.5	64.6	64.1
	N1	74.6	70.9	73.6	71.9	72.8	61.5	57.7	57.7	58.5	58.9
	L.S.D 0.05	n.s				0.45	L.S.D 0.05	0.88			0.54
	Organic waste	**Nanocomposite * bio-enriched**				**average**	**Nanocomposite * bio-enriched**				**average**
	b0	83.2	77.8	79.5	75.2	78.9	70.3	67.7	66.5	68.5	68.3
	b1	70.8	65.8	70.2	72	69.7	59.2	57.7	60.7	62.2	59.9
	b2	74.7	72.5	75.8	72.2	73.8	61.5	57.5	58.5	58.2	58.9
	b3	75.7	72.7	73.8	72.8	73.8	66.2	59.2	58.2	58.7	60.5
	b4	74.3	71.7	74	72.7	73.2	61.2	58.3	59.3	60.3	59.8
	L.S.D 0.05	1.21				0.52	L.S.D 0.05	1.26			0.39

Table 2. indicate to excelling the plants of bio-fertilizers treatment *Mycorihiza* gave it lowest average number days from planting at flowering 50% of plants recorded ,(72.8 and 58.9) days of for both seasons respectively, while the plants of treatment C0 gave the highest average recorded (75.7 and 63.7) days for both season respectively, the reason of the result the plants were treated with bio-fertilizers activates the growth promising by increasing the supply and available nutrients. the levels of organic manure significantly affected the number of days flowering 50% of plants, where the level (B1) chemical fertilizer (N.P.K) (300, 150 and 75 Kg.ha^{-1}) gave the lowest average number of days form planting at flowering 50% of plants recorded (69.7 , 58.9) days for both season respective, while the plants of the treatments (B0) gave the highest average number of days form planting at flowering 50% of plants recorded (78.9 , 68.3) days for both seasons respectively. Plants of the treatment with nano ZnO (N1) was excelled by giving it lowest average number of days form planting at flowering 50% of plants recorded (72.8 and 58.9) days for both seasons respectively, while the plants (N0) treated with nano ZnO (N0) gave the highest average recorded (75.) and 64.1) days for both seasons respectively. The effect of interaction between bio-fertilizers and NanoZnO was no significantly affected. The treatment N1C1 and N1C2 was excelled by giving lowest average recorded 57.7 days. The effect of interaction between organic manure and nanoZnO was significantly affected, where the plants of the treatment (N1B1) gave the lowest average number of days form planting at flowering 50% of plants recorded (56.3 day in the autumn season, As for the interaction between bio-fertilizer and organic manure was significantly af-

fected, where the plants of the treatment (B1C1) and (B2C1) gave the lowest average recorded (65.8 and 57.5) day for both seasons respectively, while the plants of treatment (B0C0) gave the highest average of number of days form planting at flowering 50% of plants recorded (83.2 and 70.3) day for both seasons respectively. The results of the statistical analysis showed that there were no significantly differences between three factors on autumn season the plants treated with the N1B2C1 was excelled by giving the lowest average recorded 55.33 day.

Height plant

Table 3. Effect of biofertilizer , organic manure , Nano ZnO and interactions in the height plant cm of sunflower

Nanomedicine	Organic waste	Spring agricultural season 2019				average N*B	Fall agricultural season 2019				average N*B
		Biofertilizers					Biofertilizers				
		C0	C1	C2	C3		C0	C1	C2	C3	
N0	b0	121.3	139	132.3	140	133.2	110.3	121.7	119	125.3	119.1
	b1	160.2	171.3	173.3	179.3	171.6	131.7	142.3	138.3	145	139.3
	b2	151	158.7	155.7	162	156.8	134.3	137.3	131.7	138	135.3
	b3	156.3	174.7	166.7	177	168.7	125.3	132.7	135	137.7	132.7
	b4	159.3	174	165.3	175.3	168.5	132	137.7	134	141.3	136.3
N1	b0	137.7	149	146.3	151.3	146.1	121.7	133	130.7	133.3	129.7
	b1	181.3	182.3	179.3	185	182	145.7	152.7	148	150.3	149.2
	b2	154.7	163.7	159.3	168.3	161.5	140	144.7	143.3	148	144
	b3	164.7	186.7	176	189	179.1	139.3	141	138.7	143	140.5
	b4	150.3	181	172.3	183.3	171.8	140.7	150.3	148.3	149.3	147.2
average		153.9	168.1	162.7	171.1		132.1	139.3	136.7	141.1	
L.S.D 0.05	A*B*C	4.02		C =1.4		1.3	n.s		C=1.8		n.s

Nanomedicine	Nanocomposite * bio-enriched				average	Nanocomposite * bio-enriched				average
N0	150	163.6	158.7	166.7	159.8	126.7	134.3	131.6	137.5	132.5
N1	157.7	172.5	166.7	175.4	168.1	137.5	144.3	141.8	144.8	142.1
L.S.D 0.05	n.s				1	L.S.D 0.05	n.s			2.5
Organic waste	Nanocomposite * bio-enriched				average	Nanocomposite * bio-enriched				average
b0	129.5	144	139.3	145.7	139.6	116	127.3	124.8	129.3	124.4
b1	171.7	177	176.3	182.2	176.8	138.7	147.5	143.2	147.7	144.3

b2	152.8	161.2	157.5	165.2	159.2	137.2	141	137.5	143	139.7
b3	160.5	180.7	171.3	179.3	173.9	132.3	136.8	136.8	140.3	136.6
b4	154.8	177.5	168.8	179.3	170.1	136.3	144	141.7	145.3	141.7
L.S.D 0.05	2.8				1.4	L.S.D 0.05	n.s			1.7

Table 3. Indicate to the excellent of the plants of biofertilizers treatment (*Mycorrihiza*)+ *Azospeirillum* was gave the highest average of high plant recorded (171.1, 141.1)cm for both seasons respectively, while the plants of treatment C0 gave lowest average of high plant recorded (121.3 , 110.3)cm for both seasons respectively. The organic manure significantly affected the high plant, where The plants treated with treatment (B1) gave highest average high plant recorded (176.8 , 144.3) cm for both seasons respectively, while the plants of the treatment(B0) gave the lowest average high plant recorded (139.6 , 124.4) cm for both seasons respectively. The plants of treatment with nanoZnO (N1) excelled by giving in the highest average high plant recorded (168.1 ,142.1) cm for both seasons respectively, while the plants treated without nano ZnO (N0) gave the lowest high plant recorded (159.8 , 132.5) cm for both seasons respectively. The interaction between organic manure and nanoZnO was significantly affected for spring season, where the plants of the treatment (N1B1) gave the highest high plant recorded 182 cm, while the plants of the treatment (N0B0) gave the lowest high plant recorded 140 cm, The interaction between biofertilizer and organic manure was significantly affected in the average high plant, where the plants of the treatment (B1C3) was excelled by giving the highest average of high plant recorded (182.2 , 147.7) cm for both seasons respectively , While the plants of treatment B0C0 gave the lowest average high plant recorded (129.5,116.0) cm for both seasons respectively, the interaction between three factors significantly affected on the average of high plant for spring season, the plants of the treatment N1B3C3 gave the highest average of the high plant recorded 189 cm.

Maturation period days

Table 4. Effect of biofertilizer , organic manure , Nano ZnO and interactions in the number days from planting to maturation of sunflower

Nanomedicine	Organic waste	Spring agricultural season 2019				average N*B	Fall agricultural season 2019				average N*B
		Biofertilizers					Biofertilizers				
		C0	C1	C2	C3		C0	C1	C2	C3	
N0	b0	113.3	110	109	110.3	110.7	106.3	100.3	100	99	101.42
	b1	102	105.3	108	107.7	105.8	91.7	89.7	96	97.7	93.75
	b2	102.3	99.7	101	100	100.8	94.7	90.3	91	90	91.5
	b3	108.7	101.3	100.7	103.7	103.6	96	90.7	91.3	91.7	92.42
	b4	103.7	100.7	102	103.3	102.4	94.3	90.7	92.3	93.3	92.67
N1	b0	107.3	105	104.3	106.7	105.8	97.3	95	94.3	96	95.67

	b1	97	105.7	106	106.7	103.8	87	86	86.3	86.7	86.5
	b2	100.7	95.7	96	96.3	97.2	91	88.3	87.3	86.2	88.25
	b3	103.7	96.7	95.7	95.3	97.3	94.3	91	91.3	91	91.92
	b4	98	96	96.7	97.3	97	89.3	86	87.7	86.7	87.42
average		103.7	101.6	101.9	102.7		94.2	92.5	91.7	91.8	
L.S.D 0.05	A*B*C	0.6=C		1.78		0.4	C=0.68		1.93		0.78

Nanomedicine	**Nanocomposite * bio-enriched**				**average**	**Nanocomposite * bio-enriched**				**average**
N0	106	103.4	104.1	105	104.6	96.6	92.33	94.13	94.33	94.35
N1	101.3	99.8	99.7	100.5	100.3	91.8	89.27	89.9	89.33	89.95
L.S.D 0.05	n.s				0.5	L.S.D 0.05	0.97			0.85
Organic waste	**Nanocomposite * bio-enriched**				**average**	**Nanocomposite * bio-enriched**				**average**
b0	110.3	107.5	106.7	108.5	108.3	101.83	97.66	97.17	97.5	98.54
b1	99.5	105.5	107	107.2	104.8	89.33	87.83	91.17	92.17	90.13
b2	101.5	97.7	98.5	98.2	99	92.83	89.33	89.17	88.17	89.88
b3	106.7	99	98.2	99.5	100.7	95.17	90.83	91.33	91.33	92.17
b4	100.8	98.3	99.3	100.3	99.7	91.83	88.33	90	90	90.04
L.S.D 0.05	1.26				0.34	L.S.D 0.05	1.365			0.63

Table 4. Indicate to the excelling plants of bio-fertilizers treatment *Mycorrihiza* (C1) by giving it the lowest average maturation period recorded 101.6 days for spring season, as the plants of *Azosprillum* gave the lowest average maturation period recorded 91.7 days for autumn season, While the plants of treatment C0 gave the highest average recorded (103.7 , 94.2) days for both seasons respectively, The organic manure significantly affected the maturation period, where the plants treated with the B2 poultry manure fertilizer was gave the lowest average of maturation period recorded (99.0 , 89.88) day for both seasons respectively. Plant gave treatment with the NanoZnO highest average recorded (100.3 , 89.95) day for both seasons respectively, while plants used to control treatment nano ZnO (N0) gave the highest average of maturation period recorded (104.6 , 94.35) for both seasons respectively. The results of the statistical analysis showed that there were significantly differences between the bio-fertilizers and NanoZnO in the autumn season only, where the plants of the treatment N1C1, was excelled by giving it the lowest average maturation period for the plants recorded 89.27 day. while the plants of the treatment N0C0 gave the highest average maturation period for the plants recorded 96.6 day for both autumn sea-

sons. The interaction between the NanoZnO and organic manure was significantly affected in the average maturation period for plants, where the plants of treatment N1B4 gave the lowest average maturation period recorded 97 day for spring seasons, while the plants of the treatment N1B1 gave the lowest average maturation period of the plants recorded 86.5 day for autumn seasons . while the plant of interaction of the treatment N0B0 gave the highest average of maturation period recorded (110.7 , 101.40) day for both seasons respectively . the interaction between organic manure and bio-fertilizers was significantly affected of the maturation period for the plants in both seasons, where the plants of the treatment C1B2 gave the lowest average of maturation period recorded 97.7 day for spring seasons, but the plant of treated with the C3B2 gave lowest average recorded 88.17 day for autumn season. while the plants of the control treatment B0C0 gave the highest average the maturation period recorded (110.3 , 101.83) day for both seasons respectively, Triple interaction showed significantly affect in this trait, where the plants in treatment N1B3C3 gave the lowest average of maturation period recorded 95.3 day for spring seasons, but the plants treated with the N1B1C1 and N1B1C3 gave average of maturation period recorded 86 day for autumn season, while the plants of treatments N0B0C0 gave the highest average of the maturation period recorded (113.3 , 106.3) day for both seasons respectively.

Leaf area

Table 5: Effect of biofertilizer , organic manure , Nano ZnO and interactions in the leaf area cm^2 of sunflower

Nanomedicine	Organic waste	Spring agricultural season 2019				average N*B	Fall agricultural season 2019				average N*B
		Biofertilizers					Biofertilizers				
		C0	C1	C2	C3		C0	C1	C2	C3	
N0	b0	1499	1622	1539	1576	1559	4333	4933	4567	5000	4714
	b1	7715	7857	8096	7966	7909	6867	11800	10333	12500	10375
	b2	6283	6976	6868	6909	6894	7300	7667	7800	9733	8035
	b3	5238	5802	5633	5493	5542	6200	9333	6267	8000	6255
	b4	6858	6624	6835	6863	6795	6267	8567	8067	8800	7919
N1	b0	2196	2681	2505	2567	2487	5100	6100	6000	6100	5818
	b1	8781	9135	8880	8973	8943	11600	13800	12167	14100	12917
	b2	6977	7192	6945	7069	7045	8000	9267	8667	9467	8559
	b3	5822	5966	5755	5751	5824	8333	7133	7033	7233	7062
	b4	7014	7130	6909	6948	6999	7100	9600	9600	9900	9058
average		5892	6098.3	5996.8	6012		6848	8582	8047	8927	
L.S.D 0.05	A*B*C	77= C		219		143.7	C= 50		n.s		69

Nanomedicine	Nanocomposite * bio-enriched				average	Nanocomposite * bio-enriched				average
N0	5627	5776	5794	5762	5740	6201	7984	7340	8487	7518
N1	6158	6419	6198	6262	6259	7495	7179	8687	9367	8682
L.S.D 0.05	109				61	L.S.D 0.05	n.s			96
Organic waste	**Nanocomposite * bio-enriched**				**average**	**Nanocomposite * bio-enriched**				**average**
b0	1847	2151	2022	2072	2023	4716	5511	5283	5555	5267
b1	8248	8496	8488	8470	8426	9246	12791	11235	13291	11641
b2	6900	7084	6906	6999	6969	7058	8476	8247	9407	8296
b3	5530	5884	5694	5622	5683	6531	7039	6640	7018	6808
b4	6936	6874	6872	6905	6897	6688	9090	8827	9350	8488
L.S.D 0.05	154				117	L.S.D 0.05	101			56

Table 5. Indicate to the excelling the plants of bio-fertilizers treatment control (C1) gave it the highest average of leaf area for the plants recorded 6098.3 cm^2 for the spring season , but the plant was treated with the C3 excelled by giving the highest average of leaf area recorded 8927 cm^2 for autumn season , while the plants of the treatment C0 gave the lowest average leaf area for the plants recorded (5892 , 6848) cm^2 for both season respectively. the treatments of organic manure significantly affected in the leaf area of plant , where the treatment of organic manure (B1) gave the highest average of the leaf area for the plants recorded 8426 , 11641 cm^2 for both seasons respectively, while the plants of the treatments (B0) gave the lowest average of leaf area recorded 2023 , 5267 cm^2 for both season respectively , The plants of the treatments with NanoZnO gave the highest average of leaf area recorded (6259 , 8682) cm^2 for both season respectively. The statistical analysis showed that there were significant differences between the Nano Zno and organic manure , where the plants of the treatment (N1B1) gave the highest average of the leaf area recorded (8943 , 12910) cm^2 for both seasons respectively . while the plants of the treatment (N0B0) gave the lowest average of leaf area for the plants recorded (1559 , 4714) cm^2 for both season respectively. The interaction between bio-fertilizer and organic manure was significantly affected in the average leaf area for the plant . where the plants of the treatment (B1C1) was excelled by giving it the highest average leaf area for the plants recorded 8496 cm^2 for the spring season, but the plant of treatment B1C3 was excelled by giving the highest average of leaf area recorded 13291 cm^2 for autumn season, the interaction between nano ZnO and bio-fertilizer was significantly affected in the average of leaf area on autumn season, the plants treated with the N1C3 gave highest average recorded 9367 cm^2.

Leaves Chlorophyll content spade

Table 6: Effect of biofertilizer , organic manure , Nano ZnO and interactions in the leaves chlorophyll content spad of sunflower

Nanomedicine	Organic waste	Spring agricultural season 2019				average N*B	Fall agricultural season 2019				average N*B
		Biofertilizers					Biofertilizers				
		C0	C1	C2	C3		C0	C1	C2	C3	
N0	b0	36.7	40.7	39	37.3	38.4	39.67	42.67	41	41.67	41.25
	b1	50	52	50.7	50.7	50.8	50.67	54	52.67	55	52.58
	b2	50.7	53.3	52.3	51.7	52	49	54.33	53	55	52.83
	b3	49	51.3	50.3	50.7	50.3	51.33	53.67	51.67	52.67	52.33
	b4	49	51	51.3	51	50.6	51.33	52.67	51.67	52	51.92
N1	b0	40.7	43.7	41.7	41.7	41.8	42.67	45.33	43.67	54.33	44
	b1	53.3	54.7	54	54.3	54.1	55.33	56.67	56.33	57	56.33
	b2	51.7	54.7	53	51.7	52.8	55.33	57	55.33	53.33	54.75
	b3	49.3	51.3	51	51	50.8	51.67	54.33	55.33	53.67	53.42
	b4	49.7	52.3	51.3	51.3	51.8	52.33	53.67	53	54	53.25
average		48	50.5	49.5	49.1		49.73	52.43	51.17	51.73	
L.S.D 0.05	A*B*C	0.40 =C		n.s		0.43	0.5=C			1.41	0.44

Nanomedicine	Nanocomposite * bio-enriched				average	Nanocomposite * bio-enriched				average
N0	47.1	49.7	48.7	48.3	48.43	48.4	51.47	50	50.87	50.18
N1	48.9	51.3	50.2	50	50.10	51.07	53.4	52.33	52.6	52.35
L.S.D 0.05	n.s				0.53	L.S.D 0.05	n.s			0.92
Organic waste	Nanocomposite * bio-enriched				average	Nanocomposite * bio-enriched				average
b0	38.7	42	40.4	39.5	40.1	41.17	44	42.33	43	42.63
b1	51.7	53.4	52.4	52.5	52.46	53	55.33	54.5	55	54.46
b2	51.2	54	52.7	51.7	52.38	51.17	55.67	54.17	54.17	53.79
b3	49.2	51.2	51.2	51	50.63	51.5	54	53.5	53.5	52.88
b4	49.4	51.7	50.9	51	50.75	51.83	53.17	52.33	53	52.58
L.S.D 0.05	0.8				0.36	L.S.D 0.05	1			0.36

Table 6. Indicate to the excelling the plants of bio-fertilizers treatment (*Mycorrihiza*) C1 by giving it the highest average the leaf chlorophyll content recorded (50.5 ,

52.43) SPAD unit for both seasons respectively. While the plants of treatment C0 gave the lowest average of leaf chlorophyll content for plants recorded (48.00 , 49.73) SPAD unit for both seasons respectively. The treatments of organic manure significantly affected the leaf chlorophyll content for the plants, where the plants of organic manure (B1) gave the highest average leaf chlorophyll content for the plant recorded (52.46 , 54.46) SPAD unit for the both seasons respectively, while the plants treated with organic manure (B2) gave highest average of the leaf chlorophyll content for the plants recorded 52.38 SPAD unit for spring seasons it was no significantly with the B1, while the plants of treatment (B0) gave the lowest average leaf chlorophyll content for the plants recorded (40.1 and 42.63) SPAD unit for both seasons respectively. The Plants treated with NanoZno excelled by giving it the highest average of leaf chlorophyll content recorded (50.1 , 52.35) SPAD unit for the both seasons respectively, while the plants of the no treated with NanoZno (control) N0 gave the lowest average recorded (48.43 , 50.18) SPAD unit for the both season respectively. The results of the statistical analysis showed that there were significantly differences between the bio-fertilizer and NanoZno, where the plants of the treatment N1B1 was excelled by giving it the highest average leaves chlorophyll content for the plants recorded (54.1 , 56.33) SPAD unit for both seasons respectively , while the plants of the no treated with ZNO and bio-fertilizers N0B0 gave the lowest average recorded (38.4 , 41.25) SPAD unit for both seasons respectively, The interaction between bio-fertilizer and organic manure was significantly affected in average of the leaves chlorophyll content for the plants , where the plants of the treatment B2C1 was excelled by giving it the highest average leaves chlorophyll content for the plants recorded (54.0 , 55.67) SPAD unit for both season respectively, while the plants of the treatment B0C0 gave the lowest average of the leaf chlorophyll content of plants recorded (38.7 , 41.17) SPAD unit for both season respectably. Triple interaction showed significant effect in the leaf chlorophyll content for spring season, where the plants of the treatment N1B1C1 where the plants were excelled giving highest average of the plants recorded 57.4 , 57.00 SPAD unit respectively. while the plants of the treatment N0B0C0 gave the lowest average recorded 39.67 SPAD unit.

Number leaves on plant

Table 7: Effect of biofertilizer , organic manure , Nano ZnO and interactions in the number leaves of plant for sunflower

Nanomedicine	Organic waste	Spring agricultural season 2019				average N*B	Fall agricultural season 2019				average N*B
		Biofertilizers					Biofertilizers				
		C0	C1	C2	C3		C0	C1	C2	C3	
N0	b0	11	12.3	12.3	11.7	11.8	13.67	14.33	14.67	15	14.42
	b1	15.3	16.3	15.4	14.7	15.4	17	18.67	18.33	19	18.25
	b2	13.3	14.3	11.7	14	13.8	16	18	18	18.33	17.58
	b3	11.7	13.3	13	13.7	12.9	15.33	16.33	16.33	16	16
	b4	12.7	14	13.4	14	13.5	16.33	18	18	18.67	17.75

N1	b0	14	15.3	15.3	14.7	14.8	14.67	15.67	15.67	16	15.5
	b1	18.3	19.4	18.7	17.7	18.4	19	21	22	18.67	20.17
	b2	14	16.3	15.7	15.7	15.4	16.33	19.67	18.67	18	18.17
	b3	13.3	15.3	15	15.3	14.8	16	17.67	17	16.67	16.83
	b4	15	17	15.3	16	15.8	17	19.67	18.67	18.33	18.42
average		13.86	15.37	14.7	14.7		16.13	17.9	17.73	17.47	
L.S.D 0.05	A*B*C	0.64=C		n.s		0.59	C=0.93		n.s		n.s

Nanomedicine	**Nanocomposite * bio-enriched**				**average**	**Nanocomposite * bio-enriched**				**average**
N0	12.8	14.1	13.5	12.6	13.5	15.67	17.07	17.07	17.4	16.8
N1	14.9	16.7	15.9	19.8	15.9	16.5	18.73	18.4	17.53	17.82
L.S.D 0.05	n.s				0.23	L.S.D 0.05	n.s			0.95
Organic waste	**Nanocomposite * bio-enriched**				**average**	**Nanocomposite * bio-enriched**				**average**
b0	12.5	13.8	13.8	13.2	13.3	14.17	15	15.17	15.5	14.96
b1	16.8	17.8	16.8	16.2	16.9	18	19.83	20.17	18.83	19.21
b2	13.7	15.3	14.7	14.8	14.6	16.17	18.33	18.33	18.17	17.88
b3	12.5	14.3	14	14.5	13.8	15.67	17	16.67	16.33	16.42
b4	13.8	15.3	14.3	15	14.7	16.67	18.83	18.33	18.5	18.08
L.S.D 0.05	n.s				0.48	L.S.D 0.05	n.s			0.73

Table 7. Indicate to the excelling the plants of bio-fertilizers treatment (*Mycorrihiza*) C1 by giving it the lowest average the number of leaves plant^{-1} recorded (15.37 , 17.9) leaf for both seasons respectively. As well as the treatment C1 no significant with the treatments C2 and C3 on autumn season, While the plants of treatment C0 gave the lowest average of number of leaves plant^{-1} recorded (13.86 , 16.13) leaf for both seasons respectively. The treatments of organic manure significantly affected the number of leaves plant^{-1}, where the plants of organic manure (B1) gave the highest average number of leaves plant^{-1} for the plant recorded (13.3 , 14.96) leaf for the both seasons respectively, The Plants treated with NanoZno excelled by giving it the highest average of number of leaves plant^{-1} recorded (15.9 , 17.82) leaf for the both seasons respectively , while the plants of the no treated with NanoZno (control) N0 gave the lowest average recorded (13.5 , 16.8) leaf for the both season respectively . The interaction between bio-fertilizer and nano ZnO was significantly affected in average of the number of leaves plant^{-1} for the plants , where the plants of the treatment N1B1 was excelled by giving it the highest average number of leaves plant^{-1} for the plants recorded 18.4 leaf for

spring season, while the plants of the treatment N0B0 gave the lowest average of the number of leaves plant^{-1} recorded 11.8 leaf.

Disk diameter cm

Table 8: Effect of biofertilizer , organic manure , Nano ZnO and interactions in the disk diameter cm of sunflower

Nanomedicine	Organic waste	Spring agricultural season 2019				average N*B	Fall agricultural season 2019				average N*B
		Biofertilizers					Biofertilizers				
		C0	C1	C2	C3		C0	C1	C2	C3	
N0	b0	13.27	15.7	14.2	15.3	14.6	18.3	19.3	18.7	20	19.08
	b1	15	17.6	16.7	17.2	16.4	22	24	23.3	23.3	23.17
	b2	14.3	16.6	16	16.5	15.8	19.7	21.7	21.3	22	21.17
	b3	14.3	15.8	15.1	15.8	15.3	19	20	19.3	20.3	19.67
	b4	14.7	16.1	16.1	16.2	15.8	21	21.3	21.3	22.3	21.58
N1	b0	15.7	17.7	16.3	15.9	16.4	19.7	22.3	20.7	22.3	21.25
	b1	17.1	20.5	18.8	18.1	18.6	23.3	24.7	24	25.7	24.42
	b2	15.1	18.1	16.1	17.7	16.7	21.7	22.7	23.7	23.7	22.58
	b3	13.8	15.7	14.8	15.4	14.9	21.3	22	21.7	22.7	21.92
	b4	14.5	16.9	16.4	17.3	16.3	22.7	23	22.7	24.3	23.17
average		14.8	17.1	16.1	16.5		20.9	22.1	21.5	22.7	
L.S.D 0.05	A*B*C	0.22=C			0.61	0.27	C=0.43			n.s	0.36

Nanomedicine	Nanocomposite * bio-enriched				average	Nanocomposite * bio-enriched				average
N0	14.3	16.4	15.6	16.2	15.6	20	21.27	20.8	27.73	20.93
N1	15	17.8	16.5	16.9	16.6	21.73	22.93	22.27	23.73	22.67
L.S.D 0.05	0.31				0.16	L.S.D 0.05	n.s			0.32
Organic waste	Nanocomposite * bio-enriched				average	Nanocomposite * bio-enriched				average
b0	14.5	16.7	15.2	15.6	15.5	19	20.83	19.67	21.17	20.17
b1	16.1	19.1	17.8	17.7	17.6	22.67	24.33	23.67	24.5	23.79
b2	14.7	17.3	16	17.1	16.3	20.67	22.17	21.83	22.83	21.88
b3	14.1	15.7	15	15.6	15.1	20.17	21	20.5	21.5	20.79
b4	14.6	16.5	16.2	16.7	16	21.83	22.17	22	23.5	22.38
L.S.D 0.05	0.4				0.22	L.S.D 0.05	n.s			0.29

Table 8. Indicate to the excelling the plants of bio-fertilizers treatment control (C1) gave it the highest average of disk diameter cm for the plants recorded 17.1 cm for the spring season, but the plant was treated with the C3 excelled by giving the highest average of disk diameter cm recorded 22.7 cm for autumn season , while the plants of the treatment C0 gave the lowest average disk diameter cm for the plants recorded (14.8 , 20.9) cm for both season respectively. the treatments of organic manure significantly affected in the disk diameter cm of plant, where the treatment of organic manure (B1) gave the highest average of the disk diameter cm for the plants recorded (17.6 , 23.79) cm for both seasons respectively, while the plants of the treatments (B0) gave the lowest average of disk diameter cm recorded (15.5 , 20.17) cm for both season respectively, The plants of the treatments with NanoZnO gave the highest average of disk diameter cm recorded (16.6 , 22.67) cm for both season respectively, while the plants of the treatments (N0) gave the lowest average of disk diameter cm recorded (15.6 , 20.93) cm for both season respectively. The statistical analysis showed that there were significant differences between the Nano Zno and organic manure, where the plants of the treatment (N1B1) gave the highest average of the disk diameter cm recorded (18.6 , 24.42) cm for both seasons respectively. while the plants of the treatment (N0B0) gave the lowest average of disk diameter cm for the plants recorded (14.6 , 19.08) cm for both season respectively .the interaction between bio-fertilizer and organic manure was significantly affected in the average disk diameter cm for the plant . where the plants of the treatment (B1C1) was excelled by giving it the highest average disk diameter cm for the plants recorded 19.1 cm for the spring season , while the plants of the treatment (N0B0) gave the lowest average of disk diameter cm for the plants recorded 14.5 cm for spring season, the interaction between nano ZnO and bio-fertilizer was significantly affected in the average of disk diameter cm in spring season , the plants treated with the N0C0 gave lowest average recorded 14.3cm. the interaction between tree factors was significantly affected on disk diameter cm were the plants of the treatment N1B1C1 was giving the highest average of disk diameter cm recorded (20.5) cm on spring season while the plants was treated with the N0B0C0 gave the highest average of disk diameter cm recorded 13.27 cm on spring season.

The reason is due to the role of bio-fertilizers in the increase root growth and increase root hairs, which play role in increasing absorption nutrient and nutrient elements , which increases the availability of photosynthesis production and increases effectiveness of bio-enzymes that stimulate the sink activity in receiving of manufactured materials , nutrients and nutrient element , which was positively reflected in the increasing the growth parameter such as plant hight, leaf area , number of leaves , leaves chlorophyll content and disk diameter for sunflower . this results according with result of researcher (Byrareddy *et al*, 2008 , kalkoran *et al*, 2013 , pramnik and bera 2013, Farina, 2014 , Abdsalam *et al*, 2016 , Basher *et al*, 2016, Mirparsa *et al*, 2016 and kandekar *et al*, (2018)

The reason for the superiority of the organic manure increasing the availability of nutrient elements and increasing 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 photosynthesis production to the stored dry matter and transferred to sink , which was positively reflected in increasing the growth parameter such as plant height, leaf area, number of leaves, leaf chlorophyll content and disk diameter for sunflower, there for the chemical fertilizer replaced with organic manure, also the organic fertilizer no hazarded healthy and pollution, (Ahmed and Jabeen , 2009 , Javahely and Rokhzaei, 2011 , yousfi *et al*, 2011 , jamnohamnadi *et al*, 2016 , Misra, 2017 and kandekar *et al*,(2018).

The reason for superiority of the plants of the NanoZnO to the growth of active and health roots, Nano elements play an important rolled improving the existing crop management, also using Nano fertilizer is away to release nutrients in to the soil gradually and control way, this treatment increased the growth parameter such as the number of days from planting to 50% flowering, plant height, number of days form planting to maturation, leaf area, number of leaves, leaf chlorophyll content and disk diameter for sunflower yield, these results agree with (Naderi and lui, 2012 , Nair *et al*, 2016 and Sharifi, (2016).

The reason for excelling the interaction (bio fertilizer and Nano ZnO to increasing yield components, and oil yield because it increased the growth parameters such as the number of days from planting to 50% flowering, plant height, number of days form planting to maturation, leaf area, number of leaves, leaf chlorophyll content and disk diameter for sunflower of root, wherever its ability to absorb nutrients, which was positively reflected in the increasing for these traits. These results agree with (Das and Ansari, 2009 , Jirlad *et al*, (year ??) and seghatoleslami and Reza, (2016).

The reason for excelling the increasing (organic manure and bio fertilizers) may be due to the role of microorganisms contained on the microorganisms (*Mycorrhiza* and *Azospirillum*) in the analysis of organic matter in the soil and the secretion it to the enzymes , proteins and acids , that release of nutrient elements and the role of microorganisms in improving the growth of root and activate its absorption for the mineral elements and their accumulation in the plant which provided the necessary nutrition support for growth and increasing the traits (Patra *et al*, 2013)

The interaction for excelling , the interaction organic manure and nano ZnO plays an important role in growth parameters of sunflower, due to good growth, increasing absorb nutrients, increasing humic acid and the enzyme and hormones, which was positively reflected in the increasing these traits , these results agree which (Waraich *et al*, 2011 and Sharifi, 2016). as well as the triple interaction was significantly effected on some traits for both seasons and alone season.

The conclusion of the result that added the bio-fertilizer , organic manure , nano ZnO and all interaction between then was very important for the plants growth activated due to increasing the photosynthesis, cell division and elongation, enzyme, nutrient absorption and chemical formation.

References:

Abdasalm, S., Lai, E.P. and Singh, C. K. (2016). Effect of biofertilizers on growth and yield of sunflower comparison in indolybian natural condition. IOSR *Journal of Agricultural and Veterinary Science*, 9(6): Ver. II, 07-14.

Ahmed, R. & Jabeen, N. (2009). Demonstration of growth improvement in sunflower (*Helianthus annuus* L.) by the use of organic fertilizers under saline condition. *Pakistanian Journal of Botany*, 41 (3): 1373 – 1384.

Ahmed, A.G., Orabi ,S. & Gaballah, A. (2010). Effect of Bio-N-P Fertilizer on the growth, yield and some biochemical component of two Sunflower cultivars. *International Journal of Academic Research*, 4(2): 271-277.

Byrareddy, B., Uppar, D. S., Vyakarnahal, B. S., Hiremath, S. M., Hunje, R., & Nadaf, H. L. (2010). Effect of integrated nutrient management on sunflower hybrid (KBSH-I) seed production. *Karnataka Journal of Agricultural Sciences*, 21(2).

Das, I., & Ansari, S. A. (2009). Nanomaterials in science and technology. *Journal of Scientific and Industrial Research*, 68 (8): 657-667.

Janmohammadi, M., Seifi, A., Pasandi, M., & Sabaghnia, N. (2016). The impact of organic manure and nano-inorganic fertilizers on the growth, yield and oil content of sunflowers under well-watered conditions. *Biologija*, 62(4).

Javahery, M., & Rokhzadi, A. (2011). Effects of biofertilizer application on phenology and growth of sunflower (*Helianthus annuus* L.) cultivars. *Journal of Basic and Applied Scientific Research*, 1: 2336-2338.

Shoghi-Kalkhoran, S., Ghalavand, A., Modarres-Sanavy, S. A. M., Mokhtassi-Bidgoli, A., & Akbari, P. (2013). Integrated fertilization systems enhance quality and yield of sunflower (*Helianthus annuus* L.). Journal of *Agricultural Science and Technology*, 15(7): 1343-1352.

Mirparsa, T., Ganjali, H. R., & Dahmardeh, M. (2016). The effect of bio fertilizers on yield and yield components of sunflower oil seed and nut. *International Journal of Agriculture and Biosciences*, 5(1): 46-49.

Misra, P., Shukla,P. K., Pramanik, K., Gautarm S.and Kole, P. (2017). Effect of different modes and concentration of zinc oxide Nanoparticles on Floral properties sunflower variety SSH61263. *International Journal of Plant Research*, 3012: 307-313.

Naderi, M. R. & Liu, A. (2012). Application of nanotechnology in agriculture and refinement of environmental pollutants. *Nanotechnology Journal*, 11(1): 18-26.

Nair, R., Varghese, S. H., Nair, B. G., Maekawa, T., Yoshida, Y., & Kumar, D. S. (2010). Nanoparticulate material delivery to plants. *Plant science*, 179(3): 154-163.

Patra, P., Pati, B. K., Ghosh, G. K., Mura, S. S., & Saha, A. (2013). Effect of bio-fertilizers and Sulphur on growth, yield, and oil content of hybrid sunflower (*Helianthus annuus* L.) in a typical lateritic soil. 2, 603. Inoculation of PSB+ VAM+Azotobacter recorded significantly higher thalamus diameter, weight of thalamus, filled seeds capitulum-1 and, 100.

Waraich, E. A., Ahmad, R., Ashraf, M. Y., Saifullah, & Ahmad, M. (2011). Improving agricultural water use efficiency by nutrient management in crop plants. Acta Agriculturae Scandinavica, *Section B-Soil & Plant Science*, 61(4): 291-304.

Yousefi, K., Galavi, M., Ramrodi, M. & Mousavi, S. R. (2011). Effect of bio-phosphate and chemical phosphorus fertilizer accompanied with micronutrient foliar application on growth, yield and yield components of maize (Single Cross704). *Australian Journal of crop Science*, 5(2): 175-180.

Ministry of planting, statistics department (2018). The republic of Iraq directory of agricultural statistics. central Bureau of statistics Iraq.

Farnia, A. M. (2014). Effect of phosphate and Nitrogen Bio- fertilizer on yield, yield components, oil and protein in sunflower (*Helianthus annuus* L.) Buffet of Environment. *Pharmacology and Life Sciences*, 3: 110-117.

Basher, H.G., Atif, E. J. & BadrEldin, A. M. A. (2016). Impact of Bio-fertilizer on growth and yield of two sunflower (*Helianthus amnuus* L.) Hybrids at sham bat, Sudan sch. *Journal of Agriculture and Veterinary Science*, 3(4): 332-336.

Al.sultani, A. T. K. & Hashem, R. L. (2019). Effect of Bio-fertilizer, organic, fertilizer and irrigation periods in the traits of yield and components for rice plant (Oryza sativa L) anber 33 cultivar. *International Journal of Plant Research*,19 (1) : 1366 - 1393.

Steel, R. G. D. & Torrie, J. M. (1980). Principles and procedures of statistics 2nd ed .Mc graw . Hill book Cv., new york.

Hafizi, Z. and Nasrin, N. (2018). The effect of Zinc Oxide nanoparticles on sunflower plant growth and physiology. *Engineering, Technology & Applied Science Research*, 8 (1): 2508-2513.

Sharifi, S. R. (2016). Application of bio fertilizers and zinc increases yield, nodulation and unsaturated fatty acids of soylaenn. *Zemdirbyste Agriculture*, 103 (3):251-258.

Khanderkar, S. D.; A. K. Ghotmukale; A. S. Damble & Suryawanshi, S. B. (2018). Research of Kharif sunflower to Biofertilizers and different fertilizer levels. *International Journal of Current Microbiology and Applied Sciences*, 6: 1558.

Janmohammadi, M.; K. Seifi; M. Pasandi & Naser, S. (2016). The impact of organic manure and Nano inorganic fertilizers on the growth, yield and oil content of sunflower under well- water condition. *Biological*, 62 (4):227-244.

Pramanik L. & Bera A. K. (2013). Effect of bio-fertilizers and phytohromone on growth, productivity and quality of sunflower (*Helianthus annuus* L.). *Journal of Crop and Weed*, 9 (2): 122-127.