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Effect of Bio, Nitrogen and Phosphorus Fertilizers on Growth, Yield and Yield Components of Sunflower Crop Grown in El-Kharga Oasis, New Valley

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Abstract:

Field experiment was conducted for two successive summer seasons of 2007/2008 and 2008/2009 at the Experimental Research Station of the Desert Research Center at El-Kharga Oasis, the New Valley governorate. The objective of this work was to study the effect of bio, nitrogen and phosphorus fertilizers on the growth, yield and yield components of sunflower crop.Results indicated that application of biofertilizer had significant effect on plant height, head diameter, 1000-seed weight, seed yield and oil% in seeds and oil yield respectively in the second growing season. Biofertilizer increased seed yield (kg/fed) and oil yield (kg/fed) by 11.0%, 12.0% and 16.6%, 14.0% over the control in the first and second growth seasons respectively. Nitrogen fertilization at rates of 30, 60 and 90 kg/fed, significantly resulted in increases in all studied parameters. Addition of nitrogen fertilizer at 90 kg N/fed gave the highest seed and oil yields in the two season when compared with 30 and 60 kg/fed. Results also showed that application of phosphorus at rates of 0, 15 and 45 $P_2O_{5\ kg/fed}$ were of highly significant influence on all studied triats.

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Introduction:

Sunflower (*Helianthus annus L.*) is an important edible vegetable oil that ranks the fourth next to soybean, palm oil and canola as a source of edible oil in the world (FAS. USDA 2008). In Egypt, the cultivated area of sunflower is limited in Nile Valley and the delta due to the competition with other important summer crops. However, it could be cultivated on newly reclaimed soils in the desert area, which represents 96% of Egypt total area.

Biofertilizers are organic products containing specific microorganisms in concentrated forms, derived from the soil root zone (Rhizosphere**)** (Mishra and Dadhich, 2010). Biofertilizers are considered as an important environment friendly sustainable agricultural practices, with low cost inputs ; mainly including nitrogen fixing bacteria (*Rhizobium, Azotobacter, Azospirillumetc.*) phosphate solubilizing bacteria (*Bacillus Polymxa*; *B. megtherium*) and potash mobilizing and plant promoting microorganisms (Sharma and Namdeo, 1999). The beneficial effect of biofertilizers inoculation on sunflower has been reported by several investigators. Nawar (1994) and Radwan (1996) reported that inoculation of sunflower seeds with phosphate dissolving bacteria (phosphorine) significantly increased number and weight of seeds/head and head diameter. The obtained results by Keshta and El-Kholy (1994) indicated that the application of biofertilizers as a source of N2 fixing bacteria to sunflower increased plant height, head diameter, 100-seed weight, seed yield/fed and seed oil content. Also, results of AbouKhadra *et.al*., (2002) and Mohamed (2003) revealed that inoculation of sunflower seeds with N2 fixing-baceria (cerealine)or with phosphate dissolving bacteria (phosphorine) or with the combined of the two biofertilizers significantly enhanced all studied traits over the control; dry matter accumulation, plant head diameter, number of seed/head, seed oil content, seed yield/plant as well as seed and oil yields/fed.

Hala and Magda (2012) recently, evaluated the influence of nitrogen fixing, phosphate solubilizing and potash mobilizing bacteria on growth and yield of peanuts and sunflower crops. Their field experiment data indicated that total biomass and seed yield showed superiority in peanut and sunflower cultured on soil incorporated with potash. The percentage increases in seed yield compared with corresponding control were 149.2, 168.8 and 173.4% in sunflower for nitrobeine, phosphorine and potash amendments respectively.

Aowad and Mohamed (2009) studied the effect of bio, organic and mineral fertilizers an seed and yield of sunflower through inoculcation with rhizobacterium or microbine. Their results showed that sunflower plants which received 20 or 30 m^3farm yard manure (FYM) with biofertilizers as mixer of Microbin and Rhizobacterine were among those having great dry matter accumulations plant, leaf area index, stem diameter, head diameter, plant height, 100-seed weight, seed oil contents as well as seed and oil yields/fed compared with these received 30 kg N/fed in both seasons.

Nitrogen is one of the most important nutrient to plant growth. Plant need too much nitrogen so that it is basis to form protein and nueleic acids. Nitrogen supply and consume in form of chemical fertilizers.

Several investigators showed the effect of mineral and organic fertilizers on sunflower as; AbouKhadra *et. al.,* (2002), and Mohamed (2003). Recently Osman and Awed (2010) in their study on sunflower showed that increasing nitrogen level from 30 kg to 60 kg N/fed significantly increased all yield components in the two growth seasons, except oil % which was decreased with increasing N level. They added that maximum values of plant height, head diameter, 100-seed weight, seed yield/plant and oil yield were observed with adding 30kg N/fed. Also, Soleymanifad and Sidat (2011) studied the effect of inoculation with biofertilizers in different levels of nitrogen fertilizer on yield and yield components of sunflower in Iran.Their results showed that nitrogen rates had significant effect on yield and yield components. Significant increases were observed in most studied traits when N rates were increased from zero to 30 kg N/ha.

Phosphorus is an essential element for reproductive plant organs as well as in florescence, grain formation and repining. Regarding the effect of phosphorus on sunflower; Jahangir (2006) found that maximum number of seeds/head and yield were produced by the application of 75 kg P_2O_5/ha. In the New Valley Osman and Awed (2010) studied the response of sunflower to phosphorus and nitrogen fertilization. Their obtained results revealed that increasing phosphorus fertilizer levels from 15 to 30 kg P_2O_5/fed significantly increased all yield components in both growth seasons.

Vegetative growth is a measure of response of crops to various management practices particularly nutrients. P starvation retarded the growth of sunflower at every stage of life cycle. Plant height and stem diameter were increased with increasing P application (Chaniara *et. al.,* 1989). Maheswarappa *et. al;* 1983 found that higher response to P application up to 90 kg/ha increased the germination and establishment of sunflower.

The aim of this research was to study the effect of bio, nitrogen and phosphorus fertilizers on the growth, yield and yield component of sunflower crop grown on the soil of El-Kharga Oasis, New Valley governorate during the two growth seasons of 2007/2008 and 2008/2009.

Materials and Methods:

Field experiment was carried out at the Experimental Research Station of the Desert Research Center (DRC) at El-Kharga Oasis, the New Valley governorate for the two successive summer seasons of 2007/2008 and 2008/2009. Composite soil samples were taken from the experimental site from the surface (0-30 cm). Some physical and chemical properties of the soil are present in Table (1). The analyses were accomplished according to Page *et. al.,* (1984) and Klute (1986).

Table (1): Soil properties of the experimental field prior to cultivation in EL-kharga Oasis.

Experimental design and fertilizer treatments:

Soil properties	Values	Chemical analysis	
Physical analysis		**Cations (c mole/g soil)**	
Sand %	51.4 %	Na^{+}	29.11
Clay %	30.5 %	K^{+}	1.98
Silt %	18.1 %	Ca^{+2}	9.1
Texture	Sandy clay loam	Mg^{+2}	2.45
		Anions (c mole/kg soil)	
Organic matter(%)	1.34	$CO_3^{=}$	0.0
pH (soil paste)	8.30	HCO_3^{-}	8
EC(soil paste) ds/m	3.32	Cl^{-}	26.6
CEC(med/100g.soil)	13.70	$SO_4^{=}$	8.04
Moisture			
F.C (%)	28	$Caco_3$ (%)	11.38
W.P (%)	12	$Caso_4$ (%)	0
A.W (%)	16		

A split sub subunits experimental design was followed in this study. The whole units were assigned for biofertilizer treatments, the subunits were devoted to nitrogen fertilizer levels. The sub-subunits were assigned to phosphorus fertilizer treatments. The field was to be shaped into furrows, at the spacing of 12 furrows/7m. After words 3.0X3.5m^2 (1/400feddan) experimental units were formed for the layout of the experimental field plants.

Biofertilizer treatments:

A solution containing a mixture of two inoculants; the first was a free-living atmospheric nitrogen fixer of *Azotobacter* and the other one, soil free –living phosphorus dissolving bacteria (PDB) of *Bacillus megatherium* was recruited for the purpose of this research. These two inoculants + the contents of a yeast sac + 2 kg of black mollase honey were all thoroughly mixed with 100 liters of irrigation water. This quantity was intended to be applied to the soil at two doses. Half of this amount was used each spray time. The solution containing the biological mixture was applied in the vicinity of the plants during the start of the rapid vegetative growth using a back- carried sprayer. The application took place on August 10 and 18, 2007 and August 12 and 19, 2008 for sunflower crop. This application was testified against a control treatment or no application, so the treatments in this regard are control (no application) versus the application (two treatment levels); Bio vs. n Bio.

Nitrogen fertilizer treatments:

Urea (46.5% N) was selected to be the source of N where it is the dominant form of N in the New Valley. This solid fertilizer was dressed on the soil surface 10-15 cm away from the plant stems to avoid its burring. The application took place on August 18 and September 11, 2007 season and August 19 and September 10, 2008 season. Owing to the essentiality of N to plant growth, no control

treatment was included among N applied levels. Nevertheless, N was applied at three rates: 30,60and 90 kg N/fed.

Phosphorus fertilizer treatments:

Calcium monophosphate (15.5% P_2O_5) as a source of phosphorus fertilizer was applied once during the seedbed preparation practice it was broadcasted on the furrows just prior to seeding sunflower seeds. The application took place on August 2, 2007season and August 5, 2008 season. These fertilization treatments were achieved at the rates of 0, 15 and 45 kg P_2O_5/fed.

Cultivation of sunflower:

Sunflower seeds (variety Hybrid Vidoc) were brought from the Seed Propagation Unit of Field Crops; Institute of the Agricultural Research Center, at Giza governorate. Seeding of sunflower took place by planting 3 seeds per 25-30 cm apart hills in the in the furrows. Then, the seeds were covered by light layer of the soil. Sunflower was sown on August 2, 2007 season and on August 5, 2008 season. Surface flood irrigation was adopted. Sunflower received irrigation water every 8-day long periods for up to 13 irrigation per season. Seedlings of sunflower were thinned to one strong seedling per hill 20 days from emergence.

Plant sampling and measurements:

Sunflower plant samples were taken after 110 days age (from emergence) on November 22, 2007 season and on November 25, 2008 season. Five-plant samples were taken randomly from each experimental unit. The following measurement was determined

1- Plant height (in cm).

2- Head diameter (cm).

3- 1000-seed weight (gram).

4- Total seed yield (kg/fed).

5- Oil content of seeds was measured by extraction using sox let apparatus and hexane as an organic solvent acceding to A.O.A.C (1986). Oil yield (in kg)/feddan was calculated.

Statistical analysis:

All obtained data were subjected to statistical analysis to evaluate the influence of the applied treatments on the measurement of plant characteristics. The analysis of variance was calculated to verify whether the differences among the treatments were significant or not according to Gomez and Gomez, (1986). The least significant difference (LSD) at 5% level of significance was recruited to differentiate every two significant means.

Results and Discussion:

Data in Table (2) summarize the effect of biofertilization treatment on growth, yield and its components of sunflower during the two successive seasons of 2007 and 2008. The statistical analysis of the obtained data showed that the application of biofertilizer (*Azotobacter* and *Bacillus megatherium*) had significant influence on plant height , head diameter , 1000-seed weight , seed yield , oil % in seeds and oil yield (kg/fed) respectively in the second growing season. Plant height and 1000-seed were not significantly affected by adding biofertilizer in the first season (2007). Application of biofertilizer resulted in increases in seed yield (kg/fed) and oil yield (/fed) by 11.0%, 12% and 16.6% and 14% over the control in the first and second seasons respec-

tively. These findings are in agreement with those reported by Soleymanifard and Sidat (2011),Sheta and El-Kawas (2003) and Hala and Magda (2012). In general, biofertilization excreted significant impact on growth, yield and yield components of sunflower.

Table (2): Effect of bio fertilization treatments on yield and its components of sunflower during 2007 and 2008 growing seasons.

Characters / Bio fertilizer	Plant height (cm)	Head diameter (cm)	1000- seed weight (g)	Seed yield (kg/ fed.)	Oil % in seeds	Oil yield (kg/ fed.)
	2007 Season					
Without bio	132.5	19.2	56.07	769.0	37.36	288.3
Bio fertilizer	138.6	21.1	58.06	852.8	39.30	336.2
F. test	N.S	*	*	*	*	*
LSD at 5%	N.S	0.63	0.61	7.76	0.11	2.44
2008 Season						
Without bio	134.7	20.0	56.09	774.3	38.15	297.2
Bio fertilizer	140.2	22.3	59.84	867.2	39.21	339.8
F. test	*	*	*	*	*	*
LSD at 5%	1.81	0.99	0.43	9.90	0.31	5.04

Data present in Table (3) show the effect of nitrogen fertilization at three rates: 30, 60 and 90 kg N/fed on growth, yield and yield components of sunflower during the two growing seasons of 2007 and 2008. In general, nitrogen fertilization had significant influence on all parameters studied in the two seasons. Data also, show that increasing nitrogen level from 30 to 90 kg N/fed led to significant increases in plant height by 28% and 26% in the first and in the second seasons respectively. On the other hand, head diameter significantly increased by 45% and 35.45% in the first and the second season respectively compared to the 30 kg N/fed treatment. Increasing the applied nitrogen rate from 30 to 90 kg N/fed was of highly significant influence on both seed and oil yield/fed. These increases amounted to 50, 51% in the first and second seasons respectively. Oil yields were increased by 37 and 43.3% in the first and second season respectively when compared to 30 kg N/fed. The same trend was observed concerning the 1000-seed weight in the two seasons. Data also indicate that application of 90 kg N/fed produced the highest and significant increases in seed yields (1018.7 and 1035.5 kg/fed) in the first and the second seasons respectively. Oil percentage in seeds of sunflower were significantly decreased as nitrogen level was increased. The increases in these characters with increasing nitrogen levels might be due to the role of nitrogen in activating the growth and yield components. Similar results were obtained by Kasem and El-Mesilhy (1992) Sailisbury and Ross (1994), Mojiri and Azani (2003), Killi (2004) and Ozer *et.al.* (2004).

Table (3): Effect of nitrogen fertilization treatments on yield and its components of

Characters / N fertilizer	Plant height (cm)	Head diameter (cm)	1000- seed weight (g)	Seed yield (kg/ fed.)	Oil % in seeds	Oil yield (kg/ fed.)
	2007 Season					
30 kg N/ fed.	121.2	16.1	46.26	679.1	40.00	274.1
60 kg N/ fed.	129.8	21.0	62.94	734.9	38.75	287.2
90 kg N/ fed.	155.7	23.4	62.00	1018.7	36.23	375.5
F. test	**	**	**	**	**	**
LSD at 5%	8.06	0.42	3.73	21.39	0.63	10.96
2008 Season						
30 kg N/ fed.	123.5	17.5	47.64	685.8	39.51	272.9
60 kg N / fed.	133.1	22.3	63.93	741.6	39.28	291.5
90 kg N / fed.	155.8	23.7	62.33	1035.0	37.26	391.2
F. test	**	**	**	**	**	**
LSD at 5%	3.38	0.84	1.55	14.36	0.97	6.53

Data in Table (4) clearly indicate that all studied parameters: plant height, head diameter, 1000-seed weight, seed and oil yields and oil % in seeds were highly significantly affected by phosphorus fertilization rates applied to sunflower plants in the two growth seasons. The highest values of parameter studied were recorded at the highest rate of phosphorus fertilizer (45g $P2O_5$ /fed) in the two seasons in comparison to the control (0kg P_2O_5/fed). Also, increasing the rate of phosphorus from zero to 15 kg P_2O_5/fed caused significant increases in all parameters studied compared to the control (0 kg P_2O_5/fed). On contrary to nitrogen, effect on seed yield, and oil content, phosphorus addition resulted in increases in oil % in seeds in the two seasons. These findings are in agreement with those obtained by Bhilegaonkar *et.al.* (1995) and Jahangir (2006).

Table (4): Effect of phosphorus fertilization treatments on yield and its components of sunflower during 2007 and 2008 growing seasons.

Characters / P fertilizer	Plant height (cm)	Head diameter (cm)	1000- seed weight (g)	Seed yield (kg/ fed.)	Oil % in seeds	Oil yield (kg/ fed.)
	2007 Season					
0 kg P2O5/ fed.	122.6	18.5	48.02	719.6	33.09	237.1
15 kg P2O5/ fed.	136.1	20.5	54.71	799.2	38.08	302.4
45 kg P2O5/ fed.	148.0	21.6	68.47	913.9	43.81	397.3
F. test	**	**	**	**	**	**
LSD at 5%	4.64	0.52	2.98	21.11	0.65	7.57
2008 Season						
0 kg P2O5/ fed.	123.3	19.8	48.50	728.0	33.90	245.9
15 kg P2O5/ fed.	139.2	21.3	55.85	806.9	38.79	309.4
45 kg P2O5/ fed.	149.8	22.4	69.55	927.4	43.37	400.3
F. test	**	**	**	**	**	**
LSD at 5%	2.99	0.70	1.46	16.65	0.93	8.73

Data in Table (5) show that the interaction effect between biofertilizer and nitrogen fertilization rates had exerted a significant impact on head diameter; 1000-seed weight seed yield (kg/fed); oil percentage in seeds and oil yield (kg/fed) in the first season. In the second season, only 1000-seed weight; seed yield; oil % in seeds and oil yield were significantly affected by the interaction between biofertilizer and nitrogen rates applied to sunflower plants. Both plant height and head diameter were not significantly affected by Bio X N treatments interaction. The highest values of seed yield and oil yield were found when 90 kg N/fed were added with biofertilization treatment in both seasons. In the two seasons oil % in seeds were significantly decreased with increasing level of nitrogen fertilization either with or without biofertilizationin in the first and the second season's respectively.

Table (5): Effect of the interaction between bio and nitrogen fertilization treatments on yield and its components of sunflower during 2007 and 2008 growing seasons.

Characters / B x N		Plant height (cm)	Head di-ameter (cm)	1000- seed weight (g)	Seed yield (kg/ fed.)	Oil % in seeds	Oil yield (kg/ fed.)
2007 Season							
Without bio	30 kg N/ fed.	119.1	15.3	44.99	651.8	38.40	252.2
	60 kg N/ fed.	127.8	20.5	62.03	707.7	38.11	271.2
	90 kg N/ fed.	150.8	21.9	61.19	947.5	35.55	341.6
Bio fertilizer	30 kg N/ fed.	123.3	16.9	47.53	706.4	41.60	295.9
	60 kg N/ fed.	131.9	21.6	63.84	762.1	39.38	303.1
	90 kg N/ fed.	160.6	24.9	62.82	1090.0	36.91	409.4
F. test		-	**	-	**	*	*
LSD at 5%		N.S.	0.60	N.S.	30.24	0.89	15.50
2008 Season							
Without bio	30 kg N/ fed.	121.6	16.5	45.00	656.5	38.34	253.3
	60 kg N/ fed.	131.3	21.2	61.91	712.0	38.82	277.6
	90 kg N/ fed.	151.3	22.4	61.36	954.6	37.31	360.7
Bio fertilizer	30 kg N/ fed.	125.4	18.4	50.29	715.1	40.69	292.5
	60 kg N/ fed.	134.9	23.4	65.94	771.2	39.75	305.4
	90 kg N/ fed.	160.4	25.0	63.29	1115.4	37.21	421.7
F. test		-	-	*	**	*	**
LSD at 5%		N.S.	N.S.	2.20	20.31	N.S.	9.23

Regarding the interaction effect between biofertilizer and phosphorus application, data in Table (6) revealed that only seed and oil yields (kg/fed) were significantly influenced by Bio X P interaction effect in the two growth seasons. On the other hand, plant height, head diameter, 1000-seed weight and oil % in seeds were not significantly affected by the interaction effect Bio X phosphorus. Data also indicate that the highest values of seed yields (973.2, 993 kg/fed) and oil yields (433.8 and 433.7 kg/fed) were obtained when 45 kg P_2O_5/fed were added to plants fertilized with or without biofertilizer in the first and the second seasons respectively.

Table (6): Effect of the interaction between bio and phosphorus fertilization treatments on yield and its components of sunflower during 2007 and 2008 growing seasons.

Characters		Plant height (cm)	Head diameter (cm)	1000- seed weight (g)	Seed yield (kg/ fed.)	Oil % in seeds	Oil yield (kg/ fed.)
B x P		2007 Season					
Without bio	0 kg P2O5/fed.	120.0	17.4	47.47	689.3	32.40	222.3
	15 kg P2O5/fed.	133.1	19.6	53.65	763.1	37.14	281.9
	45 kg P2O5/fed.	144.5	20.6	67.09	854.5	42.54	360.9
Bio fertilizer	0 kg P2O5/fed.	125.1	19.5	48.56	749.9	33.78	251.8
	15 kg P2O5/fed.	139.1	21.3	55.77	835.4	39.02	322.9
	45 kg P2O5/ fed	151.5	22.6	69.85	973.2	45.08	433.8
F. test		-	-	-	*	-	**
LSD at 5%		N.S.	N.S.	N.S.	29.85	N.S.	10.70
2008 Season							
Without bio	0 kg P2O5/fed.	121.1	18.6	47.36	695.2	33.47	232.1
	15 kg P2O5/fed.	136.6	20.0	53.31	766.0	38.27	292.6
	45 kg P2O5/fed.	146.5	21.5	67.62	861.7	42.72	366.9
Bio fertilizer	0 kg P2O5/fed.	125.6	21.0	49.64	760.8	34.33	259.7
	15 kg P2O5/fed.	141.9	22.6	58.39	847.8	39.30	326.2
	45 kg P2O5/ fed	153.2	23.2	47.36	993.0	44.01	433.7
F. test		-	-	-	**	-	**
LSD at 5%		N.S.	N.S.	N.S.	23.55	N.S.	12.34

The interaction effect between N X P fertilization treatments on yield of sunflower and its components during the two growth seasons of 2007 and 2008 is illustrated in Table (7). This interaction had no significant impact on plant height, head diameter and oil % in seeds in the first season. On the other hand, 1000-seed weight; seed and oil yields (kg/fed) were significantly affected by the N X P interaction in the first season. In the second season all parameters were significantly influenced by the N X P interaction except the head diameter. Data also indicate that the highest values of seed yields (1209.9, 1237.6 kg/fed) and oil yields (501.3 and 518.7 kg/fed) were obtained by application of 90 kg N/fed with 45 kg P_2O_5/fed in the first and the second seasons respectively. It is clear that increasing level of phosphorus fertilizer caused remarkable increases in oil % in seeds in the first season and significant increases in the second season with increasing of nitrogen fertilizer levels.

Table (7): Effect of the interaction between nitrogen and phosphorus fertilization treatments on yield and its components of sunflower during 2007 and 2008 growing seasons.

Characters		Plant height (cm)	Head diameter (cm)	1000-seed weight (g)	Seed yield (kg/ fed.)	Oil % in seeds	Oil yield (kg/ fed.)
N x P		2007 Season					
30 kg N/ fed.	0 kg P2O5/ fed.	109.6	14.3	41.21	619.2	34.72	215.3
	15 kg P2O5/ fed.	122.8	16.6	43.49	687.7	39.75	273.7
	45 kg P2O5/ fed.	131.2	17.4	54.08	730.3	45.54	333.2
60 kg N/ fed.	0 kg P2O5/ fed.	118.1	19.3	50.86	687.1	33.12	227.5
	15 kg P2O5/ fed.	128.9	21.3	61.75	716.3	38.59	276.5
	45 kg P2O5/ fed.	142.5	22.5	76.20	801.4	44.53	357.6
90 kg N/ fed.	0 kg P2O5/ fed.	140.1	21.9	51.98	852.5	31.43	268.3
	15 kg P2O5/ fed.	156.6	23.4	58.89	993.7	35.90	356.9
	45 kg P2O5/ fed.	170.4	24.9	75.14	1209.9	41.36	501.3
F. test		-	-	**	**	-	**
LSD at 5%		N.S.	N.S.	5.16	36.56	N.S.	13.11
2008 Season							
30 kg N/ fed.	0 kg P2O5/ fed.	110.0	16.1	42.13	623.7	35.20	219.9
	15 kg P2O5/ fed.	127.5	18.0	45.42	694.1	40.11	278.9
	45 kg P2O5/ fed.	133.0	18.3	55.38	739.5	43.23	319.9
60 kg N/ fed.	0 kg P2O5/ fed.	121.3	20.5	51.46	695.3	33.86	235.4
	15 kg P2O5/ fed.	133.0	22.7	63.22	724.4	39.03	276.7
	45 kg P2O5/ fed	144.9	23.8	77.10	805.0	44.97	362.3
90 kg N/ fed.	0 kg P2O5/ fed.	138.7	22.8	51.91	865.1	32.65	282.5
	15 kg P2O5/ fed.	157.3	23.2	58.91	1002.3	37.22	372.5
	45 kg P2O5/ fed.	171.5	25.0	76.17	1237.6	41.91	518.7
F. test		*	-	**	**	*	**
LSD at 5%		5.17	N.S.	2.53	28.84	N.S.	15.12

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تأثير إضافة الأسمدة الحيوية والنيتروجينية والفوسفاتية على نمو ومحصول عباد الشمس ومكوناته المنزرع فى واحة الخارجة الوادي الجديد

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الملخص:

أجريت تجربة حقلية لمدة موسمين متتاليين ٢٠٠٧، ٢٠٠٨ في محطة التجارب الزراعية التابعة لمركز بحوث الصحراء في الخارجة – الوادي الجديد. كان الهدف من هذا العمل هو دراسة تأثير كل من الأسمدة الحيوية والنيتروجينية والفوسفاتية على النمو و المحصول و مكوناته لمحصول دوار الشمس.

أظهرت النتائج أن إضافة السماد الحيوي كان له تأثير معنوي على ارتفاع النباتات، وقطر القرص و وزن الأف بذرة و محصولى البذور ونسبة الزيت فى البذور في الموسم الثاني. أدى إضافة السماد الحيوي إلى زيادة في محصولي البذور و الزيت بمعدل ١٦.٦% ، ١٤.٠٦%، ١١.٥% ، ١٢% فى الموسمين الأول والثاني على الترتيب.

أدى إضافة سماد النيتروجين بمعدل ٣٠ ، ٦٠ و ٩٠ كجم نيتروجين / فدان إلى زيادة معنوية فى جميع الصفات المدروسة و كان أعلى محصول للبذور و الزيت عند إضافة ٩٠ كجم نيتروجين/ فدان مقارنة ب٣٠ ،٦٠ كجم نيتروجين / فدان فى الموسمين.

أظهرت النتائج أيضا أن إضافة السوبر فوسفات بمعدلات صفر ، ١٥ و ٤٥كجم P_2O_5/ فدان إلى زيادة معنوية فى جميع الصفات المدروسة.