

Growth, Yield and Yield Components of Canola Crop (*Brassica napus*) in El-Kharga Oasis New Valley as affected by bio, Nitrogen and Phosphorus Fertilization.

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Abstract

Field experiments were conducted for two successive 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 object of this work was to study the effect of bio, nitrogen and phosphorus fertilizers on the growth, yield and yield components on canola crop. The results showed that the application of biofertilizers (*Azotobacter* and *Bacillus megatherium*) caused significant increases in seed oil % in seeds and total oil yield (kg/fed) in the first season while plant height 1000-seed weight and seed yield were not significantly affected by biofertilizers application. In the second season, plant growth yield and yield components were not significantly increased.

Nitrogen fertilization showed significant increases on all parameters studied in the two seasons. Data also showed that increasing nitrogen level from 30 to 90 kg N/fed led to significant increases in plant height by 15.9 and 16.3 % in the first and the second seasons respectively.

Increasing phosphorus level from 0 to 45 kg P₂O₅/fed resulted in significant increases in seed yield by 15.5 % and 16.3 % in the first and the second seasons respectively.

Keywords: *Canola, Rapeseed, Canola Oil, N, P and biofertilizer, Oases.*

Introduction

Rapeseed (canola, *Brassica napus* L.) is an important oilseed crop in the agricultural systems of many arid and semiarid areas where its yield is often restricted by water deficit and high temperatures during the productive growth. Canola seeds contain an average content of 38% oil, which may represent an agronomically sustainable choice (Tomm *et al.*, 2010).

It contains 40-45% oil and 36-40% protein. Canola oil has low content of erucic acid and glucosinolates, and high content of omega 3 and vitamin E which is also considered one

of the healthier oils for human consumption, being recognized by medicine as a functional food (Brown *et al.*, 2008).

Biofertilizer is a material containing microorganism(s) added to a soil directly or indirectly to make certain essential elements available to plants for their nutrition. Various sources of biofertilizers include nitrogen fixers, phosphate solubilizing bacteria, plant growth promoting rhizobacteria, etc... (Shekh, 2006).

A number of different bacteria promote plant growth including *Azotobacter* spp., *Azospirillum* spp., *Pseudomonas* spp., *Bacillus* spp. were

used in inoculation of canola plants. The biofertilizer had significant and positive effect on plant height and yield of canola (Gupta and Samnotra, 2004; Turan and Sahin 2006).

Seed inoculation with different isolates of rhizosphere of different *Brassica* species showed significant increase in plant height (up to 5.5%), stem diameter (up to 11.0%), Number of branches (up to 35.7%), number of pods/plant (up to 26.75), 1000-seed weight (up to 33.9 %), grain yield (up to 45.4%) and oil content (up to 5.6%) over the noninoculated control plants (Abd-El-Gawad *et al.*, 2009).

Growth characteristics of canola such as plant height, number of branches/plant, number of pods/plant, seed yield and oil content are positively related to soil N level (Ahmadi and Bahrani 2009). Mottalebipour and Bahrani (2006) found that increasing nitrogen application level as a vegetative growth stimulant, the number of secondary branches and accordingly the number of pods per plant increased. Also, Fatma and Wafaa, (2009) reported that increasing nitrogen fertilization significantly increased plant height, leaf area/plant, number of branches/plant, 1000-seed weight, seed yield/plant, seed and oil yield/fed., but decreased oil percentage in seeds. Similarly Fathy and Ahmed (2009) showed that as nitrogen fertilizer level increased, plant height, number of fruit/plant, 1000-seed weight, seed weight/plant and protein content increased.

Many researchers have found that increasing of N fertilization rate to canola was of reverse effect on oil seed content. As mentioned previously nitrogen fertilizer application

recorded positively response on seed yield. In this respect, Fathi *et al.*, (2002) observed that seeds from plots fertilized by 45 kg N/ha contained 44.9% oil while seeds from these received 225 kg N/ha contained 40.6% oil.

In general, high nitrogen amount reduced oil seed content; this was consistent with previous research works. This is probably due to the fact that presence of more available N in soil may delay plant maturity and increase seed filling period.

With regard to the effects of P fertilization on canola, Brady and Weil (2002) showed that phosphorus is required in large quantities, especially in meristemic tissues, where cells are rapidly dividing and enlarging. Mohanty *et al.*, (2006) found that phosphorus fertilization helps in energy storage, root development and early maturity of crops.

The objective of this research was to study the effects of biofertilizer, nitrogen and phosphorus fertilizers on the growth, yield and yield components of canola under El-Karga Oasis conditions.

Materials and Methods

1. Experimental sites and soil sampling:

The experimental field was conducted at the experimental research station of the Desert Research Center (DRC) at El-Kharga Oasis, New Valley, Egypt.

This study was carried out for two successive winter seasons of 2007/2008 and 2008/2009. Completely randomized design (CRD) for field experiments with three replications for each treatment was employed.

The experimental soil was sampled using the composite sample technique from the surface soil layer and sub-surface (0-30 cm and 30-60 cm) just to define what the initial physical, chemical, and nutritional status prior to field preparation for the cultivation of any of the two

crops. Some physical and chemical properties of the studied soil before cultivation in El-Kharga Oasis, the New Valley are presented in Table (1). Analyses were accomplished according to Page, *et al.*, 1984 and Klute, 1986.

Table 1. Some chemical and physical properties of Soil prior cultivation in EL-Kharga Oasis the New Valley.

Depth cm	pH (1:1)	ECe soil paste dS/m	OM	CaCO ₃	Sand	Silt	Clay	CEC Cmole/kg soil	Texture grqde
			%						
0-30	8.11	3.32	1.35	3.61	51.40	27.50	21.10	17.6	SCL
30-60	7.95	2.86	1.15	4.14	46.76	30.06	23.18	20.76	L
Soluble cations and anions in (meq/L) Soil paste extract									
Depth	Na ⁺	K ⁺	Ca ⁺²	Mg ⁺²	CO ₃ ⁼	HCO ₃ ⁻	Cl ⁻	SO ₄ ⁼	
0-30	19.21	2.16	9.1	2.85	0	8.11	16.6	8.61	
30-60	16.17	1.96	7.96	2.53	0	6.97	14.82	6.83	
Available nutrients in soil (mg/kg)									
Depth	N%	P	K	Fe	Mn	Zn	Cu	B	
0-30	0.003	2.93	246	31.9	12.9	0.58	0.32	0.28	
30-60	0.002	2.25	283	38.4	18.4	0.47	0.28	0.21	

SCL = Sandy clay loam
 L = Loam

2- Experimental fields and fertilizer treatments:

The experimental field is intended to be nourished with the application of 10 m³ of well-decomposed organic manure at the time of land preparation. This was practiced for both adopted crops after which the land was to be ploughed two times with the second going perpendicular to the first plowing. The field was to be shaped into furrows at the spacing of 12 furrows/7m (about 60-cm furrows). Afterwards,

3.0x3.5m² (1/400 feddan) (1 feddan = 0.42 hectare) experimental plots were formed for the layout of the experimental field plots for both crops.

The applied treatments included 2 biofertilizer treatments x 3 N levels x 3 P levels x 3 replications for a sum of 54 experimental units. In the external fringe around the experimental layout, there was a protection zone to achieve true responses of the plants to the applied treatments and avoid the effect of advection of the surrounding ecological system.

Canola Pactol variety was used at the rate of 5kg seeds/fed. The seeds for canola were bought from the Seed Propagation Unit of the Field Crops Institute of the Agricultural Research Center, at Giza Research Station, Giza governorate.

Canola, thinning took place when the seedlings reached the height of 5-8 cm high above the soil surface, i.e. at the age of about 20 days from emergence. Two plants were left per hill for a population density of about 56,000 plants/fed. Generally, seedling thinning was achieved during the soil surface hand hoeing which is attained either to mulch the soil surface by breaking the continuity of the capillary tubes, or to control weeds in the field.

All field plots received a basal dose of micronutrients (Fe, Mn, Cu & Zn) 0.5% solution sprayed onto the aerial parts of the plants during the rapid vegetative growth (shooting stage). The doses were applied on march 5th, 2008 and march 2nd, 2009 in the first and the second seasons respectively.

3- Fertilization treatments:

3-1 Biofertilizer:

A solution containing a mixture of two inoculants; one soil free-living atmospheric nitrogen fixer of *Azotobacter* and the other one soil free-living phosphorus dissolving bacteria of *Bacillus megatherum* (PDB) was recruited for the purpose of this research. These two inoculants + the contents of 2kg of sugar cane molasses were all thoroughly mixed with 100 liters of irrigation water. This quantity was intended for soil application at two doses. Therefore, half of this amount was used at 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 December 12th and 19th, 2007 and december 2nd and 10th, 2008. 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. no Bio.

3-2 Nitrogen fertilization:

The application of Nitrogen fertilizer took place on November 30th, 2007 and January 1st, 2008 in the first season and November 25th and December 29th, 2008. Owing to the essentiality of N to plant growth, no control treatment was included among N applied levels. Nevertheless, N was applied at three levels 30, 60, 90 kg N/fed.

3-3 Phosphorus fertilization treatments:

This application took place on November 12th, 2007 and November 5th, 2008 for canola. These fertilization treatments were achieved at the levels of 0, 15, 45 kg P₂O₅/fed which were testified versus a control; i.e. three treatment levels.

3-4 Plant sampling and measurements:

3-4-1 Measurements:

1. Plant height (cm).
2. 1000-seed weight (g) at harvest.
3. Total seed yield per fed using the yield per 1square meter basis, then separating the seeds and weighing them, then calculating the yield per fed by multiplying by the appropriate factor of 4200 m²/fed.

4. For canola, was harvested after 150 days of age (from emergence) on April 15th, 2008 and April 7th, 2009.

3-4-2- Plant measurements

During harvest: five-plant samples were taken from each experimental unit and the dry weight was recorded, then total seed weight and 1000-seed weight were recorded. The straw yield, seed yield, biological yield, and the weight of 1000-seed yield were recorded.

3-5 Statistical analysis and manipulations:

3-5-1 Analysis of variance:

All obtained data were subjected to statistical analysis to exhibit the influences of the applied treat-

ments on the measured plant and soil characteristics and traits. The split-split plot technique was used in three replications assigned to each experimental treatment combination according to Gomez and Gomez (1986). The biofertilization treatment occupied the grand main treatment which was randomly assigned to the three replicates. Then each main was split into the three submain level of N treatment which thus occupied the sub-main experimental units that were randomly assigned to the three subunits. The subunits, were then split into the three subunits for the random distribution of the three levels of P. the total number of experimental units becomes 54 plots as follows:

Bio fertilization	= With vs. Without Bio	= 2 levels
N fertilization	= 30 vs. 60 vs. 90 kg N/fed.	= 3 levels
P fertilization	= zero vs. 15 vs. 45 P ₂ O ₅ /fed.	= 3 levels
Replication	=	= 3 reps.

Total plots	= 2 x 3 x 3 x 3	= 54 plots

The analysis of variance (ANOVA) was calculated to verify whether the differences among the treatments were significant or not (Gomez and Gomez, 1986). The least

significant difference (LSD) at 5% level of significance was recruited to differentiate every two significant means.

- With Bio
- 30 N- 0 P₂O₅
- 30 N- 15 P₂O₅
- 30 N- 45 P₂O₅
- 60 N- 0 P₂O₅
- 60 N- 15 P₂O₅
- 60 N- 45 P₂O₅
- 90 N- 0 P₂O₅
- 90 N- 15 P₂O₅
- 90 N- 45 P₂O₅

- Without Bio
- 30 N- 0 P₂O₅
- 30 N- 15 P₂O₅
- 30 N- 45 P₂O₅
- 60 N- 0 P₂O₅
- 60 N- 15 P₂O₅
- 60 N- 45 P₂O₅
- 90 N- 0 P₂O₅
- 90 N- 15 P₂O₅
- 90 N- 45 P₂O₅

Results and Discussion

Effect of fertilization treatments bio, N and P on plant growth, yield and yield components of canola:

Data in Table (2) summarize the effect of biofertilizers treatments (*Azotobacter* and *Bacillus megathierium*) on growth, yield and its components of canola during the two successive winter seasons of 2007-2008 and 2008-2009. The statistical analysis of obtained data show that the application of biofertilizers significantly increased oil % in seed and oil yield (kg/fed.) in the first season. Plant

height, 1000-seed weight and seed yield were not significantly affected by biofertilization either in the first or in the second season.

Naderifar and Daneshian (2012) found that biofertilizers (*Azotobacter* and *Azospirillum*) inoculation had significant effect on seed number per silques, number of silques per plant, seed yield, 1000-seed weight and seed yield of canola plants. Inoculation with *penicillium bilgi*, *Bacillus thuringiensis* and phosphate solubilizing rhizobacteria increase vegetative growth and seed yield of canola (Freitas *et al.*, 1997).

Table 2. Effect of bio fertilization treatments on yield and its components of canola during 2007-2008 and 2008-2009 growing seasons.

Characters	Plant height (cm)	1000- seed weight (g)	Seed yield (kg/ fed.)	Oil in seeds (%)	Oil yield (kg/ fed.)
Bio fertilizer	2007-2008 season				
Without bio	132.2	3.94	824.4	38.71	319.1
Bio fertilizer	133.4	3.98	832.3	40.06	329.8
F. test	N.S.	N.S.	N.S.	*	*
	2008-2009 season				
Without bio	132.2	3.95	823.9	38.39	316.3
Bio fertilizer	134.1	4.00	836.0	39.68	331.7
F. test	N.S.	N.S.	N.S.	N.S.	N.S.

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 canola during the two growing winter seasons of 2007-2008 and 2008-2009. In general, nitrogen fertilization resulted in significant increases in 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 16.32 and 15.91% in the first and in the second

season respectively. On the other hand treatment of 90 kg N/fed significantly increased the 1000-seed weight by 24.02% and 24.20% in the first and in 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. These increases amounted to 30.20% and 23.30% in the first season and 30.40% and 26.0% in the second season; data also indicate that increasing

nitrogen levels from 30 to 90 kg/fed resulted decreases in oil % in seeds in the two seasons.

The decreases in these characters with increasing nitrogen level might be due to role of nitrogen in activating the growth and yield component. These results are in agree-

ment with those reported by Naderifar and Daneshian (2012), where they found nitrogen fertilizer had significant effect on the seed number, seed yield, 1000-seed weight and plant height of canola plants. The highest yield was obtained from nitrogen level 150 kg/ha. treatment.

Table 3. Effect of nitrogen fertilization treatments on yield and its components of canola during 2007-2008 and 2008-2009 growing seasons.

Characters N fertilizer	Plant height (cm)	1000- seed weight (g)	Seed yield (kg/ fed.)	Oil in seeds (%)	Oil yield (kg/ fed.)
	2007-2008 season				
30 kg N/ fed.	121.9	3.45	688.9	40.84	281.4
60 kg N/ fed.	134.6	4.16	808.5	40.14	324.5
90 kg N/ fed.	141.8	4.28	987.6	37.16	367.0
LSD at 5%	2.31	0.04	12.65	0.71	9.25
2008-2009 season					
30 kg N/ fed.	122.5	3.47	690.6	39.87	275.3
60 kg N/ fed.	135.0	4.16	806.6	39.73	320.5
90 kg N/ fed.	142.0	4.31	992.6	37.50	372.2
LSD at 5%	2.11	0.03	12.54	1.22	13.32

Data in Table (4) show that all studied parameters; plant height, 1000-seed weight, seed yield, oil percent in seeds and oil yield were significantly affected by phosphorus fertilization rates (0, 15 and 45kg P₂O₅/fed), applied to canola plants in the two seasons. Increasing phosphorus level from 0 to 45 kg P₂O₅/fed. led to significant increase in seed yield by 13.4% and 14.0% in the first and second season respectively. The

highest values of the studied parameters were recorded when the level 45 kg P₂O₅/fed. was added in the two seasons in comparison to the control (0 kg P₂O₅/fed.). Also, on contrary to nitrogen effect on oil percent, phosphorus addition resulted in increases in oil % in seeds in the two seasons the phosphorus deficiency in the soil (Table 1)(2.3 ppm) is the reason for the applying 45 kg P₂O₅/fed.

Table 4. Effect of phosphorus fertilization treatments on yield and its components of canola during 2007-2008 and 2008-2009 growing seasons.

P fertilizer	Plant height (cm)	1000- seed weight (g)	Seed yield (kg/ fed.)	Oil in seeds(%)	Oil yield (kg/ fed.)
	2007-2008 season				
0 kg P ₂ O ₅ / fed.	128.1	3.77	771.3	36.03	277.9
15 kg P ₂ O ₅ / fed.	133.0	3.97	823.5	38.30	315.4
45 kg P ₂ O ₅ / fed.	137.3	4.15	890.2	43.82	390.1
LSD at 5%	2.55	0.04	16.32	0.86	9.20
2008-2009 season					
0 kg P ₂ O ₅ / fed.	127.7	3.78	768.1	35.39	271.8
15 kg P ₂ O ₅ / fed.	133.0	3.98	828.3	38.75	320.9
45 kg P ₂ O ₅ / fed.	138.8	4.17	893.4	42.97	383.9
LSD at 5%	2.06	0.04	11.89	0.82	8.52

Data in Table (5) show that the interaction effect of biofertilizer and nitrogen fertilization rates on plant height, 1000-seed weight, seed yield, oil percentage in seed and oil yield was not significant in the two seasons. In the second season, only 1000-seed weight was significantly affected by the interaction between biofertilizer and nitrogen rates applied to canola plants. The highest

values were found when 90 kg N/fed. with added along biofertilizer treatment in both seasons. In the two seasons oil % in seeds were decreased as nitrogen level increased either with or without biofertilization. Generally, biofertilization accompanied by N fertilization scored remarkable increments in all parameter studied during the two seasons.

Table 5. Effect of the interaction between bio and nitrogen fertilization treatments on yield and its components of canola during 2007-2008 and 2008-2009 growing seasons.

Characters		Plant height (cm)	1000- seed weight (g)	Seed yield (kg/ fed.)	Oil in seeds (%)	Oil yield (kg/ fed.)
		2007-2008 season				
Without bio	30 kg N/ fed.	120.9	3.42	682.1	40.09	273.5
	60 kg N/ fed.	134.0	4.15	809.9	39.47	319.7
	90 kg N/ fed.	141.7	4.25	981.2	36.56	358.7
Bio fertilizer	30 kg N/ fed.	122.9	3.48	695.8	41.60	289.5
	60 kg N/ fed.	135.2	4.17	807.1	40.81	329.4
	90 kg N/ fed.	141.9	4.31	993.9	37.76	375.3
LSD at 5%		N.S.	N.S.	N.S.	N.S.	N.S.
2008-2009 season						
Without bio	30 kg N/ fed.	121.1	3.43	683.7	39.14	367.6
	60 kg N/ fed.	134.7	4.16	808.3	39.21	316.9
	90 kg N/ fed.	140.8	4.26	979.6	36.82	360.7
Bio fertilizer	30 kg N/ fed.	124.0	3.50	697.4	40.61	283.2
	60 kg N/ fed.	135.3	4.16	804.9	40.25	323.9
	90 kg N/ fed.	143.1	4.35	1005.6	38.18	283.9
LSD at 5%		N.S.	0.03	N.S.	N.S.	N.S.

Regarding the interaction between biofertilizer and phosphorus application; data in Table (6) reveal that all growth parameters, yield and yield components were not significantly affected by bio×P interaction effect in the two growing seasons.

The highest values of seed yield (897.4 and 900 kg/fed.) were obtained when 45 kg P₂O₅/fed. were added to canola plants fertilized with 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 canola during 2007-2008 and 2008-2009 growing seasons

Characters		Plant height (cm)	1000-seed weight (g)	Seed yield (kg/ fed.)	Oil in seeds (%)	Oil yield (kg/ fed.)
B x P		season 2007-2008				
Without bio	0 kg P ₂ O ₅ / fed.	128.2	3.75	767.3	35.90	273.4
	15 kg P ₂ O ₅ / fed.	132.3	3.96	823.0	37.56	307.0
	45 kg P ₂ O ₅ / fed.	136.1	4.11	882.9	42.66	375.6
Bio fertilizer	0 kg P ₂ O ₅ / fed.	128.0	3.78	775.3	36.15	278.7
	15 kg P ₂ O ₅ / fed.	133.7	3.98	824.1	39.04	319.8
	45 kg P ₂ O ₅ / fed.	138.5	4.19	897.4	44.98	401.1
LSD at 5%		N.S.	N.S.	N.S.	N.S.	N.S.
		season 2008-2009				
Without bio	0 kg P ₂ O ₅ / fed.	126.3	3.76	761.1	35.21	266.8
	15 kg P ₂ O ₅ / fed.	131.3	3.96	823.7	37.89	310.7
	45 kg P ₂ O ₅ / fed.	138.9	4.13	886.8	42.06	372.3
Bio fertilizer	0 kg P ₂ O ₅ / fed.	129.1	3.80	775.0	35.56	274.7
	15 kg P ₂ O ₅ / fed.	134.6	4.01	832.9	39.61	327.9
	45 kg P ₂ O ₅ / fed.	138.7	4.21	900.0	43.88	266.8
LSD at 5%		N.S.	N.S.	N.S.	N.S.	N.S.

NS = net significant

The interaction effect between N×P fertilization treatments on growth, yield and yield components of canola during the two seasons 2007 and 2008 was illustrated in Table (7). This interaction showed significant increases in 1000-seed weight, seed yield and oil yield in the two seasons.

On the other hand plant height and oil percentage were not significantly influenced by N×P interaction in the two seasons. However, oil %

was reduced steadily but not significantly by N x P interaction effect. Data also indicate that the highest values of seed yields (1050.6 and 1073 kg/fed.) were obtained by application of 90 kg N/fed. with 45 kg P₂O₅/fed. in the first and the second seasons respectively. Also, it is clear that increasing level of phosphorus fertilizer caused remarkable increases in oil percentage in canola seeds in the two seasons.

Table 7. Effect of the interaction between nitrogen and phosphorus fertilization treatments on yield and its components of canola during 2007-2008 and 2008-2009 growing seasons

Characters		Plant height (cm)	1000- seed weight (g)	Seed yield (kg/ fed.)	Oil in seeds(%)	Oil yield (kg/ fed.)
2007-2008 season						
30 kg N/ fed.	0 kg P ₂ O ₅ / fed.	115.4	3.30	623.1	37.24	232.0
	15 kg P ₂ O ₅ / fed.	124.2	3.43	704.7	40.19	283.2
	45 kg P ₂ O ₅ / fed.	126.2	3.61	739.0	45.10	333.3
60 kg N/ fed.	0 kg P ₂ O ₅ / fed.	129.2	3.92	761.4	37.04	282.0
	15 kg P ₂ O ₅ / fed.	134.1	4.18	783.3	38.70	303.1
	45 kg P ₂ O ₅ / fed.	140.6	4.38	880.8	44.70	393.7
90 kg N/ fed.	0 kg P ₂ O ₅ / fed.	139.6	4.08	929.4	33.80	314.1
	15 kg P ₂ O ₅ / fed.	140.8	4.31	982.7	36.01	353.9
	45 kg P ₂ O ₅ / fed.	145.0	4.46	1050.6	41.66	437.9
LSD at 5%		N.S.	0.05	23.44	N.S.	19.24
2008-2009 season						
30 kg N/ fed.	0 kg P ₂ O ₅ / fed.	113.4	3.34	627.5	36.37	228.3
	15 kg P ₂ O ₅ / fed.	124.8	3.43	702.8	40.36	283.6
	45 kg P ₂ O ₅ / fed.	129.4	3.63	741.5	42.90	318.1
60 kg N/ fed.	0 kg P ₂ O ₅ / fed.	131.0	3.90	758.9	35.72	271.1
	15 kg P ₂ O ₅ / fed.	134.5	4.19	795.1	38.99	310.0
	45 kg P ₂ O ₅ / fed.	139.5	4.38	865.8	44.48	385.1
90 kg N/ fed.	0 kg P ₂ O ₅ / fed.	138.7	4.11	917.7	34.08	312.9
	15 kg P ₂ O ₅ / fed.	139.6	4.33	987.0	36.89	364.2
	45 kg P ₂ O ₅ / fed.	147.6	4.48	1073.0	41.54	446.0
LSD at 5%		N.S.	0.07	24.86	N.S.	14.76

NS = Not significant

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تأثير التسميد الحيوي والنتروجيني والفوسفاتي علي النمو والمحصول ومكوناته في نبات الكانولا في الخارجة - الوادي الجديد

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الملخص

أجريت تجربتان حقليتان بالمزرعة البحثية بالخارجة التابعة لمركز بحوث الصحراء بمحافظة الوادي الجديد علي محصول الشلجم (الكانولا) لمدة موسمين متتاليين ٢٠٠٧/٢٠٠٨ ، ٢٠٠٨/٢٠٠٩ لدراسة تأثير كل من الأسمدة الحيوية والنتروجينية علي النمو والمحصول ومكوناته وكذلك محتوى البذور من الزيت وعناصر النتروجين والفوسفور والبوتاسيوم والحديد والمنجنيز والزنك استخدام مخلوط من بكتريا *Azotobacter, Bacillus megatherium* كسماد حيوي (تسميد بدون تسميد حيوي) أمنا معدلات التسميد النتروجيني كانت : ٣٠ ، ٦٠ ، ٩٠ كجم نتروجين/الفدان في حين مستويات التسميد الفوسفاتي صفر ، ١٥ ، ٤٥ كجم P_2O_5 / الفدان اتبع تصميم القطع المنشقة باستخدام ثلاث مكررات حيث وزع التسميد الحيوي في القطع الرئيسية والتسميد النتروجيني في القطع الفرعية والتسميد الفوسفاتي في القطع تحت الفرعية. أظهر التحليل الإحصائي للبيانات المتحصل عليها إن كلا من النسبة المئوية للزيت في بذور الكانولا وكذلك محصول الزيت (كجم / فدان) تأثر معنويا بمعاملات التسميد الحيوي في الموسم الأول في حين لم يكن هناك زيادة معنوية في ارتفاعات النباتات ، وزن اللب بذرة ومحصول البذور في الموسم الثاني.

أدي النتروجين إلي زيادة معنوية في جميع الصفات المدروسة. ادت إضافة السماد النتروجيني عند معدل ٩٠ كجم نتروجين/ للفدان إلي زيادة معنوية في وزن الألف بذرة بمعدل ٢٤% ، ٢٤ر٢% خلال الموسم الأول والثاني.

في المقابل زيادة معدل التسميد الفوسفاتي من صفر إلي ٤٥ كجم P_2O_5 / فدان أدي إلي زيادة معنوية في محصول البذور بمعدل ١٤ر٥% ، ١٦ر٣% في الموسم الأول والثاني علي التوالي.