YIELD RESPONSE OF TWO CANOLA VARIETIES TO NITROGEN AND BIO FERTILIZERS UNDER SANDY SOIL CONDITIONS

Abd El-Mottaleb, H. M.* and. Gomaa, A. M.**

* Agronomy Dept., Fac. Agric., Suez Canal Univ., Ismailia, Egypt.

** Microbiology Dept., Agric. Sec., NRC, Cairo, Egypt

(Received, November 28, 2004)

ABSTRACT

Two field experiments were carried out during 1999/2000 and 2000/2001 seasons at the Experimental Farm, Faculty of Agriculture, Suez Canal University, Ismailia Governorate, Egypt to study the effect of nitrogenous and bio fertilization on yield and yield components of two canola cultivars (Topas and AD 201). The results showed that AD 201 cv. surpassed Topas cv. in seed and oil yields/fed. The highest seed and oil yields were obtained by applying 50 kg N/fed. Inoculation with Pseudomonas or soil yeast (Rhodotorula) significantly increased number of branches /plant, 1000- seed weight, siliques yield/fed., seed yield/fed. and oil yield/fed. The highest values of increases were recorded owing to the combined application of Pseudomonas and Rhodotorula.

INTRODUCTION

In Egypt, the agricultural policy stresses hard to increase the cultivated area under oil crops as well as to maximize the production per unit area.

Canola (Brassica *napus*, L.) is a newly introduced crop to contribute in reducing oil shortage, especially it can be cultivated in the new reclaimed lands. To maximize canola productivity under newly sandy soil, it is essential to identify the promising varieties and determine the optimum nitrogenous level as well as the suitable biofertilizers that promote plant growth and improve yield quality.

Oilseed rape varieties significantly differ in growth characteristics, yield attributes and seed and oil yields per feddan (Noureldin *et al*., 1994 a and b; Hassan and El-Hakeem, 1996; Afiah *et al*., 1999; Said and Keshta, 1999; Ali and Hassan, 2002).

Increasing nitrogenous fertilization level significantly increased plant height (Kandil, 1981; Badr, 1987; Noureldin *et al*., 1993 a; Hassan and El-Hakeem, 1996; Said and Keshta, 1999; Sharief and Keshta, 2000; Ali and Hassan, 2002), number of branches/plant (Badr, 1987; Noureldin *et al*, 1994 a; Hammad and El-Shebiny, 1999; Said and Keshta, 1999; Sharief and Keshta, 2000; Ali and Hassan, 2002), number of pods/plant (Kandil, 1981; Noureldin *et al*, 1994 b; Ali and Hassan, 2002), 1000-seed weight (Noureldin *et al*, 1994 b; Hassan and El-Hakeem, 1996; Sharief and Keshta, 2000; Ali and Hassan, 2002), seed yield/plant and seed yield/fed. (Kandil, 1981; Noureldin *et al*, 1993 b + 1994 b; Hassan and El-Hakeem, 1996; Hammad and El-Shebiny, 1999; Said and Keshta, 1999; Ali and Hassan, 2002), oil yield/fed. (Noureldin *et al*, 1993 b + 1994 b; Said and Keshta, 1999; Sharief and Keshta, 2000; Ali and Hassan, 2002). On the other hand, increasing N level up to 60 kg/fed.did not influence seed oil content (Kandil, 1981) and up to 75 or 90 kg/fed.decreased seed oil content (Hassan and El-Hakeem, 1996; Sharief and Keshta, 2000).

It was found that the interaction between canola varieties and nitrogen levels had significant effect on seed and oil yields/fed.(Noureldin *et al*., 1994 b; Hassan and El-Hakeem, 1996; Afiah *et al*., 1999 and Sarief and Keshta, 2000). Moreover, Ali and Hassan, 2002 reported that rapeseed varieties x N levels had significant effect on number of branches/plant, number of pods/plant, seed yield/plant and seed yield/fed.

The application of biofertilizers had a great importance to lower the heavy use of chemical fertilizers that affect negatively on the environment and to get agricultural products of good quality safe for human consumption (Gomaa *et al*., 2002; Khattab and Gomaa, 2003).

Therefore, this work aimed to study the response of two canola varieties to biofertilization with *Pseudomonas aeruginosa* and/ or soil yeast (*Rhodotorula glutinis*) in the presence of two nitrogenous rates i.e., low rate (25 kg/fed) and the recommended rate (50 kg/fed.) under sandy soil conditions.

MATERIALS AND METHODS

Tow field experiments were carried out during 1999/2000 and 2000/2001 growing seasons at the Experimental Farm, Faculty of Agriculture, Suez Canal University, Ismailia, Egypt.

A split - split plot design with four replicates was used. The main plots contained two canola varieties, namely Topas and AD 201. The sub-plots included two nitrogenous fertilizer rates i.e. 25 and 50 kg N/fed. The sub - sub plots were assigned to four biofertilization treatments i.e., without biofertilizer, yeast (*Rhodotorula glutinis*), *Pseudomonas aeruginosa* and yeast + *Pseudomonas*. The experimental unit area was 10.5 m^2 consisted of five ridges 60 cm apart, and 3.5 m long.

Calcium super phosphate (15.5 % P_2O_5) at the rate of 100 kg/fed and, potassium sulfate (48 % K_2O)

at the rate of 50 kg/fed. were applied during soil preparation. Canola seeds were sown on one side of the ridges on November 7th and 18th in the first and second seasons, respectively. Plants were thinned after 21 days from sowing to secure two plants per hill. Hills were spaced 20 cm apart. within the ridge. Soil was inoculated with biofertilizers (*Pseudomonas*, yeast and *Pseudomonas* + yeast) directly after sowing. Liquid cultures of *Pseudomonas* (2.6 x 10^{7} cells/ml) and yeast (6.4 x 10^{5} CFU/ml) were used at the rate of 40 L/fed. Nitrogenous fertilizer was applied as ammonium nitrate (33.5%) at rates of 25 and 50 kg N/fed. Each nitrogen rate was applied in three equal doses after 21, 40 and 60 days from sowing. Mechanical and chemical analyses of the experimental soil in the two seasons are shown in Table (1).

Canola plants were harvested on April 24 th and May 8 th in the first and second seasons, respectively. At harvest, ten guarded plants were taken at random for each sub-sub plot and the following characters were determined: plant height (cm), number of branches/plant, number of siliques /plant, siliques yield /plant (g), seed yield /plant (g), hulling percentage (seed yield per feddan/siliques yield per /feddan X 100), 1000-seed weight and seed oil percentage. Oil seed content was estimated according to A.O.A.C. (1975) using Soxhelt apparatus and petroleum ether as a solvent, then the oil percentage was calculated on dry weight basis. Siliques and seed yields /fed. (kg) were recorded according to the yield taken from the two central ridges. Oil yield /fed was calculated by multiplying seed yield per feddan by seed oil percentage.

Data of the two seasons were subjected to the proper statistical analysis according to Gomez and Gomez (1984). L.S.D. at 5% level of significance was used for comparison between averages.

Table (1): Mechanical and chemical analyses of the experimental soil in 1999/2000 and 2000/2001seasons.

Soil properties	Seasons	
	1999/2000	2000/2001
	A- Mechanical analysis	
Coarse sand	63.4	78.1
Fine sand	27.3	14.6
Coarse + fine sand	90.7	92.7
Silt + clay	9.3	7.3
Soil texture	Sandy	Sandy
	B- Chemical analysis	
pH *	7.9	8.1
ECe (dSm $^{-1}$) **	3.5	5.5
Organic matter %	0.76	0.28
$CaCO_3$ %	4.0	4.5
N m eq/l	8.7	5.6
P m eq/l	14.1	15.3
Km eq/l	39.0	40.0

*In soil-water suspension 1: 2.5

**In soil saturation extract

RESULTS AND DISCUSSION

1. Growth characteristics:

Data given in Table (2) show that plant height and number of branches /plant were significantly affected by the three studied main factors i.e. varieties, N-levels and biofertilization treatments. The all-possible interactions among these factors were not significant, except plant height was affected significantly by cvs. x N levels and N levels x Biofertilizers interactions in the second season only and number of branches/plant that was affected significantly by cvs. x N levels and cvs. x Biofertilizers interactions in the first season.

Over N levels and biofertilization treatments, AD 201 cv. surpassed Topas cv. by 9.8 % and 6.4 % in plant height and by 16.4% and 6.3 % in number of branches/plant in the two seasons, respectively. This could be attributed to differences in the genetical constitution of the two varieties. The present results are in agreement with those of Noureldin *et al*, 1993 a + 1994 a ; Afiah *et al*, 1999 and Ali and Hassan, 2002.

Increasing N level from 25 to 50 kg N/fed. had significant favourable effect on both studied vegetative traits, where plant height increased by 4.3% and 15.4 % and number of branches/plant by 23.7 % and 25.6 % in the two seasons, respectively. Increasing nitrogenous fertilizer rate stimulated cell division and cell elongation, which in turn enhanced the vegetative growth of plants as expressed herein by plant height and number of branches/plant. These results are in agreement with those of Kandil, 1981; Badr, 1987; Noureldin *et al*, 1993 a + 1994 a; Said and Keshta, 1999; Sharief and Keshta, 2000 and Ali and Hassan, 2002.

Over varieties and N levels, the three biofertilization treatments i.e. *Pseudomonas*, yeast and *Pseudomonas* + yeast increased significantly plant height and number of branches/plant comparing with the untreated control, except the effect of *Pseudomonas* did not differ from control for plant height/plant in the first season. The highest values for both traits were recorded with the application of Pseudomonas + yeast followed by applying yeast followed by Pseudomonas. That held true in both seasons of experimentation. In this respect, Amany and Gomaa, 2002 stated that inoculation of tritical with soil yeast *Rhodotorula glutinis* and/ or *Azospirillum lipoferum* increased both growth and yield parameters.

2. Siliques and seed yields/plant:

Averages given in Table (2) indicate that AD 201 cv. surpassed Topas in number of siliques/plant by 15.9 % and 15.8 %, in siliques yield/plant by 8.1 % and 5.4 % and in seed yield/plant by 4.8 % and 9.0 % in the two seasons, respectively. The differences between the two cvs. were significant. This might be attributed to that AD 201 was more vigorous in its vegetative growth as expressed previously by plant height and number of branches/plant which might increase the number of fruits set on the plant as well as the number of seeds formed in siliquae and consequently the seed yield/plant. These results are confirmed by those of Noureldin *et al*., 1994 b; Hassan and El-Hakeem, 1996; Afiah *et al*., 1999 and Ali and Hassan, 2002.

Also, increasing N level from 25 to 50 kg N/fed. had significant favourable effects on reproductive growth of canola plants as applying of 50 kg N/fed. increased number of siliques/plant by 3.3 % and 12.4 %, siliques yield /plant by 13.0 % and 4.4 % and seed yield/plant by 13.2 % and 10.5 % comparing with 25 kg N /fed. in the two seasons, respectively (Table 2).This could be due to the important role of nitrogen as an essential nutrient in growth of canola plants and consequently its productivity. In this respect number of pods/plant and seed yield/plant were found to increase significantly with increasing N level up to 45 kg/fed.by Ali and Hassan, 2002, up to 60 kg/fed.by Kandil, 1981, and up to 75 kg N/fed. by Said and Keshta, 1999 and Sharief and Keshta, 2000.

Table (2) indicates also that biofertilization had positive significant effect on number and yield of siliques/plant and consequently on seed yield/plant. The highest values were recorded with applying *Pseudomonas* + yeast followed by yeast followed by *Pseudomonas* and the differences among the three treatments were significant. Comparing with the unbiofertilized control, increments in seed yield/plant attained in 1999/2000 season, 26.1 %, 16.5 % and 9.7 % and in 2000/2001 season, 24.1 %, 12.7 % and 6.3 % with applying *Pseudomonas* + yeast, yeast and *Pseudomonas*, respectively. This might be attributed to the plant growth promoting substances produced by these organisms (Gomaa, 1995).

All the possible interactions among the three studied factors did not have significant effects on number and yield of siliques/plant as well as seed yield/plant, except that in the first season, siliques yield/plant was affected significantly by cvs. x N levels and cvs. x biofertlizers interactions, while in the second season, the effects of N levels x biofertilizer on number of siliques/plant and cvs. x biofertilizer on seed yield/plant were significant (Table 2).

3.1000 seed weight:

1000-seed weight took nearly similar trend, whereas the three studied factors affected it significantly and the highest values were recorded in favour AD 201 cv., 50 kg N/fed.level and biofertilization with *Pseudomonas* + yeast. That held true in the two seasons (Table 3). These results are in general accordance with Afiah *et al*., 1999 and Ali and Hassan, 2002 regarding varietal differences and Hassan and El-Hakeem, 1996; Sharief and Keshta, 2000 and Ali and Hassan, 2002 concerning N fertilization.

Furthermore, the three studied factors affected 1000-seed weight independently as the interactions among them were insignificant (Table 3).

4. Hulling %:

Over N levels and biofertilization, Topas recorded higher hulling % compared with AD 201 but the difference between the two cvs., did not reach the level of significance (Table 3).

Increasing N level from 25 to 50 kg /fed had favourable positive effect on hulling %. This might due to that increasing N resulted more translocation of syntheses to fruits, which resulted increasing number of formed seeds and their size in the siliques.

On contrary, data in Table (3) show that application of biofertilizer decreased significantly hulling % and applying *Pseudomonas* + yeast gave the lowest hulling %. That was true in each season. Table (2) shows that application of biofertilizers increased evidently number of siliques/plant, which might increase the intra-competition among siliques resulting in decrease of their size, which could account much for the decrease in hulling %.

CVS. x biofertilizers in the first season and cvs. x N levels in the second season affected hulling % significantly, while all other interactions were insignificant.

5. Siliques and seed yields/fed:

Table (3) shows that AD 201 variety overyielded Topas and surpassed it in siliques yield/fed. by 274.1 and 103.6 kg (i.e. by 15.7 % and 5.4 %) and in seed yield/fed. by 82.7 and 43.9 kg (i.e. by 8.1 % and 5.0 %) in 1999/2000 and 2000/2001 seasons, respectively. AD 201 plants were more vigorous in vegetative growth as well as in siliques and seed yield per plant, which interpreted the superiority of this variety in siliques and seed yields/fed. comparing with Topas. Varietal differences in seed yield/unit area were reported also by Noureldin *et al.*, 1993 b + 1994 b; Hassan and El-Hakeem, 1996; Afiah *et al.*, 1999; Said and Keshta, 1999 and Ali and Hassan, 2002.

With applying 50 kg N/fed. siliques yield/fed. increased by 255.2 and 83.7 kg (*i.e.* by 14.5 % and 4.4 %) and seed yield/fed. by 177.5 and 96.2 kg (*i.e.* by 18.3 % and 11.4 %) comparing with applying 25 kg N/fed. in the two seasons, respectively. This could also be attributed to the favourable effects of the high N rate on growth and productivity of canola. In this respect, Noureldin *et al.*, 1993 b + 1994 b; Hassan and El-Hakeem, 1996; Hammad and El-Shebiny, 1999; Said and Keshta, 1999; Sharief and Keshta, 2000 and Ali and Hassan, 2002 stated that increasing N level significantly increased seed yield/fed.

Over varieties and N levels, biofertilization with *Pseudomonas*, yeast or *Pseudomonas* + yeast increased significantly siliques and seed yields/fed. compared to the untreated control. That was true in the two seasons. The highest values for both traits were detected with applying *Pseudomonas* + yeast, which resulted increments over control in siliques yield/fed. by 356.3 and 607.3 kg (i.e. by 20.9 % and 37.5 %) and in seed yield/fed. by 132.7 and 225.5 kg (i.e. by 13.3 % and 28.2 %) in the two seasons, respectively. Adding biofertilizers particularly *Pseudomonas* + yeast, as aforementioned, encouraged growth and branching of canola plants, which in turn increased number of siliques/plant as well as siliques and seed yields/plant and consequently their yields/fed.

All interactions among the three studied factors did not have significant effects on siliques yield/fed., except cvs. x biofertilization in the first season. Meanwhile, cvs. x N levels in both seasons and cvs. x biofertilization in the first season affected significantly seed yield/fed. Data in Table (4) show the averages of seed yield/fed. as affected by the interaction between canola cvs. and N levels in the two seasons. The highest yield was obtained from AD 201 cv. fertilized with 50 kg N while the lowest yield resulted from Topas cv. fertilized with 25 kg N/fed. and that was true in the two seasons. Moreover, AD 201 cv. overyielded significantly Topas under 25 and 50 kg N/fed in the first season as well as under 50 kg N/fed. in the second season, while under 25 kg N/fed. in the second season the difference between the two cvs. did not attain the statistical significance. However, both cvs. responded significantly to increasing N level from 25 to 50 kg /fed., regarding seed yield/fed. Significant interactions between canola varieties and N levels were mentioned also by Noureldin *et al.*, 1994 b; Afiah *et al.*, 1999; Sharief and Keshta, 2000 and Ali and Hassan, 2002.

6. Seed oil content (%):

Data in Table (3) indicate that oil contents (%) of AD 201 cv. seeds were significantly higher than those of Topas by 1.59 % and 2.0 % in 1999/2000 and 2000/2001 seasons, respectively. Significant differences in seed oil contents among oil seed rape varieties were found also by Afiah *et al.*, 1999 and Said and Keshta, 1999.

On the other hand, increasing N level from 25 to 50 kg/fed. reduced seed oil content but the differences between the two N levels attained the statistical significance in the first season only. It was aforementioned that increasing N level increased seed size as expressed by 1000 seed weight. This might was in favour protein and carbohydrates content rather than oil content. Hassan and El-Hakims, 1996 and Sharief and Keshta, 2000 came to similar conclusions regarding the negative effect of increased N level on seed oil content.

On contrary, application of biofertilizers had favorable significant effects on canola seed oil % comparing with the untreated control. *Pseudomonas* + yeast followed by yeast alone resulted the highest seed oil contents without significant differences between them. Both treatments surpassed significantly application of *Pseudomonas* in this respect. That was true in each season. These results are in harmony with those obtained by Youssef *et al.* 2004, where they stated that application of Biofertilizers (*Azospirillum* and/or *Azotobacter*) improved the essential oil content of sage.

All the possible interactions among the three studied factors did not affect seed oil % significantly, except cvs. x biofertilization treatments, which was significant in the two seasons. Table (5) indicates that in the two seasons, AD 201 seeds were significantly higher than those of Topas in oil content under all biofertilization treatments, except that the differences between the two cvs. were not significant in the untreated control in the first season as well as in the yeast treatment in the second season.

7. Oil yield (kg/fed.):

Averages given in Table (3) clear that over N levels and biofertilization treatments, AD 201 resulted significant higher oil yield/fed. than Topas by 54.2 kg (11.9 %) in 1999/2000 season and by 37 kg (9.7%) in 2000/2001 season. This was expected as AD 201 was superior in its seed yield and seed oil content. Varietal differences regarding oil yield per unit area were mentioned also by Noureldin *et al.*, 1993 b + 1994 b; Afiah *et al.*, 1999; Said and Keshta, 1999 and Ali and Hassan, 2002.

Also, increasing N level from 25 to 50 kg N /fed. increased significantly oil yield/fed. The increments attained 14.7 % in the first season and 10.6 % in the second season. Although, increasing N level to 50 kg/fed had negative effect on seed oil content, it increased seed yield/fed. to the extent it resulted oil yield higher than that obtained with applying 25 kg N/fed. Similar results were obtained by Noureldin *et al.*, 1993 b + 1994 b; Said and Keshta, 1999 and Sharief and Keshta, 2000.

Biofertilization treatments had also favorable significant effects on oil yield/fed., when compared with the untreated control and that was true in each season (Table 3). The highest increases were obtained with applying *Pseudomonas* + yeast, followed by yeast followed by *Pseudomonas*. This could be interpreted by the favorable effect of these biofertilizers on the resulted seed yield as well as seed oil content.

Varieties x N levels interaction significantly affected oil yield/fed. (Table 6). The highest oil yield was obtained from AD 201 cv. fertilized with 50 kg N/fed. (546.2 and 442.8 kg oil/fed. in the two seasons, respectively). These results are in harmony with those obtained by Afiah *et al.*, 1999 and Sharief and Keshta, 2000.

Table (2): Plant height, number of branches/plant, number of siliques/plant, yield /plant and seed yield /plant as affected by canola varieties, nitrogen levels and biofertilization treatments in 1999/2000 and 2000/2001 seasons.

Treatments	Plant height (cm)		No of branches/plant		No of siliques/plant		Siliques yield /plant (g)		Seed yield /plant (g)	
	1999/ 2000	2000/ 2001	1999/ 2000	2000/ 2001	1999/ 2000	2000/ 2001	1999/ 2000	2000/ 2001	1999/ 2000	2000/ 2001
Varieties (Var):										
AD 201	142.3	111.2	13.24	10.08	216.9	204.8	29.28	28.66	18.78	16.42
TOPAS	129.6	104.5	11.37	9.48	187.2	176.9	27.09	27.18	17.92	15.06
F-test	*	*	*	*	*	**	**	*	*	*
N- level (N):										
25 kg/fed	133.1	100.1	11.00	8.67	198.8	179.7	26.47	27.32	17.21	14.95
50 kg/fed	138.8	115.5	13.61	10.89	205.3	202.0	29.90	28.52	19.49	16.52
F-test	**	**	**	**	*	**	**	**	**	**
Biofertilizers (Bio):										
Without	133.0	90.4	10.33	8.22	185.9	164.9	25.44	23.16	16.23	14.21
Pseudomonas	135.0	102.6	12.22	9.77	196.4	179.5	27.27	27.25	17.80	15.10
Yeast	137.3	113.7	12.80	10.22	205.8	201.5	29.03	29.44	18.90	16.01
Pseudomonas + Yeast	138.6	124.5	13.88	10.92	220.2	217.5	31.00	31.84	20.47	17.63
F-test	**	**	**	**	**	**	**	**	**	**
L.S.D. at 5 %	2.1	3.0	0.50	0.48	6.2	3.7	0.85	0.67	0.73	0.48
Interactions										
Var * N	NS	**	**	NS	NS	NS	*	NS	NS	NS
Var * Bio	NS	NS	**	NS	NS	NS	**	NS	NS	*
N * Bio	NS	*	NS	NS	NS	**	NS	NS	NS	NS
Var * N*Bio	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table (3): 1000-seed weight, hulling %, siliques yield/fed, seed yield/fed, seed oil content, and oil yield/fed as affected by canola varieties, nitrogen levels and biofertilization treatments in 1999/2000 and 2000/2001 seasons.

Treatments	1000-seed weight (g)		Hulling %		siliques yield /fed (kg)		Seed yield /fed (kg)		Seed oil content (%)		Oil yield /fed (kg)	
	1999/ 2000	2000/ 2001	1999/ 2000	2000/ 2001	1999/ 2000	2000/ 2001	1999/ 2000	2000/ 2001	1999/ 2000	2000/ 2001	1999/ 2000	2000/ 2001
Varieties (Var):												
AD 201	3.56	3.18	56.39	45.93	2020.9	2006.5	1101.5	917.6	45.96	45.54	506.1	418.2
TOPAS	3.43	3.05	56.58	45.98	1746.8	1902.9	1018.7	873.7	44.37	43.50	452.1	381.2
F-test	*	*	NS	NS	**	*	**	NS	*	**	**	**
N- level (N):												
25 kg/fed	3.41	2.99	55.62	44.45	1756.2	1912.8	971.4	847.5	45.87	44.67	446.3	379.6
50 kg/fed	3.58	3.24	57.35	47.46	2011.4	1996.6	1148.8	943.7	44.46	44.37	511.9	419.8
F-test	*	**	**	**	**	**	**	**	**	NS	**	**
Biofertilizers (Bio):												
Without	3.13	2.95	58.72	49.20	1704.2	1621.5	1000.6	798.6	43.25	43.00	431.9	344.0
Pseudomonas	3.43	3.07	56.82	44.83	1830.4	1907.6	1037.9	855.1	44.50	44.08	461.6	376.9
Yeast	3.63	3.12	55.32	43.83	1940.2	2060.9	1068.6	904.6	46.16	45.16	493.5	408.7
Pseudomonas + Yeast	3.80	3.32	55.08	45.96	2060.5	2228.8	1133.3	1024.1	46.75	45.83	529.4	469.3
F-test	**	**	**	**	**	**	**	**	**	**	**	**
L.S.D. at 5 %	0.06	0.16	1.15	1.58	22.5	47.1	18.5	27.2	0.69	0.76	12.3	15.3
Interactions												
Var * N	NS	NS	NS	*	NS	NS	**	*	NS	NS	*	*
Var * Bio	NS	NS	**	NS	*	NS	*	NS	**	*	NS	NS
N * Bio	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Var * N*Bio	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table (4): Seed yield per feddan (kg) as affected by canola varieties x nitrogen levels interaction in 1999/2000 and 2000/2001 seasons.

Nitrogen level	Canola varieties			
	AD 201	Topas	AD 201	Topas
	1999/2000		2000/2001	
25 kg/fed.	997.6	945.1	861.2	833.8
50 kg/fed.	1205.3	1092.4	973.9	913.5
LSD at 5%	24.4		28.1	

Table (5): Seed oil content (%) as affected by canola varieties x biofertilizer treatments interaction in 1999/2000 and 2000/2001 seasons.

Biofertilizer treatments	Canola varieties			
	AD 201	Topas	AD 201	Topas
	1999/2000		2000/2001	
Without	43.16	43.33	44.66	41.33
Pseudomonas	45.50	43.50	45.33	42.83
Yeast	47.33	45.00	45.66	44.66
Pseudomonas + Yeast	47.83	45.66	46.50	45.16
LSD at 5%	0.98		1.08	

Table (6): Oil yield per feddan (kg) as affected by canola varieties x nitrogen levels interaction in 1999/2000 and 2000/2001 seasons.

Nitrogen level	Canola varieties			
	AD 201	Topas	AD 201	Topas
	1999/2000		2000/2001	
25 kg/fed.	466.1	426.5	393.8	365.5
50 kg/fed.	546.2	477.6	442.7	397.0
LSD at 5%	17.7		12.4	

References

Afiah, S.A.N.; H .A. Sallam and N.M. Mahrous (1999). Screening Canola (*Brassica napus* L.) varieties for yield and its attributes in relation to chemical constituents under saline conditions. Annals Agric. Sci., Ain -Shams Univ., Cairo, 44 (1): 227-246.

Ali, E. A. and A.E. Hassan (2002). Anatomical structure, chemical constituents, yield and yield components of two rapeseed (*Brassica napus* L.) cultivars as affected by nitrogen and potassium fertilization. Egypt. J. Appl. Sci; 17 (10): 176-197.

Amany, A. Bahr and Gomaa, A.M. (2002). The integrated system of bio- and organic fertilizers for improving growth and yield of tritical. Egypt. J. Appl. Sci, 17 (11): 512-523.

A.O.A.C.(1975). Official Methods of Analysis of the Association of Official Agricultural Chemists. 12 th Ed., Washington, D.C.

Badr, B. A.(1987). Effect of fertilization and spacing on rape production. M. Sci. Thesis, Fac. Agric., Alexandria Univ.

Gomaa, A.M.(1995). Response of certain vegetable crops to biofertilization. Ph. D. Thesis, Fac. Agric., Cairo Univ.

Gomaa, A.M; Bahr, Amany, A. and El-Kramany, M.F.(2002). The bio-organic farming and its effect on nodulation, growth and yield parameters of vetch (*Vicia sativa* L.). Egypt. J. Agron., 24:79-92.

Gomez, K.A. and A.A. Gomez (1984). Statistical Procedures for Agricultural Research. 2 nd Ed. John Willey and Sons. Inc. New York.

Hammad, K. M. and G.M. El-Shebiny (1999). Optimization of canola seed yield (*Brassica napus* L.) under calcareous soil conditions. J. Agric. Sci., Mansoura Univ.,24 (11):7071-7084.

Hassan, Kh. H. and M.S. El-Hakeem (1996).Response of some rapeseed cultivars to nitrogen rates and plant density under saline conditions at Siwa Oasis. Annals Agric. Sci., Ain -Shams Univ., Cairo,41(1): 229-242.

Kandil, A.A.(1981). Preliminary study on the effect of NPK fertilization on oil seed rape (*Brassica napus* L.) in Egypt. Res. Bull., No. 429, Fac. Agric., Zagazig Univ.

Khattab, M.E. and Gomaa, A.M. (2003). Growth parameters and yield quality of *Genovese basil* grown under organic farming system. Egypt. Pharmaceutical J., 2:150-169.

Noureldin, N.A.; M.S. El- Habbal; M.A. Hamada and M.A. Hamed (1993 a). Growth response of two rapeseed cultivars to irrigation intervals and nitrogen application under sandy soil conditions. Annals Agric. Sci., Ain -Shams Univ., Cairo, 38 (2): 499-509.

------------- (1993 b). Yield response of two rapeseed cultivars to irrigation intervals and nitrogen fertilizer under sandy soil conditions. Annals Agric. Sci., Ain-Shams Univ., Cairo, 38 (2): 511-519.

Noureldin, N.A.; M.S. El- Habbal; A.O. Osman and M. M. Badran (1994 a). Growth performance of two rapeseed varieties under irrigation and fertilization in saline soils. Annals Agric. Sci., Ain Shams Univ., Cairo, 39 (1): 191-209.

------------- (1994 b). Yield performance of two rapeseed varieties under irrigation and fertilization in saline soils. Annals Agric. Sci., Ain -Shams Univ., Cairo, 39 (1): 177-189.

Said, E.M. and M. M. Keshta (1999). Response of some canola cultivars (*Brassica napus*,L.) to different nitrogen fertilization levels. J. Agric. Sci., Mansoura Univ., 24 (4): 1689-1697.

Sharief, A.E. and M.M. Keshta (2000). Response of some canola cultivars (*Brassica napus*,L.) to different sources and levels of nitrogen fertilizer in soil affected by salinity. Zagazig J. Agric. Res., 27 (3): 603-616.

Youssef, A.A.; A. E. Edris and A.M. Gomaa (2004). A comparative study between some plant growth regulators and certain growth hormones producing microorganisms on growth and essential oil composition of *Salvia officinalis* L. plants. Annals Agric. Sci, Ain Shams Univ., Cairo,49:299-311.

الملخص العربى

استجابة محصول صنفين من الكانولا للسماد الأزوتى والحيوى تحت ظروف الأراضي الرملية

حسن محمد عبد المطلب * أبو بكر محمود جمعه **

*** قسم المحاصيل – كلية الزراعة بالإسماعيلية – جامعة قناة السويس**

**** قسم الميكروبيولوجى- شعبة الإنتاج الزراعي – المركز القومي للبحوث**

أقيمت تجربتان حقليتان خلال موسمي الزراعة ١٩٩٩/٢٠٠٠، ٢٠٠٠/٢٠٠١ بالمزرعة التجريبية بكلية الزراعة بالإسماعيلية وذلك لدراسة تأثير التسميد الأزوتي والحيوي على صنفين من الكانولا.

أوضحت النتائج تفوق الصنف AD201 على الصنف Topas فى محصولى البذور والزيت للفدان. ونتج أعلى محصول من البذور والزيت من إضافة ٥٠ وحدة أزوت/فدان. المعاملة ببكتريا *Pseudomonas* أو الخميرة *Rhodotorula* أعطت زيادة في عدد أفرع النبات، وزن ١٠٠٠ بذرة، محصول القرون والبذور والزيت /فدان. بينما أعطت المعاملة بكل من *Pseudomonas* + *Rhodotorula* أعلى زيادة معنوية لهذه الصفات.