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RESPONSE OF CANOLA TO SOME FERTILIZATION TREATMENTS UNDER SANDY SOIL CONDITIONS

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ABSTRACT: An experiment with split-split plot design was conducted in each season of 2001/2002 and 2002/2003 under sprinkler irrigation to study the effect of 2 compost rates (20 and 40 m^3/fed), 4 phosphorus fertilization treatments (0, 20, 40 kg P_2O_5/fed and 20 kg P_2O_5/fed + biofertilizer phosphorin) and foliar spray with urea (without or with) on yield and yield components of canola crop. At harvest, the following data were recorded: plant height, number of branches/plant, number of pods/plant, number of seeds/pod, weight of pods and seeds/plant, 1000-seed weight, seed oil content, and pod, seed and oil yields/fed. Regarding main factors, the highest values for the mentioned traits were recorded with applying 40 m^3 compost, 20 kg P_2O_5 + phosphorin as well as spray with urea. Meanwhile, and over the two seasons, applying 40 m^3 compost combined with 20 kg P_2O_5 + phosphorin resulted the highest pod yield (3495.5 kg/fed), seed yield (1734.2 kg/fed) and oil yield (852.9 kg/fed). Moreover, compost × urea, phosphorus fertilization × urea and compost × phosphorus fertilization × urea did not affect significantly seed and oil yields/fed.

Key words: Canola, organic matter (compost), phosphor, urea.

INTRODUCTION

In Egypt, canola (*Brassica nupas*, L.) is one of the newly introduced crops to contribute in reducing vegetable oil shortage; especially it can be cultivated in the new reclaimed land.

Organic, bio, mineral phosphorus and nitrogen fertilization are very important to maximize yield of canola under newly sandy soil conditions.

Using farm yard manure had favorable effect on the yield and yield components of oil crops [Salamah, (1989) and Ataallah, (1998) in peanut, Abou-Bakr and Omar, (1996) and El- Afendy *et al*,

(2000) in sunflower, El-karamity, (1998) in safflower, Keshta *et al*, (1999) in rapeseed and Abdel-Wahab *et al*, (1999) and Abdel-Moez, (2001) in soybean]. Moreover, organic matter is the most effective amendment in improving the physical properties of the soil and encouraging the bacterial activity (El- Afendy *et al*, 2000).

Also, application of mineral phosphorus positively affected yield and yield components of canola (Kandil, 1981; El-Baz, 1989; Abdel-Gawad *et al*, 1990; Attia *et al*, 1992; El-Emam, 1993; Noureldin *et al*, 1995 and Hammad and El-Shebiny, 1999). Moreover, application of bio-fertilizers has 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 and Khattab and Gomaa, 2003). Bio - phosphatic fertilizer (phosphate dissolving bacteria) is very important for increasing availability of phosphorus under Egyptian soil conditions which characterized with alkaline pH. Many investigators pronounced the positive effect of bio-phosphatic fertilization (Kabesh *et al*, 1989; Saber *et al*, 1989; El-Mandoh and Abdel-Magid, 1996; Bahr, 1997; El-Kalla *et al*, 1997; Abdel-Wahab *et al*, 1999 and Abdel-Mohsen *et al*, 2002).

Foliar spraying with urea is necessary to avoid the lost of nitrogen by leaching in sandy soils. Many researches stated beneficial effects of foliar nutrition with urea on growth, yield, its attributes and yield quality (Haggag *et al*, 1984; Yakout *et al*, 1985; Okaz *et al*, 1987; Abdel-Gawad *et al*, 1988; Selim, 1992; Hafiz, 1994; Salwau and Hassanein, 1994 and Hassanein *et al*, 1996).

Therefore, this work aimed to study the effect of organic, bio and phosphorus fertilization as well as foliar spray with urea on growth, yield attributes and yield of canola under sprinkler irrigation system on sandy soil conditions.

MATERIALS AND METHODS

Two field experiments were carried out during 2001/2002 and 2002/2003 growing seasons under sprinkler irrigation system at the Experimental Farm, Faculty of Agriculture, Suez Canal University, Ismailia. Total amount of water consumed throughout the growth season attained 2978 and 2936 m^3/fed in the two seasons, respectively.

In each season, a split - split plots design with four replicates was used. The main plots contained two compost treatments, the sub-plots included phosphorus fertilization treatments and the sub - sub plots were assigned to foliar spraying with urea. Each experiment included 16 treatments which were the combination of two levels of compost (20 and 40 m^3/fed), four treatments of phosphorus fertilization namely 0, 20, 40 kg P_2O_5/fed and 20 kg P_2O_5/fed + bio-fertilizer (Phosphorin) and foliar spraying with urea at a concentration of 1.5 % (with and without). The experimental unit area was 10 m^2 (5 rows 50 cm apart and 4 m long).

Seeds of canola Paktol variety were sown in hills 10 cm apart within the rows on 6 November and 28 October in the first and second seasons, respectively. Plants were thinned after 35 days from sowing to secure two plants per hill. Mineral phosphorus fertilizer as calcium super phosphate (15.5 % P_2 O_5) and compost were applied during soil preparation.. Seeds of canola coated with Arab gum and inoculated with Phosphorin [contains phosphate dissolving bacteria (*Bacillus megakherium* var. *phosphaticum*) as a commercial bio-fertilizer packet produced by Ministry of Agriculture in Egypt] immediately before sowing. Foliar spraying with 1.5 % urea was applied twice after 40 and 55 days from sowing with volume spray of 400 liter/fed. A basal dose of 30 kg N/fed of ammonium sulfate (20.6 % N) and 36 kg K_2O/fed of potassium sulfate (48 % K_2O) were added at two equal doses after 35 and 50 days from sowing. Soil of experiments was sandy texture with pH 7.89 and 7.76, organic matter 0.04 and 0.06 %, available nitrogen 3.15 and 3.34 ppm, available phosphorus 1.32 and 1.46 ppm and available potassium 9.75 and 10.66 ppm in the first and second seasons, respectively. Physical and chemical analyses of compost are shown in Table 1.

At harvest, after 165 days from sowing, samples of ten guarded plants were randomly taken from the inner rows in each sub – sub plot to estimate plant height (cm), number of branches/plant, number of pods/plant, number of seeds /pod, weight of pods /plant (g), weight of seeds /plant (g), 1000-seed weight (g) and seed oil content %. Oil seed content was estimated according to A.O.A.C. (1980) using Soxhelt apparatus and petroleum ether as a solvent, and then the oil percentage was calculated on dry weight basis. Pod and seed yields /fed (Kg) were determined from the two central rows of each sub- subplot and then calculated per feddan. Oil yield /fed was calculated by multiplying seed yield per feddan by seed oil percentage.

Table 1. Physical and chemical analysis of compost

Weight of 1 m^3	617 kg
Moisture	18.1 %
pH (1:2.5 ext.)	8.3
Ec ds/cm	9.86
Organic carbon	29.6 %
Organic matter	51.1 %
Total nitrogen	2.4 %
Carbon: nitrogen	12.3:1
Total phosphor	1.2 %
Total potassium	1.7 %
Available potassium	35 m eq /L
Sodium	52.5 m eq/L
Magnesium	2.1 m eq/L
Calcium	7.4 m eq/L
Humos	5
Exchangeable cation capacity	62.4 meq/100g compost

The analysis of variance of split-split plots design was used in each season and combined analysis of variance for the two seasons was undertaken according to Snedecor and Chocran (1981). Means followed by the same alphabetical letters are not statistically different according to Duncan's multiple range test at 5 % level of significance (Duncan, 1955).

RESULTS AND DISCUSSION

Effect of Organic Matter (compost) on:

-Yield components

Data in Table 2 show that increasing the rate of organic matter (compost) from 20 to 40 m^3/fed significantly increased plant height, number of branches /plant, number of pods /plant and number of seeds/pod. That was true in the two seasons and over them. The combined data indicate that the increases attained in plant height 13.5%, in number of branches /plant 44.1%, in number of pods/plant 74% and in number of seeds/pod 41.5 %. These results could be interpreted on the light of the favorable effects of the applied compost on the physical and chemical properties of soil. Compost contains ratio of macro and microelements, increases cations exchange capacity of soil and subsequently decreases the loss of nutrients by leaching, increases humus % which increases water holding capacity of sandy soil and decreases pH of soil and consequently increases availability of essential nutrients. Therefore, compost encouraged plant growth and yield components such as plant height, number of branches/plant, number of pods /plant and number of seeds/pod.

Also, Table 3 illustrate that both pod and seed weights per plant, 1000-seed weight and seed oil content (%) significantly increased by increasing the level of compost in each season and over them. Combined data revealed that pod weight/plant was increased by 76%, seed weight/plant by 83%, 1000-seed weight by 19.6 % and seed oil content (%) by 9.8 %. The favorable effect of compost on vegetative growth of plants as expressed by plant height, number of branches and pods/plant and number of seeds/pod, could interpret the increases in weight of pods and seeds/plant. These results are in a good line with those of Abou-Bakr and Omar, (1996) and El- Afendy *et al*, (2000) in sunflower, Ataallah, (1998) in peanut, El-karamity, (1998) in safflower, Keshta *et al*, (1999) in rapeseed and Abdel-Wahab *et al*, (1999) and Abdel-Moez, (2001) in soybean.

-Yield

The significant increases in yield components as expressed by plant height, number of branches/ plant, number of pods/plant, number of seeds/pod, pod weight/ plant, seed weight /plant, 1000-seed weight and seed oil content (%) as a result to the increase in the level of organic matter (Tables 2 and 3) resulted significant increases in pod, seed and oil yields/fed in each season and over the two seasons (Table 4). Over both seasons, pod yield/fed was increased by 1086.4 kg i.e. by 68.4%, seed yield/fed by 604.9 kg i.e. 83.3% and oil yield/fed by 318.5 kg i.e. by 100% over both seasons. These results are in a good agreement with those of Salamah, (1989) and Ataallah, (1998) in peanut, Abou-Bakr and Omar, (1996) and El- Afendy *et al*, (2000) in sunflower, El-karamity, (1998) in safflower and Keshta *et al*, (1999) in rapeseed.

Effect of Phosphorus and Bio Fertilization on:

-Yield components

It is clearly evident from data in Tables 2 and 3 that increasing phosphorus fertilizer level from 20 to 40 kg P_2O_5/fed significantly increased yield components as expressed by plant height, number of branches and pods/plant, number of seeds/pod, weight of pods and seeds/plant, 1000-seed weight and seed oil content (%) and both of the two phosphorus fertilizer levels surpassed the

Table 2. Plant height, number of branches and pods/plant and number of seeds/pod of canola as affected by compost, phosphorus and bio fertilization as well as spraying with urea in 2001/2002, 2002/2003 seasons and combined data

Treatments	Plant height (cm)			No. of branches/plant			No. of pods/plant			No. of seeds/pod		
	2001/02	2002/03	Combin.	2001/02	2002/03	Combin.	2001/02	2002/03	Combin.	2001/02	2002/03	Combin.
Compost (m^3/fed):												
20	116.1	135.4	125.8	7.1	10.1	8.6	127.6	128.0	127.8	17.8	15.4	16.6
40	129.9	155.7	142.8	10.8	14.1	12.4	213.5	231.9	222.6	22.1	24.9	23.5
F-test	*	*	*	*	*	*	*	*	*	*	*	*
P_2O_5 (Kg/fed) & Bio:												
0 (control)	117.5 d	135.7 d	126.6 d	7.5 d	10.0 d	8.7 d	135.4 d	142.2 d	138.8 c	18.0 d	15.9 d	17.0 c
20	120.3 c	142.6 c	131.5 c	8.1 c	11.5 c	9.8 c	157.9 c	160.3 c	158.9 bc	19.5 c	19.6 c	19.6 b
40	124.8 b	149.2 b	137.0 b	9.3 b	12.8 b	11.1 b	175.7 b	183.8 b	179.8 b	20.5 b	21.6 b	21.0 ab
20 + Phosphorin	129.3 a	154.8 a	142.1 a	10.8 a	14.1 a	12.5 a	213.3 a	233.4 a	223.4 a	21.7 a	23.5 a	22.6 a
F-test	ns	*	*	ns	*	*	*	*	*	*	*	*
Spray with urea:												
Without urea	122.0	143.3	132.7	8.6	11.7	10.2	164.5	174.2	169.2	19.5	19.5	19.5
Urea	124.0	147.9	135.9	9.2	12.5	10.9	176.7	185.7	181.2	20.3	20.9	20.6
F-test	*	*	*	*	*	*	*	*	*	*	*	*

Table 3. Pod weight/plant, seed weight/plant, 1000-seed weight and seed oil content of canola as affected by compost, phosphorus and bio fertilization as well as spraying with urea in 2001/2002, 2002/2003 seasons and combined data

Treatments	Pod weight /plant (g)			Seed weight /plant (g)			1000-seed weight (g)			Seed oil content (%)		
	2001/02	2002/03	Combin.	2001/02	2002/03	Combin.	2001/02	2002/03	Combin.	2001/02	2002/03	Combin.
Compost (m^3/fed)												
20	14.4	14.3	14.4	6.17	7.38	6.77	2.96	2.74	2.85	44.57	41.45	43.01
40	24.1	26.7	25.4	11.43	13.37	12.40	3.52	3.29	3.41	47.79	46.70	47.25
F-test	*	*	*	*	*	*	*	*	*	*	*	*
P_2O_5 (Kg/fed) & Bio :												
0 (control)	15.5 c	15.5 d	15.5 c	7.03 c	8.30 d	7.66 c	2.99 d	2.80 d	2.89 d	44.71 d	42.07 d	43.39 c
20	17.0 c	17.4 c	17.2 c	7.59 c	9.09 c	8.34 c	3.19 c	2.93 c	3.06 c	45.93 c	43.46 c	44.69 b
40	20.8 b	21.5 b	21.1 b	9.52 b	10.85 b	10.18 b	3.32 b	3.07 b	3.19 b	46.58 b	44.43 b	45.51 b
20 + Phosphorin	23.8 a	27.5 a	25.6 a	11.05 a	13.27 a	12.16 a	3.47 a	3.27 a	3.37 a	47.50 a	46.34 a	46.92 a
F-test	*	*	*	*	*	*	*	*	*	*	*	*
Spray with urea												
Without urea	18.7	19.3	19.0	8.51	9.90	9.20	3.20	2.96	3.08	45.90	43.72	44.81
Urea	19.8	21.6	20.7	9.09	10.85	9.97	3.28	3.07	3.18	46.46	44.43	45.45
F-test	ns	*	*	ns	*	*	ns	ns	*	*	*	*

control treatment. That was true over the two seasons for all studied yield components traits except that 20 kg P_2O_5/fed did not differ significantly from the control treatment regarding the effect on number and weight of pods/plant and seed weight/plant, while 20 kg P_2O_5/fed did not differ significantly with 40 kg P_2O_5/fed regarding the effect on number of pods/plant, number of seeds/ pod and seed oil content (%). The beneficial effect of phosphorus fertilization on growth and yield components of canola was expected since phosphorus is a constituent of nucleic acid (DNA and RNA), high energy storage compound ATP, stimulates cell division and metabolism process such as photosynthesis as well as enhances synthesis of protein, carbohydrates and lipids (Marschner, 1986). Moreover, phosphorus stimulates root growth which in turn increases efficiency of roots in absorbing nutrients from soil. Also, P increases accumulation of dry matter in plants as well as encourages translocation of metabolites synthesized. The positive effect of increasing phosphorus level on yield components of canola was found by El-Baz, (1989), Abdel-Gawad *et al*, (1990), Attia *et al*, (1992), El-Emam, (1993), Noureldin *et al*, (1995) and Hammad and El-Shebiny, (1999).

However, over the two seasons, application of bio-fertilizer (phosphorin) combined with adding 20 kg P_2O_5/fed recorded the highest values of all studied characteristics of yield components and surpassed significantly those recorded with applying 40 kg P_2O_5/fed, except number of seeds/pod whereas 20 kg P_2O_5 + phosphorin resulted insignificant increase over applying 40 kg P_2O_5 only. Bio-fertilizer phosphorin (phosphate dissolving bacteria) plays important role in converting the fixed form of phosphate to a soluble form ready for plant nutrition, which consequently enhances plant growth and yield components such as plant height, number of branches and pods /plant, number of seeds/pod, weight of pods and seeds/plant, 1000-seed weight and seed oil content. The positive significant effect of bio-fertilizer on yield components were reported by Kabesh *et al*, (1989), Abdel-Wahab *et al*, (1999) and Abdel-Mohsen *et al*, (2002) in soybean and El-Mandoh and Abdel-Magid, (1996) in sesame.

-Yield

Comparing with the control, the studied phosphorus fertilization treatments affected significantly the resulted pod, seed and oil yields/fed and the highest values of

Table 4: Pod, seed and oil yields/fed of canola as affected by compost, phosphorus and bio fertilization as well as spraying with urea in 2001/2002, 2002/2003 seasons and combined data

Treatments	Pod yield (Kg/fed)			Seed yield (Kg/fed)			Oil yield (Kg/fed)		
	2001/02	2002/03	Combin.	2001/02	2002/03	Combin.	2001/02	2002/03	Combin.
Compost (m^3/fed):									
20	1795.2	1378.0	1586.6	765.1	686.9	726.0	342.5	286.1	314.3
40	2993.6	2352.4	2673.0	1418.0	1243.7	1330.9	680.3	585.3	632.8
F-test	*	*	*	*	*	*	*	*	*
P_2O_5 (Kg/fed) & Bio:									
0 (control)	1932.0 c	1441.1 d	1686.6 c	872.4 c	772.0 d	822.2 c	394.9 c	330.0 d	362.4 d
20	2107.8 c	1616.8 c	1862.3 c	941.9 c	845.5 c	893.7 c	436.7 c	371.6 c	404.2 c
40	2585.9 b	1958.1 b	2272.0 b	1181.4 b	1009.1 b	1095.3 b	555.7 b	456.4 b	506.1 b
20 & Phosphorin	2951.9 a	2444.8 a	2698.4 a	1370.4 a	1234.8 a	1302.6 a	658.2 a	584.8 a	621.5 a
F-test	*	*	*	*	*	*	*	*	*
Spray with urea:									
Without urea	2323.7	1755.0	2039.3	1055.6	920.9	988.2	491.5	411.8	451.6
Urea	2465.2	1975.4	2220.3	1127.5	1009.8	1068.7	531.3	459.6	495.5
F-test	*	*	*	*	*	*	*	*	*

these traits were recorded with applying 20 kg P_2O_5 + biofertilizer followed by 40 kg P_2O_5 and then by 20 kg P_2O_5. That was true in each season and in combined data of the two seasons. However, over the two seasons, applying 20 kg P_2O_5 only did not differ significantly with the unfertilized control regarding the effect on pod and seed yields/fed. It is worthy to mention that the soil of experimental site was poor in its phosphorus contents (it contained available phosphorus 1.39 ppm in average of the two seasons), which might interpret the response of canola plants in the present study to phosphorus fertilization as expressed by the studied growth characteristics, yield components and pod, seed and oil yields/fed. Moreover, because the important role of biofertilizer phosphorin (phosphate dissolving bacteria) in increasing the availability of phosphorus, application of 20 kg P_2O_5 + phosphorin increased the efficiency of canola plants in utilizing phosphatic fertilizer which resulted more favorable effects on their growth and productivity. Positive effects of increasing phosphorus fertilizer level on pod, seed and oil yields of canola per feddan were reported by Kandil, (1981); El-Baz, (1989); Abdel-Gawad *et al*, (1990); Attia *et al*, (1992); El-Emam, (1993) and Noureldin *et al*, (1995). Moreover, several authers reported that application of bio-fertilizer significantly increased pod and seed yields / fed of soybean (Kabesh *et al*, 1989; Saber *et al*, 1989; Abdel-Wahab *et al*, 1999 and Abdel-Mohsen *et al*, 2002) and of sesame (El-Mandoh and Abdel-Magid, 1996).

Effect of Spray with Urea :

-Yield components

Data in Tables 2 and 3 show the positive effect of urea spraying on yield components of canola. Foliar spraying with urea significantly increased all studied yield components of canola as expressed by plant height, number of branches/plant, number pods /plant, number of seeds/pod, weight of pods and seeds /plant, 1000-seed weight and seed oil content compared with the untreated control and that was true over the two seasons. Foliar spraying of urea is readily absorbed by the foliage and not lost through decomposition or leaching from soil. Urea as a nitrogen source is characterized by high percentage of N, high water solubility and is less toxic to plants. Therefore, urea application enhanced plant growth and increased yield components of canola. Similar findings were reported by Haggag *et al*,(1984), Yakout *et al*, (1985), Okaz *et al*, (1987), Abdel-Gawad *et al*, (1988), Hafiz (1994), Salwau and Hassanein (1994) and Hassanein *et al*, (1996).

-Yield

Spraying urea significantly increased pod, seed and oil yields /fed (Table 4). That was true in each season and over the two seasons. Over the two seasons, the increases attained 8.9 %, 8.1 5 and 9.7 % in pod, seed and oil yields/ fed, respectively. These increases in pod and seed yields/ fed might be due to the increases in pod and seed yields/ plant. Moreover, the increase in oil yield /fed may be due to the increases of both seed yield/ fed and seed oil content. Similar results were obtained by Haggag *et al*,(1984), Yakout *et al*, (1985), Okaz *et al*, (1987), Abdel-Gawad *et al*, (1988), Hafiz (1994), Salwau and Hassanein (1994) and Hassanein *et al*, (1996).

Effect of Interactions

Table 5 illustrates all possibale interactions between the three factors of the experiment (compost, phosphorus and bio-ferilizer and spray of urea) in the first and second season as well as over the two seasons. Regarding the first order interaction, over the two seasons, compost levels × phosphorus fertilization treatments had significant effects on number of branches and pods/plant, seed weight/plant and pod, seed and oil yields/fed. Data in Table 6 show that the highest values for these traits were recorded with applying 40 m^3 compost combined with 20 kg P_2O_5 + phosphorin /fed, while the lowest values were obtained with applying 20 m^3 compost/fed only without phosphorous fertilization. Moreover, application of 40 m^3 compost/fed resulted significantly higher values for the mentioned traits compared with applying 20 m^3 compost/fed under all studied phosphorus fertilization treatments. Meanwhile, applying 20 kg P_2O_5 + phosphorin almost gave significantly higher values compared with the other phosphorus fertilization treatments under 40 m^3 compost, while under 20 m^3 compost, 20 kg P_2O_5 + phosphorin did not differ significantly with applying 40 kg P_2O_5/fed regarding the effect on pod, seed and oil yields/fed as well as with applying 40 or 20 P_2O_5/fed regarding number of branches / plant, number of pods/plant and seed weight/plant.

The interaction between compost levels and urea had significant effect on pod yield/fed only (combined data), where applying 40 m^3 compost/fed combined with urea spray resulted the highest pod yield/fed (2805.9

Table 5. Effect of all possibale interactions on yield components and yield of canola in 2001/2002, 2002/2003 seasons and combined data

Interactions	Plant height (cm)			No. of branches/plant			No. of pods/plant			No. of seeds/pod		
	2001/02	2002/03	Comb.	2001/02	2002/03	Comb.	2001/02	2002/03	Comb.	2001/02	2002/03	Comb.
Compost × Phosphor	NS	*	NS	*	*	*	*	*	*	NS	*	NS
Compost × Urea	NS	NS	NS	NS	*	NS	NS	*	NS	NS	NS	NS
Phosphor × Urea	NS	*	NS	*	NS	NS	*	NS	NS	NS	*	NS
Comp. × Phosph.× Urea	NS	*	NS	*	NS	NS	*	NS	NS	NS	*	NS
Interactions	Pod weight /plant (g)			Seed weight /plant (g)			1000-seed weight (g)			Seed oil content (%)		
	2001/02	2002/03	Comb.	2001/02	2002/03	Comb.	2001/02	2002/03	Comb.	2001/02	2002/03	Comb.
Compost × Phosphor	NS	*	NS	*	*	*	NS	*	NS	NS	NS	NS
Compost × Urea	*	*	NS	NS	*	NS	*	NS	NS	NS	*	NS
Phosphor × Urea	NS	*	NS	*	*	NS	*	NS	NS	NS	NS	NS
Comp. × Phosph. × Urea	*	*	NS	NS	*	NS	*	NS	NS	*	NS	*
Interactions	Pod yield(Kg/fed)			Seed yield(Kg/fed)			Oil yield(Kg/fed)					
	2001/02	2002/03	Comb.	2001/02	2002/03	Comb.	2001/02	2002/03	Comb.			
Compost × Phosphor	NS	*	*	*	*	*	*	*	*			
Compost × Urea	*	*	*	NS	*	NS	*	*	NS			
Phosphor × Urea	NS	*	NS	*	*	NS	*	*	NS			
Comp. × Phosph. × Urea	*	*	*	NS	*	NS	*	*	NS			

kg), while the lowest yield (1538.5 kg/fed) was obtained with applying 20 m^3 compost/fed without application of urea (Table 7). Under 40 m^3 compost/fed, spraying urea increased significantly the pod yield/fed, while under 20 m^3 compost/fed, this trait did not respond significantly to urea spray.

Table 6. Effect of compost × phosphorus and bio fertilization interaction on number of branches/plant, number of pods/plant and seed weight/plant as well as on pod, seed and oil yields of canola (combined data)

Compost (m^3/fed)	Phosphorus fertilization (Kg P_2O_5/fed)				Phosphorus fertilization (Kg P_2O_5/fed)			
	0	20	40	20 & phosphori	0	20	40	20 & phosphorin
	Number of branches/plant				Number of pods/plant			
20	7.0	8.4	9.2	9.9	104.2	121.1	135.7	150.2
40	10.4	11.3	13.0	15.1	173.4	196.6	223.8	296.6
LSD 5 %	1.6				32.7			
	Seed weight/plant (g)				Pod yield/fed (Kg)			
20	5.60	6.27	7.14	8.09	1269.6	1475.4	1700.1	1901.2
40	9.72	10.41	13.23	16.23	2103.56	2249.2	2843.94	3495.5
LSD 5 %	2.0				419.5			
	Seed yield/fed (Kg)				Oil yield/fed (Kg)			
20	598.4	667.9	766.7	871.1	246.7	286.0	334.3	390.1
40	1046.0	1119.5	1423.8	1734.2	478.1	522.4	677.8	852.9
LSD 5 %	173.0				96.6			

Table 7. Effect of compost × spraying with urea interaction on pod yield of canola (kg/ fed), combined data

Compost (m^3/fed)	Application of urea	
	Unsprayed	Sprayed
20	1538.5	1634.7
40	2540.2	2805.9
LSD 5 %	108.9	

REFERENCES

Abdel-Gawad, A.A., N.I. Ashour, A.O.M. Saad, A.M. Abo-Shetia and M.K.A. Ahmed. 1988. Effect of foliar fertilization of soybean (*Glycine max* L.) during the pod- filling stage on source and sink relationship. Ann. Agric. Sci., Fac. Agric., Ain Shams Univ. 33(1):231-247.

Abdel-Gawad,A.A.,A.El-Tabbakh, A. M. Abo-Shetaia and M.G. El-Baz. 1990. Effect of nitrogen, phosphorus and potassium fertilization on the yield and yield components of rape plant. Ann. Agric. Sci., Fac. Agric., Ain Shams Univ. 35(1):279-293.

Abdel-Moez,M.R. 2001. Response of nutrients uptake and yield of soybean plant to application of organic composts and foliar spray under two tillage methods. J. Agric. Sci. Mansoura Univ., 26(10): 6525-6535.

Abdel-Mohsen, M.I., M.S. Aly and A.M.A. Rizk. 2002. Response of soybean (*Glycine max* L.) to bio and mineral phosphate fertilization under different levels of soil moisture. J. Agric. Sci. Mansoura Univ., 27(10): 6523- 6532.

Abdel-Wahab,A.M., G.M. Yakout, E. A. Ali and M.H.Greish. 1999. Response of soybean crop to phosphatic fertilization, organic manuring and biofertilization under new reclaimed sandy soil conditions. Egypt. J. Appl. Sci., 14(8):125-138.

Abou-Bakr, M.A.and A.M.Omar. 1996. Contribution of municipal waste as organic fertilizer to sunflower production. Egypt. J. Soil Sci., 36(1/4): 69-82.

A.O.A.C. 1980. Association of Official Agricultural Chemists- Official methods of analysis. 13th Ed. Washington D.C.

Ataallah, S.A.A. 1998. Utilization of some soil amendments and bacterial inoculation to increase yield of two peanut cultivars in a newly reclaimed sandy soil. J. Agric. Sci. Mansoura Univ., 23 (10):4191-4200.

Attia, S.A.N., A.M. El-Saadani, A.O.M.Osman and S. Gh. Awad. 1992. Oilseed rape *Brassica napus* L. as affected by K.P.S. and different micronutrients in sandy soils. Zagazig J. Agric. Res., 19(5 B): 2371-2377.

Bahr, A.A.H. 1997. Response of chickpea crop to some fertilization treatments. Ph.D. Thesis, Fac. Agric., Suez Canal Univ.

Duncan, D.B. 1955. Multiple range and multiple F. test. Biometries 11, 1-42.

El-Afendy, h.T.,A.. bdelghany and M.G. El-Baz. 2000. Response of some sunflower (*Helianthus* *annus* L.) cultivars to organic matter and phosphorus fertilizers under saline conditions at South Sinai. J. Agric. Sci. Mansoura Univ., 25 (7):3793-3802.

El-Baz, M. G. M. 1989. The effect of nitrogen, phosphorus and potassium fertilization on seed and oil yield of rape plant. M. Sci. Thesis, Fac. Agric.Ain Shams Univ.

El-Emam, M.A.1993. Effect of some agricultural treatments on rapeseed (*Brassica napus* L.). Ph. D. Thesis, Fac. Agric., Al-Azhar Univ., Egypt.

El-Kalla, S.E., A.K. Mostafa, A.A. Leilah and R.A. Awad. 1997. Mineral and bio-phosphatic fertilization for intercropped faba bean and onion. Egypt. J. Agric. Res., 77(1):253-271.

El-Karamity, A.E. (1998).Effect of some soil amendments and plant density on productivity of safflower in newly reclaimed sandy calcareous soils. Ann. Agric. Sci. Moshtohor, 36 (1): 83-94.

El-Mandoh, M.E. and M.N. Abdel-Magid.1996. Response of some sesame genotypes (*Sesamum indicum* L.) to inoculation by different biofertilizers. Assiut J. Agric. Sci., 27(1):169-178.

Gomaa, A.M, Bahr, A.A. and M.F. El-Kramany. 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.

Hafiz,S.I. 1994. Studies on soybean productivity under Ismailia Governorate cond-itions. Ph.D. Thesis, Fac. Agric., Suez Canal Univ.

Haggag, M.E.A., A.M. Hassanein, A.M. Hagras and O.M.S. Herb. 1984. Effect of foliar nitrogen fertilization on yield and yield components of soybean. Ann. Agric.Sci. Moshtohor, 22 (1): 43-45.

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.

Hassanein, M.S., D.M. El-Hariri and M.A. Ahmed. 1996. Growth and yield responses of soybean cultivars to application methods for nitrogen and potassium fertilizers. Ann. Agric. Sci., Fac. Agric., Ain Shams Univ. 41(2):713-724.

Kabesh, M.O., T.A. Nour and M.S.M.Saber. 1989. Utilization of biofertilizers in increasing field crop production 5- Effect of some chemo- and/ or bio-additives on growth and yield characteristics of soybean plants. Bull. Egypt. Soc. Physiol. Sci., 9(4):13-24.

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.

Keshta, M.M., M.A. El-Hawary and M.A. Haekal. 1999. Effect of farmyard manure, bio and mineral phosphorus fertilizer on rapeseed under salt affected soil. Al-Azhar J. Agric. Res., 29 (1):15-24.

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

Marschner, H. 1986. Mineral nutrition of higher plants. Academic Press INC, USA, pp.269-369.

Noureldin,N.A.,M.H. El- Agroudy, A.O. Osman and M. M. Badran. 1995. Effect of phosphorus fertilizer and plant density on rapeseed productivity under sandy soil conditions. Ann. Agric. Sci., Ain Shams Univ., Cairo, 40 (1): 227-235.

Okaz, A.M., E.A. El-Ghareib and O.M.S. Herb. 1987. Response of soybean to foliar nitrogen and phosphorus fertilization. Ann. Agric. Sci. Moshtohor, 25(4):1891-1902.

Saber, M.S.M., F.K. El-Baz and M.O. Kabesh. 1989. Utilization of biofertilizers in increasing field crop production. 6-Effect of elemental sulphur application and / or biofertilizration on the chemical composition of soybean seed. Egypt. J. Agron., 14(1-2):241-252.

Salama, G.G.D. 1989. Effect of some sandy soil conditions on yield and its components of peanut (*Arachis hypogaea* L.). Minia J. Res.&Dev. 11:21-31.

Salwau, M.I.M. and M.S. El-S. Hassanein. 1994. Response of soybean to irrigation treatments and foliar nitrogen and potassium fertilization. Zagazig J. Agric. Res., 21 (3A) :707-717.

Selim, M.M. 1992. Effect of sowing methods and foliar nutrition with urea and some micronutrients on growth and yield of soybean (*Glycine max* L.). Egypt. J. Agron. 17 (1-2): 141-154.

Snedecor, G.W. and W.G.Cochran. 1981. Statistical Methods. 7th Ed. Iowa State Univ. Press. Ames Iowa . U.S.A.

Yakout, G.M., M.A. El-Ashry, A.A. Mohamed and S.I. Hafiz. 1985. The response of peanut to foliar nutrition with urea and certain microelements under Ismailia Governorate conditions. Ann. Agric. Sci. Moshtohor, 23(4):1543-1554.

استجابة محصول الكانولا لبعض المعاملات السمادية تحت ظروف الاراضى الرملية

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أجريت تجربتان حقليتان في موسمي ٢٠٠٢/٢٠٠١ ، ٢٠٠٣/٢٠٠٢ بمزرعة كلية الزراعة ـ جامعة قناة السويس بالإسماعيلية لدراسة استجابة محصول الكانولا ومكوناته للتسميد العضوي (٢٠ ، ٤٠ م٣ كمبوست/ فدان) ، والتسميد الفوسفاتي والحيوى (صفر ، ٢٠ كجم فو٢ أ٥ ، ٤٠ كجم فو٢ أ٥ ، ٢٠ كجم فو٢ أ٥ / فدان + المعاملة بالفوسفورين) ، وكذلك الرش الو رقى باليوريا و بدون يوريا على محصول الكانولا و مكوناته . عند الحصاد تم تسجيل القراءات التالية: ارتفاع النبات ، عدد الأفرع والقرون/نبات ، عدد البذور/ القرن ، وزن القرون والبذور/ نبات ، وزن ١٠٠٠ بذرة ، نسبة الزيت بالبذور (%) ، محصول الفدان من القرون والبذور والزيت . سجل المحصول ومكوناته أعلى القيم عند التسميد بمعدل ٤٠ م٣ كمبوست أو التسميد بمعدل ٢٠ كجم فو٢ أ٥ + المعاملة بالفوسفورين ، و كذلك عند الرش باليوريا مقارنة بالمعاملات السمادية الأخرى . عند التحليل التجميعي للموسمين سجلت أعلى القيم لكل من عدد الأفرع والقرون/نبات ، وزن البذور/نبات ، وكذلك أعلى إنتاجية للفدان من محصول القرون (٣٤٩٥,٥ كجم) والبذور (١٧٣٤,٢ كجم) والزيت (٨٥٢,٩ كجم) عند استخدام ٤٠ م٣ كمبوست + ٢٠ كجم فو٢ أ٥ + المعاملة بالفوسفورين . لم يتأثر محصولي البذور والزيت للفدان بالتفاعل بين الكمبوست × اليوريا ، معاملات التسميد الفوسفاتي × اليوريا ، الكمبوست × معاملات التسميد الفوسفاتي × اليوريا .