

## **RESPONSE OF CANOLA PLANTS TO HILL SPACING AND DIFFERENT LEVELS OF ORGANO-MINERAL FERTILIZERS UNDER DRIP IRRIGATION IN SANDY CALCAREOUS SOIL**

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**Abstract:** A field experiment was carried out during 2003/2004 and 2004/2005 seasons in El- Wadi El-Assiuty farm, Faculty of Agriculture, Assiut University to study the response of canola plants fertilized by tacamolia organo-mineral fertilizer (TOMF) combination with mineral nitrogen fertilizers ( 1.0 ton TOMF +80kgN, 2.0 ton TOMF +70kgN , 3.0 ton TOMF + 60 kg N, 4.0 ton TOMF + 50kgN and 5.0 ton TOMF + 40 kgN/ha). Control canola plants were fertilized with 90 kg N/ha mineral nitrogen without adding TOMF and three hill spacing (10, 20 and 30 cm) in sandy calcareous soil under drip irrigation system.

The obtained results indicated that TOMF at all tested rates significantly increased plant height, number of primary racemes/plant, number of siliques/plant, number of seeds/ siliqua,

1000-seed weight, seed yield / plant, seed oil percentage seed yield/ha as well as oil yield/ ha and water use efficiency compared with the control treatment with the superiority for the highest TOMF rate 5.0 ton +40kg N/ ha) which exhibited the upper most values of the previous traits. Seed oil percentage followed an opposite trend in the two seasons. Plants sowed at the widest space (30 cm) gained the highest values of the prementioned traits, except plant height in comparison with the other two hill spacing. The interaction between TOMF rates and hill spacing had a significant effect on the most tested traits in both seasons. The highest values of the previous traits were gained when canola plants were sowed at the widest space (30 cm) and fertilized with the highest TOMF rate (5.0ton TOMF +40kgN/ ha).

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**Key words:** sandy calcareous, drip irrigation, organo-mineral, hill spacing, canola.

### **Introduction**

Edible oil consumption in Egypt increased dramatically as a result of the over population growth. The local production amounted to be less than 15% of total consumption requirements. This reflects the size

of the problem and shows the need for horizontal and vertical expansion by increasing oil crops yield and area not on the account of the cultivated area in delta and valley which are now intensively cultivated, but through the desert area. Canola (*Brassica napus* L) is a

promising winter oil crop which produce a healthy edible oil, versatile and light. Canola oil is highly recommended by chefs, nutritionists and busy homemakers. It's low in saturated fat, rich in vitamin E and a good source of omega-3 fatty acids. Because of its light color and taste, canola oil performs equally well in cooking, baking, salads and marinades. Also canola meal is one of the most widely used protein sources in animal feeds. It has an excellent amino acid profile and rich in vitamins and essential minerals. It is palatable and non-toxic. A process has been patented to create a 90 per cent protein isolate that has excellent nutritional and functional characteristics for human consumption. Canola meal is also a high-quality organic fertilizer. Both soil fertility and productivity of field crops were increased by using filter mud cake and vinasse as by products of sugar cane industry (Ahmed,1997&2001; Attia 2001, El-Gharably 2002 and Ahmed and Osman (2003).Concerning hill spacing Ali (2002) found that serw 4 variety response to the wide spacing (15cm apart ) when compared with narrow one (10cm apart) in all studied traits, except plant height in the two growing seasons of study.

The aim of the present investigation was to study the effect of tacamolia organo- mineral fertilizer (TOMF) and different hill

spacing on canola yield and yield components as well as oil percentage and water use efficiency under drip irrigation system in sandy calcareous soils.

### **Materials and Methods**

This experiment was carried out during 2003 / 2004 and 2004/ 2005 seasons in the experimental farm of Faculty of Agriculture at El-wadi El-Assiuty, Assiut University, Assiut Governorate, Egypt. The study was planned to evaluate the response of canola (*Brassica napus* L.) plants variety Serw4 to various levels of tacamolia organo-mineral fertilizer (TOMF) and hill spacing, in split plot design with three replicates in sandy calcareous soil. The tacamolia organo – mineral fertilizer (TOMF) is a new fertilizer manufactured from sugar cane industry wastes (filter mud cake and vinasse at rate of 1:5 w/ w) supplemented with 50kg of each of potassium sulphate, calcium super phosphates and sulphur per ton of the dried mixture. Five levels of the combinations between tacamolia organo-mineral fertilizer (TOMF) and mineral nitrogen( 1.0 ton +80kgN, 2.0 ton+70kgN , 3.0 ton + 60 kg N, 4.0 ton + 50kgN and 5.0 ton + 40 kgN/ha) were arranged in main plots. TOMF were mixed with soil surface layer (0-15) before planting in each season. Three hill spacing (10, 20 and 30 cm) were arranged in the sub-plots. Control canola plants were fertilized with 90kg N/ha in a

form of Ammonium nitrate 33.5%. Mineral nitrogen fertilizer was divided into two equal doses, the first dose was applied at 8 leaves stage, while the second half was applied 30 days after the first nitrogen application. Each sub-plot area was 10.5 m<sup>2</sup> contains 7 rows, 3 m length and 50 cm apart. Canola seeds were hand sowed on 1<sup>st</sup> and 3<sup>rd</sup> of November in the first and second seasons, respectively. Drip irrigated for one hour day after day. The amount of irrigation water used covered the evapotranspiration

requirement of canola plants under the environmental condition of the experimental location i.e.4500 m<sup>3</sup> / ha (Ali, 2002). The other cultural practices needed for canola plants were done through the two growing seasons. Before planting representative soil samples were taken from the experimental site and analyzed according to the procedures of Jackson (1967). Some physical and chemical properties of (TOMF) and soil of the experimental site are shown in Table (1).

**Table(1):** Some physical and chemical properties of soil of the experimental site and some chemical properties of the TOMF.

Soil properties		TOMF properties	
Sand %	91.0	pH( 1: 1suspension)	6.55
Silt %	6.55	EC (1:1 extract) ds/m	6.51
Clay%	2.45	Organic matter %	63.18
Texture	sandy	C/N ratio	17.65
pH(1:1suspension)in water	8.1	N%	3.5
EC (1:1extract) ds/m	1.13	P%	2.0
Total CaCO <sub>3</sub> %	17.4	K%	2.12
Total N %	0.05		

each sub-plot area were threshed and weighted then transferred to seed yield in kg/ ha. Seed oil content was determined by Soxhlet apparatus using petroleum ether (40-60 c. b. p) as a solvent according to A.O. A. C. (199 5). Oil yield (kg / ha) was

At harvest, ten guarded plants from each sub-plot were taken to measure plant height (cm), number of primary racemes, number of siliquas/ plant, number of seeds/ siliqua, 1000- seed weight (g) and seed yield/ plant (g). All plants in

compared with untreated soils or increasing cation exchange capacity (CEC) of the treated soils (Abo-Arab, 1988) or the improvement of soil structure which reflected on water movement and decreasing nutrient losses by leaching and deep percolation (Metwally and Abdel-Bary, 1999; Abd-El-Moez *et al.* 1999 and Ahmed, 2001). Similar results were recorded by Ahmed & Osman (2003) and Ahmed & Ali (2005). The present results revealed also that plant height was significantly influenced by hill spacing in the two growing seasons. Increasing hill spacing from 10 to 30 cm decreased the height of plant significantly. The denser-sown plants had taller plants as compared to lower plant densities. These results may be due to the decrease in plant population per unit area increases light penetration within the plant canopy, which affect auxin balance within the plants and consequently reduced plant height. Number of primary racemes/plant and number of siliques / plant followed an opposite trend in both seasons. Similar trends were obtained by Keshta *et al.* (1993), Salera (1998), Ali (2002) and Allam *et al.* (2003).

The combination between the highest rate of TOMF ( 5.0 ton TOMF +40kgN/ha) and the widest hill spacing ( 30 cm ) gained the highest values for number of

calculated through multiplication oil percentage in seed yield/ha. Water use efficiency (WUE) was estimated by the formula described by Begg & Turner (1976), since,  $WUE = [(seed\ yield\ in\ kg/ha) / (evapotranspiration\ in\ m^3/ha)]$ . The obtained data were computed according to Gomez and Gomez (1984). Differences between means were compared by LSD at 5% level.

## Results and Discussion

### Growth traits

Illustrated data in Tables (2, 3 and 4) clearly showed that there are significant differences between the tested treatments in plant height, number of primary racemes/ plant and number of siliques / plant. Application of TOMF significantly increased plant height, number of primary racemes /plant and number of siliques / plant in both seasons compared with the untreated (control) plants. Application of 5.0 ton TOMF+40kgN /ha significantly increased plant height by 35.16 and 32.58% , number of primary racemes /plant by 66.10 and 68.06 % and number of silique/ plant by 53.02 and 58.82 % over the control in the 1<sup>st</sup> and 2<sup>nd</sup> seasons, respectively. According to Ahmed, 1997; El-Ghozoli, 1998; El-Emam, 1999; Hassanein, 1999 and Mohamed, 1999 this result may be due to the increasing in N, P and K uptake by canola plants mainly because high content of these nutrients in the tested fertilizer as

**Table(2):** Effect of Tacamolia Organo- Mineral fertilizer (TOMF) and hill spacing on plant height (cm) of canola plants in 2003/2004 and 2004/2005 seasons.

Seasons	2003/2004				2004/2005			
Hill spacing(cm) Fertilizers rates	10	20	30	Mean	10	20	30	Mean
0tonTOMF+90kgN/ha(control)	145.13	140.15	130.10	138.46	150.12	146.13	137.13	144.46
1 ton TOMF+80kgN/ha	152.40	146.13	140.12	146.22	160.12	152.13	143.14	151.79
2 ton TOMF +70kgN/ha	166.31	161.20	154.30	160.03	168.12	160.14	155.10	161.12
3 ton TOM+60kgN/ha	175.15	170.15	163.14	169.48	179.12	173.21	166.14	172.83
4 ton TOMF +50kgN/ha	183.14	176.20	171.13	176.82	185.20	180.14	173.12	179.49
5 ton TOMF +40kgN/ha	195.16	186.12	180.14	187.14	200.10	189.30	185.20	191.53
Mean	169.55	163.33	156.49	163.12	173.80	166.84	159.97	166.87
L.S.D.0.05 for fertilizer	3.16				4.00			
L.S.D.0.05 for spacing	4.10				3.74			
L.S.D.0.05 for interaction	6.05				5.18			

**Table(3):** Effect of Tacamolia Organo- Mineral fertilizer (TOMF) and hill spacing on number of primary racemes of canola plants in 2003/2004 and 2004/2005 seasons.

Seasons	2003/2004				2004/2005			
Hill spacing(cm) Fertilizers rates	10	20	30	Mean	10	20	30	Mean
0tonTOMF+90kgN/ha(control)	6.20	6.60	6.85	6.55	6.00	6.50	6.96	6.45
1 ton TOMF+80kgN/ha	6.48	6.90	7.12	6.83	6.50	7.00	7.65	7.05
2 ton TOMF +70kgN/ha	7.15	7.56	7.94	7.55	7.10	7.90	8.00	7.67
3 ton TOM+60kgN/ha	8.40	8.90	9.10	8.80	8.50	8.79	9.00	8.76
4 ton TOMF +50kgN/ha	9.50	10.00	11.02	10.17	9.45	10.12	10.95	10.17
5 ton TOMF +40kgN/ha	10.15	10.80	11.69	10.88	10.25	10.78	11.48	10.84
Mean	7.98	8.46	8.95	8.46	7.97	8.52	9.01	8.50
L.S.D.0.05 for fertilizer	0.10				0.15			
L.S.D.0.05 for spacing	0.20				0.18			
L.S.D.0.05 for interaction	0.40				0.36			

**Table(4):** Effect of Tacamolia Organo- Mineral fertilizer (TOMF) and hill spacing on number of siliquas / plant of canola plants in 2003/2004 and 2004/2005 seasons.

Seasons	2003/2004				2004/2005			
Hill spacing(cm) Fertilizers rates	10	20	30	Mean	10	20	30	Mean
0tonTOMF+90kgN/ha(control)	370.20	390.00	410.15	390.12	350.14	384.10	400.20	378.15
1 ton TOMF+80kgN/ha	400.10	425.20	460.10	428.47	410.20	421.10	440.15	423.82
2 ton TOMF +70kgN/ha	440.20	460.40	498.00	466.20	436.00	470.10	485.60	464.90
3 ton TOMF+60kgN/ha	480.30	500.10	560.00	513.47	470.10	495.10	545.20	503.47
4 ton TOMF +50kgN/ha	500.30	550.20	590.30	546.93	510.00	560.10	586.40	552.17
5 ton TOMF +40kgN/ha	550.20	590.40	650.30	596.97	540.10	601.20	660.40	600.57
Mean	456.88	486.08	528.14	490.37	452.76	488.62	519.66	487.01
L.S.D.0.05 for fertilizer	12.10				10.16			
L.S.D.0.05 for spacing	10.14				11.012			
L.S.D.0.05 for interaction	20.25				22.30			

nitrogen (3.7%) which increased synthetics rate and growth and reflect on seed number and size and consequently increased seed yield /plant(Ahmed, 1997& 2001; EL-Kafoury *et al.*, 1997; Johnston *et al.*, 2002; Santonoceto *et al.*, 2002 and Ahmed and Osman, 2003).

Hill spacing had a significant effect on the previous traits in the two growing seasons. Wide spacing (30cm) produced the highest values in this respect as compared to narrow spacing (10 and 20cm). This could be attributed to less competition on light, water and nutrients which contributed in raising carbohydrates synthesis for each plant in wide spacing.

primary racemes and siliuqas/ plant in two seasons. On the other hand, the tallest plants (195.16 and 200.10 cm in two seasons, respectively) were obtained from the highest rate of TOMF and the narrowest hill spacing.

#### Yield components traits

Data in Tables (5, 6 and 7) revealed that the number of seeds / siliqua, 1000-seed weight and seed yield/plant were reacted significantly to TOMF in both seasons of study. Results indicated that 5.0ton TOMF +40kgN/ha surpassed all studied treatments in this respect. This could be explained on the basis that TOMF contains high levels of nutrients especially

**Table(5):** Effect of Tacamolia Organo- Mineral fertilizer (TOMF) and hill spacing on number of seeds/ siliqua of canola plants in 2003/2004 and 2004/2005 seasons.

Seasons	2003/2004				2004/2005			
Hill spacing(cm) Fertilizers rates	10	20	30	Mean	10	20	30	Mean
0tonTOMF+90kgN/ha(control)	16.20	17.02	18.02	17.08	16.40	16.80	17.20	16.80
1 ton TOMF+80kgN/ha	17.10	18.00	18.50	17.87	17.60	18.20	18.40	18.07
2 ton TOMF +70kgN/ha	17.60	18.25	18.70	18.18	18.10	18.50	19.00	18.53
3 ton TOM+60kgN/ha	19.00	19.60	20.10	19.57	19.50	19.89	20.33	19.91
4 ton TOMF +50kgN/ha	21.20	22.00	23.10	22.10	20.70	21.20	22.40	21.43
5 ton TOMF +40kgN/ha	23.40	24.20	26.00	24.53	22.80	23.10	24.50	23.47
Mean	19.08	19.85	20.67	19.87	19.18	19.62	20.31	19.70
L.S.D.0.05 for fertilizer	0.60				0.30			
L.S.D.0.05 for spacing	0.50				0.60			
L.S.D.0.05 for interaction	NS				NS			

**Table(6):** Effect of Tacamolia Organo- Mineral fertilizer (TOMF) and hill spacing on 1000-seed weight (g) of canola plants in 2003/2004 and 2004/2005 seasons.

Seasons	2003/2004				2004/2005			
Hill spacing(cm) Fertilizers rates	10	20	30	Mean	10	20	30	Mean
0tonTOMF+90kgN/ha(control)	2.20	2.50	2.80	2.50	2.00	2.20	2.50	2.23
1 ton TOMF+80kgN/ha	2.60	2.86	3.00	2.82	2.52	2.75	2.94	2.74
2 ton TOMF +70kgN/ha	2.70	2.94	3.30	2.98	2.65	2.86	3.20	2.90
3 ton TOM+60kgN/ha	2.91	3.15	3.56	3.21	2.95	3.20	3.45	3.20
4 ton TOMF +50kgN/ha	3.20	3.45	3.91	3.52	3.10	3.36	3.85	3.44
5 ton TOMF +40kgN/ha	3.50	3.80	4.20	3.83	3.44	3.75	4.05	3.75
Mean	2.85	3.12	3.46	3.14	2.77	3.02	3.33	3.04
L.S.D.0.05 for fertilizer	0.05				0.03			
L.S.D.0.05 for spacing	0.06				0.04			
L.S.D.0.05 for interaction	NS				NS			

**Table(7):** Effect of Tacamolia Organo- Mineral fertilizer (TOMF) and hill spacing on seed yield / plant (g) of canola plants in 2003/2004 and 2004/2005 seasons.

Seasons	2003/2004				2004/2005			
Hill spacing(cm) Fertilizers rates	10	20	30	Mean	10	20	30	Mean
0tonTOMF+90kgN/ha(control)	17.30	17.90	18.10	17.77	16.50	17.10	17.80	17.13
1 ton TOMF+80kgN/ha	18.40	19.50	19.90	19.27	18.20	18.90	19.10	18.73
2 ton TOMF +70kgN/ha	20.20	21.40	22.50	21.37	20.00	20.90	21.60	20.33
3 ton TOM+60kgN/ha	21.30	23.00	24.30	22.87	21.60	22.80	24.10	22.83
4 ton TOMF +50kgN/ha	23.60	24.50	26.10	24.73	23.80	25.40	26.40	25.20
5 ton TOMF +40kgN/ha	25.30	27.00	31.00	27.77	24.90	26.80	28.90	26.87
Mean	21.02	22.22	23.65	22.97	20.83	21.98	22.98	21.93
L.S.D.0.05 for fertilizer	0.80				0.72			
L.S.D.0.05 for spacing	0.60				0.55			
L.S.D.0.05 for interaction	NS				Ns			

*et al.* , 2002; Santonoceto *et al*, 2002 and Ahmed and Osman, 2003. Wide spacing (30cm) surpassed the other tested spacing in this respect. This was quite expected, since the wide spacing produced the highest values of seed yield / plant. Similar trend was detected by Ali (2002).

The combination between the highest rate of TOMF and the widest hill spacing gave the highest values for yield and its components traits in the two seasons.

#### Seed oil percentage and oil yield

Data in Tables (9 and10) showed that TOMF had a significant effect on oil percentage and oil yield / ha in the two growing seasons. High

The obtained results are in the same line with that obtained by Ali (2002).

#### Seed yield in kg / ha

Data in Table (8) showed that canola seed yield in kg / ha was increased significantly due to all studied variables in both seasons. Application 5.0 ton TOMF+40kgN / ha of produced the highest values of seed yield / ha as compared with the others fertilizers treatments and control. This was expected since the same treatment gave the highest values of the studied yield components presented in (Tables 5,6 and 7).These results confirm those obtained by Ahmed, 1997&2001; EL- Kafoury *et al.*, 1997; Johnston





**Table(9):**Effect of Tacamolia Organo- Mineral fertilizer (TOMF) and hill spacing on seed oil % of canola plants in 2003/2004 and 2004/2005 seasons.

Seasons	2003/2004				2004/2005			
Hill spacing(cm)	10	20	30	Mean	10	20	30	Mean
Fertilizers rates								
0tonTOMF+90kgN/ha(control)	45.15	45.16	45.12	45.14	44.95	44.90	44.91	44.92
1 ton TOMF+80kgN/ha	44.17	44.20	44.18	44.18	44.50	44.60	44.56	44.56
2 ton TOMF +70kgN/ha	43.80	43.85	43.84	43.83	43.90	43.85	43.80	43.85
3 ton TOM+60kgN/ha	43.10	43.02	43.12	43.08	43.40	43.50	43.10	43.33
4 ton TOMF +50kgN/ha	42.82	42.83	42.80	42.82	42.75	42.35	42.40	42.50
5 ton TOMF +40kgN/ha	42.10	42.16	42.14	42.13	42.00	41.85	42.00	41.95
Mean	43.52	43.54	43.53	43.53	43.58	43.51	43.46	43.52
L.S.D.0.05 for fertilizer	0.03				0.04			
L.S.D.0.05 for spacing	NS				NS			
L.S.D.0.05 for interaction	NS				NS			

plants at wide spacing (30cm) and fertilizing with 5.0 ton TOMF + 40kgN/ ha led to produce the highest oil yield / ha .

#### Water use efficiency (WUE) in kg/m<sup>3</sup>

As shown in Table (11) the studied variables significantly affected water use efficiency in the two growing seasons. Application of 5.0 ton TOMF+40kgN/ha surpassed all the tested treatments in this respect, mainly because this treatment yielded the highest seed yield / ha compared with the others.

rates of TOMF reduced oil percentage and increased oil yield (Table 8). These results are in harmony with that obtained by Ali(2002).Wide hill spacing (30cm ) surpassed the other spacing in oil yield / ha, while oil percentage was insignificant affected by hill spacing in both seasons. This means that the obtained increase in oil yield/ha is mainly due to the high seed yield / ha produced under the wide spacing.

The interaction between TOMF and hill spacing affected significantly oil yield /ha, in the two growing seasons. Sowing canola



**Table(11):** Effect of Tacamolia Organo- Mineral fertilizer (TOMF) and hill spacing on water use efficiency (WUE) of canola plants in 2003/2004 and 2004/2005 seasons.

Seasons	2003/2004				2004/2005			
Hill spacing(cm)	10	20	30	Mean	10	20	30	Mean
Fertilizers rates								
0tonTOMF+90kgN/ha(control)	0.37	0.39	0.40	0.39	0.37	0.39	0.41	0.39
1 ton TOMF+80kgN/ha	0.42	0.45	0.47	0.45	0.43	0.46	0.49	0.46
2 ton TOMF +70kgN/ha	0.46	0.47	0.50	0.48	0.45	0.48	0.51	0.48
3 ton TOMF+60kgN/ha	0.48	0.53	0.58	0.53	0.48	0.51	0.57	0.52
4 ton TOMF +50kgN/ha	0.55	0.59	0.62	0.59	0.55	0.60	0.62	0.59
5 ton TOMF +40kgN/ha	0.63	0.66	0.68	0.66	0.62	0.65	0.67	0.65
Mean	0.49	0.52	0.54	0.52	0.48	0.52	0.55	0.52
L.S.D.0.05 for fertilizer	0.01				0.01			
L.S.D.0.05 for spacing	0.003				0.004			
L.S.D.0.05 for interaction	0.007				0.009			

TOMF+40kgN /ha under similar environmental conditions.

Hill spacing significantly affected water use efficiency in both seasons.

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Plant sown at the wide spacing (30cm) gave the highest values in this respect, since wide spacing produced the highest seed yield / ha.

The interaction between TOMF and hill space (30cm) and supplemented with 5.0 ton TOMF+40kgN/ha gained the highest water use efficiency in the tow growing seasons compared with the other tested treatments.

**Conclusion**

It could be recommended to sown canola plants at a wide space (30cm) and supply them with 5.0 ton

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## استجابة نباتات الكانولا للمسافة بين الجور و للتسميد بالسماد العضوي المعدني تحت نظام الري بالتنقيط في الاراضى الرملية الجيرية

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اجريت تجربة حقلية في مزرعة الوادي الاسيوطى-كلية الزراعة-جامعة أسيوط خلال موسمي ٢٠٠٣/٢٠٠٤ و ٢٠٠٤/٢٠٠٥ لدراسة استجابة نباتات الكانولا للتسميد بالسماد العضوي المعدني (١,٠ طن + ٨,٠ كجم ازوت و ٢,٠ طن + ٧,٠ كجم ازوت و ٣,٠ طن + ٦,٠ كجم ازوت و ٤,٠ طن + ٥,٠ كجم ازوت و ٥,٠ طن + ٤,٠ كجم ازوت / هكتاربالاضافة الى معاملة المقارنة والتي سمدت بى ٩٠ كجم ازوت معدنى بدون اضافة السماد العضوي) والمسافة بين الجور (١٠ و ٢٠ و ٣٠ سم) في الاراضى الرملية الجيرية تحت نظام الري بالتنقيط. وفيما يلي اهم النتائج:

- ادت كل معاملات السماد العضوي المعدني (TOMF) الى زيادة كلا من طول النبات ، عدد الافرع الاولية / نبات، عدد الخردال/ نبات، عدد البذور / خردله، وزن الالف بذره، وحاصل البذور والزيت للهكتار وكذلك كفاءة استخدام الماء بالمقارنة بمعاملة المقارنة، وقد حقق المعدل الاعلى للسماد (٥,٠ طن سماد عضوى + ٤,٠ كجم ازوت معدنى/هكتار) اعلى القيم فى هذا الصدد. فى حين اتخذت نسبة الزيت فى البذور اتجاها مضادا حيث قلت بزيادة معدل التسميد .
- حققت النباتات التي زرعت على مسافات واسعه بين الجور (٣٠ سم) اعلى القيم للصفات السابقة باستثناء طول النبات الذى قل بزيادة مسافة الزراعة.
- كان للتفاعل بين معاملات السماد TOMF والمسافة بين الجور تأثيرا معنويا على معظم الصفات محل الدراسة. حيث تحققت اعلى القيم للصفات محل الدراسة باستثناء طول النبات عند زراعة نباتات الكانولا على مسافى ٣٠ سم بين الجور وتسميدها بسماد TOMF بمعدل ٥,٠ طن سماد عضوى + ٤,٠ كجم ازوت معدنى للهكتار.