SEED PRODUCTIVITY AND SEED OIL CONTENT OF CANOLA (*BRASSICA NAPUS* L.) AS AFFECTED BY PLANT POPULATION DENSITY AND NITROGEN FERTILIZER RATES UNDER SOUTHERN EGYPT CONDITIONS.

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ABSTRACT

A field study was executed during 2006/2007 and 2007/2008 seasons on a sandy soil in the Experimental Farm of the Faculty of Agriculture, South Valley University at Qena Governorate, Egypt, to study the effect of four plant population densities, being P_1 (15 cm between hills, 1 plant/hill, 1 side of the ridge =46666 plants/fad.), P_2 (20 cm between hills, 2 plants/hill, 1 side of the ridge =70000 plants/fad.), P_3 (15 cm between hills, 1 plant/hill, both sides of the ridge =93333 plants/fad.) and P_4 (20 cm between hills, 2 plants/hill, both sides of the ridge =140000 plants/fad.), as well as four nitrogen fertilization levels (30, 45, 60 and 75 kg N/fad.) on productivity of canola Serw 4 variety.

The four plant population densities had a significant effect on all studied characteristics (plant height, number of racemes/plant, number of siliques /plant, 1000-seed weight, seed yield/plant and seed and oil yields/fad.). P_2 density of 70000 plants /fad. gave the greatest mean values of all above studied characteristics. Meanwhile, seed oil content was not affected by plant population density.

In addition, application of 60 or 75 kg N/fad. significantly increased all above mentioned traits, but significantly decreased seed oil content, compared to 30 and 45 kg N/fad.

The interaction between the two factors had a significant effect on the number of racemes/plant, seed yield/plant and seed and oil yields/fad. The highest values of such traits were obtained when canola planted at P_2 (20 cm between hills, 2 plants/hill, 1 side of the ridge =70000 plants/fad.) and fertilized with 60 kg N/fad.

Positive and significant correlation coefficients were found between oil yield and its contributing characteristics, except for oil %, which was insignificant. Crop equations were computed to predict seed yield/plant, seed oil content and seed and oil yields/fad that resulted from the independent variable nitrogen rates and that might enable the use of the results obtained from this study to be extrapolated to similar agro-climatic conditions.

So, planting at 20 cm between hills, 2 plants/hill, 1 side of the ridge (70000 plants/fad) and fertilization with 60 kg N/fad might be recommended for increasing the productivity of canola under the conditions of the study.

Key words: Canola, population density, nitrogen, oil content, oil yield, correlation.

INTRODUCTION

Canola (*Brassica napus* L.) is one of the important oil crops in the world, that ranked second after soybean, concerning seed and oil production from worldwide cultivated area (Anonymous, 2005). Recently, canola is considered a new oil seed crop in the newly reclaimed areas in Egypt because there is a great shortage in edible oils, and large amounts are imported annually from abroad. Canola, as a winter crop, can play an important role to partially cover or reduce this shortage. There is a growing need to understand the effects of plant population density and nitrogen fertilization rates on canola productivity and seed quality, especially in the newly reclaimed soils.

Plant population density is an important way for increasing canola production. Bassal *et al* (1998) found that plant height, number of branches per plant, 1000-seed weight, seed oil content, seed, oil and straw yields/fad. were higher with planting canola either on one side/ridge or in rows, 60 cm apart, and 20 cm between plants. Sharief and Keshta (2002) found that increasing plant population density from 8.3 or 10.9 to 16.6 plants /m^2 significantly increased number of branches/plant, seed yield/plant and seed and oil yields/ fad. While, the oil percentage was insignificantly affected by plant population density. Yousaf *et al* (2002) found that 10 cm between plants produced higher grain yield of canola, compared to other plant spacings (20 and 30 cm).

Nitrogen is one of the major inputs of canola seed and oil production. In this concern, Abdel-Gawad *et al* (1990) reported that the highest seed and oil yields were obtained from applying 60 kg N/fad. Also, increasing nitrogen levels resulted in marked increases in seed and oil yields and all yield components, except for seed oil content, which was markedly decreased as nitrogen rate increased (Leilah *et al*, 2003). Also, increasing nitrogen fertilization rate up to 40 kg N/fad. significantly increased yield components and seed and oil yields/fad. (El-Demrdash and Ali, 2005 and Abdel-Ati, 2006). El-Bably and Awad (2007) revealed that increasing N fertilizer rate from 15 to 60 kg N/fad. significantly increased plant height, number of racemes, 1000-seed weight, seed yield per plant and seed and oil yields /fad. Also, they found that increasing N rate significantly decreased the seed oil content. Oil content of canola seeds responded negatively to the increasing N levels (Jackson, 2000 and Ahmad *et al*, 2007).

Concerning the interaction, Hosseini *et al* (2006) reported that the highest seed yield was obtained with 190 plants m^2 with 138 kg N ha^{-1}. On the other side, the highest values of the yield attributes and seed and oil yields were gained when canola plants were sown at the widest space (30 cm) and fertilized with the highest TOMF rate at 5 tons TOMF + 40 kg N/ha (Ali, 2007). Mobasser *et al* (2008) revealed that

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application of 138 kg N ha^{-1} and plant density of 80 plants/ m^2 were recommended for obtaining the best plant attributes.

The present investigation aimed to study the effect of plant population density and nitrogen fertilization on agronomic characteristics, seed yield and seed oil content of canola.

MATERIALS AND METHODS

Two field experiments were carried out at the Experimental Farm of the Faculty of Agriculture, South Valley University at Qena Governorate, Egypt, during 2006/2007 and 2007/2008 winter seasons. Some mechanical and chemical properties of the experimental site are presented in Table 1.

Table 1: Some characteristics of soil of the experimental site.

Season	Clay (%)	Silt (%)	Sand (%)	Textural class	pH	E.C (dSm^{-1})	O.M (%)	Total N (%)	Available P (ppm)	Available K (ppm)
1st	3.5	7.0	89.5	Sandy	7.92	2.84	0.50	0.32	7.83	185
2nd	3.5	6.5	90.0	Sandy	8.01	2.87	0.48	0.31	7.52	181

The experimental treatments were as follows:

1- **Plant population density (P):** P_1= 15 cm between hills, 1 plant/hill, 1 side of the ridge (46666 plants/fad.), P_2 = 20 cm between hills, 2 plants/hill, 1 side of the ridge (70000 plants/fad.), P_3 = 15 cm between hills, 1 plant/hill, both sides of the ridge (93333 plants/fad.), P_4 = 20 cm between hills, 2 plants/hill, both sides of the ridge (140000 plants/fad.).

2-**Nitrogen fertilizer rates (N):** 30, 45, 60 and 75 kg N/fad.

The treatments were arranged as split plots in randomized complete blocks design, with three replications. Main plots were devoted to plant population densities, while, sub-plots were assigned to nitrogen levels.

Seeds of canola Serw 4 variety were sown on the 5th of November in both seasons. Nitrogen fertilizer, in the form of ammonium nitrate (33.5 % N), was added in four equal doses, at sowing and at 21, 42 and 63 days after sowing. Phosphorus and potassium fertilizers were applied, in forms of calcium superphosphate (15.5% P_2O_5) at the rate of 30 kg P_2O_5 /fad. and potassium sulphate (50% K_2O) for rate of 50 kg K_2O/fad at sowing. Other cultural practices, like irrigation and weeding, were carried out as recommended. The sub-plot size was 24 m^2 (8 ridges, 5 m long and 60 cm apart). The preceding crop was forage sorghum in the first and second seasons.

Canola plants were harvested on April 25th in both seasons. Ten guarded plants were randomly taken from each sub-plot to determine plant height (cm), number of racemes/plant, number of siliques /plant, 1000-seed weight (g) and seed yield/plant (g). Seed yield (kg/fad.) was determined from the six central ridges. Seed oil percentage was calculated by using the modified Soxhlet Apparatus and pure petroleum ether as a solvent, according to A.O.A.C. (1984). Oil yield (kg/fad.) was calculated by multiplying seed yield (kg/fad.) by seed oil content (%).

Data of each season were subjected to analysis of variance and the test of homogeneity of variance was done (Bartlett's test of homogeneity) and the combined analysis of both seasons was performed, as described by Gomez and Gomez (1984). The significant differences among the treatment means were judged with the help of Duncan's multiple range test (Duncan, 1955). In the interaction tables, the pooled data were only recorded, where capital and small letters were used for the comparison among row and columns means, respectively.

RESULTS AND DISCUSSION

1-Effect of plant population density:

Tables 2 and 3 show the effect of plant population density on seed yield and its attributes. Significant effect ,was found on all studied characteristics in both seasons and combined analysis of the two seasons. The P_2 of 70000 plants /fad (20 cm between hills, 2 plants/hill, 1 side of ridge) gave the largest height (cm), number of racemes/plant, number of siliques /plant, 1000-seed weight (g), seed yield/plant (g) and seed and oil yields/fad (kg). P_2 significantly increased seed yield by 29.3, 8.7 and 15.7% and oil yield by 25.7, 9.1 and 15.9%, compared to P_1 of 46666 plants /fad (15 cm between hills, 1 plant/hill, 1 side of ridge), P_3 of 93333 plants /fad (15 cm between hills, 1 plant/hill, both sides of ridge) and P_4 of 140000 plants /fad (20 cm between hills, 2 plants/hill, both sides of ridge), respectively, over both seasons. The superiority of P_2 might be explained by the most suitable distribution of canola plants over the soil surface, which resulted in an effective use of light and other growth factors, which increased the metabolites of canola plants. Analogous findings were documented by Bassal *et al* (1998) and Sharief and Keshta (2002). On the other hand, Yousaf *et al* (2002) found that plant spacing at 10 cm between plants produced higher grain yield of canola, compared to other plant spacings (20 and 30 cm).

Table 2: Mean values of plant height, number of racemes/plant, number of siliques /plant and 1000-seed weight of canola as affected by plant population densities and nitrogen rates in the two seasons and combined analysis.

Treatments	Plant height (cm)			Number of racemes/plant			Number of siliques /plant			1000-seed weight (g)		
	Season1	Season2	Comb.	Season1	Season2	Comb.	Season1	Season2	Comb.	Season1	Season2	Comb.
Planting density (P)•:												
P_1	146.0 c	139.0 c	142.5 c	12.58 a	12.00 a	12.29 a	325.8 a	313.0 a	318.3 a	2.825 c	2.642 c	2.733 c
P_2	160.8 a	156.5 a	158.6 a	12.29 a	11.99 a	12.14 a	325.1 a	313.3 a	319.2 a	3.233 a	3.033 a	3.133 a
P_3	153.8 b	147.2 b	150.5 b	10.88 b	10.28 b	10.58 b	315.3 b	302.6 b	309.0 b	3.058 b	2.867 b	2.963 b
P_4	153.7 b	145.3 b	149.5 b	10.53 b	9.80 b	10.17 b	315.2 b	301.5 b	308.0 b	3.042 b	2.842 b	2.942 b
F-test	**	**	**	**	*	**	*	*	*	**	**	**
Nitrogen rates (kg N /fad.):												
30	142.2 c	133.9 c	138.0 c	9.62 c	9.05 c	9.34 c	302.3 c	288.3 b	295.3 c	2.850 b	2.650 b	2.750 c
45	148.1 b	142.1 b	145.1 b	10.58 b	10.17 b	10.45 b	313.0 b	299.0 b	306.0 b	2.942 b	2.742 b	2.842 b
60	161.9 a	155.9 a	158.9 a	12.96 a	12.43 a	12.69 a	330.1 a	321.1 a	325.6 a	3.175 a	2.983 a	3.100 a
75	162.0 a	156.0 a	159.0 a	13.13 a	12.43 a	12.78 a	336.0 a	322.0 a	327.9 a	3.192 a	3.008 a	3.079 a
F-test	**	**	**	**	**	**	**	**	**	**	**	**
Interactions:												
P x N	NS	NS	NS	*	**	**	NS	NS	NS	NS	NS	NS
P x Season	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
N x Season	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
P x N x Season	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

•: Planting density (P): P_1= 15 cm between hills, 1 plant/hill, 1 side of the ridge (46666 plants/fad.), P_2 = 20 cm between hills, 2 plants /hill, 1 side of the ridge (70000 plant/fad.), P_3 = 15 cm between hills, 1 plant/hill, both sides of the ridge (93333 plants/fad.), P_4 = 20 cm between hills, 2 plants/hill, both sides of the ridge (140000 plants/fad.).

*,** Denotes significance at 0.05 and 0.01 probability levels, respectively - N.S : Indicates not significant.

Table 3: Mean values of seed yield/plant, seed yield/fad., seed oil content and oil yield/fad. of canola as affected by plant population densities and nitrogen rates in the two seasons and combined analysis.

Treatments	Seed yield/plant (g)			Seed yield/fad. (kg)			Seed oil content (%)			Oil yield/fad. (kg)		
	Season1	Season2	Comb.	Season1	Season2	Comb.	Season1	Season2	Comb.	Season1	Season2	Comb.
Planting density (P)•:												
P_1	30.50 a	28.67 a	29.58 a	871 d	803 d	837 d	45.13	44.85	44.99	395 c	368 d	382 d
P_2	30.67 a	28.73 a	29.70 a	1065 a	1038 a	1051 a	46.47	46.04	46.26	493 a	468 a	480 a
P_3	26.83 b	23.65 b	25.24 b	1011 b	955 b	983 b	45.63	45.94	45.79	455 b	424 b	440 b
P_4	26.92 b	23.50 b	25.21 b	950 c	867 c	908 c	45.47	45.21	45.34	431 b	397 c	414 c
F-test	*	**	**	**	**	**	N.S	N.S	N.S	**	**	**
Nitrogen rates (kg N /fad.):												
30	24.17 c	20.92 c	22.54 c	840 c	783 c	812 c	48.29 a	48.39 a	48.34 a	406 c	379 b	392 c
45	27.16 b	23.56 b	25.36 b	913 b	854 b	884 b	46.71 b	46.52 b	46.62 b	426 b	396 b	411 b
60	31.16 a	29.58 a	30.38 a	1075 a	1004 a	1040 a	43.99 c	43.72 c	43.86 c	474 a	439 a	456 a
75	32.42 a	30.48 a	31.45 a	1069 a	1020 a	1045 a	43.71 c	43.42 c	43.57 c	467 a	442 a	455 a
F-test	**	**	**	**	**	**	**	**	**	**	**	**
Interactions:												
P x N	*	*	*	*	**	**	NS	NS	NS	**	*	**
P x Season	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
N x Season	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
P x N x Season	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

•: Planting density (P): P_1= 15 cm between hills, 1 plant/hill, 1 side of the ridge (46666 plants/fad.), P_2 = 20 cm between hills, 2 plants /hill, 1 side of the ridge (70000 plants/fad.), P_3 = 15 cm between hills, 1 plant/hill, both sides of the ridge (93333 plants/fad.), P_4 = 20 cm between hills, 2 plants/hill, both sides of the ridge (140000 plants/fad.).

*, ** Denotes significance at 0.05 and 0.01 probability levels, respectively - N.S : Indicates not significant.

Data listed in Table 3 showed that seed oil content was not affected by population density in the first and second seasons and combined data. Similar results were reported by Sharief and Keshta (2002).

II-Effect of nitrogen fertilizer rates:

Results of Table 1 indicated that the soil fertility of the experimental site was poor due to the low content of organic matter and total nitrogen. So, the response of canola to the application of nitrogen was pronounced.

Data in Tables 2 and 3 revealed that nitrogen fertilizer rates had significant effects on all estimated characteristics, in both seasons. Increasing nitrogen fertilizer rate from 30 to 60 kg N/fad. significantly increased plant height, number of racemes/plant, number of siliques /plant, 1000-seed weight, seed yield/plant and seed and oil yields/fad. by 15.1, 35.9, 10.3, 12.7, 34.8, 28.1 and 16.3% , respectively, over the two seasons. However, the differences in all estimated characteristics with raising nitrogen level from 60 to 75 kg N/fad. were not significant at 5 % level of probability. These results could be attributed to the role of nitrogen, which enhanced plant growth. These results are similar to those obtained by Abdel-Gawad *et al* (1990), El-Demrdash and Ali (2005), Abdel-Ati (2006) and El-Bably and Awad (2007).

Seed oil content was significantly decreased as nitrogen fertilizer rate increased, but, insignificant effect to increasing nitrogen fertilizer rate from 60 to 75 kg N/fad. was found (Table 3). Over both seasons, seed oil content decreased from 48.34 to 46.62, 43.86 and 43.57 % with increasing nitrogen levels from 30 to 45, 60 and 75 kg N/fad., respectively. Several reasons have been given by different researchers for the decrease in oil content with increasing N rates. Kutcher *et al* (2005) stated that it might be due to the dilution effect of increased seed yield with increased N fertilization and the inverse relationship of protein and oil content. Jackson (2000) believed that N delayed plant maturity, which resulted in poor seed filling and greater proportion of green seed. Holmes (1980) reported that a better supply of N increased the formation of N containing protein precursors so that protein formation competed more strongly for photosynthates, as a result, less of the latter were available for fat synthesis. Likewise, Rathke *et al* (2005) linked this fact with reduced availability of carbohydrates for oil synthesis at high N application. The decrease in oil content of canola with the increasing levels of N was consistent with other reports (Ahmad *et al*, 2007).

III- Effect of interaction:

The interaction effect of plant population density x season, nitrogen fertilization x season and plant population density x nitrogen fertilization x season was not significant for all traits. Such results indicated that plant population density or nitrogen fertilization treatments showed similar effects from one season to another (Tables 2 and 3). The interaction between plant population density and nitrogen fertilizer rates had a significant effect on the number of racemes/plant, seed yield/plant and seed and oil yields/fad. in the first and second seasons, and over both seasons, as presented in Tables 2 and 3. Results in Table 4 indicated that the largest number of racemes/plant was obtained when N fertilizer was applied to P_1 at 60 or 75 kg N/fad. Data in Table 4 showed that increasing N level from 30 to 45, 60 and 75 kg N/fad. significantly increased seed yield /plant under all plant population densities. In addition, 60 and 75 kg N/fad. were insignificantly different under all plant population densities, except for P_4 and 75 kg N/fad., where 60 kg N/fad. was significantly superior in seed yield /plant. Also, data in Table 4 showed different response of plant densities to increasing N rates concerning seed yield/ fad. Increasing N level from 30 to 75 kg N/fad. increased seed yield by 42.9, 26.9, 27.3 and 20.7% for P_1, P_2, P_3 and P_4, respectively. Results in Table 4, also, showed similar trend for oil yield/ fad. The highest oil yield /fad. (521 kg) was obtained from planting canola at 70000 plants/fad. (20 cm between hills, 2 plants/hill, 1 side of the ridge) and fertilized with 60 kg N/fad. (Table 4). Several workers studied the interaction between plant density and nitrogen fertilization, such as Hosseini *et al* (2006), Ali (2007) and Mobasser *et al* (2008).

Table 4: Interaction between plant population densities and nitrogen rates on number of racemes /plant, seed yield/plant, seed yield/fad. and oil yield/fad. of canola, over both growing seasons.

Variables	Number of racemes/plant			
	Planting density*			
	P_1	P_2	P_3	P_4
Nitrogen rates (kg/fad.):				
30	10.33 A c (**)	10.52 A c	8.53 B c	7.97 C c
45	11.33 A b	11.52 A b	8.53 C c	10.43 B b
60	13.75 A a	13.35 A a	13.20 A a	10.47 B b
75	14.08 A a	13.19 A a	12.03 B b	11.80 B a
Nitrogen rates (kg/fad.):	Seed yield/plant (g)			
30	24.83 A c	23.42 AB c	20.92 B b	21.00 B c
45	29.17 A b	27.21 AB b	19.58 C b	25.50 B b
60	31.33 A ab	34.00 A a	30.83 A a	25.33 B b
75	33.00 AB a	34.17 A a	29.63 BC a	29.00 C a
Nitrogen rates (kg/fad.):	Seed yield/fad. (kg)			
30	659 C c	913 A c	862 ABb	812 B c
45	810 C b	980 A b	851 BC b	894 B b
60	937 B a	1153 A a	1120 A a	949 B a
75	942 C a	1159 A a	1097 B a	980 C a
Nitrogen rates (kg/fad.):	Oil yield/fad. (kg)			
30	317 C b	441 A b	414 AB b	396 B b
45	387 C a	454 A b	386 C b	418 B ab
60	409 C a	521 A a	489 B a	407 C ab
75	412 C a	504 A a	469 B a	433 C a

*: Planting density: P_1= 15 cm between hills, 1 plant/hill, 1 side of the ridge (46666 plants/fad.), P_2 = 20 cm between hills, 2 plants/hill, 1 side of the ridge (70000 plants/fad.), P_3 = 15 cm between hills, 1 plant/hill, both sides of the ridge (93333 plants/fad.), P4 = 20 cm between hills, 2 plants/hill, both sides of the ridge (140000 plants/fad.).

** Means followed by the same letters are not significantly different.

IV- Correlation and production equations:

Data of simple correlation coefficients between oil yield of canola and its contributing characteristics are presented in Table 5. It can be seen from such data that positive and highly significant correlation coefficients were found between oil yield/fad and plant height (0.699), number of racemes/plant (0.496), number of siliques /plant (0.434), 1000-seed weight (0.747), seed yield/plant (0.514) and seed yield/fad (0.922). On the other hand, oil percentage, on one hand, was negatively and highly significantly correlated with plant height (-0.499), number of racemes/plant (-0.504), number of siliques /plant (-0.530), 1000-seed weight (-0.433), seed yield/plant (-0.397) and seed yield/fad (-0.549), as well as, it had insignificant correlation with oil yield/fad. These results are in accordance with those obtained by Sharief and Keshta (2002) who found positive and significant correlation between oil yield/fad of canola and plant height and seed yield/fad.

Table 5: Simple correlation coefficients of oil yield/fad. as affected by oil yield attributes (data over both seasons and treatments)

Variables	7	6	5	4	3	2	1
Y: Oil yield/fad	-0.187	0.922**	0.514**	0.747**	0.434**	0.496**	0.699**
1-Pant height	-0.499**	0.783**	0.596**	0.752**	0.723**	0.515**	-
2- No. of racemes/plant	-0.504**	0.597**	0.763**	0.502**	0.652**	-	
3-No.of siliques /plant	-0.530**	0.578**	0.775**	0.563**	-		
4-1000-seed weight	-0.433**	0.805**	0.484**	-			
5- Seed yield/plant	-0.397**	0.592**	-				
6- Seed yield/fad	-0.549**	-					
7- Seed oil content	-						

**Significant at 0.01 level.

Data in Table 6 showed that a linear and positive relationship was obtained between the nitrogen rates and each of seed yield/plant (r =0.650), seed yield/fad (r =0.674) and oil yield/fad. (r =0.468). Equations in Table 6 indicated that each one kilogram of nitrogen applied further increased 0.212 g/plant, 5.705 kg/fad. and 1.550 kg/fad. of seed yield/plant, seed yield/fad and oil yield/fad, respectively. On the contrary, a negative and linear relationship was found between nitrogen rates and seed oil percentage (r =-0.706). Seed oil percentage decreased by 0.114 % with application of one kilogram of nitrogen.

Table 6: Regression equations, regression coefficients and correlation coefficients between oil yield and selected oil yield attributes (Y) and nitrogen fertilizer rates (X), data over both seasons.

Variables	Regression equation	Regression coefficient	Correlation coefficient
Seed yield/plant	$\hat{Y}$= 16.33 + 0.212 X	0.212	0.650 **
Seed yield/fad	$\hat{Y}$= 645.3 + 5.705 X	5.705	0.674 **
Seed oil content	$\hat{Y}$= 51.58 - 0.114 X	-0.114	-0.706 **
Oil yield/fad	$\hat{Y}$= 347.2 + 1.550 X	1.550	0.468 **

**Significant at 0.01 level.

Finally, it could be concluded that, under the conditions of this study, the highest oil yield of canola was produced by planting at 20 cm between hills, thinned to two plants /hill and planting on one side of the ridge, as well as application of N at the rate of 60 kg N/fad.

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الملخص العربى

تأثير الكثافة النباتية ومعدلات السماد النتروجينى على الانتاجية من البذور ونسبة الزيت لمحصول الكانولا تحت ظروف جنوب مصر

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تمت إقامة تجربتين حقليتين في موسمين شتويين (٢٠٠٦/٢٠٠٧و ٢٠٠٧/٢٠٠٨) في ارض رملية بمحطة التجارب بكلية الزراعة- جامعة جنوب الوادي بقنا – مصر لدراسة تأثير أربع كثافات زراعية (١- ١٥ سم بين الجور و نبات واحد بالجورة و الزراعة على جانب واحد من الخط وحققت هذه الكثافة ٤٦٦٦٦ نبات للفدان؛ ٢- ٢٠ سم بين الجور و نباتان بالجورة و الزراعة على جانب واحد من الخط وحققت هذه الكثافة ٧٠٠٠٠ نبات للفدان؛ ٣- ١٥ سم بين الجور و نبات واحد بالجورة و الزراعة على جانبي الخط وحققت هذه الكثافة ٩٣٣٣٣ نبات للفدان؛ ٤- ٢٠ سم بين الجور و نباتان بالجورة و الزراعة على جانبي الخط وحققت هذه الكثافة ١٤٠٠٠٠ نبات للفدان) و أربع معدلات سماد نيتروجيني (٣٠ و ٤٥ و ٦٠ و ٧٥ كجم نيتروجين للفدان) على الإنتاجية ونسبة الزيت لمحصول الكانولا الصنف "سرو ٤ ". و كان التصميم التجريبي المستخدم هو القطع المنشقة مرة واحدة في ثلاث مكررات حيث وزعت الكثافة النباتية عشوائيا بالقطع الرئيسية ومعدلات السماد النيتروجيني على القطع المنشقة.

وتتلخص أهم النتائج في الأتي:

- كان للكثافة النباتية تأثير معنوى على ارتفاع النبات و عدد الأفرع بالنبات و عدد الخرادل بالنبات ووزن الألف بذرة ومحصول النبات ومحصول البذور والزيت للفدان. وقد اعطت الزراعة على ٢٠ سم بين الجور و نباتين بالجورة و الزراعة على جانب واحد من الخط (٧٠٠٠٠ نبات للفدان) أعلى القيم لهذه الصفات. في حين أن نسبة الزيت لم تتأثر معنويا بهذه المعاملة.
- زادت كل الصفات المدروسة معنويا بزيادة معدلات السماد النتروجيني من ٣٠ إلى ٦٠ كجم نتروجين للفدان ماعدا نسبة الزيت التي قلت معنويا بزيادة هذه المعدلات.
- كان التفاعل بين الكثافة النباتية ومعدلات السماد النتروجيني معنويا على عدد الأفرع بالنبات ومحصول النبات ومحصول البذور والزيت للفدان. و قد حققت الكثافة النباتية ٢٠ سم بين الجور و نباتان بالجورة و الزراعة على جانب واحد من الخط (٧٠٠٠٠ نبات للفدان) مع التسميد بمعدل ٦٠ كجم نيتروجين للفدان أفضل القيم لهذه الصفات.
- بينت النتائج وجود علاقة ارتباط موجب بين محصول الزيت للفدان وكل الصفات المدروسة ماعدا نسبة الزيت، فكانت هذه العلاقة غير معنوية. كذلك تم حساب نموذج الارتداد للتنبؤ بكل من محصول النبات و نسبة الزيت ومحصول البذور والزيت للفدان التي نتجت من المتغير المستقل معدلات السماد النتروجيني .
- بناءا على النتائج المتحصل عليها وتحت ظروف هذه التجربة فأنه يمكن التوصية بزراعة الكانولا صنف "سرو ٤" على٢٠ سم بين الجوروالخف على نباتين بالجورة و الزراعة على جانب واحد من الخط (٧٠٠٠٠ نبات للفدان) مع التسميد بمعدل ٦٠ كجم نيتروجين للفدان والتي أعطت اعلي محصول زيت للفدان (٥٢١ كجم).