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RESPONSE OF SOME CANOLA VARIETIES TO DRILL SPACING AND NITROGEN FERTILIZER RATES

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ABSTRACT

Two field experiments were conducted at Al-Azhar Farm, Assiut Governorate in 2000/2001 and 2001/2002 seasons to study the effect of two drill spacing (50 and 70 cm) as well as four nitrogen fertilizer rates (30, 45, 60 and 90 kg N/fed) on growth and yield of two Canola varieties, i.e. Serw 4 and Pactol. The main results could be summarized as follows: varieties affected significantly on plant height, number of racemes/plant, number of siliqua/plant, 1000-seed weight, seed yield and oil yield/fed in favour of Serw 4 variety in the two growing seasons of study, while Pactol variety surpassed Serw 4 variety in oil percent trait. Increasing the distance between rows from 50 to 70 cm resulted a significant increase in number of racemes/plant, number of siliqua/plant, 1000-seed weight as well as seed and oil yields/fed in both seasons.

The results indicated that, all studied traits increased with increasing nitrogen levels up to 60 kg/fed. except oil percent which was response to the lowest dose. While plant height was response to the highest dose in both seasons.

INTRODUCTION

Total oil consumption in Egypt increased drastically as a result of overall population growth which exceeded 2.5 percent/year. Therefore, the consumption reached more than 1.100.000 MT by the year 2002. However, the local production did not exceed 150.000 MT. This means that percentage of production amounted to be less than 10% of the total consumption. This reflects the size of problem and show the need for increasing seed oil crops productivity by horizontal and vertical expansion by introducing new oil crops such as winter oil crop, Canola. Canola not rapeseed is an oil seed crop, which is growing primarily in regions of western Canada with some acreage being planted in the North and Southeast of United State. The seed contain about 40% oil. The remainder of the seed is processed into Canola meal with high protein to livestock feed. Nutrition experts recognize Canola oil as having the best fatty acid profile of any edible oil. It is characterized by less than 2% erucic acid and higher percent of oleic acid which has been shown to reduce serum cholesterol level (LDL). In addition it contains a moderate percent of the essential fatty acids such as linoleic and alpha-linolenic acid as stated by Canola Council of Canada (1998). The management of Canola in Egypt is scanty yet. Thus the present research is concerned with studying the response of some Canola varieties to drill spacing and nitrogen fertilizer rates. Oilseed rape varieties were differed significantly in seed yield and its components as mentioned by sexual invetigators such as Raihana *et al.* (2000), Sharief and Keshta (2000), Kandil *et al.* (2001) and Ali (2002).

In this respect Buttar and Aulakh (1999) and Rameshwar *et al.* (2000) indicated that seed yield/ha was decreased by increasing row spacing. On

the other hand, Hassan and El-Hakeem (1996) and Kolink and Zubal (1998) reported that seed yield/unit area was not affected significantly by plant density. Previous studies showed that Canola plants proved significant responses to different levels of applied nitrogen in terms of seed yield by unit area. Increasing N fertilizer level up to 60 kg N/unit area increased seed yield significantly as detected by Qayyum *et al.* (1999), Ahmed (2001). Also, Kandil *et al.* (2001) and Ali (2002) revealed that seed yield/fed. was increased significantly by increasing nitrogen fertilizer rate up to 48 kg N/fed.

MATERIALS AND METHODS

Two field experiments were carried out at Al-Azhar Farm, Assiut Governorate in 2000/2001 and 2001/2002 seasons, to study the response of two Canola varieties, i.e. Serw 4 and Pactol to drill spacing (50 and 70 cm) and nitrogen fertilizer rates (30, 45, 60 and 90 kg N/fed). Planting was done in hills spaced 20 cm apart within the seedlings were thinned to secure two plants hill before the first irrigation. Canola seeds cultivars was sowing on the 1st of October in both seasons, leaving two plants after thinning. A split-split plot design with three replications was used in both seasons. The sub-plot area was 3x3.5 m plot area 10.5 m^2. Canola varieties were randomly allocated to the main plots, while drill spacing to sub-plots and nitrogen rates in sub-sub-plots after sorghum. Nitrogen treatments were used in the form of ammonium nitrate. Nitrogen was applied in three equal doses, one before first irrigation then second and third doses were added before the second and third irrigation, respectively. The physical and chemical analysis of the soil site are presented in Table 1.

Table 1: Some physical and chemical properties of the clay soils used in the experiment.

Soil properties	
Particle size distribution	
Sand %	21.5
Silt %	29.5
Clay %	51.0
Texture	Clay
pH 1:1 (suspension)	7.4
E.C. (m mhos/cm)	1.37
$CaCO_3$ %	3.01%
N	0.081%
P	15.2 ppm
K^+	0.08%
Org. matter	1.40 %

A random sample of ten plants was taken at harvest time to determine the following traits:

1 - Plant height (cm).
2 - Number of racemes/plant.
3 - Number of siliqua/plant.
4 - Number of seeds/ siliqua .

5 - Seed index (g)
6 - Oil percentage in seeds: It was estimated using soxhlet apparatus and petroleum ether as solvent according to (A.O.A.C., 1995.)
7 - Seed yield/fed. The mature Canola plants for each plot were harvested, then threshed and seed yield was weighed in kg/plot and transferred into seed yield in kg/fed.
8 - Oil yield/fed. It was determined by the multiplication of oil percent by seed yield/fed.

The obtained data were statistically analyzed as described by Gomez and Gomez (1984). Means were compared by using L.S.D. at 5% level of significant.

RESULTS AND DISCUSSION

1- Effect of variety:

Data reported in Table 2 show that studied varieties affected significantly plant height, number of racemes/plant, number of siliqua/plant, number of seeds/ siliqua, seed index, seed yield in kg/fed and oil yield in kg/fed in favour of Serw 4 variety while the reverse was true with regard to oil percent. This is may be due to the genotypic behaviour in combination with the environmental condition which may be suitable for Serw 4 variety more than Pactol . These results are in harmony with those obtained by Sharief and Keshta (2000) and Kandil *et al.* (2001) and Ali (2002)

2- Effect of spacing between drill:

Data presented in Table 3 reveal that spacing between row affected significantly number of racemes/plant, number of siliqua/plant, number of seeds/ siliqua, seed index, seed yield/fed, oil percentage and oil yield/fed. in favour of wider spacing but plant height response to narrow one. This is to be expect since the narrow spacing may cause higher competition among Canola plants for light as well as nutrients and consequently plants tended to be directed towards the light. These results are in general harmony with those obtained by Singh *et al.* (1985), Hassan and El-Hakeem (1996) and Buttar and Aulakh (1999). On the other hand, Thakur (1999) reported that plant height was not affected significantly by spacing.

3- Effect of nitrogen fertilize rate:

Data illustrated in Table 4 revealed that nitrogen fertilizer affected significantly number of racemes/plant, number of siliqua/plant, number of seeds/ siliqua, seed index, seed yield/fed. and oil yield/fed. in favour of 60 kg N/fed. while the reverse was true with regard to oil percent which was response to the lowest dose of nitrogen applied. Moreover, plant height response to the highest dose of nitrogen applied. The present trend is due to the fact which proved that positive correlation is existed between nitrogen rate and amino acids which, in turn, increase protein content. This may be on the account of seed oil percentage. The same trend was detected by Dileep and

Arvind (1999), Brennan *et al.* (2000), Bali *et al.* (2000), Ahmed (2000), Cheema *et al.* (2001) and Ali (2002).

4- Effect of interactions:

The illustrated data in Table 5 indicate that the first order interaction of varieties x spacing proved to be significant. Serw 4 variety surpassed Pactol one, in the response to wider spacing for most traits studied. Also, the first order interaction of varieties x nitrogen rates was significant Table 6, where, Serw 4 variety surpassed Pactol in the response to 60 kg N/fed. in the all traits studied except plant height and oil percentage.

In addition the first order interaction of spacing x nitrogen rates seemed to be significant. Data presented in Table 7 explained that wider spacing surpassed narrow one in the rate of response to 60 kg N/fed. Here too, the second order interaction of varieties x spacing x nitrogen rates proved to be significant. Data reported in Table 8 denote that wider spacing enhanced the response of Serw 4 variety to 60 kg N/fed. as compared with narrow one in the most studied characters.

Table 2: Effect of varieties on yield & yield components of Canola (combined data).

Varieties	Plant height, cm.	No. of racemes/plant	No. of siliqua/ Plant	No. of seeds/ siliqua	Seed index gm	Oil %	Seed Yield Kg/fed	Oil yield Kg/fed
Serw 4	193.2	9.77	594.9	26.78	3.778	40.61	1546.3	627.9
Pactol	170.2	8.10	530.7	24.38	3.488	45.57	1231.2	561.0
F-test	**	**	**	**	**	**	**	**

Table 3: Effect of drill spacing on yield & yield components of Canola (combined data)

Drill spacing	Plant height, cm.	No. of racemes/plant	No. of siliqua/ Plant	No. of seeds/ siliqua	Seed index gm	Oil %	Seed yield Kg/fed	Oil yield Kg/fed
50 cm	190.5	8.27	498.0	24.86	2.905	42.65	1354.7	574.5
70 cm	173.0	9.61	627.6	26.29	3.361	43.53	1422.8	614.2
F-test	**	**	**	**	**	**	**	**

Table 4: Effect of nitrogen fertilizer rates on yield & yield components of Canola (combined data)

Nitrogen fertilizer rates	Plant height, cm.	No. of racemes/plant	No. of siliqua/ Plant	No. of seeds/ siliqua	Seed index gm	Oil %	Seed yield Kg/fed	Oil yield Kg/fed
30	168.9	7.83	442.3	24.98	2.949	44.39	1330.0	586.1
45	179.6	8.92	553.4	25.47	3.094	43.00	1385.8	592.8
60	186.6	9.86	654.8	26.42	3.245	42.56	1450.7	613.2
90	191.8	9.14	600.7	25.43	3.244	42.41	1388.4	585.3
F-test	**	**	**	**	**	**	**	**
LSD 5%	2.9	0.2	7.2	0.27	0.02	0.36	12	7.4

Table 5: Effect of the interaction between varieties and species on yield and yield components of Canola (combined data)

Varieties x Spacing		Plant height, cm.	No. of racemes/plant	No. of siliqua/ plant	No. of seeds/ siliqua	Seed Index (1000 seeds) gm	Oil %	Seed yield Kg/fed	Oil yield Kg/fed
Serw 4	50	180.5	10.58	665.1	28.05	3.791	40.51	1496.2	605.8
	70	206.0	8.97	524.8	25.50	3.186	40.71	1596.3	649.6
Pactol	50	165.5	8.64	590.1	24.53	2.932	44.79	1213.2	543.2
	70	174.9	7.56	471.2	24.22	2.623	46.35	1249.2	578.7
F-test		**	**	**	**	**	**	**	**
LSD 5%		3.0	0.20	4.5	0.35	0.040	0.37	13.4	14.2

Table 6: Effect of the interaction between varieties and nitrogen fertilizer levels on yield and yield components of Canola (combined data).

Varieties x Nitrogen fert. Kg		Plant height, cm.	No. of racemes/plant	No. of siliqua/ plant	No. of seeds/ siliqua	Seed Index (1000 seeds) gm	Oil %	Seed yield Kg/fed	Oil yield Kg/fed
	30	183.7	8.66	461.2	25.96	3.264	41.47	1473.6	610.7
Serw 4	45	190.4	9.87	582.8	26.64	3.435	40.72	1524.3	620.7
	60	198.2	10.75	698.6	27.93	3.599	40.29	1638.6	660.1
	90	200.6	9.81	637.1	26.58	3.655	39.96	1548.6	619.3
	30	154.0	7.00	423.5	24.00	2.633	47.32	1186.4	561.5
Pactol	45	168.8	7.96	524.0	24.31	2.752	45.28	1247.4	564.9
	60	175.0	8.98	611.0	24.91	2.890	44.83	1262.8	566.3
	90	183.1	8.47	564.2	24.29	2.834	44.86	1228.2	551.2
F-test		**	*	**	**	**	**	**	**
LSD 5%		4.0	0.28	10.2	0.38	0.027	0.51	16.9	10.5

Table 7: Effect of the interaction between species and nitrogen on yield and yield components of Canola (combined data).

Spacing x Nitrogen fert.kg		No. of siliqua/ plant	No. of seeds/ siliqua	Seed Index (1000 seeds) gm	Oil %	Seed yield Kg/fed	Oil yield Kg/fed
	30	420.0	24.26	2.794	44.44	1370.7	603.1
50	45	462.7	24.85	2.917	43.38	1427.0	615.2
	60	578.7	25.48	2.977	42.95	1477.3	628.8
	90	530.6	24.85	2.931	43.35	1416.1	609.5
	30	464.6	25.70	3.104	44.34	1289.3	569.1
70	45	644.1	26.09	3.270	42.62	1344.7	570.4
	60	730.9	27.36	3.513	42.17	1424.1	597.6
	90	670.7	26.02	3.558	41.47	1360.7	561.0
F-test		**	*	**	**	*	**

Table (8): Effect of the interaction between varieties, species and nitrogen fertilizer levels on yield & yield components of Canola (combined data).

Varieties x spacing x Nitrogen fert. Kg			Plant height, cm.	No. of racemes/plant	No. of siliqua / Plant	Seed Index (1000 seeds) gm	Oil %	Seed yield Kg/fed	Oil yield Kg/fed
		30	199.3	8.02	434.8	3.005	41.05	1545.3	587.3
	50	45	203.3	9.37	489.1	3.208	40.93	1575.6	596.6
		60	210.9	9.61	605.0	3.288	40.06	1675.1	649.2
Serw 4		90	210.5	8.87	570.1	3.241	40.79	1589.3	590.2
		30	168.2	9.30	487.5	3.523	41.89	1402.0	587.3
	70	45	177.6	10.37	676.6	3.663	40.50	1473.0	596.6
		60	185.5	11.88	792.2	3.910	40.53	1602.1	649.2
		90	190.7	10.76	704.2	4.068	39.14	1507.8	590.2
		30	157.6	6.13	405.2	2.582	47.84	1196.2	572.0
	50	45	172.7	7.33	436.2	2.627	45.82	1278.4	585.6
		60	179.7	8.65	552.3	2.665	45.85	1279.4	586.5
Pactol		90	189.7	8.15	491.2	2.620	45.91	1242.9	570.7
		30	150.4	7.88	441.7	2.685	46.80	1176.7	551.0
	70	45	164.9	8.60	611.7	2.877	44.74	1216.3	544.2
		60	170.3	9.31	669.7	3.116	43.81	1246.1	546.0
		90	176.5	8.79	637.3	3.048	43.81	1213.6	531.7
F-test			*	**	**	**	*	**	*
LSD 5%			5.7	0.40	14.5	0.04	0.720	24	14.8

V = Means varieties
S = Means spacing between drill
N = Means nitrogen fertilizer rates

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استجابة بعض أصناف الكانولا للمسافة بين السطور ومعدلات التسميد النيتروجينى

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اجريت تجربتان حقليتان فى مزرعة كلية الزراعة بجامعة الازهر فرع أسيوط خلال موسمى الزراعة ٢٠٠٠/٢٠٠١ و ٢٠٠١/٢٠٠٢ لدراسة تأثير المسافة بين السطور (٥٠ ، ٧٠ سم) والأصناف (سرو ٤ وباكتول) ومعدلات السماد النيتروجينى (٣٠ ، ٤٥ ، ٦٠ ، ٩٠ كجم / فدان) على نمو ومحصول الكانولا .

استخدم تصميم القطع المنشقة مرتين حيث وضعت الأصناف فى القطع الرئيسية والمسافات فى القطع الشقية الأولى والسماد النيتروجينى فى القطع تحت الشقيه .

وتتلخص أهم النتائج المتحصل عليها فيما يلى :

تفوق الصنف المحلى سرو ٤ على الصنف المستورد باكتول فى كل الصفات المدروسة والتى تتمثل فى طول النبات ، عدد الفروع / نبات ، عدد الخرادل / نبات ، وزن الألف بذرة ومحصولى البذور والزيت فى كلا موسمى الدراسة . كما تفوقت المسافة ٧٠ سم بين السطور فى كل الصفات المدروسة على المسافة ٥٠ سم ما عدا طول النبات . كما أدت إضافة السماد الازوتى حتى معدل ٦٠ كجم / فدان إلى زيادة كل الصفات المدروسة ما عدا نسبة الزيت التى استجابت للمستويات المنخفضة من التسميد الازوتى وصفة طول النبات فقد استجابت للمستوى المنخفض (٣٠ كجم / فدان) وأما صفة طول النبات فقد استجابت لمعدل التسميد العالى ٩٠ كجم / فدان .