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RESPONSES OF SOME CANOLA VARIETIES (*Brassica napus* L.) TO NITROGEN FERTILIZER LEVELS UNDER DIFFERENT SOWING DATES IN A NEW RECLAIMED SOIL

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ABSTRACT

The present study was carried out to investigate the influence of sowing dates and nitrogen fertilizer levels on yield of five canola varieties in a new reclaimed soil. The experiment took place at the experimental farm of the Environmental Studies and Research Institute, Minufiya University, Sadat City, Egypt, during 2007/2008 and 2008 /2009 seasons. Complete block design with spilt split plot with three replications was used. Where the main plots included four sowing dates (15 October, first November, 16 November, first December). The sub -plots contained three nitrogen fertilizer levels (30, 60 &90 Kg N/fed). The sub – sub plots were assigned to five canola varieties (Sedo, Duplo, Serw – 4, Pectol, Drakkar). The results indicated that, the first of November was the best sowing date, it gave the highest values of all the studied traits and the highest seed yield per plant (43.76 and 48.94 g)in both seasons. Best nitrogen fertilizer level was 90Kg N/fed. It scored the highest mean values (45.20 and 46.92g)of seed yield per plant. Serw-4 gave the highest seed yield (64.63 and 71.56g) in both seasons, respectively. Serw-4 had the best response for nitrogen fertilizer especially when planted at 1st November and gave the highest seed yield(87.97 and 99.98 g / plant) followed by Duplo variety(75.57 , 93.90 g)/ plant in both seasons, respectively. Sowing date at the first of November with 90Kg N per fed. were recommended for maximizing seed yield in new reclaimed soils with poor content of available nitrogen. Serw – 4 and Duplo were the best varieties under the conditions of this study.

***Key words*:** *Brassica napus, canola oil, nitrogen fertilizer, sowing dates.*

1. INTRODUCTION

Canola oil is considered one of the most important oil crops allover the world, ranking the third largest source of edible oil following soybean and palm oil (Francois, 1994). In Egypt, canola is a recent introduction, but has a bright future and hopefully to contribute in reducing edible oil deficiency, where the degree of self sufficient ratio in edible plant oils declined from 25.6 %in1980 to 12.3 % in 1996 (El-Tantawy and Soliman 1999).Growing canola in Egypt may become easier if it is grown in the less fertile and / or salt affected soils. Growing a crop in such soils may become successful if it could produce relatively high economic yield with low level of inputs mainly nitrogen fertilizer. Fertilization is an important vital factor affecting plant growth and the produced canola seed yield especially nitrogen fertilizer. Nitrogen is referred as a balance wheel of plant nutrition. Canola is extremely sensitive to nitrogen fertilizer, especially in the less fertile and / or salt affected soils. Also, nitrogen is one of the most important factors as a nutrient, which comprised about 50 % of the dry matter of protoplasm in canola cells and is one of the essential elements for proper growth and development of the plant (Sing, 1984). Increasing nitrogen fertilizer levels significantly increased seed yield and yield components. (Chauhan *et al.*,1993 ; Sarandon *et al.*,1993; Hassan and El Hakeem, 1996; Saini and sidhu, 1997; Patel , 1998; Said and Keshta 1999; Sharief and Keshta 2000 and 2002 ; Leilah *et al.*, 2003 &Asfour, 2006).

Sowing date is an important factor that determines the length of growing season as well as yield. Early sowing of canola delayed flowering and reduced reflection of radiation during flowering which were important factors leading to the highest yield achieved by late sowing. Jenkins and Leitch, 1986; Jasinska *et al.*, 1989 reported that seed yield /ha decreased with delay in sowing dates. Moreover, Leto *et al.*, 1995 found that the optimum sowing date on mid – November produced the highest seed yield / ha, compared to sowing on 31 October, 30November or mid

December. Starner *et al.,* 1996 reported that the optimum sowing dates for rape cv. Cascade was at late September or early October .Miralles *et al.,* 2001; stated that developmental patterns of canola were greatly affected by sowing dates. Sharief and Keshta (2002) stated that the best sowing dates for plant height , number of branches / plant as well as seed yield/plant were in the 5 th November. In Egypt late sowing dates of canola causes extensive damage by *Brevicoryne brassica* L , and serious losses of siliqua and seed yield . (Amany, 2009).

Therefore, this investigation is aimed to study the performance of some canola varieties under different nitrogen fertilizer levels and different sowing dates as well as their interaction in a new reclaimed soil as affected by salinity.

2. MATERIALS AND METHODES

The investigation was carried out during two winter successive seasons of 2007/2008 and 2008/2009 at the farm of the Environmental Studies and Research Institute, Minufiya University, Sadat city, to evaluate five of canola varieties under different levels of nitrogen fertilizer and different sowing dates. A split – split plot design with three replications was used . The main plots included four sowing dates (15 October, First November, 16 November, & first December). The sub Plots contained three nitrogen fertilizer levels (30 , 60 & 90 Kg N/fed.). The sub – sub plots were assigned to five canola varieties (Sedo, Duplo, Serw – 4, Pactol, Drakkar). The experimental unit included five ridges 70cm apart and 3.5 m long contributing a plot area of 12.25 m^2. The experimental soil was sandy loamy soil. The physical and chemical analysis of the experimental soil are shown in Table (1) The chemical analysis of the experimental soil was achieved according to Cottenie *et al.* (1982).

Nitrogen was applied in the form of ammonium nitrate (33.5 % N) as three portions, the first was 20% added at sowing date as reactive portion, the second portion was 40% added after 30 days from sowing and the third was 40% added at the flowering stage. Phosphorus as calcium super- phosphate (15.5 % P_2O_5), at a rate of 150 Kg /fed and potassium as potassium sulphate (48% K_2O) at a rate of 50 Kg /fed were applied during soil preparation . Canola seeds were hand sown on one side of the ridge as the usual dry method . Plants were thinned to one plant per hill, 25 cm between hills to insure 24,000 plants per Fadden. The number of days to 50% flowering, was calculated from sowing dates for each sub-sub plot. Also, plant height (cm), number of primary branches, number of siliqua per plant, number of seeds per siliqua, 1000 seeds weight, seed yield per plant and seed yield per Fadden were recorded at harvest on ten guarded plants taken at random from each sub-sub plot . Data of the two seasons were subjected to the proper statistical analysis as the technique of analysis of variance of split – split plot design as mentioned by Gomez and Gomez (1984). Treatment mean values were compared using least significant difference (L.S.D) tested at 0.05 level of probability.

3. RESULTS AND DISCUSSION

The analysis of variance in Table 2 indicated that there were high significant differences among all sowing dates in all studied traits in 2007/2008 and 2008/2009 season. This may be due to the variation in weather condition such as the length of light period for all sowing dates under study. Also, data showed that the nitrogen fertilizer levels had significantly effect on all studied traits in both season. Interaction between sowing dates and nitrogen fertilizer levels had significant effect in all the studied traits. Also, there were high significant differences among all varieties in all the studied traits in 2007/2008 and 2008/2009 seasons. This may be due to genetic background differences among all varieties under study. Interaction between sowing dates and varieties showed high significant effect on all the studied traits in both years. Interaction between nitrogen fertilizer levels and varieties showed high significant effect on all the studied traits in both seasons. Interaction among sowing dates, nitrogen fertilizer levels and varieties showed high significant effect on all the studied traits in both seasons.

Table (1): Some physical and chemical properties of the experimental field soil in the two seasons.

Season	Chemical properties		Available (mg/kg)			Physical properties			
	pH	Ec ds/m	N	P	K	Sand	Silt	Clay	Texture
2007/2008	7.41	1.78	11.80	5.86	32.4	72.78	19.34	7.88	Sand loamy
2008/2009	7.42	1.80	12.00	6.07	33.2	72.74	19.37	7.89	Sand loamy

Table (2) : Mean squares of ordinary analysis of sowing date, nitrogen fertilizer levels , and varieties and their interaction for all the studied traits in (2007/2008). and (2008/2009) season .

S.O.V	Days to 50% flowering	Plant height (cm)	No . of primary branches / Plant	No . of siliquas / plant	No . of seeds /siliqua	1000 seed weight (g)	Seed yield / plant (g)	Seed yield/ Fed (kg)
2007/2008 season								
Sowing Date(SD)	29.71**	136.884**	54.979**	109399.338**	6.694**	0.283**	841.856**	483902.382**
Error (a)	0.828	2.462	0.299	783.972	0.026	0.004	6.780	3700.684
Nitrogen (N)	94.21**	1162.685**	101.938**	503215.382**	6.218**	0.265**	3495.38**	2017147.47**
SD×N	12.54**	104.63**	1.428*	26112.755**	3.394**	0.111**	265.727**	156011.175**
Error (b)	0.71	2.848	0.536	678.164	0.022	0.006	4.143	2546.960
Varieties (V)	569.34**	1412.83**	137.644**	392777.690**	56.056**	5.818**	8732.002**	5033623.112**
SD×V	2.61**	21.879**	2.537**	1662.189*	1.123**	0.042**	43.107**	24731.047**
N×V	4.14**	50.379**	1.933**	2858.272**	1.446**	0.046**	123.029**	71346.758**
SD×N×V	5.07**	31.11**	2.382**	6189.746**	1.872**	0.064**	48.462**	27986.485**
Error (C)	0.576	2.939	0.363	791.889	0.033	0.008	5.166	3058.896
2008/2009 season								
Sowing Date(SD)	34.954**	432.216**	27.602**	280981.178**	12.723**	0.705**	2947.037**	1680232.423**
Error (a)	0.143	1.408	0.418	1119.137	0.05	0.006	11.777	10103.944
Nitrogen (N)	111.872**	562.045**	57.566**	301812.82**	12.152**	3.272**	4437.873**	2645108.095**
SD×N	5.198**	96.498**	7.063**	5718.567**	1.719**	0.042**	93.005**	55560.552**
Error (b)	0.117	6.604	0.124	533.481	0.051	0.010	6.156	4062.437
Varieties (V)	674.250**	1319.264**	107.486**	705499.44**	61.482**	5.462**	12741.684**	7391745.64**
SD×V	3.787**	27.277**	0.967**	12480.14**	1.455**	0.025*	188.376**	109658.895**
N×V	0.796**	29.965**	0.571**	4438.21**	0.509**	0.018ns	90.963**	50180.942**
SD×N×V	2.761**	40.240**	1.071**	7313.625**	1.205**	0.041**	49.825**	31362.277**
Error (C)	0.172	6.054	0.143	683.347	0.054	0.011	6.970	4889.324

* and ** Significant at 0.05 and 0.01 probability respectively and ns = not significant .

3.1. Effect of sowing dates

The results in Table(3) indicated that days to 50% flowering was increased from (81.53 , 81.42) for early sowing at 15 October to (83.27 , 83.16) for late sowing on 1st December in the two successive seasons. Also, the results in Table (3) revealed that sowing on Nov 1st showed the greatest value for seed yield / fedden (1050.13& 1175.40Kg) in the two successive seasons . This was attributed to the highest seed yield per plant (43.76 & 48.94 g), as well as the highest values for yield components, *i.e.*, No. of primary branches per plant, No. of Siliqua /plant, seeds/siliquas and 1000 seed weight. The results also cleared that early sowing on Oct.16 produced the least seed yield / fedden and per plant as well as the least values for plant seed yield and its components, followed by the latest sowing. However, sowing on Nov.16 ranked 2nd followed by sowing on Dec.1st .

Generally, these data proved that ,the planting at 1st November was the best for seed yield and its contributes. However the early and late sowing dates recorded a significant reduction in aforementioned characters. This may be attributed to weather conditions during the reproductive stage of the late sowing date which was very warm resulting in a reduction in number of primary branches and number of siliquas per plant. This trend decreased seed yield per plant. Also, in the late sowing dates, the plants were attacked by the cabbage aphid which caused a lot of damage in yield per plant. The result is in harmony with the results found by Jenkins and Leitch (1986) Thomas *et al.* (1990) Taylor and Smith (1992) Leto *et al.* (1995), Starner *et al* (1996), Saini and Sidhu (1997), Ozer (2002) Sharief and Keshta (2002), Leilah, *et al.* (2003), Mohsen *et al.* (2004), Fathi *et al.* (2005) Gul and Ahmad (2007) Daneshian *et al.* (2008) and Shah and Rahman (2009).

3.2. Effect of nitrogen fertilizer

Data in Table (4) indicated that increasing N level from 30 to 60 or 90 Kg/Fadden caused significant increase in all the studied traits in both seasons. Seed yield per Fadden increased by 39.30% and 51.50%on the same order as an average of both seasons. This was attributed with similar increase in seed yield per plant 40.00% and 53.30% as an average in both seasons . The increase in seed yield per plant as N level was increased was associated with an increase in plant yield components ,*i.e*. No.of. branches per plant, No.of. siliquas per plant, seeds/siliqua and 1000 seed weight. Also, increasing N level delayed flowering and increased plant height in both seasons.These findings reflected the important main role of nitrogen fertilizer for plant growth, yield and its components. And the important role of nitrogen in stimulating the meristematic activity and cell elongation of the plant and increasing photosynthesis activity of canola. These results are in agreement with those obtained by Singh and Srivastava (1986) Chauhan *et al.* (1993), Starner *et al.* (1996), Said and Keshta (1999), Sharief and Keshta (2000), Ozer (2002) Leilah *et al.* (2003) and Asfour (2006) .

Table (3) : Effect of sowing date on all the studied traits (over all nitrogen fertilizer levels and varieties) in 2007/2008 and 2008/2009 seasons.

Sowing date	Days to 50% flowering	Plant height (cm)	No . of primary branches / Plant	No . of siliquas / plant	No . of seeds/ siliqua	1000 seed weight	Seed yield / plant (g)	Seed yield/ fed (kg)
2007/2008 season								
15 October	81.53	119.34	10.76	478.56	23.16	2.89	33.52	804.43
1 November	81.93	123.40	13.41	586.18	24.03	2.99	43.76	1050.13
16 November	82.91	121.96	12.54	579.52	23.68	2.86	40.68	976.21
1 December	83.27	122.50	12.34	553.20	23.91	2.80	38.20	918.35
LSD at 0.05	0.47	0.81	0.28	14.46	0.09	0.03	1.35	31.42
2008/2009 season								
15 October	81.42	117.06	11.70	436.42	23.19	2.86	30.72	737.28
1 November	82.07	123.55	13.31	619.04	24.17	3.12	48.94	1175.40
16 November	83.24	120.63	12.84	579.51	23.97	3.02	44.47	1059.44
1 December	83.16	117.20	11.83	526.08	23.14	2.87	36.72	881.45
LSD at 0.05	0.19	0.61	0.33	17.28	0.12	0.05	1.77	51.92

Table (4) : Effect of nitrogen fertilizer levels on all the studied traits (over all sowing date and varieties) in 2007/2008 and 2008/2009 seasons.

Nitrogen levels Kg/Fed	Days to 50% flowering	Plant height (cm)	No . of primary branches/Plan	No . of siliquas / plant	No . of seeds /siliqua	1000 seed weight(g)	Seed yield / plant (g)	Seed yield/ Fed (kg)
2007/2008 season								
30	81.50	116.91	10.83	447.55	23.33	2.81	30.50	732.00
60	82.67	123.04	12.58	575.50	23.81	2.93	41.41	995.04
90	83.52	125.45	13.37	625.03	23.94	2.91	45.20	1084.80
LSD at0.05	**0.33**	**0.65**	**0.28**	**10.08**	**0.06**	**0.04**	**0.79**	**13.81**
2008/2009 season								
30	81.03	116.12	11.37	459.47	23.10	2.71	30.52	726.39
60	82.63	121.83	12.59	569.55	23.80	3.03	43.20	1037.67
90	83.75	120.89	13.30	592.26	23.94	3.17	46.92	1126.12
LSD at0.05	0.13	0.99	0.14	8.94	0.09	0.04	0.96	24.67

3.3. Interaction between sowing dates and nitrogen fertilizer levels

The interaction mean values presented in Table (5) showed that the best treatment was sowing at the first of November with 90Kg N/fedden. This showed high mean values in most of the studied traits in the two seasons. Regarding seed yield per plant and seed yield /fed, the highest mean values were (50.52gm and 1212.48K g) in the first season at the third sowing date with 90KgN added, but in the second season the best treatment was the second sowing date with 90KgN where it gave the highest seed yield and yield/fed (57.48g and 1379.53Kg/fed), respectively. However the lowest seed yield per plant were (23.63 and 22.23) at sowing date 15 October with 30Kg N/Fadden in

Table (5) :The interaction mean values between sowing dates and nitrogen fertilizer levels (over all varieties) for all the studied traits in 2007/2008and2008/2008 seasons.

Sowing date	N levels Kg/Fed	Days to 50% flowering	Plant height (cm)	No . of primary branches / Plant	No . of siliquas / plant	No . of seeds/ siliqua	1000 seed weight (g)	Seed yield/ plant (g)	Seed yield/ Fed (kg)
2007/2008 season									
15 October	30	79.33	115.32	9.40	358.67	22.83	2.79	23.63	567.20
	60	82.20	119.80	11.47	479.00	23.29	2.94	33.82	811.68
	90	83.07	122.90	11.40	598.00	23.36	2.94	43.10	1034.40
1 November	30	79.80	117.80	12.05	494.87	23.21	2.98	35.77	858.40
	60	82.40	125.14	13.47	610.33	24.45	3.07	47.09	1130.10
	90	83.60	127.25	14.70	653.33	24.43	2.91	48.41	1161.92
16 November	30	82.27	119.15	11.00	489.80	23.25	2.73	32.33	775.84
	60	82.40	119.73	12.73	576.25	23.36	2.83	39.18	940.32
	90	84.07	126.99	13.87	672.51	24.41	3.01	50.52	1212.48
1 December	30	82.80	115.37	10.85	446.89	24.03	2.72	30.27	726.56
	60	83.67	127.50	12.64	636.42	24.15	2.89	45.51	1098.10
	90	83.33	124.65	13.52	576.28	23.56	2.78	38.77	930.40
LSD at 0.05		**0.65**	**1.31**	**0.57**	**20.16**	**0.12**	**0.06**	**1.58**	**39.07**
2008/2009 season									
15 October	30	79.67	113.82	10.20	353.80	23.05	2.58	22.23	533.44
	60	81.60	117.47	11.37	470.40	23.03	2.91	33.03	792.64
	90	83.00	119.91	13.53	485.05	23.48	3.10	36.91	885.76
1 November	30	80.07	118.58	12.01	517.75	23.23	2.87	35.51	851.52
	60	82.80	124.62	13.73	669.01	24.44	3.15	53.82	1295.16
	90	83.33	127.44	14.20	670.36	24.85	3.35	57.48	1379.53
16 November	30	82.20	117.24	11.89	494.77	23.41	2.81	34.71	809.36
	60	82.73	123.18	12.93	598.03	24.33	3.05	46.52	1116.48
	90	84.80	121.46	13.69	645.74	24.16	3.21	52.19	1252.48
1 December	30	82.20	114.83	11.36	471.57	22.72	2.59	29.63	711.22
	60	83.40	122.03	12.34	538.77	23.41	3.01	39.42	964.40
	90	83.87	114.73	11.78	567.91	23.28	3.02	41.11	986.72
LSD at 0.05		**0.27**	**1.99**	**0.27**	**17.88**	**0.17**	**0.08**	**1.92**	**49.34**

both seasons, respectively. Concerning earliness the best treatment was planting at the middle of October with 30KgN /fad where it gave values (79.33 and 79.67) days from sowing dates to 50% flowering in both seasons, respectively. On the other hand, increasing nitrogen level up to 90 Kg N/fed with planting at the middle of November caused the most delay in flowering to (84.07 and 84.80 days) in both season respectively. These results are in harmony with the results found by Singh and Singh (1984) Ozer (2002) Leilah, *et al.* (2003).

3.4. Effect of varieties

Data in Table (6) showed significant differences among the used varieties in all the studied characters in both seasons.Serw-4 was the most early in flowering, however it showed the tallest plants. Also, Serw-4 produced the highest seed yield per feddan (1551.33 and 1717.27Kg)in the two successive seasons. This was due to highest seed yield per plant (64.63and71.56g)in both seasons, respectively . The highest seed yield per plant of Serw-4 was attributed to the highest plant yield components, *i.e.* No. of. Branches per plant ,No.of. siliquas /plant, number of seeds/ siliqua and 1000seed weight. Duplo variety ranked the second with significant difference from Serw-4 and Pactol variety which ranked third. The differences among the varieties could be due to the differences in the genetic constitution and their response to environmental conditions. These results are in harmony with the results by obtained Asfour, (2006).

3.5. Interaction between sowing dates and varieties

Data in Table (7a&b) cleared that the highest seed yield per fadden was obtained by sowing Serw-4 on Nov.1st in both seasons with significant difference from other all treatments. This may be due to that this variety was the most adapted for the conditions of experimental site because this treatment produced tallest plants, most early plants in flowering, plants produced more branches and siliquas per plant, highest seed number per siliqua in both seasons.

3.6. Effect of interaction between nitrogen levels and varieties

The interaction mean values are summarized in Table(8). Data obtained showed that this interaction had significant effect on all the studied traits in both seasons. This means that the response of used varieties to increasing N level was different. Therefore, Serw-4 variety was more efficient in fertilizer use than others because it produced the highest values for all traits at all N levels. Also, it produced highest seed yield per plant and per faddan as well as highest values for other traits when 90KgN/faddan was added in both seasons. On other hand Sedo variety showed the least valus for all traits with addition of 30KgN/faddan in both seasons. These results are in harmony with the results found by Asfour (2006).

3.7.The interaction among sowing dates, nitrogen fertilizer levels , and varieties

Statistical analysis data in Table (2) showed high significant differences among all the tested treatments for all studied traits in both studied seasons. Table(9a&b) cleared that this interaction had significant effect on all studied traits in both seasons. Data indicated that the highest seed yield per fadden was obtained when Serw-4 variety was sown on Nov. 1st and fertilized with 90Kg N/fadden. This was true in both seasons. This

Table (6) : Mean values of varieties on all traits (over all nitrogen fertilizer levels and sowing date) in 2007/2008and 2008/2009seasons.

Varieties	Days to 50% flowering	Plant height (cm)	No . of primary branches / Plant	No . of siliquas / plant	No . of seeds/ siliqua	1000 seed weight (g)	Seed yield/ plant (g)	Seed yield/ Fed (kg)
2007/2008 season								
Sedo	83.58	117.53	10.19	452.96	22.81	2.64	27.56	661.47
Duplo	85.19	122.58	12.41	564.35	24.20	3.14	43.11	1036.53
Serw – 4	75.39	132.42	15.44	722.20	25.67	3.46	64.63	1551.33
Pactol	84.19	118.29	11.47	509.62	22.92	2.61	30.66	735.93
Drakkar	83.69	118.17	11.79	497.68	22.87	2.55	29.21	701.13
LSD at0.05	0.35	0.80	0.28	13.13	0.08	0.04	1.06	25.81
2008/2009 season								
Sedo	83.81	116.30	11.28	420.91	22.50	2.66	25.85	610.37
Duplo	84.94	121.80	13.01	559.23	24.17	3.20	43.86	1052.60
Serw – 4	74.78	129.16	15.20	774.43	25.63	3.55	71.56	1717.27
Pactol	84.06	116.82	11.53	472.64	23.18	2.74	30.45	731.01
Drakkar	84.78	113.37	11.08	474.11	22.61	2.70	29.35	705.72
LSD at0.05	0.19	1.14	0.18	12.20	0.10	0.05	1.23	32.63

Table (7 a): The interaction mean values between sowing date and varieties (over all nitrogen fertilizer levels) for all the studied traits in 2007/2008 season.

Sowing date	Varieties	Days to 50% flowering	Plant height (cm)	No . of primary branches / Plant	No . of siliquas / plant	No . of seeds /siliqua	1000 seed weight (g)	Seed yield / plant (g)	Seed yield/ Fed (kg)
2007/2008 season									
15 October	**Sedo**	82.33	116.84	8.39	380.00	22.27	2.71	23.12	554.93
	Duplo	84.33	121.33	10.22	491.11	24.02	3.19	38.05	913.33
	Serw – 4	75.22	128.46	14.67	640.00	25.36	3.44	56.62	1358.93
	Pactol	83.67	114.11	9.72	443.89	22.07	2.54	24.96	598.93
	Drakkar	82.11	115.96	10.78	437.78	22.09	2.57	24.83	596.00
1 November	**Sedo**	83.00	120.42	11.42	498.00	22.78	2.68	30.40	729.60
	Duplo	84.67	124.10	13.53	614.56	24.67	3.27	49.20	1180.80
	Serw – 4	74.33	134.14	16.58	770.00	26.04	3.68	73.93	1774.40
	Pactol	83.67	119.67	12.36	535.00	23.33	2.73	34.13	819.20
	Drakkar	84.00	118.66	13.16	513.33	23.33	2.58	31.11	746.67
16 November	**Sedo**	84.33	117.81	10.33	496.80	22.78	2.67	30.64	735.47
	Duplo	86.22	121.78	13.00	589.28	24.07	3.04	43.31	1039.47
	Serw – 4	75.67	133.33	15.97	744.10	26.00	3.39	66.01	1584.27
	Pactol	84.67	119.00	11.84	542.59	22.84	2.62	32.68	784.27
	Drakkar	83.67	117.87	11.53	524.84	22.69	2.56	30.73	737.60
1 December	**Sedo**	84.67	115.06	10.60	437.06	23.42	2.50	26.08	625.87
	Duplo	85.56	123.12	12.89	562.46	24.04	3.08	41.86	1012.53
	Serw – 4	76.33	133.73	14.56	734.71	25.29	3.34	61.98	1487.73
	Pactol	84.78	120.40	11.96	517.01	23.42	2.56	30.89	741.33
	Drakkar	85.00	120.21	11.69	514.74	23.38	2.51	30.18	724.27
LSD at 0.05		**0.71**	**1.60**	**0.56**	**26.27**	**0.17**	**0.08**	**2.12**	**51.62**

Table (7 b) :The interaction mean values between sowing date and varieties (over all nitrogen fertilizer levels) for all the studied traits in 2008/2009seasons.

Sowing date	Varieties	Days to 50% flowering	Plant height (cm)	No . of primary branches / Plant	No . of siliquas / plant	No . of seeds/ siliqua	1000 seed weight (g)	Seed yield/ plant (g)	Seed yield/ Fed(kg)
2008/2009 season									
15 October	**Sedo**	82.33	116.12	10.69	307.01	22.18	2.50	17.33	415.73
	Duplo	83.56	119.92	12.61	493.77	23.84	3.14	37.42	897.87
	Serw – 4	74.67	125.19	14.39	602.62	24.84	3.44	52.65	1263.47
	Pactol	83.22	114.63	10.37	372.78	11.98	2.62	22.71	545.07
	Drakkar	83.33	109.46	10.46	405.90	22.09	2.61	23.51	564.27
1 November	**Sedo**	83.33	117.20	12.02	511.48	22.53	2.84	32.92	790.15
	Duplo	84.33	125.78	14.38	638.17	24.87	3.36	53.16	1275.73
	Serw – 4	73.67	134.10	15.98	885.89	25.87	3.66	84.99	2038.67
	Pactol	84.11	121.18	12.24	539.26	23.82	2.87	37.18	893.07
	Drakkar	84.89	119.48	11.94	520.42	23.78	2.90	36.43	879.40
16 November	**Sedo**	84.33	118.67	11.68	459.54	23.00	2.73	29.38	665.47
	Duplo	85.56	121.33	13.10	591.44	24.40	3.30	47.95	1150.93
	Serw – 4	76.22	130.56	15.92	867.73	26.47	3.60	82.94	1990.67
	Pactol	84.56	118.62	12.17	492.50	23.62	2.80	32.88	789.33
	Drakkar	85.56	113.96	11.33	486.34	22.36	2.67	29.20	700.80
1 December	**Sedo**	85.22	113.20	10.74	405.60	22.29	2.57	23.75	570.14
	Duplo	86.33	120.17	11.97	513.54	23.56	3.01	36.90	885.87
	Serw – 4	74.56	126.80	14.50	741.48	25.36	3.49	65.67	1576.27
	Pactol	84.33	112.84	11.33	486.04	22.29	2.68	29.02	696.57
	Drakkar	85.33	112.99	10.60	483.76	22.20	2.62	28.27	678.40
LSD at 0.05		0.39	1.34	0.35	24.40	0.22	0.10	2.46	65.27

Table (8):The interaction mean values between nitrogen fertilizer levels and varieties (over all the sowing date) for all the studied traits in 2007/2008and 2008/2009 seasons.

N levels Kg/ Fed	Varieties	Days to 50% flowering	Plant height (cm)	No . of primary branches/ Plant	No . of siliquas / plant	No . of seeds / siliqua	1000 seed weight (g)	Seed yield/ plant (g)	Seed yield/ Fed (kg)
2007/2008 season									
30	**Sedo**	81.50	111.49	8.91	351.97	22.05	2.52	19.59	470.20
	Duplo	83.50	118.00	11.08	462.84	24.03	3.07	34.43	826.40
	Serw – 4	74.42	124.63	13.43	596.25	25.52	3.33	50.85	1220.60
	Pactol	83.75	115.38	10.17	419.21	22.53	2.59	24.52	588.60
	Drakkar	82.08	115.05	10.54	407.50	22.52	2.51	23.09	554.20
60	**Sedo**	84.00	119.83	10.69	483.44	22.70	2.70	29.57	709.80
	Duplo	85.50	123.83	12.52	583.42	24.55	3.25	46.63	1125.00
	Serw – 4	75.42	133.36	15.68	748.44	25.67	3.47	66.74	1601.80
	Pactol	84.17	118.75	12.01	536.08	23.13	2.63	32.56	781.40
	Drakkar	84.25	119.45	11.99	526.13	23.02	2.60	31.55	757.20
90	**Sedo**	85.25	121.27	10.96	523.47	23.68	2.70	33.52	804.40
	Duplo	86.58	125.93	13.63	646.79	24.02	3.10	48.26	1158.20
	Serw – 4	76.33	139.26	17.23	821.92	25.83	3.58	76.32	1831.60
	Pactol	84.67	120.76	12.23	573.57	23.08	2.62	34.81	837.80
	Drakkar	84.75	120.02	12.83	559.40	23.08	2.54	32.99	792.00
LSD at 0.05		0.61	0.97	0.49	22.75	0.15	0.07	1.83	44.71
2008/2009 season									
30	**Sedo**	82.08	112.98	10.23	319.13	22.17	2.40	17.35	386.71
	Duplo	83.58	118.59	11.65	468.62	23.48	2.90	32.12	771.00
	Serw – 4	73.42	123.32	14.08	693.73	24.88	3.31	57.63	1382.40
	Pactol	82.92	113.75	10.57	405.45	22.78	2.47	22.77	546.63
	Drakkar	83.17	111.94	10.30	410.43	22.20	2.49	22.72	545.20
60	**Sedo**	84.00	118.37	11.47	462.85	22.80	2.72	29.00	696.01
	Duplo	84.92	124.01	13.14	613.73	24.35	3.25	48.77	1170.80
	Serw – 4	74.92	134.06	15.47	801.24	25.83	3.63	76.07	1825.60
	Pactol	84.33	117.53	11.74	479.22	23.27	2.83	31.57	758.40
	Drakkar	85.00	115.16	11.15	488.23	22.77	2.73	30.57	737.55
90	**Sedo**	85.33	117.54	12.15	480.74	22.53	2.87	31.19	748.41
	Duplo	86.33	122.80	14.25	595.34	24.67	3.46	50.67	1216.00
	Serw – 4	76.00	130.10	16.03	828.32	26.18	3.71	80.99	1943.80
	Pactol	84.92	119.17	12.27	533.27	23.48	2.93	37.00	888.00
	Drakkar	86.17	114.82	11.80	523.66	22.85	2.87	34.77	834.40
LSD at 0.05		**0.34**	**1.99**	**0.35**	**21.13**	**0.19**	**0.09**	**2.13**	**56.52**

Table (9 a) : The interaction mean values among nitrogen fertilizer levels , sowing date and varieties on all the studied traits in both seasons.

Sowing date	N levels Kg/Fed	Days to 50% flowering					Plant height (cm)					No . of primary branches / Plant					No . of siliquas / plant				
		V1	V2	V3	V4	V5	V1	V2	V3	V4	V5	V1	V2	V3	V4	V5	V1	V2	V3	V4	V5
2007/2008 season																					
15 October	30	80.00	82.67	74.67	83.00	76.33	114.20	117.33	125.03	108.50	111.53	7.83	9.67	12.67	7.83	9.00	226.67	346.67	520.00	363.33	336.67
	60	82.00	84.33	75.12	84.00	85.00	117.50	121.67	127.00	115.50	117.33	9.33	11.33	14.67	10.67	11.33	353.33	450.00	643.33	475.00	473.33
	90	85.00	86.00	75.33	84.00	85.00	118.83	125.00	133.33	118.33	119.00	8.00	9.67	16.67	10.67	12.00	560.00	676.67	756.67	493.33	503.33
1November	30	80.00	82.00	72.00	82.00	83.00	112.00	118.67	123.33	117.33	117.67	10.27	11.33	14.00	12.00	12.67	434.00	543.67	626.67	430.00	440.00
	60	84.00	85.00	75.00	84.00	84.00	123.83	125.30	137.43	120.33	118.80	12.00	13.00	17.33	12.67	12.33	533.33	613.33	776.67	575.00	553.33
	90	85.00	87.00	76.00	85.00	85.00	125.43	128.33	141.67	121.33	119.50	12.00	16.27	18.40	12.40	14.47	526.67	686.67	906.67	600.00	546.67
16 November	30	83.00	85.33	75.00	85.00	83.00	114.77	119.00	125.00	119.00	118.00	9.00	11.67	14.67	9.67	10.00	410.00	494.00	675.00	436.67	433.33
	60	85.00	86.00	74.00	84.00	83.00	117.33	121.33	126.67	116.00	117.33	10.00	13.33	16.00	12.33	12.00	510.00	620.00	703.33	547.23	500.70
	90	85.00	87.33	78.00	85.00	85.00	121.33	125.00	148.33	122.00	118.27	12.00	14.00	17.23	13.53	12.60	570.40	653.83	853.97	643.87	640.50
1 December	30	83.00	84.00	76.00	85.00	86.00	105.00	117.00	125.17	116.67	113.00	8.53	11.67	12.37	11.20	10.50	337.23	467.03	563.33	446.83	420.00
	60	85.00	86.67	77.00	84.67	85.00	120.67	127.00	142.33	123.17	124.33	11.43	12.40	14.70	12.37	12.30	537.10	650.33	870.43	547.10	577.13
	90	86.00	86.00	76.00	84.67	84.00	119.50	125.37	133.70	121.37	123.30	11.83	14.60	16.60	12.30	12.27	436.83	570.00	770.37	557.10	547.10
LSD at 0.05				**1.23**					**2.77**					**0.97**					**45.49**		
2008/2009 season																					
15 October	30	80.33	81.67	74.67	82.00	79.67	115.00	118.50	122.83	111.63	101.11	9.33	11.50	12.67	8.33	9.17	227.03	463.97	513.73	213.87	350.40
	60	82.00	83.67	74.00	83.67	84.67	116.63	119.27	126.07	113.60	111.77	10.33	12.17	14.17	10.43	9.77	337.03	477.03	650.33	460.63	426.97
	90	84.67	85.33	75.33	84.00	85.67	116.73	122.00	126.67	118.67	115.50	12.40	14.17	16.33	12.33	12.43	356.97	540.30	643.80	443.83	440.33
1November	30	80.00	82.00	71.00	83.00	84.33	112.83	122.50	127.13	115.50	114.93	11.27	12.37	14.47	11.40	10.53	460.43	480.43	760.33	470.43	417.13
	60	85.00	85.00	75.00	84.67	84.33	116.60	125.27	136.83	122.53	121.87	12.27	14.40	16.67	12.67	12.67	526.97	767.03	923.70	550.30	577.07
	90	85.00	86.00	75.00	84.67	86.00	122.17	129.57	138.33	125.50	121.63	12.53	16.37	16.80	12.67	12.63	547.03	667.03	973.63	597.03	567.07
16 November	30	83.00	84.67	75.00	83.67	84.67	115.60	119.03	121.67	115.20	114.70	10.83	12.00	14.57	11.50	10.57	327.07	473.67	784.03	462.00	427.07
	60	84.00	85.00	75.67	84.00	85.00	120.23	121.33	136.67	120.67	117.00	11.57	12.60	16.50	12.33	11.67	510.43	663.73	883.83	463.77	468.40
	90	86.00	87.00	78.00	86.00	87.00	120.17	123.63	133.33	120.00	110.17	12.63	14.70	16.70	12.67	11.77	541.13	636.93	935.33	551.73	563.57
1 December	30	85.00	86.00	73.00	83.00	84.00	108.50	114.33	121.67	112.67	117.00	9.49	10.73	14.63	11.03	10.93	262.00	456.40	716.83	475.50	447.10
	60	85.00	86.00	75.00	85.00	86.00	120.00	130.17	136.67	113.33	110.00	11.70	13.40	14.57	11.53	10.50	476.97	547.13	747.10	442.17	480.50
	90	85.67	87.00	75.67	85.00	86.00	111.10	116.00	122.07	112.53	111.97	11.03	11.77	14.30	11.43	10.37	477.83	537.10	760.50	540.47	523.67
LSD at 0.05				**0.29**					**0.15**					**3.68**					**89.41**		

V1,2,3,4,5 = Sedo, Duplo , Serw-4 , Pactol, and Drakkar varieties respectively .

Table (9 b): The interaction mean values among nitrogen fertilizer levels , sowing date and varieties on all the studied traits in both seasons.

Sowing date	N levels Kg/Fed	No . of seeds /siliqua					1000 seed weight (g)					Seed yield / plant (g)					Seed yield/ Fed (kg)				
		V1	V2	V3	V4	V5	V1	V2	V3	V4	V5	V1	V2	V3	V4	V5	V1	V2	V3	V4	V5
2007/2008 season																					
	30	22.00	24.07	24.00	22.00	22.07	2.64	2.97	3.27	2.53	2.57	13.30	24.77	40.73	20.27	19.10	319.20	594.40	977.60	486.40	458.40
	60	22.40	24.00	26.07	22.00	22.00	2.80	3.27	3.40	2.57	2.67	22.17	35.27	57.03	26.87	27.77	532.00	846.40	1368.80	644.80	666.40
15 October	90	22.40	24.00	26.00	22.20	22.20	2.70	3.33	3.67	2.53	2.47	33.90	54.13	72.10	27.73	27.63	813.60	1299.20	1730.40	665.60	663.20
	30	22.00	24.00	26.07	22.00	22.00	2.70	3.50	3.57	2.67	2.47	25.80	45.63	58.27	25.23	23.90	619.20	1095.20	1398.40	605.60	573.60
	60	22.20	26.00	26.07	24.00	24.00	2.77	3.50	3.73	2.73	2.60	32.77	55.80	75.57	36.77	34.53	786.40	1339.20	1813.60	882.40	828.80
1November	90	24.13	24.00	26.00	24.00	24.00	2.57	2.80	3.73	2.80	2.67	32.63	46.17	87.97	40.40	34.90	783.20	1108.00	2111.20	969.60	837.60
	30	22.13	24.07	26.00	22.07	22.00	2.47	2.90	3.17	2.63	2.50	22.40	34.43	55.57	25.39	23.83	537.60	826.40	1333.60	609.60	572.00
	60	22.20	24.13	26.00	22.40	22.07	2.63	3.00	3.33	2.60	2.57	29.83	44.80	61.03	31.88	28.37	716.00	1075.20	1464.80	764.80	680.80
16November	90	24.00	24.00	26.00	24.07	24.00	2.90	3.23	3.67	2.63	2.60	39.70	50.70	81.44	40.77	40.00	952.80	1216.80	1954.40	978.40	960.00
	30	22.07	24.00	26.00	24.07	24.00	2.27	2.93	3.33	2.53	2.53	16.87	32.90	48.85	27.20	25.53	404.80	789.60	1172.80	652.80	612.80
	60	24.00	24.07	24.53	24.13	24.00	2.60	3.23	3.43	2.63	2.57	33.53	50.63	73.33	34.73	35.53	804.80	1239.20	1760.00	833.60	852.80
1 December	90	24.20	24.07	25.33	22.07	22.13	2.63	3.07	3.27	2.50	2.43	27.83	42.03	63.77	30.73	29.46	668.00	1008.80	1530.40	737.60	707.20
LSD at 0.05		0.67					3.98					0.61					42.26				
2008/2009 season																					
	30	22.00	23.27	24.00	24.00	22.00	2.20	2.77	3.12	2.37	2.47	10.98	30.20	38.66	12.30	19.00	263.20	724.80	928.00	295.20	456.00
	60	22.20	24.20	24.53	22.20	22.00	2.50	3.17	3.50	2.70	2.67	18.65	36.53	57.31	27.60	25.07	447.20	876.80	1375.20	663.40	601.60
15 October	90	22.33	24.07	26.00	22.73	22.27	2.80	3.50	3.70	2.80	2.70	22.37	45.51	61.97	28.23	26.47	536.80	1092.00	1487.20	677.60	635.20
	30	22.40	24.40	24.33	22.53	22.47	2.63	3.07	3.27	2.73	2.67	27.17	35.93	60.43	29.00	25.00	652.01	862.40	1447.20	696.00	600.00
	60	22.47	24.53	26.53	24.27	24.40	2.93	3.40	3.83	2.83	2.77	34.73	63.70	93.90	37.83	38.93	833.60	1528.80	2253.60	910.40	949.40
1November	90	22.73	25.67	26.73	24.67	24.47	2.97	3.60	3.87	3.03	3.27	36.87	59.83	99.98	44.70	45.36	884.83	1436.00	2415.20	1072.8	1088.8
	30	22.27	24.00	26.40	22.27	22.13	2.50	3.13	3.40	2.53	2.47	18.20	35.57	70.40	26.05	23.33	318.00	853.60	1689.60	625.60	560.00
	60	24.13	24.40	26.53	24.27	22.33	2.80	3.22	3.63	2.83	2.73	34.50	52.39	85.20	31.90	28.60	828.02	1257.60	2044.80	765.60	686.40
16November	90	22.60	24.80	26.47	24.33	22.60	2.90	3.53	3.77	3.03	2.80	35.45	55.90	93.23	40.70	35.67	850.40	1341.60	2237.60	976.80	856.00
	30	22.00	22.27	24.80	22.33	22.20	2.27	2.63	3.43	2.23	2.37	13.07	26.80	61.01	23.73	23.53	313.61	643.20	1464.80	569.71	564.80
	60	22.40	24.27	25.73	22.33	22.33	2.63	3.20	3.53	2.93	2.77	28.13	42.47	67.87	28.97	29.70	675.21	1020.00	1628.80	695.20	712.80
1 December	90	22.47	24.13	25.53	22.20	22.07	2.80	3.20	3.50	2.87	2.73	30.07	41.43	68.13	34.37	31.57	721.61	994.40	1635.20	824.80	757.61
LSD at 0.05		0.38					0.17					4.27					113.04				

means that the performance of Serw-4variety under climatic conditions of Nov.1st sowing date was better than others. Also, its efficiency in uptake and utilization of nitrogen at all N levels was better than other . For that, it showed the highest values for seed yield per plant and its components at all N levels as well as all sowing dates compared to other varieties.

According to these results it could be concluded that to maximize canola productivity under the conditions of the Sadat city area, Serw-4 variety could be sown at early Nov. and N fertilization should be applied at 90Kg N/fadden in three doses, *i.e.* 20% at seeding 40% at 30days of sowing ,and 40%atflowering stage.

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استجابة بعض أصناف الكانولا(*Brassica napus* L.) لمستويات مختلفة من التسميد الأزوتي تحت مواعيد زراعة مختلفة في الأراضي حديثة الاستصلاح

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ملخص

أجريت هذه الدراسة في مزرعة معهد الدراسات والبحوث البيئية - جامعة المنوفية - فرع السادات وذلك خلال موسمي 2007/2008و2008/2009 بهدف تقدير استجابة خمسة أصناف من الكانولا (Sedo, Duplo, Serw-4, Pcatol and Drakkar) لتأثير ثلاثة مستويات من التسميد الأزوتى (30 – 60 – 90 كجم/فدان) وذلك فى أربع مواعيد زراعة مختلفة بلستخدام تصميم القطع المنشقة مرتين. وضعت مواعيد الزراعة وهى 15 أكتوبر، الأول من نوفمبر ، 16 نوفمبر ، الأول من ديسمبر فى القطع الرئيسية ومعدلات التسميد الأزوتى فى القطع الشقية والأصناف فى القطع تحت الشقية فى صورة قطاعات كاملة العشوائية فى ثلاث مكررات وتتلخص أهم النتائج فيما يلى :

1- أفضل ميعاد زراعة هو الأول من نوفمبر حيث أعطى أعلى القيم فى معظم الصفات تحت الدراسة مسجلا أعلى محصول بذور للفدان(1050.13,1175.40كجم) كذا أعلى محصول بذورللنبات (43.76، 48.94 جم) فى كلا الموسمين على التوالى .

2- كان أفضل مستوى من التسميد الأزوتى 90كجم وحدة أزوت للفدان حيث أعطى أعلى القيم فى معظم الصفات تحت الدراسة وكذلك أعلى محصول بذور للفدان(1084.80و1126.12كجم)وكذا أعلى محصول بذورللنبات (45.20,46.92 جم) فى كلا موسمى الدراسة على التوالى.

3 -كان أفضل الأصناف هو Serw - 4 حيث أظهر أعلى القيم فى جميع الصفات تحت الدراسة وأعلى محصول بذورللفدان (1551.33و1717.27كجم) وكذا أعلى محصول بذور للنبات(64.63 ، 71.56جم) فى كلا الموسمين على التوالى ويأتى فى المرتبة التالية الصنف Duploحيث أعطى محصول بذور للفدان (1036.53و1052.60 كجم) وكذا أعلى محصول بذورللنبات (43.11 و43.86 جم) فى كلا موسمى الدراسة.

4- كانت أفضل المعاملات على الاطلاق هى زراغة الصنف Serw – 4 فى الأول من نوفمبر مع اضافة 90 وحدة أزوت للفدان حيث أعطت أعلى محصول بذورللفدلن (2111.20و2415.20 كجم) وكذا أعلى محصول بذور للنبات (87.97 ، 99.98 جم) فى كلا الموسمين على التوالى.

ولذا نوصى عند زراعة الكانولا فى الأراضى الجديدة حديثة الأستصلاح بأضافة 90كجم نيتروجين للفدان على أن يكون ميعاد الزراعة المناسب هو الأول من نوفمبر وأنسب ألاصناف هو الصنف Serw – 4 ثم يتبعة الصنف Duplo.