J. Agric. Sci. Mansoura Univ., 25 (7): 4717 - 4726, 2000.

EFFECT OF NUMBER OF IRRIGATIONS AND NITROGEN FERTILIZATION LEVELS ON CANOLA PRODUCTION

Awad, H.A.

Water Requirement and Field Irrigation Dept., Soil Water and Environ . Res. Inst., ARC EGYPT

ABSTRACT

Field experiments were conducted at EL – Serw Agricultural Research Station (North Delta) in the two growing seasons 1997-1998 and 1998 –1999,to study the effect of number of irrigations and nitrogen rates on and the Canola yield,its components , water consumptive use, water use efficiency , and crop coefficient. Pactol cultivar was used in this experiment .

A split –plot design with four replications was used . Four irrigation treatments (I_1 = five irrigations, I_2=four irrigations ,I_3= three irrigations and I_4 =two irrigations) in the main plots and four N-fertilizer levels (N_1= 75kg N/fed , N_2 =50 kg N/fed, N_3 =25kg N/fed and N_4 = zero kg N /fed)in the sub – plots were tested . Results indicated that there was significant effect for the treatments on Canola seed yield and its yield components . Seed yields for I_2,I_3 and I_4 (four ,three and two irrigations) , respectively were 15 .9% ,27 % and 41% less than the yield of I_1 (five irrigations)respectively . For the N– level of 75 . N kg /fed, seed yield was 14.6% , 51.2% and 65% more than the yield of N_2, N_3 and N_4, respectively . The results showed also that there was a high significant effect for the treatments on yield components . Water consumptive use values were 34. 65 cm, 28.7cm , 20.6cm and 16.8 cm for irrigation treatment I_1 ,I_2, I_3 and I_4 respectively . Their values were 31.1 , 27.6 , 22.9 and 19.05 cm for N-rates 75, 50 ,25 and zero (kg N/fed), respectively . Water use efficiency for I_1=five irrigations was 27.5 kg seed /cm water and the value was 39.3 kg/cm for 75 kg N/fed . Crop coefficient for Canola crop at North Delta area is 0.89 .

INTRODUCTION

Canola (rapeseed) is one of the oil crops , which contains more than 40% of oil . In Egypt , rapeseed is of recent production but has bright future because of its ability to grow in the new reclaimed lands under wide soil variations as drought and salinity as revealed by some investigations carried out under Egyptian conditions (Ibrahim, et al. 1987).Sherif et al .(1995) reported that to obtain the highest yield of seed from feddan as rapeseed it must be planted on one side of 60 spaced –furrow apart and to be not subjected under water stress throughout the growth season. Daily ET increase was associated with increasing plant age to reach its maximum value through 37 days before harvesting .

Highest seasonal ET consumed by rapeseed was recorded for treatment which was not subjected to water stress throughout growth period . Abbas et al .(1999) indicated that prolonged irrigation intervals , decreased significantly plant , height , number of branches / plant, number of pods / plant,1000 seed weight .seed yield / plant ,seed yield / fed and seed oil content . Seasonal water consumptive use increased as soil moisture maintained high by

frequent irrigation and its value was found to be 45.27 cm for var. pactol. Keshta (1998) studied the effect of regular irrigation (five irrigations /season)and stress condition (two irritations / season)on12 rapseed genotypes at El - Serw , North Delta , Egypt .He found that ,plant height, number of branches / plant ,1000 seed weight, seed yield , seed oil content and oil yield / feddan were significantly decreased under stress condition .El –Mowellhi, et al. (1999) indicated that the highest Canola grain yield was obtained from the treatments of high nitrogen and irrigation water levels . The water consumptive use for Canola varieties ranged from 21.3 to 49.0 cm for irrigation levels over the N treatments .

Hocking, et al. (1997) reported that seed yield of Canola increased from 2.3 to a maximum of 3.5 ton / ha between o and 75 kg /N ha .

Said and Keshta (1999) indicated that increasing nitrogen level from 30 to 60 kg N/fed significantly increased all studied characters such as plant height , number of branches /plant , number of days to 50% flowering , seed yield /plant steaw, seed and oil yields/fed .

The objectives of this work were to study the effect of number of irrigations and nitrogen fertilization on Canola , seed yield ,its yield components , water consumptive use , water use efficiency and Canola crop coefficient for Northern Delta area in Egypt .

MATERIALS AND METHODS

Two field experiments were conducted at El - Serw Agricultural Research Station , (ARC), in the two growing seasons 1997 - 1998 and 1998 - 1999, to study the effect of number of irrigations and nitrogen rates on the Canola yield , its components , water consumptive use , water use efficiency and crop coefficient of Canola *(Brassica napus . L , var . pactol)*. Soil texture of the experimental site is clayey and mainly characterized by 2.5% $CaCO_3$, PH = 8.05, organic matter content = 0.87% , ESP = 8.3% and (EC_e) of the soil profile is 4.6 dS/m.(soil samples were taken from the upper 60 cm of soil profile for mechanical and chemical analysis) .

Main soil water characteristics of the experimental site is presented in Table (1)

Table 1 . Soil water characteristics of experimental site

Soil depth (cm)	Field capacity (% mass)	Wilting point (% mass)	Available soil moisture (% mass)	Soil bulk density (g/cm ^{3})
0-15	49.49	26.89	22.6	1.21
15-30	46.72	25.39	21.33	1.28
30-45	43.79	23.79	20.00	1.35
45-60	41.36	22.48	18.88	1.49
Average	45.34	24.64	20.70	1.33

A split - plot design was used where main plots were assigned to irrigation treatments and sub - plots to nitrogen fertilizer rates with four

replicates . The experimental unit was 42m^2.The irrigation treatments were as follows:

I_1 = five irrigations
I_2 = four irrigations
I_3 = three irrigations
I_4 = two irrigations

The four nitrogen rates were as follows

N_1 = 75 kg N / feddan
N_2 = 50 kg N / feddan
N_3 = 25 kg N / feddan
N_4 = zero kg (without nitrogen fertilizer).

Nitrogen fertilizer was applied in two equal doses at sowing and before first irrigation.

All the agronomic practices, except irrigation, and N- rates ,were applied according to the recommended practices for the canola crop.

Canola seeds were sown on the 20th and 18th of November and were harvested on the 3rd and 2nd of May in 1997-1998 and 1998 -1999 growing seasons,respectively .At harvest time, 10 plants were selected from the middle of each plot to measure plant height, branche numbers per plant, pod numbers per plant and seed yield per plant. From the middle of each plot, 21 m^2 were harvested to determine seed yield per feddan . Gravimetric soil samples, on 15 cm intervals down to 60 cm, were taken at sowing before and after each irrigation and at harvest time to determine water consumptive use (CU) or the actual evapotranspiration (ET_a) of canola crop . The (ET_a) values for the soil profile were calculated according to equation of Israelson and Hansen (1962) and given as Follows:

$$ETa = \sum_{i=1}^{n=4} \left(\frac{\theta 2 - \theta 1}{100} \right) \times p_b \times D \quad (cm)$$

Where:

ET_a = evapotranspiration (cm) .
i = soil layer .
n = total number of soil layers.
$\theta 2$= (%) soil moisture on mass basis after irrigation for layer i.
$\theta 1$= (%) soil moisture on mass basis before irrigation for layer i.
P_b = soil bulk density (g/cm^3) for layer i.
D = layer depth (cm).

Reference crop evapotranspiration (ETo)

Reference crop evapotranspiration (ET_o) values for the two growing seasons were calculated by the CROPWAT computer model (Smith , 1991) using the climatic data of EL-Serw area . The required input data for the model are the average monthly values of maximum and minimum air temperatures (^oC) , relative humidity (%) , wind speed (m/s) , sunshine duration (hr) and amount of rainfall (mm/month) . All meteorological data are measured at 2 meters high . The Eto values in the CROPWAT model

were computed according to the FAO Penman – Montieth method as recommended in the FAO Expert Consultation meeting held in May 1990 at Rome , Italy .

Crop Coefficient (KC)

Canola crop coefficient (k_c) values at El - Serw area during the growing season were calculated according to the following equation .

$$K_c = \frac{ET_a}{ET_o}$$

Water use efficiency (WUE)

Water use efficiency (WUE) of the examined treatments was calculated according the relation given by Jensen (1983) as follows:

$$WUE = \frac{\text{seed yield (kg / feddan)}}{\text{Total water consumption (cm)}}$$

Statistical analysis

The statistical package (CoHort , 1986) was used for data analysis. Averages of the four replicates of each treatment were interpreted using the analysis of variance (ANOVA) with means separation accomphished by using least significant difference (LSD). Differences reported in the text are at 0.05 level of significance.

RESULTS AND DISCUSSION

Canola seed yield :

The effect of number of irrigations and nitrogen rates on seed yield (kg / feddan) during the two growing seasons is presented in Table (2) . Results indicated that there was a high significant effect for number of irrigations on canola seed yield . Seed yield obtained from irrigation treatment. I_1 (Five irrigations) was higher than other irrigation treatments .

Seed yield for I_2 , I_3 and I_4 (four, three and two irrigations, respectively) were 15.9%, 27% and 41% less than the yield of I_1(five irrigation), respectively . But when there are drought conditions , we recommend to use I_2 .These results agree with those of Sherif et al (1995); Abbas et al. (1999) ;and Keshta (1998) .

From the same Table, results indicated also that, there was a high significant effect for nitrogen level on seed yield (kg/feddan) . For the N level of 75 kg/fed ,seed yield was 14.6%, 51,2% and 65% more than the yield of N50 ,N25 and No, respectively .These results agree with those of EL- Mowlhi et al (1999)and Hocing et al. (1997) .With respect to the interaction between irrigation and N-rate ,the results revealed that , I_1 (Five irrigation) and (N75kg/f) was the best treatment which gave seed yield at the Northern Delta area in Egypt .

Table (2). Canola seed yield (kg/feddan) as affected by number of irrigations and nitrogen rates during the two growing seasons .

	1997-1998					1998-1999				
Irrigation	I1	I2	I3	I4	mean	I1	I2	I3	I4	mean
N– Rates										
N4	**530**	**487.5**	**428.5**	**319.8**	**441.5 d**	**503.5**	**413.8**	**337.5**	**225**	**368.7 d**
N3	**780**	**663.8**	**516.3**	**429.3**	**597.4 c**	**795**	**527.5**	**430**	**382**	**534.4 c**
N2	**1250**	**1099**	**975**	**834.8**	**1039.7 b**	**1256**	**1001.5**	**867.5**	**633.3**	**939.6 b**
N1	**1385**	**1242.5**	**1178.3**	**991.5**	**1199.3 a**	**1387**	**1192.5**	**1066.8**	**826.3**	**1118.2 a**
(mean)	986.3 a	873.2 b	774.5 c	643.9 d		985.4 a	783.8 b	675.5 c	516.2 d	
LSD 0.05	(I) 17.6 (N)10.1 (I×N) 20.2					(I) 14.7 (N)15.0 (I×N) 30.0				

Within columns values followed by the same letter are not significant at 5% probability level .

Canola yield components :

Effect of number of irrigations and nitrogen levels on yield components is presented in Table (3). Results indicated that there was highly significant, effect of number of irrigations on plant height , number of branches per plant number of pods per plant , and seed yields per plant. Results indicate also that decreasing number of irrigations resulted in decreasing values of all yield components. For example plant height decreased by 28 % from treatment I_1 to treatment I_4 .The same trend was noted for the other components.

The results showed also that there was a highly significant effect of nitrogen rates on plant components. Decreasing N-rates from 75 to 0 kg/fed had on adverse effect on yield components I.e . plant height decreased from 154cm to 85.4cm . The interaction between treatments was significant and results agree with those of Abbas et al (1999) and El- Mowellhi et al ,(1999)**.**

Water consumptive use (CU):

The effect of irrigation treatments nitrogen rates and on water consumptive use for the two growing seasons is presented in Table (4). The results indicate that average water consumptive use values were 34. 65 cm, 28.7cm, 20.6 cm and 16.8 cm. for irrigation treatment I_1 , 1_2 ,I_3 and I_4 repechively.The water consumptive use values for N-Rates were 31.1, 27.6,22.9 and 19.05 cm for N-Rates 75 ,50 , 25 and o(kg /fed), respectively.

Table (3). Canola yield components as affected by number of irrigations and nitrogen rates during the two growing seasons .

	1997-1998					1998-1999				
Irrigation	I1	I2	I3	I4	mean	I1	I2	I3	I4	mean
N – rates	plant height (cm)									
N4	113.8	87.5	78.8	70	87.5 d	93.3	85.8	80.8	73	83.2 d
N3	132.2	107.5	86.3	80	101.6 c	123.8	94.5	90.5	82.5	97.8 c
N2	152.5	137.5	123.8	115	132.2 b	154.5	146.8	144.8	131.0	144.3 b
N1	177.5	158.8	142.5	132.5	152.8 a	172.8	162.5	149.3	138.8	155.9 a
mean	144.1 a	122.8 b	107.9 c	99.4 d		136.1 a	122.4 b	116.4 c	106.3 d	
LSD 0.05	(I) 4.3 (N) 3.0 (I×N) 6.1					(I) 3.6 (N) 2.6 (I×N) 5.1				
Number of branches per plant										
N4	7.6	7.3	5.9	5.9	6.6 d	7.3	7	5.6	5.0	6.2 d
N3	10.3	9.3	7.8	6.6	8.5 c	10.1	9	7.3	6	8.1 c
N2	12.2	10.4	9.6	9.3	10.4 b	12.3	10	9.5	9.0	10.2 b
N1	13.3	11.5	10.2	9.8	11.2 a	13.5	11	10	9.5	11.0 a
(mean)	10.9 a	9.7 b	8.4 c	8 d		10.8 a	9.3 b	8.1 c	74 d	
LSD 0.05	(I) 0.27(N) 0.35 (I×N) 0.67					(I) 0.27 (N) 0.35 (I×N) 0.67				
Number of pods per plant										
N4	165.3	151.3	122.5	112	137.7 d	160.8	123	115.8	77.5	119.3 d
N3	232.5	222.5	166.3	155	194.1 c	219	216.3	170	122.5	181.9 c
N2	353.8	316.3	232.5	210	278.0 b	359.8	301.3	237	188.3	274.6 b
N1	426.3	376.3	300.3	285	346.9 a	420.8	400.5	332.5	263.8	354.4 a
(mean)	294.5 a	266.6 b	205.4 c	190.5 d		315.1 a	260.3 b	213.8 c	163.0 d	
LSD 0.05	(I) 11.9 (N) 4.8 (I×N) 9.6					(I) 4	(N) 4	(I×N) 8		
Seed yield per plant (gram)										
N4	10.8	9.6	8.5	6.4	8.8 d	10.5	9.4	7.4	4.7	9.1 d
N3	15.5	13.1	10.2	8.5	11.8 c	15.8	14.6	10.6	7.5	12.1 c
N2	24.8	21.8	19.3	16.5	20.6 b	24.9	20.5	19	13.3	19.4 b
N1	27.5	24.6	23.3	19.6	23.7 a	29.3	24.1	22.8	18.5	23.7 a
(mean)	19.6 a	17.3 b	15.3 c	12.8 d		21.3 a	17.2 b	14.9 c	11.0 d	
LSD 0.05	(I) 0.75(N) 0.53 (I×N) 1.04					(I) 14.7 (N)15.0 (I×N) 30.0				

Within columns values followed by the same letters are not significant at 5% probability level .

Table (5). presents the average monthly CU values of the two growing seasons as affected by the tested variables .

The values show that water consumption increase as the growing season advances and reaches its peak during April 10.15 cm for I_1 and N_1 treatment

Table (4) .Water consumption (cm) of Canola as affected by number of irrigations and N – rates during 1997-1998 and 1998-1999 seasons .

	1997-1998					1998-1999				
Irrigation	I1	I2	I3	I4	mean	I1	I2	I3	I4	mean
N– Rates										
N4	24.1	20.2	14.5	13.9	18.2	27.8	22.3	16.6	13.1	19.9
N3	31.1	26.1	18.8	16.4	23.1	32.1	26.3	18.3	14.0	22.7
N2	37.2	32.3	24.3	20.9	28.7	37.9	31.1	31.1	15.9	26.5
N1	42.9	36.8	27.9	23.20	32.7	44.1	34.3	34.3	16.8	29.5
(mean)	33.8	28.8	21.4	18.6		35.5	28.5	19.7	14.9	

Table (5). Monthly average (CU)values, cm as affected by number of irrigations and nitrogen rates during the two growing seasons .

Irr.	**I_1**				**I_2**				**I_3**				**I_4**			
N-R	**75**	**50**	**25**	**0**	**75**	**50**	**25**	**0**	**75**	**50**	**25**	**0**	**75**	**50**	**25**	**0**
Nov	**0.7**	**0.7**	**0.7**	**0.7**	**0.7**	**0.7**	**0.7**	**0.7**	**0.7**	**0.7**	**0.7**	**0.7**	**0.7**	**0.7**	**0.7**	**0.7**
Dec	**5.59**	**4.97**	**3.99**	**3.45**	**5.59**	**4.97**	**3.99**	**3.45**	**5.59**	**4.97**	**3.99**	**3.45**	**5.59**	**4.97**	**3.99**	**3.45**
Jan	**6.2**	**5.55**	**4.9**	**4.35**	**6.2**	**5.55**	**4.9**	**4.35**	**6.2**	**5.45**	**4.9**	**4.35**	**6.2**	**5.55**	**4.9**	**4.35**
Fab	**8.55**	**8.11**	**6**	**4.65**	**8.55**	**8.11**	**6.0**	**4.65**	**8.55**	**8.11**	**6**	**4.65**	**5.42**	**5.22**	**3.67**	**3.06**
Mar	**9.85**	**8.75**	**7.9**	**6.15**	**9.85**	**8.75**	**7.9**	**6.1**	**3**	**2.0**	**1.76**	**1.27**	**1.49**	**1.36**	**1.34**	**1.34**
Apr	**10.15**	**8.85**	**8.05**	**6.25**	**4.5**	**3.26**	**2.65**	**1.8**	**1.1**	**1.1**	**1.0**	**1.5**	**.6**	**.6**	**.6**	**.6**
May	**.7**	**.6**	**0.5**	**.4**	**.3**	**.2**	**.2**	**.2**	**.2**	**.2**	**.2**	**.2**	**-**	**-**	**-**	**-**
Totel	**41.74**	**37.53**	**32.04**	**25.95**	**35.69**	**31.57**	**26.34**	**21.25**	**25.30**	**22.80**	**18.55**	**15.60**	**20**	**18.4**	**15.2**	**13.5**

Crop Coefficient (Kc)

Table (6) presents the monthly average ETo , ETa values (mm/day) and crop coefficient (k_c) values for Canola crop at EL – Serw . The table shows the calculated Canola crop coefficient during the growing season at EL – Serw area Average kc values were developed using the calculated ETo values by the FAO penman- Montieth methed and measured Eta values for irrigation treatment I1 (five irrigations) were used to calculate kc values . Average kc value for growing season of Canola crop at North Delta area is o,89.

Table(6).Average actual evapotranspiration(Eta) , potential evapotranspiration (Eto) , and crop coefficient values (kc) for Canola crop :

Month	Eta (m m/day)	Eto (mm/day)	k_c
		Penman- Montieth	Penman- Montieth
Nov.	0.7	2.5	0.28
Dec.	1.8	1.8	1.0
Jan.	2.0	1.8	1.11
Feb.	2.9	2.3	1.28
Mar.	3.2	3.2	1.00
Apr.	3.4	4.1	0.83
May	3.5	5.0	0.7

Water use efficiency (WUE)

WUE values as affected by irrigation treatment and N-rates are presented in Table(7) . Results indicated that (WUE) values increased with decreasing the number of irrigations and the highest value was 45.95 kg/cm water for the I_4 N_1 treatment and the value for I_1(five irragation) was 27.5 kg/cm .Adding more N- fertilizer the WUE values increase and the highest values of 39.3 kg/cm was obtained for N 75 .

We noticed that WUE values were the smallest between I_1 , I_2 ,N75 ,and N50 . It can be concluded that five to four irrigations and 75 to 50 kg N/fed are suitable for Canola production at the Northern Delta area in Egypt .

Table(7) . Water use efficiency(kg seed yield /cm water) values as affected by irrigations number and N- rates .

	1997-1998					1998-1999				
Irrigation	I1	I2	I3	I4	**mean**	I1	I2	I3	I4	**mean**
N– Rates										
N4	**22.0**	**24.1**	**29.6**	**23.0**	**24.7**	**18.1**	**18.6**	**20.3**	**16.8**	**18.5**
N3	**25.1**	**25.4**	**27.5**	**26.2**	**26.1**	**24.1**	**20.1**	**23.5**	**27.5**	**23.8**
N2	**33.6**	**34.0**	**40.1**	**39.9**	**36.1**	**33.1**	**32.2**	**40.7**	**39.8**	**36.5**
N1	**32.3**	**33.8**	**42.2**	**42.7**	**37.8**	**31.5**	**34.8**	**47.2**	**49.2**	**40.7**
(mean)	28.3	29.3	34.9	32.9		26.7	26.4	32.9	33.3	

CONCLUSLONS

Due to the results of this study it could be concluded that :

1-Five irrigation during the growing season and 75kg N/fed is the best treatment for Canola crop grown under Northern Delta area conditions in Egypt.

2-Water use efficiency, for five irrigations during the growing season and with 75kg N/fed, are 27.5 and 39.3 kg/seed /cm water, respectively

3-Crop coefficient for Canola at Northern Delta area is 0.89

REFERENCES

Abbas,F.A.;M.A.EL-Eman and N.A Anton.(1999).Effect of irrigation intervals on two rapeseed varieties .Third conf . of on - farm irrigation and agroclimatology volume 1 (No1) paper No37 25- 27Jan 1999, Dokk1 , Egypt .

CoHort software.(1986)costat 3.03 P.O.Box 1149 , Berkeley , ca 94701,USA

Doorenbos, J. and W.O. pruitt. (1984). Crop water requirements FAO irrigation and drainage paper No.24. Rome , Italy .

El- Mowelhi, N.M.; A.A. Wahdan ;A.A. Awad and and A.A.Osman .(1999). Response of Canola caltivars (Brassica Napus L.) to different nitrogen and irrigation water levels under calcareous soil conditions . Third conf . of on - farm irrigation and agroclimatology volume 1(No1)paper no.14-25- 27jan,Dokki, Egyp.

Hocking , P.J.; P.J.Randall.; D.De Marco and I.Bamforth(1997). Assessment of the nitrogen status of field - grown Conola (Bnassica napus L.)by plant analysis . Australian J. of experimental Agrit vol 37. 83-92.

Ibrahim , A.F.;SH.A. Shabaan and E.A. El . Metwelly (1987). Effect of some herbicides on oilseed rape (B.napus) and associated weeds . J.Agron and crop Sci., 158:236- 240.

Israelson , O.W and V.E. Hansen . (1962). irrigation principals and Practices 3rd Edit John Willey and sons Inc . New York, U S E

Jensen , M.E. (1983) Design and operation of farm irrigation systems , Amer Soc . Ag .Eng., Michigan , USA .

Keshta , M.M.(1998) Evaluation of some rapeseed genotypes under normal and stress irrigation treatments Proc .8th conf.,Agron ,Ismailia , Egypt (Abstract).

Said ,E.M. and M.M keshta (1999). Response of some Canola (Brassica napus,L.)cultivars to different nitrogen fertilization levels. J. Agric . Sci. Mansoura Univ., 24 (4):1689-97.

Sherif M.A;H.A. Awad and A.M. Osman .(1995) influence of some factors on water requirements by rapesesed. Second Conf.on–farm irrigation and agroclimatology 2-4 Jan . Giza, Egypt.

Smith , M.(1991). CROPWAT a computer program for irrigation planning an management , FAO Irrigation and Drainage paper No.46.Rome .

تأثير عدد الريات ومستويات التسميد النيتروجينى على إنتاجية الكانولا

هشام عبد الباقى عوض
قسم بحوث المقننات المائية والرى الحقلى
معهد بحوث الأراضى والمياه والبيئة – مركز البحوث الزراعية

أقيمت تجارب حقلية بمحطة البحوث الزراعية بالسرو شمال الدلتا خلال موسمين زراعيين ١٩٩٧ – ١٩٩٨ ، ١٩٩٨ -١٩٩٩ لدراسة تأثير عدد الرايات ومعدلات السماد النيتروجين على محصول الكانولا ومكوناته والاستهلاك المائى وكفاءة استخدام المياه ومعامل المحصول ، استخدم الصنف بكتول فى هذه التجربة ونظام القطع المنشقة فى أربعة مكررات وكانت معاملات الرى هى خمس ريات و أربع ريات وثلاث ريات وريتان خلال الموسم حيث شغلت هذه المعاملات القطع الرئيسية و أربعة مستويات تسميد نيتروجين فى القطع هى إضافة ٧٥ ،٥٠ ،٢٥ ، صفر كجم نيتروجين للفدان بالترتيب .

ولقد أوضحت النتائج أن هناك تأثير معنوى على المحصول ومكوناته حيث كان المحصول للمعاملات التى أعطيت أربعة وثلاثة وأثنين ريه أقل من المعاملة التى أعطيت خمس ريات على النحو التالى ١٥,٩% و٢٧%و٤١% ، وكان محصول المعاملة التى أعطيت ٧٥كجم نيتروجين للفدان أعلى من محصول المعاملات التى أضيف للفدان ٥٠،٢٥،صفر كجم نيتروجين بنحو١٤,٦ % ،٥١,٢% و٦٥% على الترتيب كذلك أوضحت النتائج أن هناك تأثر معنوى على مكونات المحصول وكان الاستهلاك المائى لمعاملات الرى ٣٤,٦٥ ،٢٨,٧ ،٢٠,٦ ، ١٦,٨ سم للمعاملات أ٥ ، أ٤ ، أ٣ ، أ٢ والاستهلاك المائى للمعاملات السمادية ٧٥،٥٠،٢٥ ، صفر هو ٣١,١ ،٢٧,٦ ،٢٢,٩ ، ١٩,٠٥سم على الترتيب وكفاءة استخدام المياه للمعاملة التى أعطيت خمس ريات ٢٧,٥كجم حبوب لكل سم ماء و٣٩,٣ كجم /سم للمعدل السمادى ٧٥ك / فدان ومعامل المحصول للكانولا فى منطقة شمال الدلتا هو ٠,٨٩