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VEGETATIVE GROWTH, CHEMICAL COMPOSITION, YIELD AND QUALITY TRAITS OF CANOLA PLANTS GROWN IN SALT AFFECTED SOIL UNDER THE EFFECT OF GROWTH REGULATOR TREATMENTS.

BY

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ABSTRACT

Two years field experiments were executed in salt affected soil at the Experimental Farm of the Fac. Agric. At Fayoum, to study the effect of two growth regulators on growth, chemical composition, yield and quality traits of two canola lines (H2 and H8). Randomized complete block design, as a Factorial, with four replications was used. The plot area was 10.5m2. Sowing dates was done on Nov. 15&18 in 2003/2004 &2004/2005, respectively. GA_3 (at 0, 100, 200 and 300ppm) and Alar (at 0, 300, 400 and 500ppm) were applied twice, at 30 and 45 days of plant age. One vegetative sample was randomly taken from each plot and used to determine five growth and eighteen chemical composition traits. Other cultural practices recommended for growing canola were followed. At harvest, another sample randomly taken from each plot and used for meaning ten yielding and quality traits.

The obtained results indicated that, the two canola lines were significantly different for No. of leaves, roots fresh and dry weight, and shoot dry weight as well as 11 out of 18 chemical composition traits, during vegetative growth stage, in addition to plant height, no. of branches, pods, seed yield per plant, seed yield/faddan and seed oil content at harvest stage. Both GA_3 and Alar counteracted salinity effect and had considerable positive effects for improving all growth criteria and all chemical composition estimates, and all yielding quality traits except protein content(%) compared with control. GA_3 at 200 and Alar at 300 and 400ppm produced the heaviest weights of roots and shoots and No. of leaves. All concentrations of GA_3 and Alar, except 100ppm GA_3, produced similar amount of total carbohydrates, 200ppm GA_3 was the most effective treatment affecting chemical composition, where it produced highest values for total and reduced sugars, anthocyanin, total indols, total N(%), K(%), total carotenoids and chlorophyll a, in addition consequently to total carbohydrates. Alar second to be of lower effect on chemical composition compared with GA_3, but it gave higher percentage of K and similar high P(%). Alar at 500ppm induced marked increases in total phenols, conjugation phenol, water content and chlorophyll b in addition to carbohydrates. Most of GA_3 and Alar concentrations had marked increase for seed index. All Alar and GA_3 (300ppm) treatment produced highest oil content, and all GA_3 and Alar (400ppm) produced heaviest seed yield/faddan.

The interaction effects between canola lines and growth regulates indicated that, Alar at 300ppm had marked effect for increasing weight of most growth criteria either of H2 or H8. Alar at 300 and 400ppm treatment on H8 substantially increased anthocyanin, total free amino acid, K(%) and P(%) in addition to leaves water content. GA_3 at 300ppm on H2 produced total carbohydrate (similar to that of Alar, 500ppm) and total carotenoids (similar to that of GA_3, 200ppm). GA_3, 200ppm on H8 and Alar, 400ppm, on H2 showed highest total sugars. Both GA_3 and Alar on the two lines induced significant increases in K(%) and decreases in Na (%) and free phenols. Interaction effect on yielding and quality traits revealed that the heaviest seed yield/feddan was produced by H2 treated with GA_3 at 300ppm and H8 treated with AG3 at 200ppm which gave improved seed yield/plant due to its advantage in plant height and pods/plant. Also, H8 treated with 300ppm GA_3 showed tallest plant height, longest fruiting zone and higher number of branches. H2 treated with 200ppm GA_3 characterized by plant height, fruiting zone, highest number of pods and heaviest seed index. H8 treated with Alar at 500ppm produced the highest oil content(%). All GA_3 and majority of Alar concentrations on both lines depressed protein content(%).> In conclusion, it could be concluded that either GA_3 and /or Alar can be used successfully in cultivating canola plants under saline soil conditions as they can counteract the bad effect of salinity in plant growth, yield and yield components.

Key word: Canola Genotypes, Growth Regulator, Soil Salinity, Chemical Composition, Yield and Its Components.

INTRODUCTION

Canola (*Brassica napus* L.) is one of the main oil crops in many countries specially in Canada, European Union and USA. Cultivation of canola in Egypt would provide an opportunity to overcome some of the local deficit of vegetable edible oil production, particularly it could be successfully grown during winter season in newly reclaimed land out side the old one of Nile valley (Kandil, 1984; Sharaan, 1986 and Sharaan *et al.*, 2002). But, unfortunately, soil in the most of the newly reclaimed areas is oftenly affected by salinity which have different adverse and impaired effects on plant growth, development and yield. Several investigators, working on different plant species, reported that salinity effect may be ascribed to; osmotic inhibition of water availability, toxic of salt ions, imbalanced ion relation, alteration of all metabolism, endogenous hormonic imbalance, decrease in photosynthetic and dry matter accumulation rates, disturbance in cell membrane selectivity or a combination of such injuries (Epstein *et al.*, 1980; Pal *et al.*, 1984; El-Khateeb, 1994: Afiah, 2000; Gadallah *et al.*, 2001 and Sharaan and Ghallab, 2005).

From breeding point of view, salt tolerance is a complex quantitative trait controlling by many genes (Shannon and Noble, 1984) but it changes with plant age and it has, therefore, been difficult to determine patterns of inheritance (Chaubey and Senadhira, 1994). The mechanism of salt tolerance is often depends on the physiological complexity of plant growth and developmental processes

So, cultivation of canola in newly reclaimed salt affected soils needs an effective cooperation between breeder and physiologist to find out genotype (s) well adapted to this harsh environment, through employment of simple techniques such as application of growth regulators, to minimize the deleterious effect of salinity and maximize its yield.

Since 50 past years, Halevy and Wittwer (1965) reported that plants treated with growth regulators remain turgid and survival longer with delayed senesce of attached leaves under salt stress, due to its well developed roots and more shoot components, compared with untreated plants. Growth regulators such as GA_3 and Alar were extensively used as a tool to nullify salinity effect and increase salt tolerance of different plant species (Ali and Baz, 1984; Kortam *et al.*, 1984; Kamel *et al.*, 1989, Eisa and Ibrahim, 1989; El-Gezawy *et al.*, 1992(a &b), Kamel *et al.*, 1998, Sallam, 1999 and El-Yazal and Matter, 2001).

In order to elucidate the effect of GA_3 and Alar in different concentrations on growth, yield and chemical composition of H2 and H8 canola lines grown in salt affected soil, the present investigation was carried out.

MATERIALS AND METHODS

Two field trials were conducted during two successive seasons (2003-2005) at the experimental Farm of the Fac. of Agriculture at Fayoum, to study the effect of gibberellic acid (GA_3) and Alar (B-9) on the growth, chemical composition and yielding traits of two promising canola lines (H2 & H8). The two lines were previously selected as promising salt tolerant to (Ghallab and Sharaan, 2002). soil was sandy loam (Table 1). Seed were handly planted in hills within rows, 60 cm apart, on November 15 & 18 in the first and second seasons respectively, complete randomized block design (as a factorial) with four replications was used. The experimental plot area was 10.5m2. Seedlings were thinned, at 28 days age, to secure two plants / hill spaced by 15 cm between hills. The growing plants were treated by GA_3 (at 0, 100, 200 and 300 ppm) and Alar (at 0. 300, 400 and 500 ppm at month age and repeated again after two weeks later. The control plants were sprayed by tap water Other cultural practices recommended for growing canola were followed.

Two samples were randomly taken from each plot. The first sample, of 5 plants, was collected at the beginning of flowering stage (70 days from sowing) to determine growth criteria and chemical composition using either fresh (F.W) or dry (D.W) weight. Leaves water content % determined according to the method described by A.O.A.C (1995) Anthocyanin concentration (mg/100g D.W) was determined according to the method described by Hogland (1980). Chlorophyll a&b (µg/g, F W) as well as total carotenoids concentration (µg/g, F.W) in fresh leaves were estimated the method described by Welburn and Lichtenthaler (1984). Total carbohydrates (mg/g, D.W) were determined colorimetrically using the method of Michel *et al.* (1956). Total and reducing sugars (mg/g, D.W) as well as free soluble phenols (mg/g, F W) were determined according to A.O.A.C (1995) Total soluble phenols (mg/g, F W) were determined according to Snell and Snell (1953), conjugated phenols (mg/g, F.W) were obtained by subtracting free phenols from total phenols, total nitrogen (%) and phosphorus (%) were estimated according to A.O.A.C(1995).

Table (1): Chemical and physical analysis of the experimental field soil.

Soil properties			Values 2003/2004		Values 2004/2005
Mechanical analysis					
Course sand %			32.83		32.32
Fine sand %			47.17		47.68
Silt %			12.00		11.70
Clay %			8.00		8.30
Soil texture			**Loamy sand**		**Loamy sand**
Soil pH			7.21		7.31
ECe (dS/m)			12.11		13.75
CEC meq/100 g soil			9.40		8.70
Organic matter %			0.63		0.75
$CaCO_3$ %			8.00		7.98
Soluble cations meq/100 g soil					
	2003/2004	**2004/2005**		**2003/2004**	**2004/2005**
Ca ++	30.7	39.59	Na+	7.30	6.90
Mg++	82.2	88.6	K+	1.20	1.60
Soluble anions meq/100 g soil					
Cos-	-	-	Cl-	99.50	110.40
HCO3-	7.30	6.20	SO4--	14.40	20.80

Proline concentration (mg/g, D.W) was determined according to Bates *et al.*, (1973). Total free amino acids (mg/g, D.W) were estimated according to Jayarman (1981). Total indols (µg/g, D.W) were determined after Larson *et al.* (1962). Sodium and potassium (%) were estimated by flam fotometer parkin-Elmer method 52 with acetylene burner according to the method outlined by Page *et al.* (1982).

The second sample of 10 plants were taken from each plot at harvesting time to measure the averages of plant height (cm), height to the first branches/plant (cm), fruiting zone/plant (cm), number of branches/plant, number of pods and seed yield per plant. Seed yield/Feddan(kg) were determined as plot basis. Seed index (g), seed protein content (according to **A.O.A.C 1995**). and seed oil content (using NMR apparatus) were estimated as an average two random seed samples/ plot .

When the error variances are homogenous, the combined analysis was followed and the means were compared by Duncan multiple test (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

1- Growth traits

a. Effect of genotypes:

Results of combined data listed in Table (2) show that the two canola lines were significantly different in shoot dry weight and both fresh and dry weights of roots. H8 surpassed H2 line for roots fresh and dry weights and No. of leaves, whereas the reverse for shoot dry weight. These results revealed that the well developed roots of H8 line may be taken as on indicator for its salt tolerance where it can absorb water and nutrients from deeper zone, compared with H2 line, and consequently had effective contribution to total plant assimilates. In this concern, Stark and Czajkowsha (1981) reported that roots may be indirectly affect photosynthesis and translocation of assimilates via biosynthesis of growth regulators. Afiah (2000) stated that salinity has a great role in the definition of the absorption feature of plant roots which could be reflected on the behavior concerning physiological and metabolic activities.

Table (2): Mean performance for vegetative traits of two canola genotypes grown under salinity stress conditions (over two seasons).

Genotypes	No. of Leaves	Root fresh weight (gm)	Shoot fresh weight (gm)	Root dry weight (gm)	Shoot dry weight (gm)
H2	10.02b	4.66b	56.99	1.11b	6.91b
H8	10.62a	4.75a	54.86	1.24a	6.81a

b. Effect of growth regulators:

The five studied growth traits, as affected by GA_3 and Alar (Table 3), exhibited significant differences due to the growth regulator and its concentration. Application of GA_3 and Alar at any concentration used in resulted a significant increases in all growth traits compared with untreated plants (control). This result supports the previously reported results obtained by Shaheen, (1984), Khafagi *et al.*, (1986), El-Gezawy *et al.*, (1992a), Kamel *et al.*, (1998) and Salama *et al.* (2000). It is evident from date in Table(3) that application of 200 ppm GA_3 produced the highest dry weights of both roots and shoots, due to is desirable effect on improving nutrients uptake, and translocation metabolic activities. These results are in agreement with those reported by Ibrahim (1984) on cotton, Sharaky *et al.* (1987) on rice and Eisa and Ibrahim (1989) on faba bean, who stated that the favoring effect of GA_3 in alleviating the harmful effect of salinity on dry matter accumulation might be due to GA_3 induced salt tolerance through supporting synthesis of different metabolites as well as increasing nutrients uptake by plant roots.

With regard to Alar, concentrations of 300 and 400 ppm gave the highest means of roots and shoots fresh weights, respectively, while 500ppm for No. of leaves/plant. This result supports those obtained by Kortam *et al.* (1984) on chickpea and El- Gezawy *et al.* (1992a) on spinach, who indicated that Alar has stimulating effect on fresh plant organs but without sizeable increase in their dry weight. Whereas, Soliman (1984) working on soybean suggested that 250 ppm Alar was the best for increasing both fresh and dry weights, and this concentration was the most economic at 7500 ppm salinity

Table (3): Effect of GA_3 and Alar on vegetative traits of canola grown under salinity stress (over two seasons).

Treatments (ppm)	No.of Leaves	Root fresh weight (gm)	Shoot fresh weight (gm)	Root dry weight (gm)	Shoot dry weight (gm)
GA_3 100	11.08ab	4.20f	54.92e	1.070e	7.705c
GA_3 200	10.08bc	5.367c	65.63b	1.482a	8.177a
GA_3 300	9.83c	4.872e	39.45f	1.217d	5.249f
Alar 300	11.08ab	5.563a	58.55d	1.268c	6.752e
Alar 400	9.67cd	5.137d	67.63a	1.305b	8.148b
Alar 500	11.83a	5.464b	64.38c	1.298b	7.310d
Control	8.67d	2.338g	37.69g	0.605f	4.697g

c. Interaction effect:

The interaction effects between the two canola lines (H2 and H8) grown in salt affected soil and the two growth regulators (GA_3 and Alar) on the five studied growth traits are presented in Table(4). It is evident that all treated plants of both lines had appricable heavier fresh and dry weights than the controls, indicating that GA_3 and Alar growth regulators counteracted the deleterious effect of salinity and improved the growth indices through their stimulating effect on plant growth, enhancement of photosynthetic activities and metabolites translocation. These results are in harmony with those recorded by Khafagi *et al.* (1986) on soybean and cowpea and El-Gezawy *et al.* (1992a) on spinach.

Table (4): Effect of interactions between genotypes and growth regulators(GA_3 or Alar) on vegetable traits of canola under salinity vegetative conditions as a combined data.

Genotypes	Treatments (ppm)	No.of leaves	Root fresh weight (gm)	Shoot fresh weight (gm)	Root dry weight (gm)	Shoot dry weight (gm)
H2	$GA_3$100	11.67a-c	4.445 f	54.15 ef	1.155 e	7.880 f
	$GA_3$200	9.17 d-f	5.413 b	68.25 b	1.448 c	8.215 d
	$GA_3$300	10.50 cd	4.985 d	38.45 h	1.110 f	4.948 k
	Alar 300	9.0 d-ef	4.515 f	40.45 g	0.975 g	4.7781
	Alar 400	10.17 c-e	5.203 c	77.60 a	1.430 c	9.657 a
	Alar 500	11.17 bc	7.393 f	76.15 a	1.105 f	8.300 c
	Control	8.50 f	2.395 h	37.38 h	0.570 i	4.605 m
H8	$GA_3$100	10.50 cd	3.955 g	55.68 e	0.985 g	7.530 g
	$GA_3$200	11.00 bc	5.322 bc	63.00 c	1.515 b	8.140 e
	$GA_3$300	9.17 d-f	4.760 e	40.45 g	1.325 d	5.50 j
	Alar 300	13.17 a	6.610 a	76.65 a	1.560 a	8.725 b
	Alar 400	9.17 d-f	5.070 d	57.65 d	1.180 e	6.640 h
	Alar 500	12.50 ab	6.535 a	52.60 f	1.490 b	6.320 I
	Control	8.83 ef	2.280 h	38.00 h	0.60 h	4.7901

The heaviest root fresh weight and high No. of leaves/plant were produced by H8 line when sprayed with Alar at 300 ppm (6.61g and 13.17, respectively) as well as by 500 ppm (6.54g and 12.5) surpassing that of 400ppm Alar and all GA_3 on H8, as well as all GA_3 and Alar on H2 line. Whereas, the highest shoot fresh weight was given by H2 line when treated by 400 ppm Alar (77.6g) which was of similar weights produced by H8 sprayed with 300 ppm Alar (76.65g) and by H2 sprayed with 500 ppm Alar (76.15g). These results indicated that Alar had greeter effect, than GA_3, on growth and weights of genotypes-response.

The highest root dry weight was given by H8 line under treatment of 300 ppm Alar (1.56) which significantly exceeded all other Alar and GA_3 treatments practiced for both canola lines. This confirmed again the different responses of the two lines to both GA_3 and Alar. In this concern, El-Gezawy *et al.* (1992a) reported that GA_3 and Alar applications led to significant increase in fresh weight of spinach plant at marketable stage, it is evident from data listed in Table (4) that, the heaviest shoot dry weight (9.66) was produced by H2 line when sprayed with 400 ppm Alar surpassing the other tested cases, due to its superiority in shoot fresh weight. It is interest to note that H8 sprayed with 300 ppm Alar produced superior weights for fresh and dry roots as well as fresh shoots, reflecting the favouring effect this treatment on growth criteria of H8 lines under the condition of salt affected soil.

2- Chemical composition :

a. Effect to genotypes:

The data presented in table (5) revealed that, the two canola lines were significantly different in eleven out of eighteen traits studied on vegetative sample collected at pre-flowering stage (70 days age). The two lines differed in total carotenoids, total carbohydrates, proline concentration and total indol, in favour to H2 line. Also, they varied in anthocyanin concentration, reduced sugars, total free amino acids, free and total phenol, total nitrogen (%) and Na (%) in favour to H8 line. These genotypic differences may be attributed to varied interacting response of the two lines to salinity in addition to the effect of their own genetic influences.

Higher number of leaves of H8 line was accompanied with marked decrease in total carotenoids and significant increase of anthocyanin concentration, but did reflect in enhancing photosynthetic activities and carbohydrate accumulation compared with those of H2 line which may be had wider leaves area. This may be attributed to that both lines possessed similar amount of chlorophyll a and b in addition to increasing reducing sugars on account of total carbohydrate in H8 line. For these reasons, H2 line showed heavier shoot dry weight than that of H8 as mentioned above for growth criteria. Total carbohydrates reduction in H8 line during growth stage may also be due to reduction in photosynthetic activities and/or the excess of respiration in order to secure enough energy required for water and nutrients absorption from soil. This was confirmed by marked increases of Na and total nitrogen percentages as well as significant increase in free amino acids which supplied with energy to the plants grown under such stress, similar results were previously obtained by Eisa and Ibrahim (1989) on faba bean. On the other hand. H2 line had higher proline concentration, total phenol and total indols which all stimulate plant growth through encouraging cell division and elongation, but the lines had lower total free amino acids compared with those of H8. The reduction of total free amino acids occurred in H2 may be ascribed, under stress condition, to conversion of protein into amino acids, and as expected this line would be lower than H8 for protein content. These results are in line with those reported by Shadded (1990) and Sallam (1999) on faba bean.

b. Effect of growth regulators:

It is evident from the data listed in Table (6) that, all studied chemical composition traits were significantly affected by growth regulator treatments. The treated plants surpassed untreated ones (control) in almost all traits except Na (%) where the untreated plants contained significant increase of sodium percentage. These results reflect the importance of growth regulators in nullifying salinity effect and ameliorating salt tolerance of canola lines. Several investigators previously reached to similar results (Shaheen, 1984; Khafagi *et al.*, 1986; Younis *et al.*, 1991; and El-Gezawy *et al.*, 1992a). Considerable reduction of Na absorbed by plants treated by growth regulators, especially by GA_3 and Alar, and phosphorus absorbed by plants sprayed with all Alar concentration used and GA_3 at 100 ppm. In addition to the ratios of K to Na were doubled in plants treated by all used concentrations of GA_3 and Alar. This situation could be resulted in improvement of photosynthetic activities and translocation of photosynthesis as well as phosphorus translocation to the youngest parts of the shoots. These results are in harmony with those obtained by Stark and Czajkowsha (1981), Huang and Redmann (1995). However, El-Gezawy *et al.* (1992a) found that both GA_3 and Alar increased significantly phosphorus (%) but they had no effect on potassium content.

Regarding GA_3 treatments, concentrations of 200 and 300 ppm markedly increased chlorophyll a & b, total carotenoids and K (%), which all improved metabolic processes and resulted in high total carbohydrates. Plants treated by 200 ppm GA_3 showed also highest values of total nitrogen (%), total indols, anthocyanin concentration as well as total and reduced sugars. Increasing sugars may be act as an osmotic agent, besides other factors, leading to the increased tolerance to salt stress. These results support the results obtained by Eisa and Ibrahim (1989) and confirmed the above mentioned result concerned with growth traits, where 200 ppm GA_3 produced the highest dry weights of roots and shoots. However, plants sprayed with 100 ppm GA_3 gave the lowest value of total carbohydrates, although it was superior for K and P (%) as well as total indol, and proline concentration as growth promoters. This inferiority may be due to its reduction in chlorophyll a & b, nitrogen (%), conjugated phenol, total free amino acid as well as total and reduced sugars.

Concerning Alar treatments, it is evident from data in Table (6) that all used Alar concentration significantly increased K and P percentages as well as total carbohydrates. Plants treated with 300 ppm Alar were also superior in leaves water content and total sugars which both considered as indication for salt tolerance and improve vegetative growth of plant organs and accumulation of more photosynthetic products. These results are in harmony with those recorded by Zaki *et al.* (1976) on tomato and El-Gezawy *et al.* (1992a) on spinach, and confirmed again the above mentioned results of growth criteria where Alar at 300 and 400 ppm produced highest fresh weights of roots and shoots, respectively. In-regard to the third Alar treatment (500 ppm), the data indicated that it possessed highest number of leaves coupled with high leaves water contents and chlorophyll b in addition to superior percentages of K and P as well as total phenols, which all encourage photosynthetic activities resulting in large amount of accumulated carbohydrates.

c. Interaction effect:

The interaction, between canola lines and growth regulators (Table 7) had considerable effects on all chemical composition traits. It is worthy to mention that plants of both lines (H2 & H8) treated either with GA_3 or Alar possessed higher means regarding chemical constituents than those of untreated ones for all traits except for free phenol and sodium percentage. This result is logic where application growth regulators could decrease Na (%) as an inducer of salinity and free phenol as growth inhibitor acting under salinity conditions. It is also noticed that untreated plants of H8 line showed higher means than those of H2 line for all studied traits except for chlorophyll a & b, total carotenoids, leaves water content, proline and consequently total carbohydrates, indicating that H2 was more tolerant than H8 line during vegetative growth stage. It is of interest to record that H8 line contained the highest K (%) but it was insignificantly different form other concentrations of both GA_3 and Alar, and all treated plants had K (%) reached more double Na (%) which is reflected in improved growth compared with untreated plants .

Table (5): Mean performance for some chemical constituents of two canola genotypes under salinity sstress conditions (over two seasons).

Parameters	Genotypes		Parameters	Genotypes	
	H2	H8		H2	H8
Total carbohydrates (mg/g D.W.)	208.43 a	181.636b	Total phenols (mg/g D.W.)	1.50 a	2.20 b
Total sugars (mg/g D.W.)	48.76	49.16	Leaves water content (%)	87.93	87.68
Reducing sugars (mg/g D.W.)	30.13 b	34.79a	Na (%)	1.45 b	1.56 a
Anthocyain concentration (mg/100 g D.W.)	45.71 b	47.79 a	Total nitrogen (%)	3.62 b	4.48 a
Total free amino acids (mg/g D.W.)	6.40 b	9.48 a	P (%)	0.17	0.17
Proline concentration (mg/g D.W.)	2.34 a	2.12 b	K (%)	3.29	3.35
Total indols (μg/g D.W.)	827.5 a	799.4 b	Total carotenoids (μg/g F.W.)	163.9a	137.9b
Conjugated phenols (mg/g D.W.)	1.09	1.51	Chlorophyll "A" (ug/g F.W.)	837.74	847.10
Free phenols (mg/g D.W.)	0.40 b	0.69 a	Chlorophyll "B" (μg/g F.W.)	503.07	489.14

Table (6): Effect of GA_3 and Alar on some chemical constituents of canola grown under salinity stress (over two seasons).

Parameters	Treatment (ppm)						
	GA_3 100	GA_3 200	GA_3 300	Alar 300	Alar 400	Alar 500	Control
Total carbohydrates (mg/g D.W.)	188.3b	199.8a	202.3a	200.8a	199.5a	198.3a	175.5c
Total sugars (mg/g D.W.)	46.80c	54.51a	45.50c	52.07b	55.48a	47.16c	41.22d
Reducing sugars (mg/g D.W.)	31.85c	39.83a	29.39d	36.35b	33.28c	29.00d	26.88e
Anthocyain concentration (mg/100 g D.W.)	47.77 b	51.00 a	7.00 b	7.82 b	47.58 b	45.34 c	40.75 d
Total free amino acids (mg/g D.W.)	8.57 b	7.65 c	6.32 d	9.97 a	8.82 b	8.14 bc	6.09 d
Proline concentration (mg/g D.W.)	2.57 a	2.42 b	2.14 c	2.43 b	2.19 c	2.02 d	1.84 e
Total indols (μg/g D.W.)	919.0a	906.3a	879.3b	801.5c	749.3d	733.3e	705.5 f
Conjugated phenols (mg/g D.W.)	0.89 d	1.59 b	1.76 a	1.59 b	1.24 c	1.77 a	0.26 e
Free phenols (mg/g D.W.)	0.49 f	0.55 c	0.54 d	0.52 e	0.55 c	0.56 b	0.60 a
Total phenols (mg/g D.W.)	1.40 d	2.14 b	2.29 a	2.12 b	1.79 c	2.33 a	0.87 e
Leaves water content (%)	87.61c	87.87c	87.09d	88.13bc	88.45ab	88.67a	86.82d
Na (%)	1.54bc	1.61b	1.47c	1.37de	1.46cd	1.29e	1.79a
Total nitrogen (%)	4.53b	4.74a	3.92d	4.10c	4.48b	3.35e	3.24f
P (%)	0.18a	0.16b	0.15b	0.19a	0.18a	0.18a	0.14c
K (%)	3.41a	3.40a	3.33a	3.38a	3.51a	3.31a	2.91b
Total carotenoids (μg/g F.W.)	140.3c	177.3a	183.8a	125.0d	162.8b	143.8c	123.3d
Chlorophyll "A" (μg/g F.W.)	779.8d	932.5a	937.1a	781.3d	827.3c	868.3b	770.8d
Chlorophyll "B" (μg/g F.W.)	454.3d	511.3b	518.9b	478.8c	514.3b	547.1a	448.3d

The highest total carbohydrates content (221.5g) was produced by H2 line sprayed with 300ppm GA_3 or 500 ppm Alar. Total (60.42) and reduced (48.459) sugar were given by H8 line when treated with 200 ppm GA_3, which showed the highest chlorophyll a similar to that 300 ppm GA_3 application on the same line. Highest means of anthocyanin, total indols and total carotenoids were given by H2 line sprayed with 200 ppm GA_3, total free amino acids was greatest (12.1) in H8 line when treated with 300 ppm Alar which showed similar values of 400 ppm Alar and 100 ppm GA_3. Proline concentration was induced in largest quantities either with 100 ppm GA_3 or 300 ppm Alar sprayed on H2 line and it was lesser sensitive to salt stress than H8 during the growth stage. In connection with this result, Honda *et al.* (1985), Afiah *et al.*, (1999) and Sallam (1999) suggested that proline accumulation considered an adaptive response to salt stress. H2 line treated with 100 or 200 ppm GA_3 produced highest values of total indols. The highest contents of conjugated and total phenols were produced by H8 treated with 500 ppm Alar, and showed greatest content of leaves water content of H2 line. The highest percentages of P were given by H2 treated with 100 ppm GA_3 and H8 treated with 300 ppm Alar. These P values were insignificantly different from those of all Alar concentration used in the study on both lines and 100 ppm GA_3.

Table (7): Effect of interactions between genotypes and growth regulators(GA_3 or Alar) on some chemical constituents of canola under salinity conditions as a combined data.

Parameters	Treatment (ppm)						
	GA_3 100	GA_3 200	GA_3 300	Alar 300	Alar 400	Alar 500	Control
Genotype	**H2**						
Total carbohydrates (mg/g D.W.)	207.5b	212.5b	221.5a	207.5b	207.0b	214.5ab	188.5ed
Total sugars (mg/g D.W.)	45.00e	48.60d	42.95e	55.60b	59.67a	49.57cd	39.95f
Reducing sugars (mg/g D.W.)	32.90cd	31.20de	28.78ef	34.75c	30.95de	26.95fg	25.40g
Anthocyain concentration (mg/100 g D.W.)	48.93b-e	51.40a	48.00d-f	44.40gh	45.95fg	42.23h	39.05I
Total free amino acids (mg/g D.W.)	6.12de	7.61c	5.78de	7.86c	6.19de	5.82de	5.43e
Proline concentration (mg/g D.W.)	2.620a	2.325cd	2.185ef	2.620a	2.390c	2.120f	2.11f
Total indols (μg/g D.W.)	981.0a	974.5a	944.5b	746.0e	746.0e	711.0f	689.5g
Conjugated phenols (mg/g D.W.)	0.71j	1.02h	1.57d	2.15b	1.13f	0.90I	0.161
Free phenols (mg/g D.W.)	0.41gh	0.37i	0.37i	0.42g	0.41gh	0.40h	0.45f
Total phenols (mg/g D.W.)	1.16i	1.39h	1.93e	2.57c	1.54g	1.30h	0.605j
Leaves water content (%)	87.50d	88.40bc	87.85cd	87.47d	88.08b-d	88.93a	87.28d
Na (%)	1.58c-e	1.65bc	1.50d-f	1.23hi	1.30gh	1.171	1.76ab
Total nitrogen (%)	4.19e	4.22e	3.51g	3.72f	3.43g	3.17h	3.08h
P (%)	0.192a	0.156ed	0.150de	0.185ab	0.175ab	0.175ab	0.133e
K (%)	3.43ab	3.42 ab	3.32ab	3.44ab	3.44ab	3.31ab	2.72c
Total carotenoids (μg/g F.W.)	157.7c	187.7a	192.5a	141.5d	159.7c	168.5bc	140.0d
Chlorophyll "A" (ug/g F.W.)	792.0de	900.0b	888.7b	792.5de	811.0d	892.5b	787.5de
Chlorophyll "B" (μg/g F.W.)	469.0g	502.5de	512.5cd	478.5fg	536.0b	559.0a	464.0g
Genotype	**H8**						
Total carbohydrates (mg/g D.W.)	169.0e	187.0cd	183.0d	194.0c	192.0c	182.0d	162.5e
Total sugars (mg/g D.W.)	48.60d	60.42a	48.05d	48.53d	51.30c	44.75e	42.50e
Reducing sugars (mg/g D.W.)	30.80de	48.45a	30.00ef	37.95b	35.60bc	31.05de	28.35fg
Anthocyain concentration (mg/100 g D.W.)	46.60e-g	50.60a-c	46.0fg	51.23ab	49.20a-d	48.45c-e	42.45h
Total free amino acids (mg/g D.W.)	11.01ab	7.68c	6.87cd	12.10a	11.45ab	10.47b	6.76ed
Proline concentration (mg/g D.W.)	2.52b	2.51b	2.10f	2.24de	1.98g	1.91g	1.57h
Total indols (μg/g D.W.)	857.0c	838.2c	814.0d	857.0c	752.5e	755.5e	721.5f
Conjugated phenols (mg/g D.W.)	1.07g	2.16b	1.94c	1.03gh	1.36e	2.64a	0.36k
Free phenols (mg/g D.W.)	0.57e	0.73b	0.71c	0.63d	0.70c	0.73b	0.76a
Total phenols (mg/g D.W.)	1.64f	2.89b	2.66c	1.66f	2.05d	3.37a	1.13i
Leaves water content (%)	87.72cd	87.33d	86.33e	88.80ab	88.82ab	88.42a-c	86.35e
Na (%)	1.50d-f	1.57c-e	1.45ef	1.52e-f	162.cd	1.41fg	1.83a
Total nitrogen (%)	4.87c	5.26b	4.32e	4.48d	5.53a	3.54g	3.40g
P (%)	0.175ab	0.170bc	0.155cd	0.190a	0.185ab	0.18ab	0.14de
K (%)	3.40ab	3.40ab	3.33ab	3.32ab	3.59a	3.32ab	3.10bc
Total carotenoids (μg/g F.W.)	123.0e	167.0bc	175.2b	108.5fg	166.0bc	119.0ef	106.5g
Chlorophyll "A" (ug/g F.W.)	767.5ef	965.0a	985.5a	770.0ef	843.7c	844.0c	754.0f
Chlorophyll "B" (μg/g F.W.)	439.5h	520.0b-d	525.3bc	479.0fg	492.5ef	535.2b	432.5h

3- Yielding and quality traits:

Averages of seed yield and its components as well as seed quality traits of two canola lines under the study grown in salt affected soil and treated with two growth regulators, determined on the second sample taken at harvest, are presented in Tables (8-10) .

a- Effect of genotypes:

It is evident from the data presented in table (8) that, the two canola lines under the study were significantly different regarding plant height, number of branches plant, number of pods/plant, seed yield/plant, seed yield/faddan and seed oil content (%) these significant differences, which frequently detected (among genotypes) by various investigator, might be due to differences in genotypic background, environmental influences and their interaction. Under the present study, the two genotypes interacted differently with soil salinity and growth regulators in addition other environmental factors.

H8 line surpassed H2 line in the above mentioned-five traits. This may be attributed to the well developed roots of H8 (where it showed the heaviest fresh and dry roots, Table 2) which enabled it to absorb water and nutrients form wider and deeper zone in addition to its greater number of leaves, higher percentage of N and better free phenol, reduced sugar and anthocyanin pigment compared with H2 lines during their vegetative growth (Table 4). These characteristics of H8 increased its tolerant to salt and enhanced photosynthetic activity and translocation of photosynthates and consequently increased dry matter accumulation during vegetative growth period. So, its total plant biomass at harvest stage (plant height, No. of branches, pods & seeds) was larger than that of H2 which may be due to the continuity of active synthetic activities and translocation of photosynthates to sink (seed) during reproductive stage as a result of its delayed leaves senescence.

Table (8): Mean performance for yield and its components of two canola genotypes under salinity stress conditions (over two seasons).

Parameters	Genotypes		Parameters	Genotypes	
	H2	H8		H2	H8
Plant height (cm)	80.01b	99.37a	Seed yield/plant (gm)	8.71b	10.12a
Height to 1st branches/ plant (cm)	32.89	35.72	Seed index (gm)	2.97	2.86
Fruiting zone (cm)	48.20	50.72	Seed yield/feddan (kg)	492.17b	556.01a
Number of branches/ plant	5.31b	5.58a	Protein content (%)	25.25	24.68
Number of bods/plant	184.30b	204.61a	Oil content (%)	43.76b	43.82a

b. Effect of growth regulators:

Data presented in Table (9) revealed that all yielding and quality were significantly different due to growth regulator treatments either kind or concentration. The average of treated plants was significantly higher than that of respective untreated one for all studied traits except seed protein content which showed reverse trends. These results reflected, the importance of growth regulates for improving yield, yield components and oil content of canola grown in newly reclaimed salt affected soil. Also, these results confirmed those of vegetative growth discussed herein (Table 3). similar results were previously recorded by various investigators (Stark and Czajkowsha, 1981; Eisa and Ibrahim, 1989, Younis *et al.*, 1991; El-Gezawy *et al.*, 1992b and Sallam, 1999). In regard to the highest percentage of protein content in untreated plant seeds can be explained as being due to that growth regulator enhanced the hydrolytic enzymes of protein (Eisa and Ibrahim, 1989; Khafagi *et al.*, 1986, Ebad *et al.*, 1990 and Sallam, 1999) and consequently relatively inhibited protein synthesis. Untreated plants also showed the lowest position of first branch.

All GA_3 concentrations compared with those of Alar, significantly increased plant height, fruiting zone length, seed index and seed yield faddan. GA_3 with 200 ppm treatment resulted also in the highest number of pods/plant, but had the lowest value of protein content (%) and acceptable oil content (%). Spraying plants with 300ppm GA_3, which possessed greatest number of branches (6.53), highest seed yield/plant (12.23g) and heaviest seed yield/faddon (604.6 kg) in addition to its high seed index (2.899) oil content (44.01%) considered the best treatment of canola grown under salt stress. Superiority of this treatment, followed by 200ppm GA_3, may be ascribed to their relative advantages detected during vegetative growth (Tables 3&6) especially dry mater, chlorophyll, K (%), carotenoids and carbohydrates.

On the contrary, Alar treatments were of lesser effect than GA_3 ones for all traits except seed oil content (%) while Alar treatments showed almost similar effect of GA_3 ones. Treatment with 300 or 500 ppm Alar produced the highest oil content (%) with insignificant difference with that of 400ppm. In this respect, El-Gezawy (1992b) reported that both GA_3 and Alar treatments caused insignificant increases of seed index. In addition, Kamel *et al.* (1998) suggested that Alar at 250 or 500ppm attained the highest increases of seed oil content (%). Treatment with 400 or 500 ppm Alar was better than 300 ppm Alar, due to their acceptable means of seed index, seed yield/faddan and seed oil content (%).

Table (9): Effect of GA_3 and Alar on yield and its components of canola grown under salinity stress (over two seasons).

Parameters	Treatment (ppm)						
	GA_3 100	GA_3 200	GA_3 300	Alar 300	Alar 400	Alar 500	Control
Plant height (cm)	103.0a	103.9a	101.6a	9.97b	93.35b	9.72b	82.91c
Height to 1st branches/ plant (cm)	36.9b	33.29cd	32.30d	32.93d	40.47a	35.80bc	28.83e
Fruiting zone (cm)	53.56ab	56.74a	55.39a	9.38bc	42.08d	6.54cd	42.51d
Number of branches/ plant	5.53bc	5.43cd	5.53a	5.13d	5.76b	5.35cd	4.40e
Number of bods/plant	22.9b	280.8a	223.9b	151.5d	182.4c	222.1b	94.97e
Seed yield/plant (gm)	10.04b	12.17a	12.23a	8.103c	10.24b	9.28bc	3.87d
Seed index (gm)	3.07a	2.99ab	2.89ab	2.80b	2.95ab	3.072a	2.61c
Seed yield/feddan (kg)	583.3a	589.1a	604.6a	512.6c	573.8ab	532.2bc	273.2d
Protein content (%)	24.99b	23.86c	24.86b	25.21b	24.91b	2.63b	26.29a
Oil content (%)	42.93d	43.75bc	44.01ab	44.14a	43.97ab	4.15a	43.57c

c- effect of interaction:

The interaction effects of the two canola lines (H2&H8) with different concentrations of GA_3 and Alar are listed in Table (10). The data showed that all treated H2 and H8 plants had trait averages higher than the corresponding ones of untreated plants; except height to first branches, and protein content (%); due to the desirable effects of the growth regulators on yielding and oil content (%). Low height of first branch of treated plants is one of the important yield components on canola, especially if it coupled with long fruiting zone. It is also noticed that the untreated H8 plants were of higher averages than those of H2 plants for all traits, except fruiting zone length, seed yield/plant and seed protein content(%), indicating that the former (H2) was more salt tolerant than the latter (H8).

Table (10): Effect of interactions between genotypes and growth regulators(GA_3 or Alar) on yield and its components of canola grown under salinity conditions (as a combined data).

Parameters	Treatment (ppm)						
	GA_3 100	GA_3 200	GA_3 300	Alar 300	Alar 400	Alar 500	Control
Genotype	H2						
Plant height (cm)	102.9a-c	103.6ab	95.35de	90.83e-g	87.70fg	92.70ef	80.00h
Height to 1st branches/ plant (cm)	36.97bc	27.77e	32.57d	33.28cd	42.10a	32.37d	25.17e
Fruiting zone (cm)	52.82bc	60.77a	50.25b-d	46.23b-e	36.07f	47.48b-e	43.73de
Number of branches/ plant	5.73cd	4.94fg	6.27b	5.20ef	5.79cd	5.13e-g	4.13h
Number of bods/plant	235.2cd	289.0a	237.8c	107.5g	178.2f	182.5f	82.77h
Seed yield/plant (gm)	10.13c-e	8.19ef	12.38b	7.68f	10.46b-d	8.217ef	3.94g
Seed index (gm)	3.13a-c	3.23a	2.85c-f	2.82d-f	3.16ab	2.99a-e	2.59f
Seed yield/feddan (kg)	572.5bc	488.2de	701.2a	470.5e	563.3bc	456.7e	192.8g
Protein content (%)	24.55c-e	23.30f	25.00b-d	25.52 b	25.32b-d	25.35b-d	27.70a
Oil content (%)	43.60de	43.87b-d	44.15bc	44.07b-d	43.72c-e	43.63de	43.27e
Genotype	H8						
Plant height (cm)	103.2ab	104.2ab	107.8a	99.12b-d	99.00b-d	96.73c-e	85.82g
Height to 1st branches/ plant (cm)	36.02b-d	38.82ab	32.03d	32.58d	38.83ab	39.23ab	32.50d
Fruiting zone (cm)	54.30ab	52.72bc	60.50a	52.53bc	48.08b-e	5.60c-e	41.28ef
Number of branches/ plant	5.33d-f	5.93bc	6.80a	5.07fg	5.74cd	5.558c-e	4.667g
Number of bods/plant	21.7dc	272.5ab	210.0e	195.5ef	186.7f	261.7b	107.2g
Seed yield/plant (gm)	9.94de	16.15a	12.08bc	8.53def	10.02de	10.35cd	3.79g
Seed index (gm)	3.02a-d	2.75d-f	2.93b-e	2.78d-f	2.73ef	3.15ab	2.63f
Seed yield/feddan (kg)	594.0b	690.0a	508.0c-e	554.7b-d	58.2b	607.7b	353.5f
Protein content (%)	25.43bc	24.42de	24.72b-e	2.90b-d	2.50c-e	23.90ef	24.88b-d
Oil content (%)	42.27f	43.63de	43.87b-d	44.22b	4.22b	44.67a	43.87b-c

GA_3, in general, sprayed on either H2 or H8 produced more favourable trait averages than Alar treatments. H2 treated with 200 ppm produced the shortest height to first branch coupled with the tallest fruiting zone with acceptable plant height in addition to heaviest seed index. While the same treatment on H8 produced the highest seed yield/faddan (690.0kg) due to its advantages in seed yield/plant, number of pods/ plant and plant height. H2 treated by GA_3 at 300ppm produced seed yield/faddan (701.21 kg) statistically similar to that of H8 line. Also, 300 ppm GA_3 one H8 resulted in highest values of plant height and number of branches/plant. Regarding Alar effect, it was noticed that 500 ppm on either H2 as H8 gave high seed index, and the same treatment with H8 line resulted in the highest seed oil content (%).

The aforementioned discussion revealed that the two canola lines considered as salt tolerant, but H8 was more tolerant to salt stress than H2. Application of growth regulators nullified the deleterious effect of salinity and encourage photosynthetic activity, dry mater accumulation and improved vegetative and reproductive growth. Alar especially at 400ppm had more desirable effects during vegetative growth, but GA_3 at 300 or 200 ppm was the best for reproductive stage particular for yielding traits.

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صفات النمو الخضري والتركيب الكيماوي والمحصول والجودة للكانولا النامية بأرض متأثرة بالملوحة تحت تأثير المعاملات بمنظمات النمو

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أقيمت تجربتان حقليتين في ارض متأثرة بالملوحة في مزرعة كلية الزراعة بالفيوم لدراسة اثنين من منظمات النمو(وذلك بمستويات صفر، ١٠٠، ٢٠٠، ٣٠٠ جزء في المليون للجبريللين و صفر، ٣٠٠، ٤٠٠، ٥٠٠ جزء في المليون للالار) علي صفات النمو والتركيب الكيماوي المحصول والجودة لسلالتين من الكانولا ، وذلك في تجربة عاملية في تصميم القطاعات الكاملة العشوائيه بأربعة مكررات وبحجم قطعة تجريبية ١٠,٥م٢ . أخذت عينة نباتية عشوائية من كل قطعة تجريبية واستخدمت لتقدير صفات النمو والتركيب الكيماوي، وعند الحصاد أخذت عينة عشوائية لتقدير قياسات المحصول والجودة.

وأشارت النتائج إلي إن كلا من السلالتين اختلفت معنويا لكل من عدد أوراق النبات ووزن الجذور الطازج والجاف وكذلك وزن المجموع الخضري الجاف وعدد ١١صفه من أصل ١٨صفه من التركيب الكيماوي أثناء مرحلة النمو الخضري بالإضافة إلي طول النبات وعدد الأفرع والقرون للنبات ومحصول النبات الفردي والفدان ونسبة الزيت في مرحلة الحصاد.

أظهرت كل من المعاملة بالجبريللين والألار تحت تأثير الملوحة تحسن إيجابي لكل قياسات النمو والتقديرات الكيماوية وصفات المحصول والجودة ماعدا محتوى البروتين عند مقارناتهم بالكنترول. معاملة الجبريللين بتركيز ٢٠٠والالاربتركيز ٣٠٠و٤٠٠جزء في المليون أنتجاعلى وزن للجذور والمجموع الخضري. كل التركيزات المستخدمة من الجبريللين والألار ماعدا الـ١٠٠جزء في المليون من الجبريللين انتجت كمية متشابه من الكربوهيدرات، وكانت معاملة الـ٢٠٠جزء في المليون من الجبريللين أكثر تأثيرا في الصفات الكيماوية حيث انتجت أعلي القيم للسكريات الكلية والمختزلة و الأنثوسيانين و الاندولات الكلية والنيتروجين والبوتاسيوم والكاروتينات و الكلوروفيل(ا) بالاضافة للكربوهيدرات. المعاملة بالألار أعطت تأثير منخفض علي المكونات الكيماوية مقارنة بالجبريللين ولكنها أعطت نسبة عالية من البوتاسيوم والفسفور.

معاملة الألار بتركيز ٥٠٠جزء في المليون أنتجت زيادة في الفينولات الكلية والمحتوي المائي والكلوروفيل(ب) بالإضافة للكربوهيدرات. معظم التركيزات من

الجبريللين والالار كانت متميزة في دليل البذرة. كل معاملات الالار والجبريلين (عند ٣٠٠ جزء في المليون) أنتجت محتوي عالي من الزيت في حين كل المعاملات من الجبريللين والالار (عند ٤٠٠ جزء في المليون) أعطت محصول عالي للفدان.

أما بالنسبة للتفاعل بين التراكيب الو راثية ومنظمات النمو فقد ظهرت النتائج أن المعاملة بالالار عند تركيز ٣٠٠ جزء في المليون قد اعطي زيادة معنوية في معظم صفات النمو للسلالتين (هـ٢، هـ٨)، والمعاملة بالالار عند تركيز ٣٠٠، ٤٠٠ جزء في المليون علي هـ٨ أعطت زيادة في صبغة الأنثوسيانين والأحماض الامينية الحرة الكلية ومحتوي البوتاسيوم والفوسفور بالإضافة الي محتوي الأوراق من الماء. أما المعاملة بالجبريللين بتركيز ٣٠٠ جزء في المليون علي هـ٢ أعطت زيادة معنوية في الكربوهيدرات (تشابة معها الالار بتركيز ٥٠٠ جزء في المليون) والكاروتينات الكلية (تشابة معها المعاملة بالجبريللين ٢٠٠ جزء في المليون). أظهرت معاملة الجبريللين بـ٢٠٠جزء في المليون والالار بـ٤٠٠ جزء في المليون علي هـ٨ زيادة في السكريات الكلية، كما اظهرت المعاملة بالجبريللين والالار عموما زيادة معنوية في البوتاسيوم ونقص في الصوديوم والفينولات الحرة. اما تأثير التفاعل علي صفات المحصول والجودة كان هناك زيادة في محصول الفدان حيث نتج زيادة في معاملة هـ٢ بـ٣٠٠ جزء في المليون من الجبريللين وهـ٨ بمعاملتها بـ٢٠٠ جزء في المليون جبريللين (وهذا بسبب زيادة طول النبات وعدد القرون/نبات). أيضا معاملة هـ٨ بـ٣٠٠ جزء في المليون جبريللين وهـ٢ بـ٢٠٠ جزء في المليون جبريللين ميزة بزيادة في طول النبات وبنقص في منطقة التفريع وزيادة طول المنطقة الثمرية وعدد اكبر من القرون/نبات ودليل بذرة عالي ، في حين معاملة هـ٨ بـ٥٠٠ جزء في المليون الالار قد ادي الي زيادة في محتوي الزيت، بينما أدت كل التركيزات المستخدمة من الجبريللين والالار الي نقص محتوي البذور من البروتين.

ونتيجة لهذة الدراسة فإنه يمكن التوصية باستخدام اى من الجبرلين أو الألار بالتركيزات الموصى بها فى الدراسة فى معاملة نباتات الكانولا النامية فى الأراضى المتأثرة بالملوحة أو الأراضى المستصلحة حديثا والتى تعانى من مشكلة الملوحة الزائدة وذلك لتقليل او تلافى الأثر الضار للملوحة على النمو الخضرى والمحصول ومكوناتة وأيضا للتوسع فى استصلاح الأراضى وزراعها بمحاصيل غير تقليدية تساعد فى سد الفجوة من احتياجات استهلاك الإنسان للزيت وأيضا الصناعات الغذائية المختلفة.