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Full Length Research Paper

Effect of Dripper Lateral Lines Length and Water Salinity on Canola Growth

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Field experiments were conducted during two successive growing seasons in split plot design with three replications each. Salinity is a major abiotic stress significantly influencing the germination and growth of plants. The objectives of this work was, to study the effect of water salinity and irrigation lateral lines length on canola growth and emission uniformity .The treatments used were as follows: different irrigation water salinityS_1,$S_2$and S_3: (1000 ,2000 and 3000 ppm). and using three irrigation lateral lines L_1, L_2;L_3 (40, 60, 80 m). The results on hand showed that increasing salinity from 1000 to 3000 ppm decreased all growth parameter of canola. Significant mean square of the salinity levels, irrigation lateral lines length and salinity ×irrigation lateral lines length interaction effects were exhibited for seeds pod ,seed yield(kg/fed.), plant height(cm.) ,no. of seeds/plant and no. of branches / plant . In all irrigation lateral lines length, this interaction could be put in the following ascending order: water salinity 3000 ppm × irrigation lateral lines length 80 cm.<water salinity 2000 ppm× irrigation lateral lines length 60 cm.<water salinity 1000 ppm× irrigation lateral lines length 40 cm. The differences in the studied parameters between any two interactions were significant at the 5% level. The best lateral length salinity were 40m and 1000 ppm, which gave the highest emission uniformity and canola plant growth.

Keywords: Canola growth, drip lateral length, water saline.

INTRODUCTION

Uniform distribution of water means that all the plants have equal access to water. This is only possible when accurate emitter manufacturing is provided by the company.

A drip irrigation method comprises pumping unit, a mixing chamber, main line, sub main, laterals and emitters. The main line carries water from pumping unit to sub main; sub main conveys water from main to laterals; the laterals are spread in the field along with the rows of plants. The emitters/drippers are then fixed in the laterals to supply water to the application points of requirement, generally near the plant. There are several types of emitters/drippers available in the market. The main purpose of these emitters/drippers is to apply nearly the same of water to each plant throughout length of lateral. However, this cannot be possible because the water carrying capacity of laterals decreases with the increase in length due to friction. Therefore, a well designed drip irrigation system should ensure relatively same amount of water to each plant along the total length of lateral line. The discharge rates for most non-pressure compensating emitters are either greater or less than expected. A coefficient of manufacturing variation integrates the discharge fluctuations along a lateral for a given operating pressure. Its values are found to be greater for pressure

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compensating emitters than for non-compensating emitters (Özekici and Sneed, 1990). Present field study was conducted to evaluate the performance of emitters/drippers under varying lengths of laterals.

Salinity is a major problem that negatively impacts agricultural activities in many regions in the world, and especially when the source of irrigation water is limited the Near East and North Africa region. Generally, salinity problems increase with increasing salt concentration in irrigation water. Crop growth reduction due to salinity is generally related to the osmotic potential of the root-zone soil solution. This will lead to certain phonological changes and substantial reduction in productivity. Salinity also, affects the soil physical properties.

Salinity is a well-known problem in most or all arid and semi-arid regions of the world especially in irrigated areas. Salinity limits productivity of irrigated soils in vast areas of the world (Corwin et al. 1996; Homaee et al. 2002). Over 400 Mha across the world are affected by either salinity or sodicity which accounts for about6% of the world's land. Of the current 230 Mha of irrigated land in the world, 45 Mha are salt-affected (19.5%), and of the 1,500 Mha under dry land agriculture32 Mha (2.1%) are salt-affected to varying degrees(Ghassemi et al. 1995).

Salinity, drought, nutrient imbalances and temperature extremes are among the chief abiotic stresses impairing crop productivity worldwide (Hamida & Shaddad, 2010 and Farooq *et al.*, 2011). Although, salinization occurs mostly in arid- and semi-arid regions of the world but in reality no climatic zone is free from salinity (Bhutta *et al.,* 2004; Rengasamy, 2006). Salinity hampers the crop growth by creating low osmotic potential of soil solution (water stress), nutritional imbalance, specific ion effect (salt stress) and or combination of these factors (Ashraf, 1994; Marschner, 1995). Decrease in osmotic potential is linked with the accumulation of ions in soil solution, whereas nutritional imbalance and specific ion effect is linked with the higher accumulation of ions mainly Na+ and Cl- at toxic levels which leads to lessen the absorption availability of other essential elements like potassium and calcium etc. (El- Bassiouny & Bekheta, 2001).

Canola is an important oilseed with worldwide importance; it is currently ranked third, after soybean and palm oils, and fifth in the world trade in agricultural crops, after rice, wheat, maize and cotton.

In an effort to develop the low erucic acid cultivars, the Canadian plant breeders also attempted to lower the glucosinolate content of the oil-free seed meal. The meal is an excellent source of protein with a favorable balance of amino acids; however, the glucosinolates, which can cause nutritional problems, limit the use of the seed meal as a supplemental animal feed (Thomas, 1986).This intensive breeding program resulted in Canada becoming the first country to produce rapeseed cultivars with low erucic acid in the oil and low glucosinolates in the meal. To differentiate between these double-low cultivars and other rapeseed cultivars, the double-lows were called canola.

The increasing awareness of the health advantages of canola oil, which contains <70 g kg^{-1}, saturated fat, will undoubtedly result in an increasing demand for this product. This demand, as well as the search for alternative crops by growers, may result in plantings on soils where salinity problems already exist or may develop from the use of saline irrigation water. Although a few preliminary studies on the salt tolerance of rapeseed have been conducted in small pot cultures (Ashraf and McNeilly, 1990; Munshi et al., 1986), salt tolerance data are not available to predict canola yield responses in the field.

A few studies were conducted about the effects of salinity on canola. He and Cramer (1992) investigated the effects of seawater salinity on six Brassica species and reported that Brassica napus (canola)was the most tolerant to salinity among the other species such as Brassica campestris, Brassica juncea, Brassica carinata, Brassica nigra, and Brassica oleracea. Redmann et al. (1994) evaluated the seedling emergence and plant

growth of two canola cultivars, HCN92 and Legend, in response to soil salinity under growth chamber conditions in Canada. Salinities varied between 0.8 and 11 dS/m. Salinity increased significantly reducing total seedling emergence and emergence rate, and also caused decreased leaf area, shoot and root biomass and evapotranspiration for both cultivars. Studies by Francois(1994) revealed that increasing the salinity level from 6to 11 dS/m decreased the germination rate of canola from 70 to 20%. The results also showed that salinity had a significant reducing effect on seed yield but non significant effect on seed oil content. Huang and Redmann (1995) reported that Brassica napus was more salt tolerant than Brassica kaber based on the growth responses like total dry matter. In another study Ashraf and Mc Neilly (1990) reported that Brassica napus and Brassica carinata were considered relatively salt-tolerant, whereas Brassica campestris and Brassica junce a relatively sensitive to salinity.

Therefore, the objectives of this work were to study the effect of water salinity and irrigation lateral line on canola growth under drip irrigation system.

MATERIAL AND METHOD

Experimental lay out:

Field experiments were conducted during two consecutive growing seasons in a in split plot design with three replications. four seeds were sown at 15 cm apart between hills and 50 cm between rows .The experimental were fertilized with 25 kg N/ fed. in the form of urea 46% N), 30kg P_2O_5 and 50 kg K_2O, single super

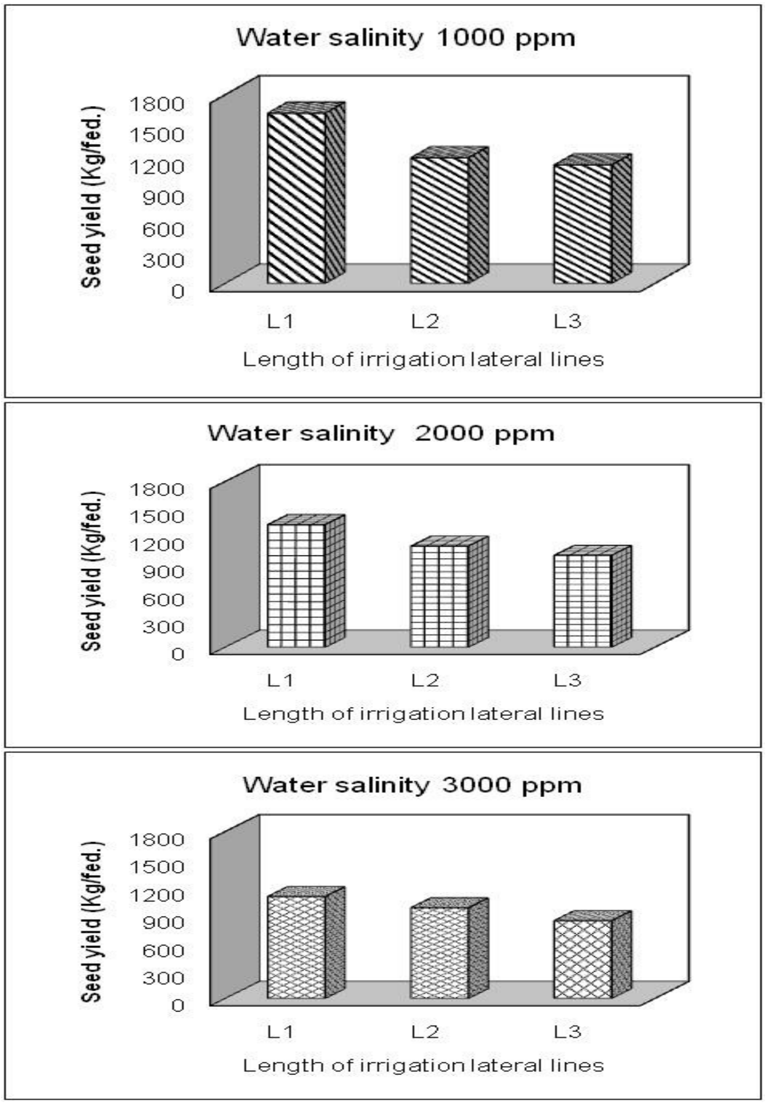

Figure 1: Effect of length of irrigation lateral lines and water salinity on seed yield (Kg/fed.)

phosphate15.5%K_2O and potassium sulphate50% P_2O_5. The single super phosphate and 50% of potassium sulphate were added at planning time, the nitrogen and the rest of potassium were divided on five irrigations after germination. Via irrigation water.

Method of Irrigation

Surface drip irrigation method was used. Standard drippers were spaced 0.3 m apart at the lateral. Dripper discharge is 4 L/hat 1 atm operating pressure.

Emission uniformity

Water distribution uniformity for each treatment by selecting 25 emitters from each treatment randomly, before starting the experiment and at the end . The discharge rates of the emitters were measured . The emission uniformity was calculated according to (Keller and Karameli, 1975) .

EU = 100 1/2[(Qn /Qa) + (Qa / Qx)] -------------(1)
Where:

EU = Field emission uniformity, %

Qn = The average of the lowest (1/4) of the emitters flow rate, Lph

Q_a = The average of the all emitters flow rate, Lph; and

Q_x = The average of the highest(1/8) of the emitters flow rate, Lph .

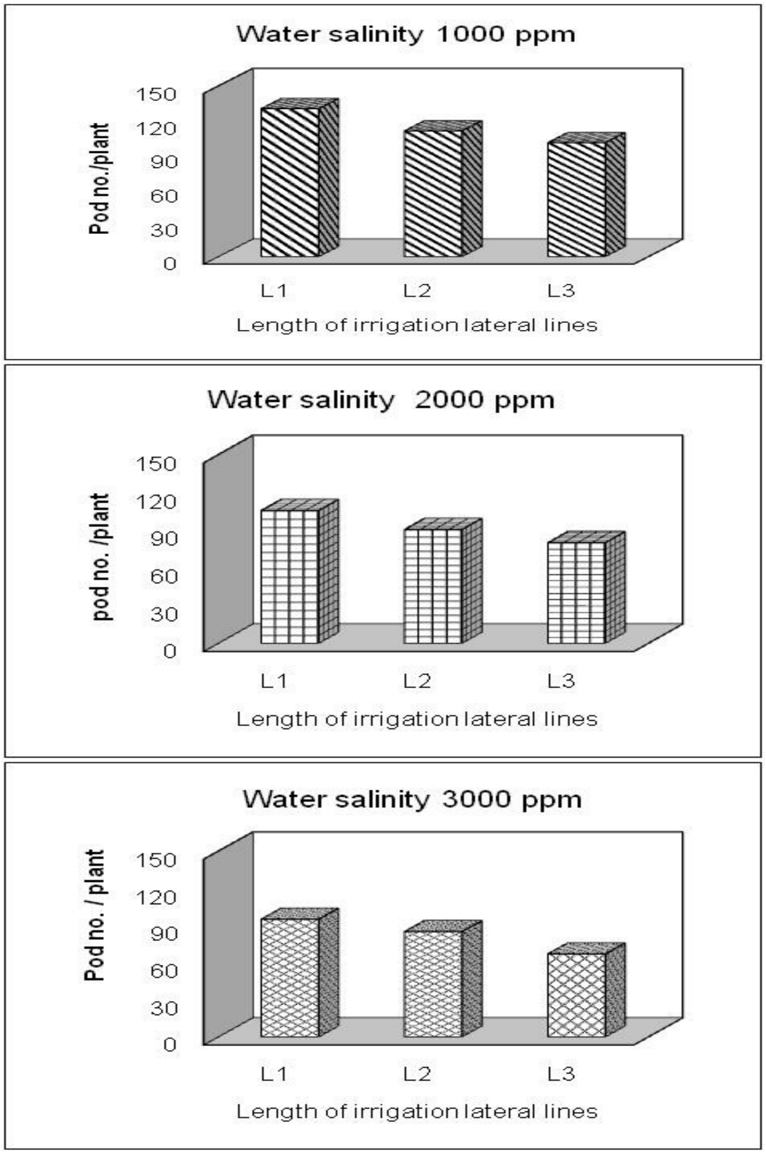

Figure 2: Effect of length of irrigation lateral lines and water salinity on pod number / plant.

Total yield

The total yield of each treatment was determined using a frame 1m × 1m size. The frame was placed randomly and the seed and straw of canola plants within the frame were weighted.

RESULTS AND DISCUSSION

Emission uniformity

Similarly the Emission Uniformity was calculated for pressure compensated type emitters with 45 m , 60 m and 75m lateral lengths .The emission uniformity observed for lateral with 45 m length was about 92.0% while it was 86.2% and 74.3% for the lateral with 60 m and 75m length under built-in emitter.

Main effect of water salinity on plant morphology

The data in fig (1,2,3,4;5)and table (3) showed that the highest seed yield and the lowest one in kg/fed. were obtained in water salinity 1000 and 3000 ppm, respectively. Main effects of water salinity on growth parameters i.e. plant height (cm), pod number / plant, seed number / plant and no. of branches /plant. The obtained data indicated that irrigation water salinity(1000 ppm) exceeded irrigation

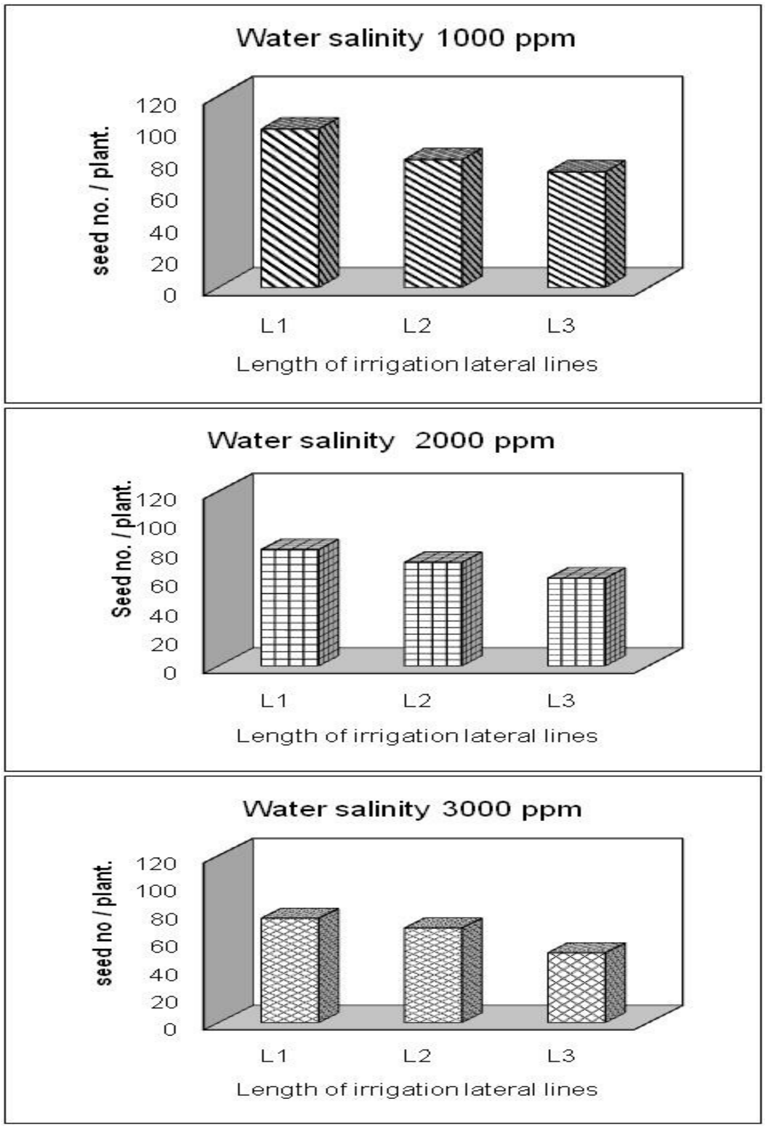

Figure 3: Effect of length of irrigation lateral lines and water salinity on seed number / plant.

water salinity(2000; 3000 ppm) in all the studied growth and growth characters. The main effect of irrigation water salinity on the studied traits could be written the following ascending order S_1<S_2<S_3.The differences in investigated characters among irrigation lateral lines length were significant at the 5% level.

Main effect of irrigation lateral lines length on plant morphology

Results showed that The differences in all investigated characters among irrigation lateral lines length were significant at the 5% level. Irrigation lateral lines (L_1) highest mean seed yield of 1404.2Kg/fed. This superiority was due to improving both vegetative growth, water and fertilizers distribution uniformity. Regard less of water salinty and irrigation lateral lines length treatments, the data in Fig (1,2,3,4;5) and table (3) demonstrated the effect of irrigation lateral lines length on the characters under study. Based upon the obtained values of the studied characters, irrigation lateral lines length could put in the flowing ascending order: L_3<L_2<L_1.

Water salinity × irrigation lateral lines length on plant morphology

In all parameter growth, this interaction could be put in the following ascending order:L_3× 3000 ppm<L_2× 2000 ppm<L_1 × 1000 ppm. Difference in the studied parameters between any two interactions was significant at the 5% level.

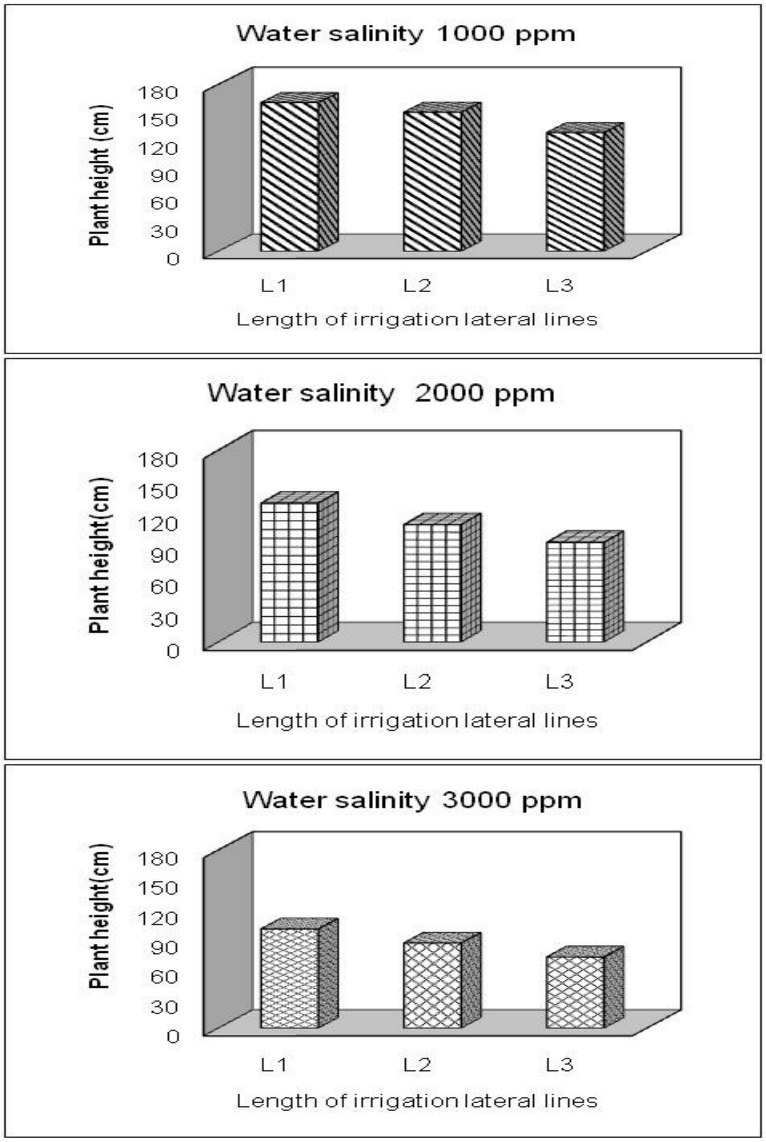

Figure 4: Effect of length of irrigation lateral lines and water salinity on plant height (cm).

Table 1: Some soil physical properties of the experiment at site

Sample depth, cm	Particle Size Distribution, %				θ_w (w/w)% at			O.M. (%)	pH (1:2.5)	EC (dSm^{-1})	Texture class
	Total sand	**Clay and Silt**	**$CaCo_3$ (%)**	**A.W**	**F.C S. P**		**W.P**				
0-20	97.55	2.45	7.02	5.4	10.1	4.7	21.0	0.65	8.7	0.35	Sandy
20-40	96.25	3.75	2.34	7.9	13.5	5.6	19.0	0.40	8.8	0.32	Sandy
40-60	96.18	3.82	4.68	7.9	12.5	4.6	22.0	0.25	9.3	0.44	Sandy

Where:
F. C : Field capacity, **A.W** :Available water , **W.P** : Welting point,

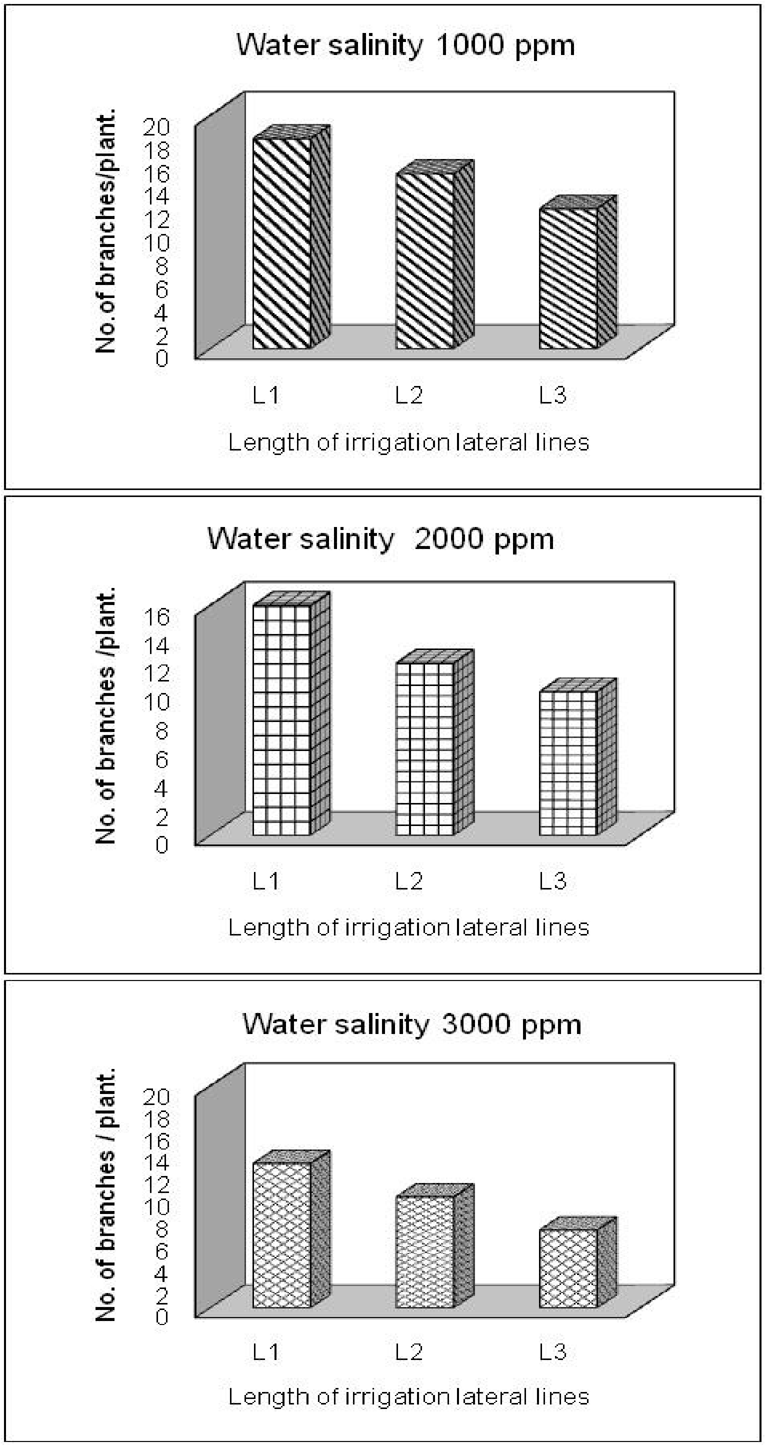

Figure 5: Effect of length of irrigation lateral lines and water salinity on no. of branches /plant.

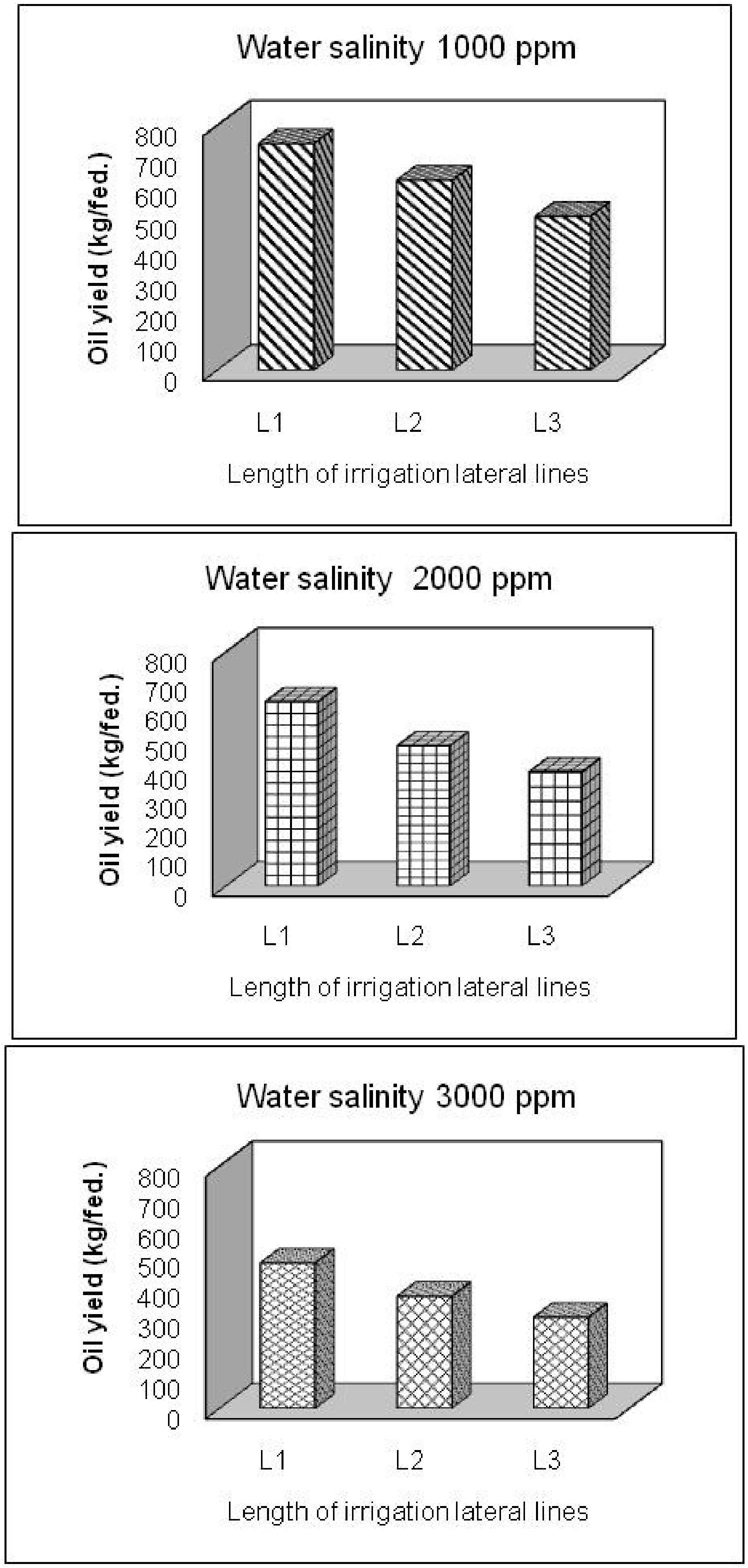

Figure 6: effect of length of irrigation lateral lines and water salinity oil yield (kg/fed.)

Table 2: Some chemical data of the irrigation water

pH 1:2.5	EC dS/m	Souluble ions meq/l							SAR
		Cations				Anions			
		Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO_3^{-}	SO_4^{--}	Cl^{-}	
7.63	0.39	1.02	0.51	2.43	0.22	0.13	1.34	2.71	2.8

Table 3: main effect of irrigation lateral lines length of drip irrigation and water salinity on canola growth

Treatments	seed yield	plant height	pod number/plant	seed number/plant	no.of branches/plant	Oil yield (kg/fed.)
L1(40cm.)	1477.8 a	130.27 a	110.2 a	84.76 a	15.6 a	617a
L_2(60cm.)	1093.5 b	115.4 b	92 b	73.1 b	12.33 b	490.36b
L_3(80cm.)	990.66 c	97.8 c	82.4 c	61 c	9.66 c	398.03c
S_1(1000ppm)	1319 a	146.1 a	113.6 a	83.9 a	15 a	621.5a
S_2(2000ppm)	1143.7 b	111.34 b	92.03 b	70.5 b	12.7 b	500.3b
S_3(3000ppm)	973.6 c	86.03 c	79 c	64.4 c	10 c	383.6c

Means with different letters within each column are significant at 0.05% level.

Table 4: Effect of interaction among treatments on canola growth

Lateral line length	Water salinity	seed yield (Kg/fed.)	pod number / plant.	seed number / plant.	plant height (cm).	no. of branches /plant.	Oil yield (kg/fed.)
L1	S1	1625a	130a	99.3a	160.3a	18a	740.5a
	S2	1330.8b	105.6c	80cb	130.33c	16b	630.5b
	S3	1100.3ed	95e	75d	100.2f	13	480e
L2	S1	1200c	110.5b	80.1b	150b	15c	621c
	S2	1100.5ed	90.5f	71.2ef	110.2e	12d	480e
	S3	980g	75g	68g	86h	10e	370.1g
L3	S1	1132d	100.2d	72.5e	128d	12d	503d
	S2	1000f	80h	60.3h	93.5g	10e	390.4f
	S3	840.4h	67i	50.2i	71.9i	7f	300.7h

Means with different letters within each column are significant at 0.05% level

The maximum values were obtained with the interaction L_1 × 1000 ppm, whereas the minimum ones with the interaction L_3 × 3000 ppm.

CONCLUSION

1. According to the mean values of canola crop growth plant height, seed yield, pod number/plant, seed number/plant and no. of branches/plant. The treatment used could be ranked in the following ascending orders: $L_3<L_2< L_1$.

2. Under the conditions of agriculture in sandy silty soils and medium salinity irrigation water variety planting according to the following order to take the best seed yield output :3000 ppm< 2000 ppm < 1000 ppm.

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