RESULTS AND DISCUSSION

FIRST EXPERIMENT (POT EXPERIMENTS):

TOLERANCE OF SOME PROMISING FLAX GENOTYPES TO SALINITY UNDER POT CONDITIONS:

I: Straw yield and its related characters:

I.1. Technical stem length:

I.1.1. Effect of genotypes:

Results in Table 5 revealed that the six genotypes differed markedly in their technical stem length in both seasons. Technical stem length combined as overall average of the four salinity levels showed that the best genotype was S.341 which was significantly superior to all other genotypes, followed by Giza 7 which was superior to the rest four genotypes. The remaining genotypes could be arranged in a descending order in regard to technical stem length as follows: S.355, Giza 8, S.2419 and S.297. All differences among all genotypes in both seasons were significant indicating a great variation in this trail.

The present results revealed clearly marked differences in the genetical constitution of the tested genotypes. Similar results were also reported by McHughen (1987) who found that flax line (STS 11) was superior in saline soil to its parent variety, McGregor, for straw yield and its components. Also, results obtained by Rowland *et al.* (1988) and Kheir (1991) support the present results.

I- 1-2: Effect of salinity concentration:

Results in Table 5 show clearly the inhibitory effect of increasing the concentration of the mixture of sodium and calcium chloride on technical stem length.

Table (5): Mean values of Technical stem length (cms.) of flax as affected by genotypes and salinity concentrations in 1992/1993 and 1993/1994 seasons

Genotypes (G)	1992 / 1993 season					1993 / 1994 season				
	Salinity conc.(ppm) (S)				Mean	Salinity conc.(ppm) (S)				Mean
	0	1500	3000	4500		0	1500	3000	4500	
1-S. 355	54.33	53.85	52.37	46.31	51.71	54.78	53.04	52.07	45.89	51.45
2- S.341	62.23	60.39	59.88	54.04	59.13	61.31	60.01	59.29	53.28	58.47
3- Giza 7	59.78	58.97	58.22	52.28	57.31	60.32	59.04	58.30	52.38	57.51
4- Giza 8	52.28	50.91	49.38	43.45	49.00	52.95	50.77	49.89	44.08	49.42
5- S. 2419	50.22	49.91	49.00	42.82	47.99	51.01	49.82	49.01	43.03	48.22
6- S. 297	44.41	42.85	41.95	35.38	41.15	43.97	42.00	41.03	35.39	40.60
Mean	53.87	52.81	51.80	45.71	51.05	54.06	52.45	51.60	45.67	50.94

L.S.D. at 0.05 level for :

1992/1993		1993/1994	
G: 0.02**	G x S: 0.05**	G: 0.02**	G x S: 0.03**
S: 0.02**		S: 0.01**	

Results reveal that there was a consistent and progressive depression in technical stem length due to the increase in salinity concentration. Applying irrigation water containing 1500, 3000, 4500 ppm salts compared with the control reduced significantly technical stem length by 1.97, 3.85 and 15.15%, respectively in the first season, corresponding to 2.98, 4.56 and 13.56% in the second season.

The results indicate also that all differences among all salinity levels were significant in both seasons of experimentation.

The present results are in line with those obtained by Balba (1960) with cotton plants, Mitkees *et al.* (1972) with flax plants and Sing *et al.* (1982) with capsicum, who found that high salinity concentrations reduced plant height.

The retarding effect of salinity on technical stem length could be attributed to the rise in the osmotic pressure which inhibits the meristematic tissue activity as stated by Hayward and Spurr (1944) and consequently the size and the number of cells per unit area are markedly reduced.

I.1.3: Interaction effect:

Results in Table 5 show that in both seasons the interaction between genotypes and salt concentration significantly affected technical stem length.

The data indicated that both S.341 and Giza 7 showed the best tolerance to salinity where the reduction in technical stem length due to irrigating with water containing salt concentration of 4500 did not exceed 13% compared with the control treatment. On the other hand technical stem length of S.297 was reduced by about 20% due the irrigation with water containing 4500 ppm salts.

The present results show that S.341 as well as Giza 7 were more tolerant than the other genotypes for technical stem length, whereas S.297 was sensitive to salinity as far as technical stem length is concerned. The results indicated that the highest technical stem length was 62.23 and 61.31 cm in the first and second season, respectively which was recorded with S.341 supplied with tap water. On the other hand, the minimum technical stem length was 35.38 cm in both seasons which was recorded with S.297 at salt concentration of 4500 ppm.

I.2- Stem diameter:

I-2.1. Effect of genotype:

Results in Table 6 show clearly that the tested genotypes significantly varied in their stem diameter in both seasons. It is quite evident from Table 6 that all differences among the six genotypes were significant. S.341 was at the top of all genotypes in stem diameter followed by Giza 7, S.355, Giza 8, S.2419 and S.297 in a descending order. The data in Table 6 indicate a great difference between the first (S.341) and least (S.297) genotypes in stem diameter. The difference being 43.7 and 43.4% in the first and second season, respectively.

These results indicate the superiority of S.341 and Giza 7 genotypes when grown under salinity conditions, and are mainly due to the differences in the genetical constitutions of the evaluated genotypes.

The results are in harmony with those obtained by McHughen (1987), Rowland *et al.* (1988) and Kheir *et al.* (1991).

I-2-2: Effect of salinity concentration:

The data presented in Table 6 show a progressive and consistent reduction in the stem diameter with the increase in salt concentration.

Table (6): Mean values of Stem diameter (mm.) of flax as affected by genotypes and salinity concentrations in 1992/1993 and 1993/1994 seasons

Genotypes (G)	1992 / 1993 season					1993 / 1994 season				
	Salinity conc.(ppm) (S)				Mean	Salinity conc.(ppm) (S)				Mean
	0	1500	3000	4500		0	1500	3000	4500	
1-S. 355	1.711	1.695	1.648	1.457	1.628	1.721	1.702	1.653	1.468	1.636
2- S.341	1.958	1.900	1.885	1.700	1.861	1.971	1.918	1.920	1.712	1.880
3- Giza 7	1.881	1.856	1.831	1.645	1.803	1.888	1.878	1.850	1.652	1.817
4- Giza 8	1.644	1.601	1.542	1.367	1.538	1.638	1.621	1.574	1.368	1.550
5- S. 2419	1.580	1.570	1.542	1.348	1.510	1.591	1.572	1.549	1.364	1.519
6- S. 297	1.397	1.348	1.320	1.113	1.295	1.398	1.358	1.325	1.162	1.311
Mean	1.695	1.662	1.628	1.438	1.606	1.701	1.675	1.645	1.454	1.619

L.S.D. at 0.05 level for :

G: 0.004** G x S: 0.008** G: 0.001** G x S: 0.003**

S: 0.003** S: 0.001**

This reduction reached the significant level at all salt concentrations in both seasons. The average reduction in stem diameter averaged over the studied flax genotypes as a percentage from the control was 1.95, 3.95 and 15.16% for salt concentrations of 1500, 3000 and 4500 ppm respectively in first season, being 1.53, 3.29 and 14.52% for the respective salt concentrations, in second season.

These results are in harmony with those reported by Rowland *et al.* (1988) working on flax plants who found that straw yield and its components recorded least values under soil salinity conditions. The decrease in stem diameter of the flax genotypes irrigated with salinized water might be due to the fact that salinity reduces the rate of water entry into roots, and this will inhibit the meristematic tissue activity (Hayward and Spur, 1944).

I.2.3. Interaction effect:

The interaction between genotypes and salinity concentration significantly affected stem diameter of flax plants in both seasons (Table 6).

The data indicated that the tested genotypes responded differently to salinity concentrations in both the seasons. Giza 7, S.341 and S.2419 showed the highest tolerance to salinity, whereas S.297 genotype was very sensitive as far as stem diameter is concerned.

Results in Table 6 show that increasing salt concentration to 4500 ppm reduced stem diameter of S.341, Giza 7 and S.2419 by 13.3, 12.5 and 13.5%, respectively in the first season compared with tap water irrigation.

The reductions in stem diameter were 10.6, 11.2 and 13.4% in the second season for the three resistant genotypes, respectively. On the other hand, Giza 8 and S.297 showed the least tolerance where the increase in salt concentration to 4500 caused a reduction of 18.8 and 21.2% in the first season and 19.8 and 16.9% in the second season, respectively. The present results indicate clearly a significant interaction effect. The best combination was recorded with S.341 irrigated with tap water in both season with an average stem diameter of 1.958 and 1.971 mm. in the first and second season, respectively. On the other hand, the minimum stem diameter was recorded with S.297 in both season when it was irrigated with a concentration of 4500 ppm, with an average stem diameter of 1.113 and 1.162 mm. in the first and second seasons, respectively.

I.3. Straw yield per plant:

I.3.1. Effect of genotypes:

Results presented in Table 7 reveal clearly that the evaluated genotypes differed greatly in straw yield per plant in both seasons.

A similar trend was also observed with straw yield per plant as that previously discussed with both technical stem length and stem diameter.

Results indicated that S.341 followed by Giza 7 were superior in this character compared with the rest genotypes.

The worst genotype who also S.297 with the lowest straw yield per plant. The six genotypes could be arranged in a descending order in regard to straw yield per plant as follows: S.341, Giza 7, S.355, Giza 8, S.2419 and S.297. This arrangement hold true in both seasons.

S.341 outyielded the rest 5 genotypes by 11.5, 20.1, 27.9 and 57.0% in the first season, respectively.

The increases in straw yield per plant recorded with S.341 in the second season were 10.7, 24.0, 44.4 and 59.6%, respectively. It is worth noting that

Table (7): Mean values of Straw yield per plant (gm) of flax as affected by genotypes and salinity concentrations in 1992/1993 and 1993/1994 seasons

Genotypes (G)	1992 / 1993 season					1993 / 1994 season				
	Salinity conc.(ppm) (S)				Mean	Salinity conc.(ppm) (S)				Mean
	0	1500	3000	4500		0	1500	3000	4500	
1-S. 355	0.843	0.821	0.809	0.746	0.805	0.838	0.820	0.803	0.682	0.786
2- S.341	1.039	0.996	0.964	0.869	0.967	1.032	1.001	0.989	0.878	0.975
3- Giza 7	0.981	0.899	0.859	0.728	0.867	0.978	0.968	0.858	0.721	0.881
4- Giza 8	0.819	0.798	0.768	0.638	0.756	0.820	0.788	0.767	0.629	0.751
5- S. 2419	0.735	0.712	0.692	0.589	0.682	0.729	0.701	0.691	0.578	0.675
6- S. 297	0.698	0.642	0.622	0.501	0.616	0.683	0.638	0.620	0.503	0.611
Mean	0.853	0.811	0.786	0.679	0.782	0.847	0.819	0.788	0.665	0.780

L.S.D. at 0.05 level for :

G: 0.003** G x S: 0.005** G: 0.009** G x S: 0.018**

S: 0.002** S: 0.007**

all differences in this trait among all genotypes were highly significant in both seasons, indicating marked variation in the genetical make up of the genotypes in general and in their tolerance to salinity in particular.

Similar results were also reported by McHughen (1987), Rowland *et al.* (1988) and Kheir *et al.* (1991).

I.3.2. Effect of salinity concentration:

Results in Table 7 indicate clearly that irrigating flax plants by saline water significantly reduced straw yield per plant in both seasons. Applying concentrations of 1500, 3000 and 4500 ppm reduced dry weight per plant by 4.92, 7.86 and 20.40% compared with irrigating with tap water respectively in 1992/1993 season. The corresponding reductions in 1993/94 season were 3.31, 6.97 and 21.49%, respectively.

This result shows clearly the negative effect of salinization on dry matter production in flax plants.

Similar results were also obtained by Mitkees *et al.* (1972), Khalil *et al.* (1978), Rowland *et al.* (1988) and Kheir *et al.* (1991). The bad effects of salinity may be due to inducing poor physical conditions of soil, decreasing water uptake, causing toxic accumulation of Na and Cl and reducing nutritive availability.

I.3.3. Interaction effect:

Results in Table 7 show clearly that the interaction between genotypes and salt concentration significantly affected straw yield per plant in both seasons.

Results indicated that the tested genotypes varied greatly in their tolerance to salinity. In both seasons the best tolerance was obtained by S.355

and S.341 and the least tolerance was recorded with S.297 and Giza 7 concerning straw yield per plant.

Increasing salinity concentration to 4500 ppm reduced straw yield per plant of S.341 by 16.4 and 14.9% in the first and second season, respectively compared with the control. On the other hand, straw yield per plant of S.297 was reduced by 28.3 and 26.4% in the first and second season, respectively due to the increase in salinity concentration from zero to 4500 ppm.

This comparison shows an evidence of interaction where the tested genotypes behaved differently in their tolerance to salinity. The highest straw yield per plant was 1.034 and 1.032 gm in the first and second season, respectively, which was recorded with S.341 supplied with non-saline water. On the other hand the minimum straw yield per plant was recorded in both season by S.297 with an average of 0.501 and 0.503 gm in the first and second season, respectively.

I.4. Fiber yield per plant:

I.4.1. Effect of genotypes:

Results presented in Table 8 revealed that the six genotypes markedly differed in their fiber yield per plant in both seasons.

The evaluated genotypes could be arranged in a descending order in regard to fiber yield per plant in both seasons as follows:

S.341, Giza 7, S.355, Giza 8, S.2419 and S.297. All differences in fiber yield per plant among the six genotypes in both seasons were significant indicating a wide variability of the fiber yielding capacity of the genotypes due to the differences in their genetical make up. It is evident that S.341 is the leading genotype under salinity conditions followed by Giza 7. The present

Table (8): Mean values of Fiber yield per plant (gm) of flax as affected by genotypes and salinity concentrations in 1992/1993 and 1993/1994 seasons

Genotypes	1992 / 1993 season					1993 / 1994 season				
	Salinity conc.(ppm) (S)				Mean	Salinity conc.(ppm) (S)				Mean
(G)	0	1500	3000	4500		0	1500	3000	4500	
1-S. 355	0.133	0.128	0.126	0.109	0.124	0.136	0.133	0.128	0.111	0.127
2- S.341	0.164	0.159	0.148	0.123	0.149	0.173	0.166	0.156	0.128	0.155
3- Giza 7	0.143	0.140	0.136	0.113	0.133	0.141	0.136	0.130	0.119	0.131
4- Giza 8	0.128	0.121	0.114	0.098	0.115	0.131	0.124	0.117	0.100	0.118
5- S. 2419	0.109	0.102	0.092	0.082	0.096	0.112	0.106	0.102	0.089	0.102
6- S. 297	0.103	0.095	0.086	0.068	0.088	0.101	0.096	0.092	0.074	0.090
Mean	0.130	0.124	0.117	0.099	0.118	0.132	0.127	0.120	0.103	0.121

L.S.D. at 0.05 level for :

G: 0.005** G x S: N.S. G: 0.004** G x S: 0.007**

S: 0.004** S: 0.003

results are expected since straw yield per plant, stem diameter and technical stem length followed the same pattern of response.

Similar results were also reported by McHughen (1987), Rowland *et al.* (1988) and Kheir *et al.* (1991).

I.4.2. Effect of salinity concentration:

Results in Table 8 revealed that applying saline water to flax plants significantly reduced fiber yield per plant in both seasons.

This reduction has been progressively increased with the increase in salt concentration of irrigation water.

Irrigating flax plants with concentrations of 1500, 3000 and 4500 ppm significantly reduced fiber yield per plant compared with the control treatment by 4.62, 10.0 and 23.85% respectively in the first season. The corresponding reductions were 3.79%, 9.09 and 21.97%, in the second season for the three concentrations.

The results of fiber yield per plant are coincidental with those of technical stem length, stem diameter and straw yield per plant. Similar results were also obtained by Mitkees *et al.* (1972), Khalil *et al.* (1978), Rowland *et al.* (1988) and Kheir *et al.* (1991).

I.4.3. Interaction effect:

Results presented in Table 8 show clearly that genotypes x salinity concentration significantly affected fiber yield per plant in both seasons.

It is evident from Table 8 that the tested genotypes showed different responses to salinity concentration.

In both seasons, S.355 and Giza 7 showed the highest tolerance where the fiber yield per plant was reduced by 18.0 and 21.0% in the first season, and by 18.4 and 15.6%, in the second season, respectively for the two genotypes as a result of supplying plants with a concentration of 4500 ppm compared with tap water. On the other hand the serious reduction in fiber yield per plant was recorded with S.297 genotype, being 34.0 and 26.7% in the first and second season, respectively due to increasing salinity level from zero to 4500 ppm.

It is clear that the highest fiber yield per plant was 0.164 and 0.173 gm in the first and second season, respectively which was recorded with S.341 supplied with tap water. Whereas the lowest fiber yield per plant was 0.068 and 0.074 gm in the first and second season, respectively which was produced by S.297 irrigated with a salt concentration of 4500 ppm.

II: Seed yield and its related characters:

II.1. Upper branching zone length:

II.1.1. Effect of genotypes:

Results presented in Table 9 revealed that the six tested genotypes markedly differed in upper branching zone length in both seasons.

It is worth mentioning that all differences among the genotypes were significant indicating a wide variation in this trait. It is clear from the Table that the tallest upper branching zone was recorded with Giza 8 followed by S.355, S.341, S.2419 and S.297 in a descending order.

In 1992/93 season the upper branching zone of Giza 8 exceeded that of the other five genotypes by 12.85, 19.34, 29.00 an 43.75%, respectively. In

Table (9): Mean values of Upper branching zone length (cms) of flax as affected by genotypes and salinity concentrations in 1992/1993 and 1993/1994 seasons

Genotypes (G)	1992 / 1993 season					1993 / 1994 season				
	Salinity conc.(ppm) (S)				Mean	Salinity conc.(ppm) (S)				Mean
	0	1500	3000	4500		0	1500	3000	4500	
1-S. 355	11.80	11.64	11.37	10.04	11.21	11.31	11.21	11.17	9.89	10.89
2- S.341	10.99	10.72	10.68	10.00	10.60	10.68	10.49	10.38	9.90	10.36
3- Giza 7	10.21	10.02	9.98	9.03	9.81	10.21	10.00	9.83	9.03	9.77
4- Giza 8	13.01	12.98	12.89	11.74	12.65	12.82	12.70	12.49	11.35	12.34
5- S. 2419	9.39	9.24	9.13	8.27	9.00	9.34	9.29	9.08	8.02	8.93
6- S. 297	9.21	9.01	8.82	8.15	8.80	8.97	8.87	8.69	7.95	8.62
Mean	10.76	10.60	10.48	9.54	10.35	10.55	10.42	10.27	9.36	10.15

L.S.D. at 0.05 level for :

1992 / 1993 season		1993 / 1994 season	
G: 0.02**	G x S: 0.03**	G: 0.02**	G x S: 0.03**
S: 0.01**		S: 0.02**	

1993/94 season the increases in upper branching zone of Giza 8 were 13.31, 19.11, 26.31 and 43.16% respectively.

This result indicates clearly a wide variation in the genetical constitution of the tested varieties. The present results are in line with those reported by McHughen (1987), Popa (1989), Rowland *et al.* (1989 a and b) and Kheir *et al.* (1991).

II.1.2. Effect of salinity concentration:

The available data demonstrate clearly the inhibitory effect of increasing the concentration of a mixture of sodium and calcium chloride on upper branching zone length (Table 9).

Results reveal that there was a progressive and consistent depression in this character due to the increase of salt concentration. The average depression in upper branching zone length for the studied genotypes as a percentage compared with the tap water control was 1.49, 2.60 and 11.34% for the salt concentrations of 1500, 3000 and 4500 ppm in the first season respectively, being 1.23, 2.65 and 11.28% for the respective salt concentrations in the second season.

The present results are in line with those reported by Abo El-Saod *et al.* (1974); Popa (1989) and Kheir *et al.* (1991) working on flax plants.

The retarding effect of salts on upper branching zone length could be attributed to the reduction in water uptake, causing toxic accumulation of Na and Cl and reducing nutrient availability, and consequently reduced the size of the number of cells per unit area. (Hayword and Spurr, 1944)

II. 1.3. Interaction effect:

Results in Table 9 show that upper branching zone length of flax plants was significantly affected by the interaction between genotypes and salinity concentrations in both seasons. It is clear that the tolerance of the tested genotypes varied markedly to the increase in salinity.

In both seasons, S.341 genotype showed the best tolerance to salinity where the increase in salinity from zero to 4500 ppm reduced upper branching zone length by 9.0 and 7.3% in the first and second season, respectively. On the other hand S.355 and S.2419 showed the least tolerance in the first and second season, respectively with a reduction of 14.9 and 14.1% in upper branching zone length due to increasing salinity level from zero to 4500 ppm.

It is evident from the Table that the highest upper branching zone length was 13.01 and 12.82 cm in the first and second season, respectively which were recorded with Giza 8 supplied with non-saline water. On the other hand, the shortest upper branching zone was recorded with S.297 supplied with salinity level of 4500 ppm in both seasons with an average length of 8.15 and 7.95 cm in the two success seasons.

II.2. Number of capsules per plant:

II.2.1. Effect of genotypes:

Results presented in Table 10 show clearly that the tested genotypes differed markedly in their number of capsules per plant in both seasons.

In both seasons the highest number of capsules per plant was recorded with Giza 7 which was significantly superior to all other genotypes. Giza 7 was followed by both Giza 8 and S.341 without significant difference between both. The rest 3 genotypes could be arranged in a descending order as follows: S.355, S.2419 and S.297.

Table (10): Mean values of Number of capsules per plant of flax as affected by genotypes and salinity concentrations in 1992/1993 and 1993/1994 seasons

Genotypes (G)	1992 / 1993 season					1993 / 1994 season				
	Salinity conc.(ppm) (S)				Mean	Salinity conc.(ppm) (S)				Mean
	0	1500	3000	4500		0	1500	3000	4500	
1-S. 355	9.25	6.40	6.25	4.10	6.50	9.28	6.38	6.27	4.17	6.53
2- S.341	9.35	7.98	8.00	5.75	7.77	9.38	7.98	7.93	5.83	7.78
3- Giza 7	8.85	8.70	8.63	6.25	8.11	8.65	8.60	8.65	6.30	8.05
4- Giza 8	8.90	8.65	8.43	5.20	7.79	9.00	8.75	8.45	5.35	7.89
5- S. 2419	6.10	6.27	6.20	3.55	5.53	6.20	6.35	6.20	3.65	5.60
6- S. 297	6.10	5.95	6.13	3.20	5.34	6.20	5.90	6.10	3.15	5.34
Mean	8.09	7.33	7.27	4.68	6.84	8.12	7.32	7.27	4.74	6.86

L.S.D. at 0.05 level for :

G: 0.09** G x S: 0.16** G: 0.13** G x S: 0.17**
S: 0.06** S: 0.07**

It could be concluded that Giza 7, Giza 8 and S.341 are superior in number of capsules per plant compared with the other genotypes.

The marked differences are mainly due to the differences in the genetical make up of the tested genotypes.

Similar results were also reported by McHughen (1987), Popa (1989), Rowland (1989 a and b) and Kheir *et al.* (1991)

II.2.2. Effect of salinity concentration:

The results given in Table 10 indicate that the number of capsules per plant was highly significantly affected by soil salinity in both season. Increasing salt concentration led to significant decrease in number of capsules per plant. The average depression in number of capsules per plant as a percentage compared with the water control was 9.39, 10.14 and 42.15% for the salt concentrations 1500, 3000 and 4500 ppm in the first season, respectively and 9.85,10.47 and 41.01% for the above salt concentrations in the second season.

These results are in accordance with those of Kaddah *et al.* (1973); Abo El-Soad *et al.* (1974); Mokable (1977); Popa (1989); Omar *et al.* (1990) and Kheir *et al.* (1991).

II.2.3. Effect of the interaction:

Results presented in Table 10 show clearly that the tested genotypes markedly differed in their tolerance to salinity in both seasons showing a clear evidence for the significant interaction between genotypes and salinity concentration.

In both seasons, Giza 7 showed the greatest tolerance to salinity followed by S.341. On the other hand S.355 was very sensitive to salinity in both seasons showing the greatest reduction in number of capsules per plant at the highest level of salinity.

The results revealed that Giza 7 ranked as third at the control treatment after S.341 and S.355 in both seasons, whereas at the salinity level of 4500 ppm, Giza 7 ranked as first recording the maximum number of capsules per plant followed by S.341 and S.355.

The reduction in number of capsules per plant for Giza 7, S.341 and S.355 due to the increase in salinity from zero to 4500 ppm was 29.4, 38.5 and 55.7% in the first season, respectively.

The corresponding reductions were 27.2, 37.8 and 55.1% in the second season. The previous results show clearly the superiority of both Giza 7 and S.341 in tolerance to salinity.

The highest number of capsules per plant was recorded with S.341 supplied with non-saline water in both seasons with an average of 9.35 and 9.38 capsules in the first and second season, respectively. On the other hand the lowest average was 3.15 in the first season and 4.75 in the second one which was produced by S.297 supplied with 4500 ppm of salinity concentration.

II.3. Number of seeds per capsule:

II.3.1. Effect of genotypes:

Results presented in Table 11 show clearly that genotypes differed significantly in number of seeds per capsule in both seasons.

The genotypes could be arranged in a descending order in regard to number of seeds per capsule as follows: Giza 8, S.341, S.355, Giza 7, S.2419, and S.297.

Table (11): Mean values of Number of seeds per capsule of flax as affected by genotypes and salinity concentrations in 1992/1993 and 1993/1994 seasons

Genotypes (G)	1992 / 1993 season					1993 / 1994 season				
	Salinity conc.(ppm) (S)				Mean	Salinity conc.(ppm) (S)				Mean
	0	1500	3000	4500		0	1500	3000	4500	
1-S. 355	6.20	6.12	6.10	5.15	5.89	6.05	6.13	6.05	5.07	5.83
2- S.341	6.95	6.98	7.00	5.15	6.52	6.95	6.88	6.98	5.08	6.47
3- Giza 7	6.13	6.07	5.98	4.80	5.74	6.10	6.08	5.98	4.83	5.73
4- Giza 8	6.93	6.98	6.68	5.70	6.57	6.95	6.88	6.55	5.55	6.48
5- S. 2419	5.98	6.10	6.08	4.80	5.74	6.03	5.80	6.00	4.77	5.65
6- S. 297	5.88	5.73	5.75	4.75	5.53	5.73	5.50	5.20	4.65	5.27
Mean	6.34	6.33	6.26	5.06	6.00	6.30	6.21	6.13	4.99	5.91

L.S.D. at 0.05 level for :

1992 / 1993		1993 / 1994	
G: 0.10**	G x S: 0.24**	G: 0.20**	G x S: 0.25**
S: 0.10**		S: 0.10**	

Number of seeds per capsule of the six genotypes averaged: 6.57, 6.52, 5.89, 5.74, 5.74 and 5.53 in the first season respectively, being 6.48, 6.47, 5.83, 5.74, 5.65 and 5.27 in the second seasons.

Most of the differences among genotypes were significant. The present results agree with those obtained by Hella *et al.* (1987), Salama (1988), Kheir *et al.* (1991) and El-Sweify (1993).

II.3.2. Effect of salinity concentration:

The analysis of variance of the number of seeds per capsule showed a significant effect of salinity levels on this trait in both seasons (Table 11).

Increasing salt concentration led to significant reduction in number of seeds per capsule. The average reduction in number of seeds per capsule as a percentage compared with the water control was 0.16, 1.26 and 20.19% for the salt concentrations 1500, 3000 and 4500 ppm. in the first season, respectively, being 1.43, 2.70 and 20.79% for the same salt concentrations in the second season.

These results reveal the inhibitory effect of increasing the concentration of a mixture of NaCl and $CaCl_2$ particularly at the high concentrations on number of seeds per capsule. These results are in accordance with those reported by Kaddah, *et al.* (1973); Mokable (1977), Popa (1989) and Kheir *et al.* (1991)

II.3.3. Effect of the interaction:

The analysis of variance showed that genotypes x salinity concentrations significantly affected number of seeds per capsule in both seasons (Table 11).

The results indicated that under non--salinity condition S.341 produced nearly the same number of seeds per capsule as Giza 8 (6.95 and 6.93 in the first season and 6.95 and 6.95 in the second season, respectively), but under 4500 ppm, Giza 8 beared significantly higher number of seeds per capsule.

The results cleared that Giza 8 beared 5.70 and 5.55 seeds per capsule at 4500 ppm in the first and second season, respectively as against 5.15 and 5.08 for S.341. The differences were highly significant.

This result evidenced the interaction effect and cleared the resistance of Giza 8. The highest number of seeds per capsule was 6.95 in both seasons recorded with S.341 in 1992/93 and with S.341 as well as Giza 8 in 1993/94 grown under non-saline conditions. On the other hand the lowest value was 4.75 and 4.65 in the first and second season, respectively, which was the resultant of S.297 grown under 4500 ppm salinity concentration.

II.4. Number of seeds per plant:

II.4.1. Effect of genotypes:

Results presented in Table 12 indicated that the six tested varieties significantly differed in number of seeds per plant in both seasons.

Giza 8 and S.341 were the leading genotypes bearing about 51 seeds per plant in both seasons on the average of all salinity levels, followed by Giza 7 with about 47 seeds per plant, then S.355 with an average of 38 seeds.

The lowest seed number was produced by S.297 with 30 and 28 seeds per plant in the first and second season, respectively.

In conclusion, genotypes were quite different in number of seeds per plant and the best genotypes were Giza 8 and S.341 which were significantly superior to the other four genotypes.

Table (12): Mean values of Number of seeds per plant of flax as affected by genotypes and salinity concentrations in 1992/1993 and 1993/1994 seasons

Genotypes (G)	1992 / 1993 season					1993 / 1994 season				
	Salinity conc.(ppm) (S)				Mean	Salinity conc.(ppm) (S)				Mean
	0	1500	3000	4500		0	1500	3000	4500	
1-S. 355	56.43	39.68	38.29	21.12	38.88	54.97	39.05	37.96	21.20	38.29
2- S.341	65.46	55.42	55.80	29.62	51.57	65.39	54.83	54.08	29.57	51.21
3- Giza 7	52.88	53.29	52.24	30.00	47.10	51.67	52.25	52.77	30.40	46.77
4- Giza 8	59.42	59.65	59.19	29.64	51.97	58.96	60.16	57.72	29.68	51.88
5- S. 2419	37.06	37.49	37.82	17.03	32.35	37.20	36.83	37.34	17.44	32.20
6- S. 297	35.08	34.96	35.05	15.20	30.07	32.22	32.43	34.93	14.66	28.56
Mean	51.05	46.75	46.40	23.77	41.99	50.07	45.93	44.13	23.82	41.49

L.S.D. at 0.05 level for :

G: 0.58** G x S: 1.84** G: 0.59** G x S: 1.95**

S: 0.75** S: 0.80**

These results are mainly due to the differences in the genetical constitution of the tested genotypes and agree with those obtained by Hella *et al.* (1987), Salama (1988), Kheir *et al.* (1991) and El-Sweify (1993).

II.4.2. Effect of salinity concentration:

The data presented in Table 12 indicated that number of seeds per plant was highly significantly affected by salt concentrations.

Increasing salt concentrations led to significant reduction in number of seeds per plant. The average depression in number of seeds per plant as a percentage compared with the water control was 8.44, 9.12 and 53.44% for the salt concentrations of 1500, 300 and 4500 ppm in the first season, respectively and 8.27, 11.86 and 52.42% for the same salt concentrations in the second season.

The results of number of seeds per plant are coincidental with those of number of seeds per capsule and number of capsules per plant and are in accordance with those of Kaddah *et al.* (1973); Mokable (1977); Popa (1989) and Keir *et al.* (1991).

II. 4.3. Effect of the interaction:

Results in Table 12 indicate a significant effect of the interaction between genotypes and salinity concentration on seeds number per plant in both season.

The most tolerant genotypes was Giza 7 showing the least reduction in this trait due to the increase in salinity level. On the other hand, the greatest reduction was observed with S.355.

The increase in salinity from zero to 4500 ppm reduced seeds number per plant by 44 and 41% in the first and second season, respectively compared with 63 and 62% for S. 355 in the two successive seasons.

It is also evident that the highest number of seeds per plant (65) was recorded with S. 341 under non salinity condition in both seasons, whereas under 4500 ppm salinity level Giza 7 was the best genotypes with an average of 30 seeds per plant followed by Giza 8 and S.341.

It could be concluded that Giza 7 showed the greatest tolerance to salinity as far as number of seeds per plant is concerned. Also Giza 8 as well as S. 341 showed also good tolerance to salinity.

II.5. Seed yield per plant:

II.5.1. Effect of genotypes:

The analysis of variance indicated that the six tested genotypes varied greatly in seed yielding capacity in both seasons (Table 13).

It is clear from Table (13) that Giza 8 was at the top of all genotypes and was significantly superior to the 5 other genotypes in both seasons.

Giza 8 was followed by both S.341 and Giza 7 which were nearly similar in their yielding capacity. In the first season, the six genotypes could be arranged in a descending order in regard to seed yield per plant as follows:

Giza 8, S. 341, Giza 7, S. 355, S. 2419 and S. 297. The arrangement was Giza 8, S. 341, Giza 7, S. 2419, S. 355 and S. 297 in the second season.

All differences in seed yield per plant were significant except those between Giza 7 and S. 341 and between S. 355 and S. 2419 in the second season.

Table (13): Mean values of Seed yield per plant (gm) of flax as affected by genotypes and salinity concentrations in 1992/1993 and 1993/1994 seasons

Genotypes (G)	1992 / 1993 season					1993 / 1994 season				
	Salinity conc.(ppm) (S)				Mean	Salinity conc.(ppm) (S)				Mean
	0	1500	3000	4500		0	1500	3000	4500	
1-S. 355	0.459	0.329	0.320	0.167	0.319	0.454	0.329	0.312	0.172	0.317
2- S.341	0.529	0.458	0.453	0.232	0.418	0.536	0.467	0.438	0.242	0.421
3- Giza 7	0.473	0.472	0.461	0.243	0.412	0.462	0.478	0.465	0.252	0.414
4- Giza 8	0.554	0.541	0.539	0.256	0.472	0.566	0.558	0.530	0.261	0.479
5- S. 2419	0.358	0.359	0.364	0..153	0.308	0.371	0.385	0.366	0.154	0.319
6- S. 297	0.340	0.337	0.338	0.138	0.288	0.329	0.336	0.283	0.130	0.269
Mean	0.450	0.418	0.413	0.198	0.370	0.453	0.425	0.399	0.201	0.370

L.S.D. at 0.05 level for :

G: 0.005** G x S: 0.016** G: 0.005** G x S: 0.019**

S: 0.007** S: 0.008**

The present results are mainly due to the marked differences among the tested genotypes in number of capsules per plant, number of seeds per capsule and number of seeds per plant.

Similar results were also reported by Hella *et al.* (1987), Salama (1988), Kheir *et al.* (1991) and El-Sweify (1993).

II.5.2. Effect of salinity concentration:

Results in Table (13), indicated that the increase in salt concentrations from zero to 1500, 3000 and 4500 ppm reduced significantly the seed yield per plant as a percentage from the water control by 7.11, 8.22 and 56.00% in the fist season, respectively and 6.18, 11.92 and 55.63% in the second season. This decrease in seed yield per plant is mainly due to the reduction in upper branching zone length , number of capsules per plant, number of seeds per capsule and number of seeds per plant. with increasing salinity levels.

These results are in accordance with those of Mitkees *et al.* (1972), Kaddah *et al.* (1973), Abo El-Saod *et al.* (1974), Mokable (1977); Khalil *et al.* (1978); Wasif *et al.* (1983); Francois *et al.* (1984); Babu *et al.* (1987); McHughen (1987), Gore and Bhagwat (1988); Rowland *et al.* (1989 a, b); Omar *et al.* (1990) and Keir *et al.* (1991).

II.5.3. Effect of the interaction:

The analysis of variance indicated a significantly interaction effect of genotypes x salinity concentration on seed yield per plant in both seasons.

The highest tolerance to salinity was observed with Giza 7 in both seasons where the reduction in seed yield per plant as a result for increasing salinity from zero to 4500 ppm was 48.6 and 45.5% in the first and second season, respectively. On the other hand the greatest reduction in seed yield per plant was observed with S. 355, reaching 63.6 and 62.1% in the two successive seasons due to raising salinity level from zero to 4500 ppm.

The highest seed yield per plant was 0.554 and 0.566 gm in the first and second season, respectively, which was recorded with Giza 8 supplied with non-saline water. On the other hand, S. 297 irrigated with water containing salt concentration of 4500 ppm produced the lowest seed yield per plant, being 0.138 and 0.130 gm in the first and second season, respectively.

II.6. Seed index:

II.6.1 Effect of genotypes:

Results showed clearly that genotypes significantly differed in their 1000-seed weight (Table 14).

S. 297 showed its superiority to all other genotypes in 1000-seed weight in the first season with an average of 9.45 gm, while S. 2419 recorded the highest seed index with an average of 9.69 gm in the second season.

The lowest seed index was 7.90 and 7.97 in the first and second season, respectively, which was obtained by S. 341.

The six genotypes could be arranged in a descending order in regard to seed index in the first season as follows: S. 297, S. 2419, Giza 8, Giza 7, S. 355 and S. 341.

All differences were significant except that between the first two genotypes. In The second season, the arrangement was as follows: S. 2419, S. 297, Giza 8, Giza 7, S. 355 and S. 341.

The differences between each of S. 297 and Giza 8, Giza 8 and Giza 7, S.355 and S. 341 were not significant. The marked differences in seed index are mainly due to the differences in the genetical make up of the tested

Table (14): Mean values of Seed index of flax as affected by genotypes and salinity concentrations in 1992/1993 and 1993/1994 seasons

Genotypes (G)	1992 / 1993 season					1993 / 1994 season				
	Salinity conc.(ppm) (S)				Mean	Salinity conc.(ppm) (S)				Mean
	0	1500	3000	4500		0	1500	3000	4500	
1-S. 355	8.203	8.295	8.192	7.730	8.105	8.100	8.295	8.003	7.923	8.080
2- S.341	8.055	8.137	7.870	7.550	7.903	8.155	8.283	7.595	7.853	7.971
3- Giza 7	8.718	8.748	8.868	8.133	8.616	8.520	8.870	8.970	8.407	8.692
4- Giza 8	8.790	9.295	9.098	8.460	8.911	9.220	9.420	8.922	8.618	9.046
5- S. 2419	9.633	9.820	9.778	8.395	9.406	9.970	10.490	9.858	8.422	9.685
6- S. 297	9.615	9.530	9.723	8.930	9.449	9.303	9.302	8.407	8.453	9.163
Mean	8.835	8.964	8.928	8.200	8.732	8.878	9.111	8.989	8.279	8.713

L.S.D. at 0.05 level for :

G: 0.122** G x S: N.S. G: 0.424** G x S: 0.461**

S: 0.182** S: 0.189**

genotypes. These results are in agreement with those obtained by Hell *et al.* (1987), Salam (1988), Kheir *et al.* (1991) and El-Sweify (1993).

II.6.2. Effect of salinity concentration:

Results in Table (14) indicated that seed index increased with the increase of salinity up to 1500 ppm level. This increase was significant in the second season only . The values of seed index tended to decrease again with the rise of salinity level up to 3000 ppm but remained higher than those of the water control then it was reduced compared with the control. The average depression in seed index as a percentage due to the increase in salt concentration from 1500 to 3000 and 4500 was 0.40 and 8.52% in the first season, respectively and 1.34 and 9.13% in the second season. These results are in accordance with those of Khalil *et al.* (1978), and Singh (1979) who reported a positive correlation between 100-seed weight and yield on sodic soil due to the indirect effect of 100-seed weight in yield. Similar results were also obtained by Rowland *et al.* (1989 a, b) and Kheir *et al.* (1991).

II.6.3. Effect of the interaction:

Results in Table 14 showed clearly that genotypes x salinity concentration significantly affected seed index in both seasons.

The results cleared that some genotypes were more tolerant to salinity compared with the other. In the first season Giza 8 and Giza 7 showed the geatest tolerance where the increase in salinity level from zero to 4500 ppm reduced seed index by 3.8 and 6.7%, respectively compared with 12.9% for S. 2419.

In the second season, raising salinity level from zero to 4500 ppm reduced seed index of Giza 7 and Giza 8 by 1.3 and 6.5% respectively as against 15.4% with S. 2419.

In general the highest seed index was 9.778 gm in the first season which was recorded with S. 2419 at salinity level of 3000 ppm, and the lowest value was 7.730 gm which was obtained by S. 355 supplied with 4500 ppm level.

In the second season, the combination of S. 2419 + 1500 ppm recorded the highest seed index, being 10.49 gm whereas S. 341 combined with 3000 ppm produced the minimum seed index which averaged 7.595 gm.

III: Technological characters:

III.1. Fiber length:

III.1.1. Effect of genotypes:

Results in Table 15 showed that the six tested genotypes significantly varied in fiber length in both seasons. All differences among the six genotypes were significant in both seasons.

The six genotypes could be arranged in a descending order in regard to fiber length in both seasons as follow: S. 341, Giza 7, S. 355, Giza 8, S. 2419 and S. 297.

S. 341 was superior to the other five genotypes in fiber length by 3.17, 14.34, 20.69, 24.34 and 43.72%, respectively.

In the second season, S. 341, was also superior to the same five genotypes by 1.69, 13.62, 18.30, 21.26 and 44.03%, respectively.

It could be concluded that the longest fibers were of S. 341 and Giza 7 whereas the shortest fibers were of S. 297 genotypes and the commercial variety Giza 7 was in between.

Table (15): Mean values of Fiber length (cm) of flax as affected by genotypes and salinity concentrations in 1992/1993 and 1993/1994 seasons

Genotypes (G)	1992 / 1993 season					1993 / 1994 season				
	Salinity conc.(ppm) (S)				Mean	Salinity conc.(ppm) (S)				Mean
	0	1500	3000	4500		0	1500	3000	4500	
1-S. 355	48.48	48.07	46.70	41.31	46.14	48.89	47.36	46.46	40.95	45.92
2- S.341	55.51	53.88	53.43	48.21	52.76	54.70	53.54	52.89	47.54	52.17
3- Giza 7	53.34	52.62	51.93	46.65	51.14	53.82	52.62	52.02	46.74	51.30
4- Giza 8	46.61	45.46	44.06	38.72	43.71	47.26	45.29	44.51	39.33	44.10
5- S. 2419	44.79	44.24	42.13	38.56	42.43	45.51	44.46	43.73	38.39	43.02
6- S. 297	39.60	38.22	37.44	31.57	36.71	39.24	37.46	36.61	31.57	36.22
Mean	48.05	47.08	45.95	40.84	45.48	48.24	46.79	46.04	40.75	45.45

L.S.D. at 0.05 level for :

G: 0.444** G x S: N.S. G: 0.084** G x S: 0.313**

S: 0.387** S: 0.128**

It is worth mentioning that the two leading genotypes in fiber length were also the best ones concerning technical stem length and fiber yield per plant.

Consequently, the present results are expected and are mainly due to the differences in the genetical make up of the tested genotypes.

The results agree those obtained by McHughen (1987), Rowland *et al.* (1988), Kheir *et al.* (1991) and El-Seweify (1993).

III. 1.2. Effect of salinity concentration:

The data presented in Table 15 show a progressive and consistent reduction in the fiber length with the increase in salt concentration.

This reduction in fiber length reached the significant level. The average reduction in fiber length combined over the six studied flax genotypes as a percentage compared with the control was 2.03, 4.39 and 15.02% for the salt concentrations of 1500, 3000 and 4500 ppm in the first season, respectively and 3.00, 4.56 and 17% for the same salt concentrations, in the second season.

The increase in fiber length at the control, low and moderate salinity concentration might be due to the previously observed superiority of technical length of flax. Control and low salinity concentration might stimulate the capacity of the plant in building metabolites and this might account much for the superiority in plant growth specially in the technical stem length of flax plant. It might also be attributed to the increase in length of fiber cells and / or to the increase in the number of cells tied together at tapering to form the fiber under the influence of low and moderate salinity concentrations. These results agree with those obtained by Mitkees *et al.* (1972), Abo El-Soad *et al.* (1974) and Kheir *et al.* (1991) working on flax.

III.1.3. Effect of the interaction:

Results presented in Table 15 showed that genotypes x salinity concentration significantly affected fiber length in the second season only. In 1993/1994 season, the greatest reduction in fiber length due to increasing salinity concentration from zero to 4500 ppm was observed with S. 297 being 19.6% compared with 13.1 and 13.2% for S. 341 and Giza 7, respectively.

In other words, S. 341 and Giza 7 showed greater tolerance to salinity compared with S. 297 which was sensitive, while S. 355, Giza 8 and S. 2419 were inbetween.

The maximum value of fiber length in 1993/1994 season was 54.70 cm which was recorded with S. 341 at the control treatment, whereas the minimum length was 31.57 cm recorded by S. 297 at 4500 ppm salinity concentration.

III.2. Fiber fineness:

III.2.1. Effect of genotypes:

Results presented in Table 16 indicated marked differences among the tested genotypes in fiber fineness in both seasons.

Data showed that S. 341 was the best genotype concerning fiber fineness and was significantly superior to other genotypes having fiber fineness of 295.59 and 288.85 Nm in the first and second season, respectively. While, the coarsest fiber was produced by S. 297 with a value of 204.85 and 201.39 Nm in the first season and second season, respectively.

It is worthy to note that the best genotypes regarding fiber fineness were also the best ones concerning fiber length and fiber yield. These results are mainly due to the differences in the genetical make up of the tested genotypes.

Table (16): Mean values of Fiber fineness (Nm) of flax as affected by genotypes and salinity concentrations in 1992/1993 and 1993/1994 seasons

Genotypes (G)	1992 / 1993 season					1993 / 1994 season				
	Salinity conc.(ppm) (S)				Mean	Salinity conc.(ppm) (S)				Mean
	0	1500	3000	4500		0	1500	3000	4500	
1-S. 355	270.80	268.40	260.80	230.70	257.68	273.00	264.50	259.63	228.70	256.46
2- S.341	310.00	304.95	298.20	269.20	295.59	305.50	289.00	295.40	265.50	288.80
3- Giza 7	297.90	293.90	290.00	260.50	285.58	300.60	293.80	290.50	261.00	286.48
4- Giza 8	262.55	253.60	246.00	216.20	244.59	263.80	252.90	248.60	219.60	246.23
5- S. 2419	250.10	248.60	242.50	213.40	238.65	254.10	248.30	244.20	214.65	240.31
6- S. 297	220.60	213.40	209.10	176.30	204.85	219.10	209.20	204.35	172.90	201.39
Mean	268.66	263.81	257.77	227.72	254.49	269.35	259.62	257.11	227.06	253.28

L.S.D. at 0.05 level for :

G: 3.698** G x S: N.S.
S: 3.578**

G: 3.929** G x S: N.S.
S: 2.901**

These results agree with those obtained by McHughen (1987), Rowland *et al.* (1988), Kheir *et al.* (1991) and El-Sweify (1993).

III.2.2. Effect of salinity concentration:

Results in Table 16 reveal that there was progressive and consistent depression in fiber fineness due to the increase of salt concentration.

The average depression in fiber fineness as a percentage compared with the water control was 1.81, 4.05 and 15.24% for the salt concentrations of 1500, 3000 and 4500 ppm in the first season, respectively being 3.61, 4.54 and 15.70% for the same respective concentrations, in the second season.

The results indicate that the highest fiber fineness was achieved at control and low salinity concentration. These results might owe much to the increase in average fiber length and the increase in number of fibers per unit weight. The present results agree with those obtained by Mitkees *et al.* (1972), Abo El-Soad *et al.* (1974) and Kheir *et al.* (1991).

III.2.3. Effect of the interaction:

Results in Table 16 showed that in both seasons genotypes x salinity concentration had no significant effect on fiber fineness. Such result indicates that each experimental factor acted independently in affecting this character.

The present result may be due to that fiber fineness is mainly governed by the genetical constitution of the genotype and is not greatly influenced by environmental factors.

In general the maximum value of fiber fineness was recorded with S. 341 supplied with non-saline water (water control), averaging 310 and 305 Nm in the first and second seasons, respectively. On the other hand the lowest value of fineness was obtained by S. 297, supplied with water containing 4500 ppm salts which was 176.3 and 172.9 Nm in the first and second seasons, respectively.

III.3. Oil percentage:

III.3.1. Effect of genotypes:

The results given in Table 17 indicated that the oil percentage was significantly affected by genotypes.

Data showed that oil percentage reached its maximum value by Giza 8 variety in both seasons with an average of 40.85 and 40.45 in the first and second season respectively, which was significantly higher than in all other genotypes and was followed by S. 341 with an average of 39.53 and 39.46% in the first and second season, respectively.

The lowest oil percentage was obtained by S.297 being 37.47 and 37.58% in 1992/93 and 1993/94 season, respectively. The present results are quite expected and are mainly due to the differences in the genetical constitution of the tested genotypes. Similar results were also reported by Kuznetsova and Rykova (1975) who noticed that seed oil content ranged from 37 to 42% in seed flax. Also Green and Marshall (1981); Salama (1983); Naqvi *et al.* (1987); Rowland *et al.* (1988) and El-Sweify (1993) found marked differences in oil content in flax seed of the different genotypes.

III.3.2. Effect of salinity concentration:

Results in Table 17 indicated that oil percentage significantly increased with the increase of salinity up to 1500 ppm level.

These values of oil percentage tended to decrease againe with the rise of salinty level up to 3000 ppm but remained higher than those of the water

Table (17): Mean values of Oil percentage of flax as affected by genotypes and salinity concentrations in 1992/1993 and 1993/1994 seasons

Genotypes (G)	1992 / 1993 season					1993 / 1994 season				
	Salinity conc.(ppm) (S)				Mean	Salinity conc.(ppm) (S)				Mean
	0	1500	3000	4500		0	1500	3000	4500	
1-S. 355	38.40	39.11	39.37	37.46	38.58	38.48	39.18	39.70	37.38	38.69
2- S.341	39.60	40.28	39.84	38.38	39.53	39.68	40.01	39.91	38.23	39.46
3- Giza 7	40.00	39.55	39.33	36.65	38.88	39.95	39.91	39.82	36.62	39.08
4- Giza 8	41.54	41.53	41.30	39.03	40.85	40.98	40.89	40.91	39.01	40.45
5- S. 2419	38.60	38.80	38.64	36.00	38.01	38.62	39.06	38.69	36.00	38.09
6- S. 297	38.20	38.00	38.02	35.64	37.47	38.30	38.25	38.15	35.62	37.58
Mean	39.35	39.55	39.46	37.19	38.89	39.34	39.55	39.53	37.14	38.89

L.S.D. at 0.05 level for :

G: 0.160** G x S: 0.329 G: 0.156** G x S: 0.234**

S: 0.135** S: 0.096**

control. The average depression in oil percentage as a percentage from the 1500 ppm level was 0.49, 0.23 and 5.95% for the salt concentrations of zero, 3000 and 4500 ppm in the first seasoon, respectively; and 0.54, 0.05 and 6.09% for the respective concentrations in the second season.

These results are in accordance with those of Ahmed *et al.* (1979) who reported increases in oil content of oil seed flax at lower salinity level, whereas higher salinities caused decreases in oil percentage. On the other hand, Omar *et al.* (1990) in their study on sunflower, found that oil seed content was significantly reduced with increasing soil salinity levels.

III.3.3. Effect of the interaction:

Results presented in Table 17 showed that the interaction between genotypes and salinity concentration significantly affected oil percentage in both seasons.

The results indicated that genotypes differed markedly in their tolerance to salinity. In both seasons S. 355 and S. 341 showed the best tolerance to salinity, whereas Giza 7 showed the lowest tolerance.

Increasing the level of salinity from zero to 4500 ppm reduced oil percentage of S. 341 by 3.1 and 1.1% in the first and second season, respectively compared with 8.4 and 8.3% for Giza 7 in the respective seasons. In general, the highest oil percentage was 41.54% in 1992/1993 and 40.98% in 1993/1994 which were recorded with Giza 8 under water control treatment. On the other hand the lowest oil percentage was 35.64 and 35.62% in the first and second season, respectively which were recorded with S. 297 combined with 4500 ppm salinity concentration.

SECOND EXPERIMENT: (FIELD EXPERIMENT):

EFFECT OF SALINITY AND SEEDING RATES ON YIELD AND ITS COMPONENTS OF FLAX UNDER SALINE SOILS CONDITIONS.

I. Straw yield and its related characters:

I.1. Technical stem length:

I.1.1. Effect of genotypes:

The data presented in Table 18 showed that the technical stem length was significantly affected by the different genotypes during the two seasons of study.

However, S. 297 gave the shortest technical stem length in the first season which recorded 70.72 cm, and the commercial variety Giza 8 gave the shortest technical stem in the second season averaging 47.87 cm. While technical stem length of S. 341 was the tallest and recorded 77.68 and 79.56 cm in the first and second season, respectively.

Genotypes could be arranged in a descending order according to technical stem length in the first season as follows: S. 341, Giza 7, S. 355, Giza 8, S. 2419, and S. 297.

All differences were significant except that between S. 341 and Giza 7. In the second season, the arrangement was as follows: S. 341, Giza 7, S. 355, S. 2419, S. 297 and Giza 8. All differences were significant except that between S. 297 and Giza 8.

These differences in technical stem length among genotypes could be attributed to genetical effect. Similar results were obtained by El-Kady (1985), McHughen, (1987); El-Kady *et al.* (1988), Rowland *et al.* (1988); Kheir *et al.*, (1991) and El-Sewefy (1993).

Table (18): Mean values of Technical stem length (cm) of flax as affected by genotypes and seeding rates under saline soil conditions in 1992/1993 and 1993/1994 seasons

Genotypes (G)	1992 / 1993 season				1993 / 1994 season			
	Seeding rates (kg/fed.) S			mean	Seeding rates (kg/fed.) S			mean
	50	60	70		60	70	80	
1-S. 355	70.525	76.963	79.640	75.709	55.325	62.460	67.630	61.805
2- S.341	72.530	77.455	83.050	77.678	64.870	85.495	88.305	79.557
3- Giza 7	70.983	77.043	81.435	76.487	60.765	66.020	68.320	65.035
4- Giza 8	69.943	75.095	79.020	74.686	35.050	53.048	55.503	47.867
5- S. 2419	68.873	71.090	75.382	71.782	44.078	55.315	56.020	51.804
6- S. 297	67.478	70.318	74.367	70.721	43.132	47.863	54.775	48.590
Mean	70.055	74.660	78.816	74.510	50.537	61.700	65.092	59.110

L.S.D. at 0.05 level for :

1992 / 1993		1993 / 1994	
G: 0.211**	G x S: 0.420**	G: 0.786**	G x S: 1.306**
S: 0.172**		S: 0.534**	

The available data demonstrate clearly the inhibitory effect of increasing level of soil salinity on technical stem length (Table 18). Results reveal that there was a progressive and consistent depression in the this character due to the increase of soil salinity from 4.5 mmho/cm in the first season to 6.5 mmho/cm in the second one.

The reduction in technical stem length caused by salinity differed from one genotype to another.

The highest reduction was observed with Giza 8 plants being 35.91%, while S. 341 showed an increase in technical stem length of 2.36%.

The depression effect of salinity on technical stem length of flax genotypes was ascertained by the work of Khalil *et al.* (1978), Rowland *et al.* (1988), and Kheir *et al.* (1991).

I.1.2. Effect of seeding rate:

The effect of seeding rate on technical stem length was highly significant during the two seasons of study (Table 18).

There was a gradual increase in technical stem length with increasing plant population density. The increase in seeding rate from 50 to 60 and 70 kg per fed. increased technical length in the first season by 6.6 and 12.4%, respectively. In the second season, increasing seeding rate from 60 to 70 and 80 kg/fed. significantly increased technical stem length by 22.2 and 28.9%, respectively.

The trend of results under saline conditions (4.5 mmho/cm in the first season and 6.5 mmhos/cm. in the second one) was similar to that under normal conditions. These results are in harmony with those mentioned by El-Hariri (1964), El-Haron and Shaaban (1984), hella *et al.* (1986), El-Kady *et al.* (1988) and El-Sweify (1993).

The data presented in Table 18 show marked reduction in the technical stem length with the increase in level of soil salinity from 4.5 in the first season to 6.5 mmho/cm in the second one. The general mean of technical length genotypes combined over the three seeding rates was reduced from 74.51 to 59.11 cm (20.7%) due to the increase in soil salinity.

I.1.3. Effect of interaction:

Results in Table 18 showed that genotypes x seeding rates significantly affected technical stem length in both seasons.

Results showed that the genotypes responded differently to seeding rate. The greatest response of technical stem length to seeding rate was observed with Giza 7, S. 341 and Giza 8 in the first season, and with Giza 8, S. 341 and S. 2419 in the second one.

In general the maximum technical length was 83.05 cm in the first season, and 88.31 cm in the second one which were recorded with S. 341 sown with 70 and 80 kg per fed. seeding rate in the first and second season, respectively. On the other hand, the minimum technical length was recorded with S. 297 sown with 50 kg/fed. in the first season, being 67.48 cm, whereas Giza 8 under 60 kg seeding rate produced the lowest technical length in the second season averaging 35.05 cm.

I.2. Stem diameter:

I.2.1. Effect of genotypes:

Results in Table 19 show that genotypes differed significantly in stem diameter in both seasons.

The trend of results under saline conditions in both season was similar to those under normal conditions.

Table (19): Mean values of Stem diameter (mm) of flax as affected by genotypes and seeding rates under saline soil conditions in 1992/1993 and 1993/1994 seasons

Genotypes (G)	1992 / 1993 season				1993 / 1994 season			
	Seeding rates (kg/fed.) S			mean	Seeding rates (kg/fed.) S			mean
	50	60	70		60	70	80	
1-S. 355	2.068	2.028	1.975	2.023	1.665	1.400	1.235	1.433
2- S.341	2.115	2.073	2.028	2.072	1.740	1.530	1.485	1.585
3- Giza 7	2.085	2.055	2.003	2.048	1.403	1.175	1.088	1.222
4- Giza 8	2.045	2.008	1.923	1.992	1.485	1.440	1.100	1.342
5- S. 2419	2.020	1.938	1.883	1.947	1.355	1.220	1.155	1.243
6- S. 297	1.960	1.870	1.825	1.885	1.495	1.393	1.338	1.408
Mean	2.049	1.995	1.939	1.994	1.524	1.360	1.233	1.372

L.S.D. at 0.05 level for :

G: 0.012** G x S: 0.023** G: 0.125** G x S: 0.119**

S: 0.009** S: 0.049**

Results showed that S. 341 gave the greatest stem diameter in the first and second seasons, which recorded 2.072 and 1.585 mm. respectively. On the other hand, S. 297 has the lowest stem diameter in the first season which recorded 1.885 mm, and the commercial variety Giza 7 has the lowest stem diameter in the second season, which recorded 1.222 mm.

The present results are mainly due to the differences in the genetical constitutions of the tested genotypes.

The data presented in Table 19 show a marked reduction in the stem diameter with the increase of soil salinity from (4.5 mmhos/cm in the first season to 6.5 mmhos/cm. in the second one).

The greatest reduction was observed with the commercial variety Giza 7 (40.33%), and the lowest reduction was observed with S. 341 plants being (23.50%). These results are in harmony with those obtained by El-Kady (1985), McHughen, (1987), El-Kady *et al.* (1988), Rowland *et al.* (1988) and Kheir *et al.* (1991) who, reported that straw yield and its components were seriously reduced by soil salinity.

I.2.2. Effect of seeding rate:

Analysis of variance showed significant differences due to seeding rates (Table 19).

There was a gradual decrease in stem diameter with increasing plant population density. The increase in seeding rate from 50 to 60 and 70 kg./fed. reduced stem diameter by 2.6 and 5.4% in the first season, respectively. In the second season, increasing seeding rate from 60 to 70 and 80 kg/fed. significantly reduced stem diameter by 10.8 and 19.1%, respectively.

This result is mainly due to the increase in competition among plants grown at dense population for water, light and nutrients, and agreed with those reported by El-Farouk (1968), Zahran *et al.* (1984), Hella *et al.* (1986), El-Kady *et al.* (1988) and El-Sweify (1993).

The data presented in Table 19 show marked reduction in the stem diameter with the increase in level of soil salinity from 4.5 mmho/cm in the first season to 6.5 mmho/cm in the second one.

The decrease in stem diameter which was 31.2% might be due to the fact that salinity reduces the rate of water entry into roots and this will inhibit the meristematic tissue activity (Hayward and Spurr, 1944).

I.2.3. Effect of the interaction:

Results in Table 19 showed that the interaction between genotypes and seeding rate significantly affected stem diameter in both seasons.

The tested genotypes responded differently to seeding rate. In the first season the greatest reduction in stem diameter due to the increase in seeding rate from 50 to 70 was observed with S. 2419, S. 297 and Giza 8 and the lowest response was observed with Giza 7.

In the second season, the greatest reduction was recorded with Giza 8, S. 355 and Giza 7 and the lowest reduction was observed with S. 297 when seeding rate was increased from 60 to 80 kg per fed.

In general, the maximum stem diameter was 2.085 mm in the first season which was recorded with Giza 7 sown with 50 kg/fed. and the lowest value was 1.825 mm obtained with S. 297 under 70 kg/fed. In the second season, the maximum stem diameter was 1.740 mm recorded with S. 341 at 60 kg/fed., whereas the minimum stem diameter was 1.100 mm produced by Giza 8 at 80 kg/fed.

I.3. Straw yield per plant:

I.3.1. Effect of genotypes:

The data presented in Table 20 showed that the straw yield per plant significantly differed among the six genotypes during the two seasons of study.

Results indicated that the highest straw yield per plant was recorded by S. 341 in the first and second season, which was 1.332 and 0.653 gm., respectively. On the other hand S. 297 produced the lowest straw yield per plant in the first season with an average of 1.254 gm, and the commercial variety Giza 8 recorded the lowest straw yield per plant in the second season with an average of 0.383 gm.

All differences among genotypes in straw yield per plant were significant in both seasons with one exception, between Giza 7 and Giza 8 in 1993/94 season, where the difference was too slight and not significant. The present results are mainly due to the differences in the genetical constitution of the genotypes. Similar results were also obtained by Mitkess *et al.* (1972); Khalil *et al.* (1978), Rowland *et al.* (1988) and Kheir *et al.* (1991).

Results in Table 20 reveal that there was a serious depression in straw yield per plant in the second season compared with the first one due to the increase of soil salinity from 4.5 to 6.5 mmhos/cm.

The highest reduction was observed with the two commercial varieties Giza 7 and Giza 8 which recorded 70.63% for both varieties. On the other

Table (20): Mean values of Straw yield per plant (gm) of flax as affected by genotypes and seeding rates under saline soil conditions in 1992/1993 and 1993/1994 seasons

Genotypes (G)	1992 / 1993 season				1993 / 1994 season			
	Seeding rates (kg/fed.) S			mean	Seeding rates (kg/fed.) S			mean
	50	60	70		60	70	80	
1-S. 355	1.277	1.324	1.342	1.314	0.473	0.513	0.624	0.537
2- S.341	1.300	1.331	1.364	1.332	0.584	0.632	0.745	0.653
3- Giza 7	1.284	1.330	1.370	1.328	0.254	0.302	0.616	0.390
4- Giza 8	1.273	1.309	1.332	1.304	0.284	0.421	0.444	0.383
5- S. 2419	1.261	1.265	1.299	1.275	0.458	0.475	0.619	0.517
6- S. 297	1.236	1.250	1.275	1.254	0.441	0.495	0.566	0.500
Mean	1.272	1.301	1.330	1.301	0.416	0.473	0.602	0.497

L.S.D. at 0.05 level for :

G: 0.003** **G x S: 0.005**** **G: 0.009**** **G x S: 0.015****
S: 0.002** **S: 0.006****

hand S. 341 showed the lowest reduction being 50.98%. On the average of the six genotypes, the increase in soil salinity reduced straw yield per plant by 61.8% in the second season compared with the first one.

I. 3.2. Effect of seeding rate:

Results in Table 20 showed that there was a gradual increase in straw yield per plant with increasing plant population density.

The increase in seeding rate from 50 to 60 and 70 kg/fed. increased straw yield per plant by 2.3 and 4.6% in the first season, respectively. In the second season increasing seeding rate from 60 to 70 and 80 kg/fed. significantly increased straw yield per plant by 13.7 and 44.7%, respectively. This results is mainly due to the increase in technical stem length with increasing plant population density.

These results are in harmony with those obtained by Liefstingh and Blink (1972), who found that the highest straw yield was at more than or equal to 2000 seeds/m^2. Also similar results were also reported by Hell *et al.* (1986).

I.3.3. Effect of the interaction:

Results in Table 20 showed that the interaction between genotypes and seeding rates significantly affected straw yield per plant in both seasons.

The tested genotypes responded differently to seeding rate. The highest increase in straw yield per plant due to the increase in seeding rate from 50 to 70 kg/fed was recorded in 1992/93 season with Giza 7 in which was 6.7% and the lowest increase was observed with S. 2419 which was 3.0%.

Also in the 1993/94 season the highest increase in straw yield per plant due to increasing seeding rate from 60 to 80 kg/fed. was 56.3% which was recorded with Giza 8 and the lowest increase was 27.6% which was obtained by S. 341.

In general the highest straw yield per plant in the first season was 1.370 gm which was recorded with Giza 7 sown with 70 kg/fed. and the lowest value was 1.236 gm, obtained by S. 297 at 50 kg/fed. seeding rate. In the second season the highest value was 0.745 gm. which was produced by S. 341 at 80 kg/fed., whereas the lowest straw yield per plant was 0.284 gm., which was obtained by Giza 8 at 60 kg/fed. seeding rate.

I.4. Straw yield per feddan:

I.4.1. Effect of genotypes:

Results in Table 21 revealed that the differences in straw yield per feddan among the genotypes used in this investigation were highly significant during the two seasons.

Results indicated that the highest straw yield per feddan was recorded by S.341 in the first and second season, which was 3.238 and 2.878 tons., respectively. On the other hand S. 297 produced the lowest straw yield per feddan in the first and second season, which was 2.956 and 0.527 tons respectively.

In the first season the six genotypes could be arranged in a descending order concerning straw yield per fed. as follows: S. 341, Giza 7, S. 355, Giza 8, S. 2419 and S. 297.

S. 341 outyielded the rest five genotypes by 3.5, 4.5, 5.3, 7.6 and 9.5%, respectively. In the second seasons, genotypes are arranged as follows: S. 341, S. 355, Giza 7, Giza 8, S. 2419 and S. 297.

Table (21): Mean values of Straw yield per faddan (tons) of flax as affected by genotypes and seeding rates under saline soil conditions in 1992/1993 and 1993/1994 seasons

Genotypes (G)	1992 / 1993 season				1993 / 1994 season			
	Seeding rates (kg/fed.) S			mean	Seeding rates (kg/fed.) S			mean
	50	60	70		60	70	80	
1-S. 355	3.015	3.123	3.161	3.100	0.998	1.015	2.894	1.636
2- S.341	3.062	3.140	3.511	3.238	2.440	2.998	3.196	2.878
3- Giza 7	3.029	3.135	3.220	3.128	0.515	1.270	3.015	1.600
4- Giza 8	3.001	3.086	3.140	3.076	0.506	0.852	1.419	0.926
5- S. 2419	2.975	2.987	3.065	3.009	0.538	0.682	0.758	0.659
6- S. 297	2.913	2.946	3.010	2.956	0.342	0.414	0.824	0.527
Mean	0.299	3.070	3.447	3.172	0.890	1.205	2.018	1.371

L.S.D. at 0.05 level for :

G: 0.001** G x S: 0.003** G: 0.048** G x S: 0.079*

S: 0.001** S: 0.032**

S. 341 outyield the five other genotypes by 75.9, 79.9, 210.8, 336.7 and 446%, respectively. It could be concluded that the superiority of S. 341 under salinity environment is clearly demonstrated.

The present results are mainly due to genetical make up of the tested genotypes and are in harmony with those obtained by Mitkees *et al.* (1972), Khalil *et al.* (1978), Rowland *et al.* (1988) and Kheir *et al.* (1991).

The data of Table 21 indicate that straw yield per feddan was markedly decreased with increasing salinity level from 4.5 in the first season to 6.5 in the second one. The reduction in straw yield per fed. caused by salinity differed from one genotype to another.

The highest reduction was observed with S. 297 plants being 82.17%. On the other hand S. 341 plants recorded the lowest reduction which was 11.12%.

In general, on the average of the six genotypes, straw yield per fed was reduced from 3.172 to 1.371 tons per fed. This reduction reached 56.8%.

I.4.2. Effect of seeding rate:

Data recorded in Table 21 indicated that there were significant differences among the three seeding rates in both season.

The straw yield per feddan increased as seeding rate increased. Increasing seeding rate from 50 to 60 and 70 kg/fed. significantly increased straw yield per fed. by 2.4 and 14.9%, respectively in the first season. Also increasing seeding rate from 60 to 70 and 80 kg/fed. increased straw yield by 35.4 and 126.7% in the second season, respectively.

It is quite evident that the response of flax to seeding rate was greater in the second season due to the increase in soil salinity.

The present result indicates clearly the importance of increasing, the seeding under saline soil condition. These results are in harmony with those mentioned by El-Hariri (1968), Liefstingh and Blink (1972), Nasr El-Din (1983), Hella *et al.* (1986), Salama (1988), Hella *et al.* (1989) and El-Sweify (1993).

Results in Table 21 indicated that increase in level of soil salinity from 4.5 mmhos/cm. in the first season. to 6.5 mmhos/cm in the second one reduced significantly the straw yield per feddan by 56.8% combined over the three seeding rates.

The decrease might be due to the fact that salinity may inhibit growth through disturbances in the water balance and reduction of turgor or ion toxicity acting possible to deplete energy required for the metabolism involved in growth.

I.4.3. Effect of the interaction:

Results in Table 21 showed that the effect of the interaction between genotypes and seeding rates on straw yield per fed. was significant in both season.

The data in Table 21 revealed that genotypes responded to seeding rates differently. In the first season, the greatest response to the increase of seeding rate from 50 to 70 kg/fed. was recorded with S. 341 showing an increase in straw yield of 14.7% compared with 3.3 % for S. 297.

In 1993/94 season, the response of Giza 7 genotype to the increase of seeding rate was quite evident where the straw yield increased to about 4.85 times as a result of increasing seeding rate from 60 to 80 kg/fed. On the other hand S. 341 showed an increase of about 41% due to its tolerance to salinity.

In general the maximum straw yield per fed. in the first season was 3.51 t/fed., which was recorded with S. 341 sown with 70 kg/fed. The minimum yield was obtained by S. 297 sown with 50 kg/fed., being 2.913 t/fed.

In 1993/94 season, the highest straw yield/fed. was 3.196 t/fed., recorded with S. 341 combined with 80 kg/fed., whereas S. 297 seeded with 60 kg/fed. produced the lowest yield which was 0.342 t/fed.

I.5. Fiber yield per plant:

I.5.1. Effect of genotypes:

The data presented in Table 22 showed that the fiber yield per plant varied significantly among the six genotypes during the seasons of study.

Results indicated that the highest fiber yield per plant was recorded by the commercial variety Giza 7 in the first season, which recorded 0.198 gm, and S. 341 plants in the second season with an average of 0.097 gm. On the other hand S. 297 gave the lowest fiber yield per plant in the first and second seasons with an average of 0.156 and 0.051 gm, respectively.

In the first season, genotypes could be arranged in a descending order in regard to fiber yield per plant as follows: Giza 7, S. 341, S. 355, Giza 8, S. 2419 and S. 297. No significant differences were detected among the first three genotypes, (Giza 7, S. 341 and S. 355).

In the second season, the arrangement was as follows: S. 341, S. 355, Giza 7, S. 2419, Giza 8 and S. 297. All differences in fiber yield per plant were significant except between S. 2419 and Giza 8.

The present results are mainly due to the differences in the genetical constitution of the genotypes. Similar results were also obtained by Abo-El-Saod (1974), Khalil *et al.* (1978); McHughen, (1987) and Kheir *et al.* (1991).

Table (22): Mean values of Fiber yield per plant (gm.) of flax as affected by genotypes and seeding rates under saline soil conditions in 1992/1993 and 1993/1994 seasons

Genotypes (G)	1992 / 1993 season				1993 / 1994 season			
	Seeding rates (kg/fed.) S			mean	Seeding rates (kg/fed.) S			mean
	50	60	70		60	70	80	
1-S. 355	0.183	0.197	0.201	0.194	0.066	0.073	0.094	0.077
2- S.341	0.191	0.194	0.207	0.197	0.086	0.089	0.116	0.097
3- Giza 7	0.189	0.200	0.205	0.198	0.038	0.043	0.101	0.061
4- Giza 8	0.171	0.183	0.184	0.179	0.040	0.058	0.070	0.056
5- S. 2419	0.155	0.163	0.170	0.163	0.051	0.056	0.063	0.057
6- S. 297	0.149	0.154	0.166	0.156	0.043	0.051	0.061	0.051
Mean	0.173	0.182	0.189	0.181	0.054	0.062	0.084	0.067

L.S.D. at 0.05 level for :

1992 / 1993 season		1993 / 1994 season	
G: 0.005**	G x S: NS	G: 0.003**	G x S: 0.004**
S: 0.005**		S: 0.002**	

Results in Table 22 reveal that there was a progressive and marked depression in fiber yield per plant due to the increase of soil salinity from (4.5 to 6.5 mmhos/cm). The greatest reduction was observed with the commercial variety Giza 7 which recorded 69.19% and S. 341 plants showed the lowest reduction, which was 50.76%.

The reduction in fiber yield per plant in the second season indicates clearly the serious effects of a high level of salinity on this trait. The present result is in line with that of straw yield per plant.

I.5.2. Effect of seeding rates:

Results in Table 22 showed that there was a gradual increase in fiber yield per plant with increasing seeding rate.

The increase in seeding rate from 50 to 60 and 70 kg/fed. in the first season increased significantly fiber yield per plant by 5.2, and 9.2% respectively.

In the second season (under higher salinity level) the increase in seeding rate from 60 to 70 and 80 kg/fed. increased fiber yield per plant by 14.8 and 55.6%, respectively. These results are in harmony with those mentioned by Liefstingh and Blink (1972).

The data presented in Table 22 show a serious reduction in fiber yield per plant with the increase in level of soil salinity in the second season.

I.5.3. Effect of the interaction:

Results in Table 22 indicate that the interaction between genotypes and seeding rates significantly affected fiber yield per plant in the second season.

In the first season, increasing seeding rate from 50 to 70 kg increased fiber yield per plant from 7.6% with Giza 8 to 11.4% with S. 297.

All genotypes were in the range between these two percentages showing no different response to seeding rates. On the other hand the response of the six genotypes to seeding rates was markedly different in the second season.

The highest increase due to increasing seeding rate from 60 to 80 kg/fed was 166% which was recorded with Giza 7 and the lowest increase was 23.5% obtained with S. 2419.

The maximum fiber yield per plant in the second season was recorded with S. 341 combined with 80 kg/fed. which was 0.116 gm, and the lowest yield was obtained with S. 297 seeded with 60 kg/fed., being 0.043 gm.

I.6. Fiber yield per feddan:

I.6.1. Effect of genotypes:

Results in Table 23 revealed that the differences in fiber yield per feddan among the six genotypes used in this investigation were highly significant during the two seasons.

Results indicated that the highest fiber yield per feddan was recorded by the commercial variety Giza 7 in the first season, which was 475.24 kg, and S. 341 produced the highest fiber yield per feddan in the second season, which was 416.99 kg. On the other hand S. 297 produced the lowest fiber yield per feddan in the first and second seasons, which was 392.21 and 54.86 kgs, respectively.

Table (23): Mean values of Fiber yield per feddan (kgs.) of flax as affected by genotypes and seeding rates under saline soil conditions in 1992/1993 and 1993/1994 seasons

Genotypes (G)	1992 / 1993 season				1993 / 1994 season			
	Seeding rates (kg/fed.) S			mean	Seeding rates (kg/fed.) S			mean
	50	60	70		60	70	80	
1-S. 355	456.515	472.725	478.995	469.412	141.808	143.113	426.098	237.006
2- S.341	457.608	475.550	480.020	471.059	348.023	435.193	467.753	416.989
3- Giza 7	460.375	476.248	489.103	475.242	068.945	180.555	487.370	245.623
4- Giza 8	454.820	461.495	470.383	462.233	067.035	111.645	198.108	125.596
5- S. 2419	404.305	412.125	420.770	412.400	056.282	069.550	078.845	068.226
6- S. 297	385.653	390.877	440.105	392.212	036.460	043.178	084.933	054.857
Mean	436.546	448.170	456.562	447.093	119.759	163.872	290.518	191.383

L.S.D. at 0.05 level for :

1992 / 1993 season		1993 / 1994 season	
G: 1.399**	G x S: 1.664**	G: 3.089**	G x S: 4.057**
S: 0.680**		S: 1.658**	

The six genotypes could be arranged in a descending order in regard to fiber yield per fed in the first season as follows: Giza 7, S. 341, S. 355, Giza 8, S. 2419 and S. 297.

In the second season, the arrangement was: S. 341, Giza 7, S. 355, Giza 8, S. 2419 and S. 297.

All differences among genotypes in both seasons were significant. These results are expected and followed the same trend of straw yield per fed. and fiber yield per plant.

The present results are mainly due to genetical make up of the tested genotypes and are in harmony with those obtained by Abo El-Saod *et al.* (1974), McHughen, (1987) and El-Sweify (1993).

The data of Table 23 indicate that fiber yield per feddan was markedly decreased with increasing salinity level in the second season. On the average of the six genotypes, fiber yield per feddan was reduced in the second season by 57.2% compared with the yield of the first season.

The greatest reduction was observed with S. 297 plants being 86.01%. On the other hand, S. 341 plants recorded the lowest reduction which was only 11.48%. This result indicates clearly the tolerance of S. 341 genotype to salinity.

I.6.2. Effect of seeding rates:

Data recorded in Table 23 indicated that there were significant differences among the three seeding rates in both seasons.

The fiber yield per feddan increased as seeding rate increased. The increase in seeding rate in the first season from 50 to 60 and 70 kg/fed. increased fiber yield per fed. by 2.7 and 4.6% respectively.

In the second season the effect of seeding rates was more evident where the increase in seeding rate from 60 to 70 and 80 kg/fed. increased fiber yield by 36.7 and 142.5%, respectively.

These results are in harmony with those obtained by Liefstingh and Blink (1972); Zahran *et al.* (1984); El-Kady *et al.* (1988), Khalil (1991) and El-Sweify (1993).

I.6.3. Effect of the interaction:

The interaction between genotypes and . seeding rates had a significant effect on fiber yield per fed. in both seasons.

Results in Table 23 showed clearly that the response of genotypes to seeding rates was markedly different. In the first season S. 297 showed the greatest response to the increase in seeding rate from 50 to 70 kg/fed., with an increase of 14.3% in fiber yield, whereas fiber yield of Giza 8 increased only by 3.5%.

In the second season the effect of the interaction was more evident, where Giza 7 recorded an excessive increase in fiber yield of about 600% compared with an increase of about 34% with S. 341 as a result of increasing seeding rate from 60 to 80 kg/fed.

In general, the highest fiber yield per fed. in the first season was 489.103 kg which was recorded with Giza 7 seeded by 70 kg/fed. and the lowest yield was 385.653kg produced by S. 297 combined with 50 kg/fed. In the second season, also Giza 7 at 80 kg seeding rate produced the maximum fiber yield per fed., which was 487.37, and S. 297 combined with 60 kg/fed. produced the lowest yield being 36.460 kg only.

I.7. Total fiber percentage:

I.7.1. Effect of genotypes:

The data presented in Table 24 showed that the total fiber percentage significantly differed among the six genotypes during the two seasons of study.

Results indicated that the highest total fiber percentage was recorded by the commercial variety Giza 7, in the first season which was 15.23% and by S. 341 which recorded 14.58% in the second season. On the other hand S. 297 showed the lowest total fiber percentage, which was 12.50 and 9.96% in the first and second season, respectively.

These results are in agreement with those obtained by McHughen, (1987), Naqvi *et al.* (1987) and Kheir *et al.* (1991).

The data of Table 24 indicate that total fiber percentage was markedly decreased with increasing salinity level in the second seasons. The overall average of total fiber percentage of the six genotypes was 13.98% in the first season compared with 12.76% in the second one.

The reduction in total fiber percentage caused by salinity differed from one genotype to another. The highest reduction was observed with S. 2419 plants being 2.78%. On the other hand S. 341 plants recorded the lowest reduction which was 0.27%. This result indicates the tolerance of S. 341 to salinity.

Table (24): Mean values of Total fiber percentage of flax as affected by genotypes and seeding rates under saline soil conditions in 1992/1993 and 1993/1994 seasons

Genotypes (G)	1992 / 1993 season				1993 / 1994 season			
	Seeding rates (kg/fed.) S			mean	Seeding rates (kg/fed.) S			mean
	50	60	70		60	70	80	
1-S. 355	14.178	14.873	15.090	14.713	13.953	14.093	14.850	14.298
2- S.341	14.478	14.870	15.195	14.848	14.153	14.638	14.935	14.575
3- Giza 7	14.753	15.055	15.895	15.233	13.643	14.208	15.623	14.491
4- Giza 8	13.208	13.883	14.310	13.800	12.775	13.108	13.773	13.218
5- S. 2419	12.440	12.853	13.090	12.794	09.768	10.118	10.140	10.008
6- S. 297	12.063	12.503	12.940	12.502	09.803	09.970	10.118	09.963
Mean	13.520	14.006	14.419	13.982	12.349	12.689	13.240	12.759

L.S.D. at 0.05 level for :

G: 0.089** **G x S: 0.151**** **G: 0.109**** **G x S: 0.216****

S: 0.062** **S: 0.088****

I.7.2. Effect of seeding rates:

The effect of seeding rate on total fiber percentage was highly significant during the two seasons of study (Table 24).

There was a gradual increase in total fiber percentage with increasing plant seeding rate. Increasing seeding rate from 50 to 60 and 70 kg/fed. significantly increased total fiber percentage from 13.520 to 14.006 and 14.419 respectively, in the first season.

In the second season, increasing seeding rate from 60 to 70 and 80 kg/fed. induced increase in fiber percentage from 12.349 to 12.689 and 13.240 %, respectively. Similar results were obtained by Zahran et al (1984) and El. Sweify (1993).

I.7.3. Effect of the interaction:

Results in Table 24 showed that genotypes x seeding rates significantly affected total fiber percentage in both seasons.

In the first season, increasing seeding rate from 50 to 70 kg/fed. caused an increase of 1.142 in total fiber percentage with Giza 7 compared with 0.877 with S. 297. Also, in the second season, Giza 7 recorded the greatest increase in total fiber percentage due to the increase in seeding rate from 60 to 80 kg per feddan which was 1.980 as against 0.305 for S. 297.

In general, the maximum total fiber percentage in the first season was 15.895% which was recorded with Giza 7 seeded by 70 kg per fed., and the minimum total fiber percentage was 12.063% recorded with S. 297 combined with 50 kg per fed. In the second season, the highest value was also recorded with Giza 7 combined with 80 kg/fed., which was 15.623% and the lowest value was 9.803% which was obtained by S. 297 at 60 kg per fed. seeding rate.

II. Seed yield and its Related characters:

II.1. Upper branching Zone length:

II.1.1. Effect of genotypes.

Results presented in Table 25 show that genotypes significantly differed in upper branching zone length in both seasons.

In 1992/93 season, Giza 7 had the highest upper branching zone length, followed by S. 355, Giza 8, S. 341, S. 2419 and S. 297, in a descending order. All differences among genotypes were significant in that season. In 1993/94 season, the results were quite different due to the increase in soil salinity and the leading genotypes in upper branching zone length were S. 297, S. 355 and S. 341 without significant differences among them.

These three genotypes were significantly superior to the other three genotypes in this trait. Also the rest three genotypes, namely Giza 8, Giza 7 and S. 2419 were similar in this trait without any significant difference.

The present results indicate clearly that S. 355 and S. 341 are tolerant to salinity compared with the other genotypes.

The differences among genotypes are mainly due to the differences in the genetical constitution. Similar results were also obtained by El-Kady (1985), El-Kady *et al.* (1988), Kheir *et al.* (1991) and El-Sweify (1993).

It is evident that the increase in soil salinity from 4.5 mmohs/cm in the first season to 6.5 mmohs/cm in the second one markedly reduced upper branching zone length on the overall average of the six genotypes from 13.319 to 4.362 cm or 67.2% showing the negative effects of salinity.

It is worth noting that the reduction due to the increase in salinity markedly differed among the six genotypes.

Table (25): Mean values of Upper branching zone length (cm.) of flax as affected by genotypes and seeding rates under saline soil conditions in 1992/1993 and 1993/1994 seasons

Genotypes (G)	1992 / 1993 season				1993 / 1994 season			
	Seeding rates (kg/fed.) S			mean	Seeding rates (kg/fed.) S			mean
	50	60	70		60	70	80	
1-S. 355	15.000	13.760	12.508	13.756	5.700	4.475	4.325	4.833
2- S.341	14.433	13.675	11.458	13.188	4.830	4.810	4.730	4.790
3- Giza 7	15.088	14.275	12.593	13.985	3.975	3.835	4.823	3.878
4- Giza 8	14.358	13.635	12.623	13.538	4.790	3.725	3.410	3.975
5- S. 2419	13.688	12.950	12.005	12.881	3.900	4.030	3.530	3.820
6- S. 297	13.418	12.705	11.570	12.564	5.630	4.918	4.080	4.876
Mean	14.330	13.500	12.126	13.319	4.804	4.299	3.983	4.362

L.S.D. at 0.05 level for :

1992 / 1993		1993 / 1994	
G: 0.137**	G x S: 0.185**	G: 0.238**	G x S: 0.506**
S: 0.076**		S: 0.207**	

The most tolerant genotypes were S. 355, S. 341 and S. 297, showing a reduction of 64.9, 63.7 and 61.2%, respectively. The three other genotypes, namely, Giza 7, Giza 8 and S. 2419 recorded a reduction in upper branching zone length in the second season of 71.4, 70.6 and 70.3%, respectively, compared with the first season.

II.1.2. Effect of seeding rates:

Results in Table 25 showed that increasing seeding rates significantly reduced upper branching zone length in both seasons.

In 1992/93 season, increasing seeding rate from 50 to 60 and 70 kg/fed. significantly reduced upper branching zone length by 5.8 and 15.4%, respectively. Also, in 1993/94 season, increasing seeding rate from 60 to 70 and 80 kg/fed., significantly reduced upper branching zone length by 10.5 and 17.1%, respectively.

The reduction in upper branching zone length due to the increase in seeding rate is mainly due to the increase in competition among growing flax plants for water, nutrients and light.

Similar results were also obtained by El-Hariri (1964); El-Farouk (1968), El-Ganayni (1985); El-Kady *et al.* (1985), Zeidan (1989) and El-Sweify (1993).

II.1.3. Effect of the interaction:

The interaction between genotypes and seeding rates significantly affected upper branching zone length in both seasons (Table 25).

In 1992/93 season, S. 341 recorded the greatest reduction in upper branching zone length due to increasing seeding rate from 50 to 70 kg per fed. which was 20.6%, whereas Giza 8 recorded the lowest reduction, being

12.1%. In 1993/94 season, the effect of the interaction was more evident where the response of the genotypes to seeding rate was quite different.

The increase in seeding rate from 60 to 80 kg/fed. significantly increased upper branching zone length of the commercial variety Giza 7 by 21.3%. On the other hand the other genotypes showed a reduction ranging from 2.1% with S. 341 to 28.8% with Giza 8. This different response indicates clearly the interaction effect.

In general, the highest upper branching zone length in the first season was 15.000 cm which was recorded with S. 355 sown with 50 kg per fed. seeding rate.

The lowest value was 11.458 cm which was recorded with S. 341 sown with 70 kg/fed. In the second season, also S. 355 combined with 60 kg per fed. seeding rate produced the highest upper branching zone length which was 5.700 cm., and the lowest value was 3.410 cm which was recorded by Giza 8 sown with 80 kg per fed.

II.2. Number of capsules per plant:

II.2.1. Effect of genotypes

Results presented in Table 26 showed that genotypes significantly differed in number of capsules per plant in both seasons.

The greatest number of capsules per plant was produced by Giza 8 in the first season followed by S. 341 and S.355 and the lowest number was produced by S. 297.

In the second season, under higher salinity level, S. 341 was the best genotype followed by Giza 8 with a difference of 15.3% and the lowest

Table (26): Mean values of Number of capsules per plant of flax as affected by genotypes and seeding rates under saline soil conditions in 1992/1993 and 1993/1994 seasons

Genotypes (G)	1992 / 1993 season				1993 / 1994 season			
	Seeding rates (kg/fed.) S			mean	Seeding rates (kg/fed.) S			mean
	50	60	70		60	70	80	
1-S. 355	11.63	10.950	09.390	10.648	3.300	2.830	2.133	2.754
2- S.341	11.520	11.635	10.093	11.083	4.228	3.635	2.795	3.554
3- Giza 7	10.483	09.753	09.648	09.961	2.720	2.078	1.758	2.185
4- Giza 8	12.150	12.085	10.595	11.610	3.405	3.148	2.698	3.083
5- S. 2419	11.150	11.608	08.793	10.517	3.298	2.783	2.640	2.907
6- S. 297	09.713	08.570	08.080	08.788	3.495	2.643	2.545	2.894
Mean	11.103	10.767	09.433	10.434	3.408	2.853	2.428	2.896

L.S.D. at 0.05 level for :

G: 0.535** **G x S: 0.714**** **G: 0.077**** **G x S: 0.172****

S: 0.292** **S: 0.070****

number was produced by S. 355 and S. 297. Most of the differences in number of capsules per plant among the tested genotypes were significant.

The present results indicate the superiority of S. 341 and Giza 8 in this trait under saline soil conditions.

The results are mainly due to the differences in the genetical make up of the tested genotypes and agree with those reported by El-Kady (1985), El-Kady *et al.* (1988), Kheir *et al.* (1991) and El-Sweify (1993).

It is worthy to note here that the increase in salinity from 4.5 in the first season to 6.5 mmhos/cm in the second season seriously reduced number of capsules per plant, as an overall average of the six genotypes from 10.434 to 2.896 or 72.2%. This serious reduction indicates the negative effects of salinity on seed production.

II.2.2. Effect of seeding rate:

The data in Table 26 show clearly that the increase in seeding rate significantly reduced number of capsules per plant in both seasons.

In 1992/93 season, increasing seeding rate from 50 to 60 and 70 kg/fed. significantly reduced number of capsules per plant by 3.0 and 15.0%, respectively. Also, in 1993/94 season, the increase in seeding rate from 60 to 70 and 80 kg per fed. significantly reduced this trait by 16.3 and 28.8%, respectively.

It is clear that under higher salinity level in the second season, the effect of seeding rate was more evident due to the stress conditions.

The reduction in capsules number per plant due to the increase in population density is mainly due to the increase in competition among growing plants. Similar results were also obtained by Obeid *et al.* (1967); El-Farouk

(1968); Shehata and Comstock (1971); Momtaz *et al.* (1982); El-Ganayni *et al.* (1985); Hella *et al.* (1986); El-Kady *et al.* (1988), Zeidan (1989), and El-Sweify (1993).

II.2.3. Effect of the interaction:

Results in Table 26 show that number of capsules per plant was significantly influenced by the interaction between genotypes and seeding rates in both season.

In 1992/93 season, the greatest reduction in number of capsules per plant due to increasing seeding rate from 50 to 70 kg per fed. was 21.1% which was observed with S. 2419 and the lowest reduction was 8.0% which was recorded with Giza 7. Also in 1993/94 season, the greatest reduction in number of capsules per plant due to raising the seeding rate from 60 to 80 kg per fed. was 35.4% recorded with Giza 7 and S. 355 and the lowest reduction was 20% observed by S. 2419.

In general, the highest value of number of capsules per plant in the first season was 12.150 which was recorded with Giza 8 combined with 50 kg per fed. seeding rate. On the other hand, the lowest value was 8.080 recorded with S. 297 combined with 70 kg per fed.

In 1993/94 season, S. 341 sown with 60 kg per fed. recorded the highest number of capsules per plant (4.228) and Giza 7 sown with 80 kg per fed. produced the lowest number (1.758).

II.3. Number of seeds per plant:

II.3.1. Effect of genotypes:

Results presented in Table 27 show that genotypes significantly differed in number of seeds per plant in both seasons.

Table (27): Mean values of Number of seeds per plant of flax as affected by genotypes and seeding rates under saline soil conditions in 1992/1993 and 1993/1994 seasons

Genotypes (G)	1992 / 1993 season				1993 / 1994 season			
	Seeding rates (kg/fed.) S			mean	Seeding rates (kg/fed.) S			mean
	50	60	70		60	70	80	
1-S. 355	74.285	71.175	61.132	68.864	21.198	17.873	13.063	17.378
2- S.341	77.360	74.170	63.393	71.641	26.668	22.345	17.053	22.022
3- Giza 7	63.430	61.615	60.965	62.003	15.160	12.470	09.665	12.432
4- Giza 8	83.375	76.245	69.257	76.293	18.815	17.778	15.575	17.389
5- S. 2419	70.983	67.930	56.778	65.230	16.520	14.585	12.095	14.400
6- S. 297	62.988	52.463	50.448	55.299	20.995	13.550	11.270	15.272
Mean	72.070	67.266	60.329	66.555	19.893	16.433	13.120	16.482

L.S.D. at 0.05 level for :

G: 0.127 G x S: 0.281** G: 0.590** G x S:1.015****

S: 0.115 S: 0.415****

In 1992/93, Giza 8 was the leading genotypes in this trait and was significantly superior to all other genotypes and significantly outnumbered S. 341, S. 355, S. 2419, Giza 7 and S. 297 by 6.50, 10.8, 17.0, 22.6 and 38.0%, respectively.

In 1993/94 season, the arrangement of genotypes was different due to the increase in soil salinity in that season. S. 341 was the best genotype due to its tolerance to salinity and was followed by Giza 8, S. 355, S. 297, S. 2419 and Giza 7 in a descending order. In that season S. 341 outnumbered these five other genotypes by 26.6, 26.7, 44.2, 52.9 and 77.1%, respectively.

The present results indicate the tolerance of S. 341 to salinity followed by Giza 8 and S. 355 in this respect.

The differences in number of seeds per plant are mainly due to the differences in the genetical constitution of the tested genotypes. Similar results were also reported by Kheir *et al.* (1991) and El-Sweify (1993).

It is worth mentioning here that, as a result of the increase in soil salinity from 4.5 in the first season to 6.5 mmhos/cm in the second season, serious reduction in number of seeds per plant was observed.

The number of seeds per plant as an over all average of the six genotypes was reduced from 66.555 to 16.482 or 75.2% which indicates the serious injury of salinity to seed production.

It is also evident, that some genotypes such as S. 341 was more tolerant than other genotypes such as Giza 7 which was more sensitive to salinity.

The results in Table 27 showed that number of seeds per plant was reduced in the second season by 69.3% for S. 341 and 80.0% for Giza 7, compared with the first season.

II.3.2. Effect of seeding rate:

Results in Table 27 revealed that the increase in seeding rates significantly reduced number of seeds per plant in both seasons.

In 1992/93 season, increasing seeding rate from 50 to 60 and 70 kg per fed. significantly reduced number of seeds per plant by 6.7 and 16.3%, respectively.

Similarly, in 1993/94 season, raising the seeding rate from 60 to 70 and 80 kg per fed. significantly reduced number of seeds per plant by 17.6 and 34.2%, respectively. The reduction in the second season was more evident due to higher level of salinity.

The reduction in number of seeds per plant due to the increase in population density is mainly due to the increase in competition among growing plants for water, nutrients and light. Similar results were also reported by Shehata and Comstock (1971); Hella *et al.* (1986); Hassan and El-Farouk (1987); Zeidan (1989) and El-Sweify (1993).

II. 3.3. Effect of the interaction:

The effect of the interaction between genotypes and seeding rates on number of seeds per plant was significant in both seasons (Table 27).

In 1992/93 season, genotypes responded differently to seeding rate. The increase in seeding rate from 50 to 70 kg per fed. reduced number of seeds per plant by 3.9% with Giza 7 compared with 20% with S. 2419.

The other four genotypes recorded reductions in this trait ranging from 16.9 to 19.9%. Similarly in the second season, raising the seeding rate from 60 to 80 kg per fed. reduced number of seeds per plant by 46.4% with S. 297 compared with 17.9% for Giza 8.

In general, the maximum number of seeds per plant in 1992/93 season was produced by Giza 8 at 50 kg per fed seeding rate which was 83.375, and the minimum number was 50.448 recorded with S. 297 seeded by 70 kg per fed. In 1993/94 season, the highest value of this trait was 26.668 which was produced by S. 341 seeded by 60 kg per fed., whereas the lowest number was only 9.665 which was produced by Giza 7 combined with 80 kg per fed. seeding rate.

II.4. Seed yield per plant:

II.4.1. Effect of genotypes:

The analysis of variance showed that genotypes significantly differed in seed yield per plant in both seasons (Table 28).

In 1992/93 season, Giza 8 was the best genotype and outyielded S. 2419, S.341, S. 355, S. 297 and Giza 7 by 7.9, 19.0, 21.5, 29.6 and 31.6%, respectively. All differences were significant.

In 1993/94 season, the arrangement was different from that of the first season due to the increase in soil salinity.

S. 341 was the leading genotype and significantly outyielded S. 355, Giza 8, S. 297, S. 2419 and Giza 7 by 28.5, 39.2, 44.0, 51.8 and 92.0%, respectively.

This result indicates that S. 341 was a tolerant genotype to salinity compared with the other genotypes, and under low salinity level, Giza 8 is more productive in seed yield per plant.

The differences among the tested genotypes are mainly due to the differences in the genetical constitution. Similar results were also, El-Kady (1985), McHughen (1987); El-Kady *et al.* (1988), Popa (1989); Rowland *et al.* (1989 a and b); Kheir *et al.* (1991) and El-Sweify (1993).

Table (28): Mean values of Seed yield per plant (gms.) of flax as affected by genotypes and seeding rates under saline soil conditions in 1992/1993 and 1993/1994 seasons

Genotypes (G)	1992 / 1993 season				1993 / 1994 season			
	Seeding rates (kg/fed.) S			mean	Seeding rates (kg/fed.) S			mean
	50	60	70		60	70	80	
1-S. 355	0.622	0.592	0.506	0.573	0.169	0.131	0.089	0.130
2- S.341	0.634	0.605	0.515	0.585	0.212	0.174	0.116	0.167
3- Giza 7	0.541	0.528	0.518	0.529	0.115	0.085	0.063	0.087
4- Giza 8	0.764	0.694	0.629	0.696	0.138	0.121	0.102	0.120
5- S. 2419	0.705	0.671	0.560	0.645	0.130	0.113	0.088	0.110
6- S. 297	0.613	0.509	0.489	0.537	0.165	0.101	0.082	0.116
Mean	0.646	0.600	0.532	0.594	0.155	0.121	0.090	0.122

L.S.D. at 0.05 level for :

G: 0.001** G x S: 0.003** G: 0.006** G x S: 0.0096**

S: 0.001** S: 0.004**

It is worth mentioning here that the increase in soil salinity from 4.5 in the first season to 6.5 mmohs/cm in the second one reduced the seed yield per plant as an overall average of the six genotypes from 0.594 gm to 0.122 or 79.5%.

This result indicates clearly the injurious effect of salinity on seed production in flax. The greatest reduction in seed yield per plant was recorded with Giza 7 which was 83.6% and the lowest reduction was 71.6% recorded with S. 341.

II.4.2. Effect of seeding rates:

The results presented in Table 28 show that increasing seeding rate significantly reduced seed yield per plant in both seasons.

In 1992/93 season, increasing seeding rate from 50 to 60 and 70 kg per fed. reduced seed yield per plant by 7.1 and 17.6%, respectively.

Also, in 1993/94 season raising the seeding rate from 60 to 70 and 80 kg per fed. significantly reduced seed yield per plant by 21.9 and 41.9%, respectively.

This result indicates clearly the effect of increasing the population density in increasing the competition among growing plants for environmental factors.

The pattern of response of seed yield per plant was similar to that with the previously discussed characters, namely, upper branching zone length, number of capsules per plant and number of seeds per plant.

Similar result were also obtained by Horodyski (1964), Obeid *et al.* (1967); El-Farouk (1968); Shehata and Comstock (1971); Hella *et al.* (1986); El-Kady *et al.* (1988), Zeidan (1989) and El-Sweify (1993).

II.4.3. Effect of the interaction:

Results in Table 28 show that seed yield per plant was significantly affected by the interaction effect between genotypes and seeding rates in both seasons.

It is clear from the results that the response of genotypes to seeding rates was greatly different. In the first season, the greatest reduction in seed yield per plant due to increasing seeding rate from 50 to 70 kg per fed. was 20.6% which was recorded with S. 2419. On the other hand, the lowest reduction was only 4.3% which was observed with the commercial variety Giza 7.

In the second season, the serious reduction in seed yield per plant was observed with S. 297 due to increasing seeding rate from 60 to 80 kg per fed., being 50.3%, compared with 26.1% for Giza 8.

In general, the maximum seed yield per plant in the first season was 0.764 gm which was produced by Giza 8 seeded by 50 kg per fed. and the minimum seed yield per plant was 0.489 gm which was recorded with S. 297 seeded by 70 kg per fed. In the second season, S. 341 seeded by 60 kg per fed. produced the highest seed yield per plant being 0.212 gm and the lowest yield was 0.063 gm which was recorded with Giza 7 combined with 80 kg per fed. seeding rate.

II.5. Seed index:

II.5.1. Effect of genotypes:

Data presented in Table 29 show that the tested genotypes significantly varied in seed index in both seasons.

In 1992/93 season, S. 2419 was the first genotype in seed index followed by S. 297, Giza 8, Giza 7, S. 355 and S. 341. All differences among genotypes were significant.

Table (29): Mean values of Seed index (in gram) of flax as affected by genotypes and seeding rates under saline soil conditions in 1992/1993 and 1993/1994 seasons

Genotypes	1992 / 1993 season				1993 / 1994 season			
	Seeding rates (kg/fed.) S			mean	Seeding rates (kg/fed.) S			mean
(G)	50	60	70		60	70	80	
1-S. 355	8.337	8.303	8.270	8.303	7.975	7.323	6.830	7.376
2- S.341	8.180	8.150	8.110	8.147	7.925	7.785	6.805	7.505
3- Giza 7	8.580	8.545	8.500	8.542	7.343	6.613	6.525	6.827
4- Giza 8	9.120	9.100	9.080	9.100	7.330	6.778	6.540	6.883
5- S. 2419	9.920	9.880	9.860	9.887	8.233	7.745	7.245	7.725
6- S. 297	9.730	9.700	9.680	9.703	8.185	7.445	7.278	7.652
Mean	8.978	8.946	8.917	8.947	7.832	7.281	6.870	7.328

L.S.D. at 0.05 level for :

G: 0.021** **G x S: NS** **G: 0.068**** **G x S: 0.114****

S: 0.008** **S: 0.047****

In 1993/94 season, Also S. 2419 was the genotype with the highest seed index and was followed by S. 297, S. 341, S. 355, Giza 8 and Giza 7 in a descending order. Most differences among genotypes were significant.

It is clear that the arrangement of genotypes was different in the second season due to the increase in soil salinity.

It is worthy to note that S. 341 was the last genotype in the first seasons, but it ranked as third in the second one due to its tolerance to salinity. It is also evident that seed index, as an overall average of the six genotypes was 8.947 gm in the first season and was reduced to 7.328 gm in the second one.

This reduction is mainly due to the increase in soil salinity in the second season. The variation in seed index among the evaluated genotypes is mainly due to the genetical constitution of the genotypes. Similar results were also reported by Kaddah *et al.* (1973); Kheir *et al.* (1991) and El-Sweify (1993).

II.5.2. Effect of seeding rates:

Results in Table 29 show that the increase in seeding rate significantly reduced seed index in both seasons.

In the first season, increasing the seeding rate from 50 to 60 and 70 kg per fed. significantly reduced seed index by 0.36 and 0.68%, respectively. Also, in the second season, seed index was reduced by 7.14 and 12.28% due to increasing seeding rate from 60 to 70 and 80 kg per fed., respectively.

The reduction in seed index is mainly due to the increase in competition among growing plants.

It is worthy to note that this reduction was more evident in the second season due to the increase in soil salinity which increased in turn the stress conditions surrounding the growing plants.

Results reported by Shehata and Comstock (1971) and Hassan and El-Farouk (1987), showed similar trend.

II.5.3. Effect of the interaction:

The effect of the interaction between genotypes and seeding rates on seed index was significant only in the second season, as shown in Table 29.

In the first season the interaction was not significant and each experimental factor acted independently in affecting seed index. In that season, the highest seed index was 9.920 gm which was produced by S.2419 seeded at 50 kg per fed, and the lowest index was 8.110 gm which was recorded with S. 341 seeded by 70 kg per fed. In the second season, the effect of the interaction was significant.

Results in Table 29 show that under the seeding rates of 60, 70 and 80 kg per fed., S.2419, S. 341 and S. 297 were the leading genotyps, respectively. In other words, the performance of flax genotypes was affected by seeding rates as far as seed index is concerned.

In general, the maximum seed index in 1993/94 was 8.233 gm which was obtained by S. 2419 combined with 60 kg per fed., and the minimum index was 6.525 gm which was obtained by Giza 7 seeded by 80 kg per fed.

II.6. Seed yield per feddan:

II.6.1. Effect of genotypes:

The results presented in Table 30 show clearly that significant differences were found in seed yield per fed. among the tested genotypes in both seasons.

In 1992/93 season, Giza 8 was the most productive genotype and significantly outyielded S. 355, S. 2419, S. 341, Giza 7 and S. 297 by 6.9, Table (30): Mean values of Seed yield per feddan (kgs.) of flax as affected by genotypes and seeding rates under saline soil conditions in 1992/1993 and 1993/1994 seasons

Genotypes (G)	1992 / 1993 season				1993 / 1994 season			
	Seeding rates (kg/fed.) S			mean	Seeding rates (kg/fed.) S			mean
	50	60	70		60	70	80	
1-S. 355	623.790	646.140	654.000	641.310	310.520	337.413	617.683	421.872
2- S.341	543.520	556.465	616.240	572.075	343.340	397.538	451.083	397.320
3- Giza 7	525.125	558.662	573.108	552.298	125.780	233.460	576.090	311.777
4- Giza 8	675.710	688.340	691.733	685.261	118.708	217.973	264.030	200.237
5- S. 2419	550.850	573.833	597.388	574.023	125.710	155.908	168.000	149.873
6- S. 297	466.285	498.610	525.343	496.746	92.150	132.228	173.398	132.592
Mean	564.213	587.008	609.635	586.952	186.035	245.753	375.047	268.945

L.S.D. at 0.05 level for :

G: 10.964** G x S: 19.844** G: 5.495** G x S: 9.322**

S: 8.109** S: 3.809**

19.3, 19.8, 24.1 and 38.1%, respectively. In that season , Giza 8 was also the best genotype in all seed yield component characters.

In 1993/94 season, the increase in soil salinity to 6.5 mmhos/cm. had great influence and the arrangement of the tested genotypes showed different trend. S. 355 was the most productive genotype and significantly outyielded S. 341, Giza 7, Giza 8, S. 2419 and S. 297 by 6.2, 35.3, 100.7, 181.6 and 218.1%, respectively.

The results of the second season indicate clearly the great tolerance of the two leading genotypes S. 355 and S. 341 to salinity and the inferior seed yield of some genotypes (S. 2419 and S. 297) is due to their lower tolerances to salinity.

In the second season, S. 355 and S. 341 were also the leading genotypes in upper branching zone length, number of seed per plant, seed yield per plant, and seed index.

Consequently, both genotypes are the leading genotypes in seed yield per fed. under the stress conditions of the higher level of salinity.

The results show also that the increase in soil salinity in the second season reduced seed yield per fed. as an overall average combined over the six genotypes from 586.952 to 268.945 kg per fed. or a reduction of 53.2%.

This serious yield reduction is a clear illustration of the negative effects of salinity. The present results are mainly due to the differences in the genetical make up of the tested genotypes and agree with those reported by Mitkees *et al.* (1972); Abo El-Saod *et al.* (1974); El-Kady (1985), McHughen (1987); El-Kady *et al.* (1988), Gore and Bhagwat (1988); Popa (1989); Rowland *et al.* (1989 a and b); Kheir *et al.* (1991) and El-Sweify (1993).

II.6.2. Effect of seeding rates:

Data in Table 30 show clearly that the increase in seeding rate significantly increased seed yield per fed. in both seasons.

The increase in the second season due to increasing seeding rate was excessive probably due to the increase in soil salinity.

In 1992/93 season, increasing seeding rate from 50 to 60 and 70 kg per fed. significantly increased seed yield by 4.0 and 8.1%, respectively. Also, in 1993/94 season, raising the seeding rate from 60 to 70 and 80 kg per fed. significantly increased seed yield per fed. by 31.7 and 101.6%, respectively.

The increase in seed yield per unit area due to the increase in population density, particularly in the second season or under higher salinity conditions, is probably due to the injurious effects of salinity on seeds and young seedlings. Similar results were also obtained by El-Hariri (1964); Mokhtar (1965); El-Farouk (1968); Shehata and Comstock (1971); El-Nkhlawy *et al.* (1978); Vasilica (1979); Momtaz *et al.* (1982); Hella *et al.* (1986); Hassan and El-Farouk (1987); Zeidan (1989) and El-Sweify (1993).

II.6.3. Effect of the interaction:

The interaction effect between genotypes and seeding rates significantly affected seed yield per fed. in both seasons (Table 30).

In 1992/93 season, the response of the tested genotypes to the increase in seeding rate was different. The highest yield increase due to raising seeding rate from 50 to 70 kg per fed. was 13.4% which was observed with S. 341 compared with an increase of only 2.4% with Giza 8.

In 1993/94 season, the greatest increase in seed yield per fed. due to increasing seeding rate from 60 to 80 kg per fed. was observed with Giza 7 which reached 360% compared with 31.5% yield increase with S. 341.

These marked variations in the response of the tested genotypes to seeding rate is a good manifestation to the significant genotype and seeding rate interaction.

In general, the highest seed yield per fed. was 691.733 kg in the first season which was the result of the combination of Giza 8 and 70 kg per fed. seeding rate.

In the second season, the highest seed yield per fed was 617.683 kg per fed. which was recorded with S. 355 sown with 80 kg per fed. On the other hand, the lowest seed yields were 466.285 and 92.150 kg per fed. in two successive seasons which were obtained with S. 297 genotype in both seasons, when it was seeded with the lowest seeding rate (50 and 60 kg per fed. in the first and second season, respectively).

III. Technological characters:

III.1. Fiber length:

III.1.1. Effect of genotypes:

The tested genotypes showed marked differences in fiber length in both seasons as indicated in (Table 31).

In 1992/93 season, Giza 7 was the best genotypes with the tallest fibers (73.97 cm) and was followed by S. 341, S. 355, Giza 8, S. 2419 and S. 297 in a descending order. Fibers of Giza 7 were longer than the fibers of these five genotypes by 1.4, 4.2, 6.4,9.3 and 10.6%, respectively.

All differences were significant except those between Giza 7 and S. 341, S. 355 and Giza 8, Giza 8 and S. 2419 and S. 2419 and S. 297.

In 1993/94 season, the arrangement of the evaluated genotypes was quite different due to the increase in soil salinity.

Table (31): Mean values of Fiber length (cms.) of flax as affected by genotypes and seeding rates under saline soil conditions in 1992/1993 and 1993/1994 seasons

Genotypes (G)	1992 / 1993 season				1993 / 1994 season			
	Seeding rates (kg/fed.) S			mean	Seeding rates (kg/fed.) S			mean
	50	60	70		60	70	80	
1-S. 355	66.955	70.983	74.885	70.941	52.565	60.310	64.363	59.079
2- S.341	68.243	72.600	78.108	72.983	61.205	81.378	86.383	76.325
3- Giza 7	67.810	76.740	77.360	73.970	58.263	64.750	66.458	63.157
4- Giza 8	65.310	69.310	74.020	69.547	32.628	51.195	54.685	46.169
5- S. 2419	63.670	68.280	71.030	67.660	42.420	52.638	54.488	49.848
6- S. 297	62.790	67.390	70.390	66.857	41.350	45.400	52.278	46.343
Mean	65.796	70.884	74.299	70.326	48.072	59.278	63.110	56.820

L.S.D. at 0.05 level for :

G:2.086** **G x S:NS** **G: 0.204**** **G x S: 0.414****

S: 1.406** **S: 0.126****

S. 341 was the first genotypes with the longest fibers (76.325 cm), and was followed by Giza 7, S. 355, S. 2419, S. 297 and Giza 8, in a descending order.

Fiber length of S. 341 exceeded that of the other five genotypes by 20.6, 29.1, 53.2, 64.8 and 65.5%, respectively. All differences among genotypes were significant except that between S. 297 and Giza 8.

It is worth mentioning here that fiber length as an overall average of the six genotypes in the first season exceeded that in the second one by 19.2% due to the increase in soil salinity in the second season.

The response of the evaluated genotypes to salinity was quite different. All genotypes showed marked reduction in fiber length in the second season except S. 341 which responded oppositely to the higher salinity showing an increase in fiber length of 2.355 cm or 4.7%.

This result indicates clearly the tolerance of S. 341 to salinity when compared with Giza 8 which showed a reduction in fiber length in the second season of 22.378 cm or 33.7%. The present results indicate the superiority of S. 341 under saline soil conditions.

The marked differences in fiber length among the different genotypes were also reported by Mitkees *et al.* (1972), Abo El-Soad *et al.* (1974), Kheir *et al.* (1991) and El-Sweify (1993).

III.1.2. Effect of seeding rate:

Results in Table 31 showed that the increase in seeding rate significantly increased fiber length in both seasons.

In the first season, fiber length increased by 7.7 and 12.9% as a result of increasing seeding rate from 50 to 60 and 70 kg per fed., respectively.

In the second season, the effect of increasing seeding rate on fiber length was more evident showing increases of 23.1 and 31.2% due to increasing seeding rate from 60 to 70 and 80 kg per fed., respectively.

The present results are mainly due to the effect of increasing seeding rate in increasing technical stem length and decreasing upper branching zone length.

Consequently the increase in fiber length is quite expected. Similar results were also obtained by El-Farouk (1968), Gad and El-Farouk (1978); Momtaz *et al.* (1982), Hella *et al.* (1986) and El-Sweify (1993).

III.1.3. Effect of the interaction:

Results presented in Table 31 showed that the interaction between genotypes and seeding rates on fiber length was only significant in the second season.

In 1992/93 season, the response of genotypes to seeding rates was nearly similar where all genotypes recorded an increase in fiber length due to increasing seeding rate of about 13 to 15%.

This result indicates that each experimental factor acted independently in affecting fiber length. In that season, the highest value of fiber length was 78.108 cm which was recorded with S. 341 sown by 70 kg per fed., and the lowest value was 62.79 cm, recorded with S. 297 at 50 kg per fed. seeding rate.

In 1993/94 season, the effect of the interaction was significant and Giza 8 showed the greatest response to seeding rate where the increase in seeding rate from 60 to 80 kg per fed. increased fiber length by 68.8% compared with an increase of 13.8% for Giza 7.

In that season, the maximum fiber length was 86.393 cm which was recorded with S. 341 sown with 80 kg per fed., and the minimum fiber length was 41.350 cm produced by S. 297 at 60 kg per fed. seeding rate.

III.2. Fiber fineness:

III.2.1. Effect of genotypes:

The results in Table 32 show that the evaluated genotypes markedly varied in fiber fineness in both seasons.

In 1992/93 season, the finest fibers were those of Giza 7, followed by S.341, S. 355, Giza 8, S. 2419 and S. 297. Fibers of Giza 7 were of higher Nm than the other five genotypes by 0.2, 1.9, 3.8, 4.3 and 6.0%, respectively.

In 1993/94 season, a slight difference occured in this arrangement and the finest fibers were produced by S. 341 which was followed by S. 355, Giza 7, Giza 8, S. 2419 and S. 297.

S. 341 exceeded the five other genotypes in fiber fineness (Nm) by 2.4, 10.1, 18.5, 23.1 and 30.1%, respectively.

All differences in both seasons among the six genotypes were significant. It is worth mentioning here that due to the increase in soil salinity in the second season, fiber fineness was markedly reduced.

On the overall average of the six genotypes, fiber fineness was 205.354 in the first season and was reduced to 169.124 Nm or by 17.6% in the second season.

S.341 was the genotypes with the greatest tolerance to salinity showing a reduction of only 9% in fiber fineness in the second season compared with a reduction of 26.3% recorded with S. 297 as the least resistant genotype.

Table (32): Mean values of Fiber fineness (Nm.) of flax as affected by genotypes and seeding rates under saline soil conditions in 1992/1993 and 1993/1994 seasons

Genotypes (G)	1992 / 1993 season				1993 / 1994 season			
	Seeding rates (kg/fed.) S			mean	Seeding rates (kg/fed.) S			mean
	50	60	70		60	70	80	
1-S. 355	208.828	206.910	209.810	206.849	182.600	187.498	190.095	186.731
2- S.341	205.710	210.110	215.380	210.400	186.768	192.003	194.540	191.103
3- Giza 7	204.120	210.008	218.355	210.828	162.170	169.310	189.575	173.685
4- Giza 8	199.780	202.330	207.428	203.179	158.455	161.793	163.468	161.238
5- S. 2419	192.110	205.800	208.300	202.070	151.268	155.528	159.200	155.332
6- S. 297	186.780	203.710	205.910	198.800	138.880	143.048	158.040	146.656
Mean	198.721	206.478	210.864	205.354	163.357	168.196	175.820	169.124

L.S.D. at 0.05 level for :

G:0.042** **G x S: 0.083**** **G: 1.099**** **G x S: 1.670****

S: 0.034** **S: 0.682****

The rest four genotypes were in between showing a reduction ranging from 9.7% (with S. 355) to 23.7% (with S. 2419).

The present results indicate the superiority of S. 341 genotype under saline soil conditions. The results are mainly due to the differences in the genetical constitution of the genotypes.

Similar results were also reported by Abo El-Soad *et al.* (1974), Salama (1983), Kheir *et al.* (1991) and El-Sweify (1993).

It is worthy to note that fiber fineness followed the same trend as that of fiber length showing a close correlation of these quality characters.

III.2.2. Effect of seeding rates:

Results in Table 32 revealed that the increase in seeding rate significantly increased fiber fineness in both seasons.

In the first season, increasing seeding rate from 50 to 60 and 70 kg per fed. significantly increased fiber fineness by 3.9 and 6.1%, respectively.

Similarly, in the second season, raising seeding rate from 60 to 70 and 80 kg per fed significantly increased fiber fineness by 2.9 and 7.7%, respectively. The increase in fiber fineness due to the increase in population density followed the same pattern of response as fiber length.

Consequently the increase in seeding rate could be recommended for improving fiber quality, particularly under saline soil conditions.

The present results agree with those obtained by El-Farouk (1968), Gad and El-Farouk (1978); Momtaz *et al.* (1982); Hella *et al.* (1986), Hassan and El-Farouk (1987) and El-Sweify (1993).

III.2.3. Effect of the interaction:

The interaction between genotypes and seeding rates significantly affected fiber fineness in both seasons (Table 32).

In 1992/93 season, increasing seeding rate from 50 to 70 kg per fed. increased fiber fineness to different extents according to the different genotypes.

The highest increase was observed with S. 297, being 10.2% and the lowest increase was recorded with S. 355 which was only 0.5%. The other four genotypes showed increases ranging from 4.0% (with Giza 8) to 8.3% (with S. 2419). Similarly, in the second season, the greatest increase in fiber fineness was 26.3% as a result of increasing seeding rate from 60 to 80 kg per fed., which was produced by S. 2419 and the lowest increase was 7.6% recorded with Giza 7.

In general, the highest value of fiber fineness in 1992/93 season, was 218.355 Nm, which was obtained by Giza 7 seeded by 70 kg per fed., and the lowest value was 186.780 Nm, which was recorded with S. 297 seeded by 50 kg per fed. In 1993/94 season, S. 341 sown with 80 kg per fed. recorded the highest value of fiber fineness, being 194.540. Nm, and S. 297 sown with the lowest seeding rate (60 kg per fed.) produced the coarsest fibers with an average of 138.880 Nm.

III.3. Oil percentage:

III.3.1. Effect of genotypes:

Data presented in Table 33 revealed that the evaluated genotypes were significantly different in oil percentage in both seasons.

Table (33): Mean values of Oil percentage of flax as affected by genotypes and seeding rates under saline soil conditions in 1992/1993 and 1993/1994 seasons

Genotypes (G)	1992 / 1993 season				1993 / 1994 season			
	Seeding rates (kg/fed.) S			mean	Seeding rates (kg/fed.) S			mean
	50	60	70		60	70	80	
1-S. 355	38.750	38.520	38.380	38.550	34.258	36.493	40.405	37.052
2- S.341	37.915	37.780	37.590	37.762	33.658	39.810	39.940	37.803
3- Giza 7	39.780	39.450	39.360	39.530	34.585	35.888	37.973	36.148
4- Giza 8	42.280	42.110	41.980	42.123	35.715	35.808	38.770	36.764
5- S. 2419	43.080	44.320	42.600	43.333	38.060	39.125	40.918	39.368
6- S. 297	42.410	42.310	42.160	42.293	38.825	40.025	41.190	40.013
Mean	40.703	40.748	40.345	40.599	35.850	37.858	39.866	37.858

L.S.D. at 0.05 level for :

G:0.615** G x S: NS G: 0.187** G x S: 0.297**

S: NS S: 0.122**

In 1992/93 season, S.2419 seeds contained the highest percentage of oil, followed by S. 297, Giza 8, Giza 7, S. 355 and S. 341. All differences among genotypes were significant except that between S. 2419 and S. 297.

In 1993/94 season this arrangement was quite different where S. 297 contained the highest oil percentage , followed by S. 2419, S. 341, S. 355, Giza 8 and Giza 7 in a descending order. All differences among genotypes were significant.

It is clear that S. 341 was the genotype with the lowest oil percentage in the first season, but it was the third genotype in the second one, due to its tolerance to salinity.

It is also clear that oil percentage was reduced from 40.599% in the first season to 37.858% in the second one on the overall average of the six genotypes. This marked reduction is mainly due to the increase in soil salinity in the second season.

The present results indicate clearly that some genotypes were more productive in oil due to their genetical constitution.

Also some genotypes, such as S. 341 and S. 355 were more tolerant to salinity showing a reduction in oil percentage of only 0.1 and 1.5%, respectively, while some others such as Giza 8 and S. 2419 were sensitive where oil percentage was reduced by 4.0 and 2.2%, respectively.

The differences in oil percentage in flax genotypes were also reported by Kuznetsova and Rykova (1975), Ahmed *et al.* (1979); Green and Marshall (1981); Salama (1983); Naqvi *et al.* (1987); Rowland *et al.* (1988); Rowland *et al.* (1989 a); Omar *et al.* (1990), Kheir *et al.* (1991) and El-Sweify (1993).

III. 3.2. Effect of seeding rates.

Results in Table 33 showed that increasing the seeding rate significantly affected oil percentage in the second season only.

In the first season, no relevance was found between seeding rates and oil percentage and the three seeding rates produced about the same oil percentage.

In the second season, probably due to the stress conditions of the high salinity level, the increase in seeding rates significantly increased oil percentage. The application of 60, 70 and 80 kg per fed. seeding rate produced oil percentages of 35.850, 37.858 and 39.866%, respectively.

These marked increases indicate clearly the importance of increasing seeding rates under salinity condition.

Results reported by Gad and El-Farouk (1978), found that oil content in flax seed was not affected by seeding rate and El- Sweify (1993), found that oil percentage in flax seed decreased gradually as seeding rate increased from 750 to 2000 seeds/m2.

III. 3.3. Effect of the interaction:

Results in Table 33 show that the interaction between genotypes and seeding rates had a significant effect on oil percentage only in the second season.

In 1992/93 season, it was clear from Table 33 that neither seeding rate nor its interaction with genotypes had significant effect on this trait. In other words, each experimental factor acted independently in affecting this trait.

In 1993/94 season, and probably due to the high salinity level, the interaction between both experimental factors influenced oil percentage.

In is clear from Table 33 that the greatest increase in oil percentage due to raising seeding rate from 60 to 80 kg per fed. were recorded with S. 341 and S. 355 which were about 18.8 and 18.1%, respectively. The lowest increase in this trait was only 5.9% which observed with S. 297.

In that season, the highest oil content was 41.190% which was recorded with S. 297 seeded at 80 kg per fed. and the lowest value was 33.658% produced by S. 341 combined with 60 kg per fed. seeding rate.

III.4. Iodine value:

III.4.1. Effect of genotypes:

Results in Table 34 showed that genotypes significantly differed in iodine value in both seasons.

In the first season, Giza 8 was the best genotype followed by S. 341, S. 355, Giza 7, S. 2419 and S. 297. All differences were significant.

In the second season, S. 341 was the leading genotype followed by Giza 8, S. 2419, S. 297, Giza 7 and S. 355 in a descending order. In that season, genotypes could be devided into two distinct groups, the first includes S. 341, Giza 8, S. 2419 and S. 297 which were nearly similar in their iodine value without any significant difference.

The second groups includes Giza 7 and S. 355 with a lower iodine value and was significantly inferior compared with first group.

The results revealed also that a marked reduction in iodine value from 173.061 in the first season to 167.658 in the second one was observed due to the increase in soil salinity.

Table (34): Mean values of Iodine value of flax as affected by genotypes and seeding rates under saline soil conditions in 1992/1993 and 1993/1994 seasons

Genotypes (G)	1992 / 1993 season				1993 / 1994 season			
	Seeding rates (kg/fed.) S			mean	Seeding rates (kg/fed.) S			mean
	50	60	70		60	70	80	
1-S. 355	171.445	172.873	174.420	172.913	165.755	164.090	161.363	163.736
2- S.341	172.608	175.020	176.760	174.796	173.383	169.330	167.445	170.053
3- Giza 7	170.320	171.998	174.003	172.107	165.890	162.888	162.078	163.618
4- Giza 8	173.790	176.033	176.485	175.436	171.918	172.315	164.740	169.658
5- S. 2419	170.880	171.940	172.725	171.848	171.150	169.640	167.718	169.503
6- S. 297	170.538	171.268	171.995	171.267	171.343	169.443	167.360	169.382
Mean	171.597	173.188	174.398	173.061	169.906	167.951	165.117	167.658

L.S.D. at 0.05 level for :

G:0.266** G x S: 0.333** G: 0.990** G x S: 1.812**

S: 0.136** S: 0.741**

S. 297 and S. 2419 recorded the least reduction, being 1.2% and Giza 7 showed the greatest reduction in iodine value in the second season which was 5.3%. The present results are mainly due to the differences in the genetical make up of the evaluated genotypes and agree with those reported by Naqvi *et al.* (1987) and Rowland *et al.* (1989 a).

III.4.2. Effect of seeding rates:

Results in Table 34 showed that seeding rates significantly affected iodine value in both seasons.

In 1992/93 season, increasing seeding rate significantly increased iodine value. Raising seeding rate from 50 to 60 and 70 kg per fed. significantly increased iodine value by 1.2 and 1.8%, respectively/

In 1993/94 season, an opposite trend was observed where increasing seeding rate from 60 to 70 and 80 kg per fed. significantly reduced iodine value by 1.2 and 2.8%, respectively. This opposite trend may be due to the increase in salinity level in the second season.

Results reported by Gad and El-Farouk (1978) indicated that oil content of oil seed flax, was not affected by seeding rate, Ahmed *et al.* (1979) also, indicated that oil seed content of oil seed flax was significantly reduced with increasing soil salinity levels and Omar *et al.* (1990).

III.4.3. Effect of the interaction:

The interaction between genotypes and seeding rates significantly affected iodine value in both seasons (Table 34).

In the first season, it is clear that the performance of the genotypes was markedly influenced by seeding rate.

It is observed that under 50 kg per fed. seeding rate, Giza 8 ranked the first position, whereas under 70 kg per fed., S. 341 was the first genotype with the highest iodine value.

In the second season, similarly the arrangement of the genotypes in relation to iodine value was different from one seeding rate to the other.

Under 60 kg per fed. seeding rate, S. 341 recorded the highest iodine value, whereas under 80 kg per fed., S. 2419 recorded the highest value.

In general, the highest iodine value in the first season was 176.760 which was recorded with S. 341 sown with 70 kg per fed., and the lowest value was 170.320 which was obtained by Giza 7 combined with 50 kg per fed. seeding rate. In the second season, S. 341 seeded by 60 kg per fed. recorded the highest iodine value which was 173.383 and S. 355 seeded by 80 kg per fed. produced the lowest value, being 161.363.

V. Anatomical Studies

V-1. Different tissue areas and fiber index:

Mean values of different tissue area in the cross sections at the middle region of flax stem and fiber index for the six genotypes as affected by seeding rates under salinity stress are presented in Table 35 and illustrated in Figures (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12).

Regarding total cross section area, data revealed that the lowest seeding rate (60 kg seeds per fed., by mark A) reached their maximum estimate among all the six flax genotypes as compared with the highest plant density at the rate of 80 kg seeds per fed. (by mark B) which produced lowest cross section areas.

Table (35): Mean values of different tissue areas in the cross section at the middle region of flax stem and fiber index for six genotypes as affected by seeding rates under salinity stress.

Genotypes	Characters	Total cross section area (mm^2)	Cortex area (mm^2)	Fiber area (mm^2)	Xylem area (mm^2)	Pith area (mm^2)	Fiber index (mm^3)
S.355	A	0791.875	090.688	168.438	305.688	227.061	093196.745
	B	0788.188	089.063	167.500	306.000	225.625	113280.250
S.341	A	1259.675	128.250	160.500	420.000	550.925	104116.350
	B	0706.250	096.250	155.800	253.125	201.075	137680.460
Giza 7	A	1127.500	160.000	116.620	302.755	548.125	070869.974
	B	0948.125	109.625	184.148	294.039	360.313	125810.250
Giza 8	A	1088.438	140.938	211.080	350.250	386.170	073985.500
	B	0706.250	128.750	181.080	275.650	120.750	100512.850
S.2419	A	0557.500	040.625	175.725	155.313	185.837	077459.580
	B	0476.875	038.850	161.418	120.375	156.232	090426.750
S.297	A	0650.313	065.375	175.890	195.875	213.173	075863.600
	B	0435.000	054.000	161.280	120.375	099.345	088351.875

(Note: In this table and in the following ones A denotes 60 kg seeds per feddan, B denotes 80 kg seeds per feddan and C.S. denotes cross section)

In the same time, flax strain S.341 (A) ranked first in this case by mean value of 1259.675 mm^2, followed by Giza 7 cv. (A), which recorded 1127.500 mm^2 and Giza 8 cv. (A) averaged 1088.438 mm^2. On the other hand, the minimum total cross section areas were obtained by S.297 (B) (435.000 mm^2) and S. 2419 (B) (476.875 mm^2). The mean values for the remaining flax genotypes under the two seeding rates which are not mentioned before were intermidiate.

Concerning cortex area (mm^2)/c.s., estimates indicated similar trend which had been shown in total cross section areas which means that all flax genotypes sown with the lowest seeding rate (A) were greater in their mean values than when sown with the highest seeding rate (B). Moreover, there is no relevance between cross section area and cortex area except with Giza 7 and Giza 8 (A), and partially with S. 2419 and S. 297 for A and B treatments. But the lowest fiber areas were recorded with Giza 7, A (116.620 mm^2), S. 341 B (155.800 mm^2) and A (160.500 mm^2).

For fiber area/c.s., results illustrated that the lowest seeding rate (A) was higher in mean values than in the higher rate (B) with all flax genotypes except with Giza 7 which had higher fiber area/c.s. in (B) (184.148 mm^2) than in (A) (116.620 mm^2) treatment.

It is worthy to note that the newly released Giza 8 cv. (B) ranked first and the other genotypes followed in a descending; order as follows: Giza 7, B (184.148 mm^2), Giza 8, B (181.08 mm^2), S. 297, A (175.890 mm^2), S. 2419, A (175.725 mm^2) and S. 355, A (168.438 mm^2).

In relation to xylem area/c.s. (mm^2), measurements were greater as affected by the seeding rate (A) in all flax genotypes except for S. 355

where the xylem areas were relatively of equal values; A (305.688 mm^2) and B (306.00 mm^2).

Xylem area reached its maximum value in S. 341, A (420.00 mm^2) followed by Giza 8 cv., A (350.250 mm^2) and S. 355 as affected by either A or B seeding rates. On the other hand, S. 297 (B) and S. 2419 (B) recorded the lowest xylem area per each of the corresponding cross section area (120.373 for each).

In respect to pith area/c.s. (mm2), this trait had higher mean values with all flax genotypes as affected by the lowest seeding rate (A) than in the highest seeding rate (B).

Results indicated that the larger pith area was related in most cases with the total cross section area, this fact is true concerning the greatest and smallest corresponding total cross section areas.

Fiber index (mm^3), is considered as a very important character and indicator for fiber content in the flax stems in volume (mm^3), without any loss in the fibers occuring in retting process.

The mean values of this trait illustrated that the fiber index of the treatment (B) were superior compared with (A) rate, due to more technical stem length and greater number of flax plants per unit area when compared with the lowest seeding rate (A).

In this connection, data revealed that S. 341 (B) ranked first in its fiber index (fiber content) and surpassed all flax genotypes under A or B treatments. Other genotypes were arranged in a descending order as follows: Giza 7 cv. (B), S. 355 (B), S. 341 (A), Giza 8 (B), S. 355 (A), S.

2419 (B), S. 297 (B), S. 2419 (A), S. 297 (A), Giza 8 (A) and finally the flax variety Giza 7 sown by the lowest seeding rate (A).

This finding confirmed the results of fiber yield per plant which was mentioned before in this investigation, which means that the arrangement of fiber index values were in similar trend as those obtained with fiber yield per plant. Moreover, the results are in the same line.

V-2. Tissue area percentages/c.s.:

Different tissue area percentages per the corresponding total cross section area in flax stems for the six genotypes as affected by seeding rates under salinity stress are presented in Table (36).

With respect to cortex ratio, the estimates of this character showed inconsistent trend concerning the flax genotypes or the two seeding rates, where the largest cortex percentages were of the lower seeding rate (A) in comparison with the higher rate (B) only in the two genotypes S. 355 (11.452 and 11.300%) as well as Giza 7 variety (14.191 and 11.562%), respectively.

Meanwhile, the four remaining flax genotypes, namely, S. 341, Giza 8, S. 2419 and S. 297 recorded (10.181 and 13.628%), (12.949 and 18.230%), (7.287 and 8.147%) and (10.053 and 12.414%), respectively.

Fiber area as a precentage of the total cross section indicated that the ratios were higher under (B) rate than under (A) one in the five genotypes, namely, S. 341, Giza 7 cv., Giza 8 cv., S. 2419 and S. 297, but only in one genotype i.e. S. 355 which showed an opposite trend of what had been noticed in the previous five flax genotypes.

Table (36): Different tissue area percentages per the corresponding total cross section area in flax stems for the six genotypes as affected by seeding rates under salinity stress.

Genotypes / Characters		Cortex/c.s %	Fiber/c.s %	Xylem/c.s %	Pith/c.s %
S.355	A	11.452	21.271	38.603	28.674
	B	11.300	21.251	38.823	28.626
S.341	A	10.181	12.741	33.342	43.736
	B	13.628	22.060	35.841	27.471
Giza 7	A	14.191	10.343	26.852	48.614
	B	11.562	19.422	31.013	38.003
Giza 8	A	12.949	19.393	32.179	35.479
	B	18.230	25.643	39.030	17.097
S.2419	A	07.287	31.520	27.859	33.334
	B	08.147	33.849	25.243	32.762
S.297	A	10.053	27.047	30.120	32.780
	B	12.414	37.076	27.672	22.838

Xylem area percentage/c.s., data revealed that the treatment (B) caused an increment in xylem ratio when compared with (A) treatment in the four flax genotypes and an opposite trend appeared in to two remaining ones.

Regarding pith area percentage/c.s., the different ratios indicated that the largest ones resulted by sowing flax with lowest seeding rate (B) in all genotypes except with S. 2419 which behaved oppositely. It must be mentioned that there is a negative relationship between xylem and pith ratio, which means that in the corresponding cross section, any increment in xylem ratio caused a decrement in pith ratio. This result was true in all flax genotypes with one exception with S. 297 which showed apposite trend.

V-3. Microscopic investigation:

Mean values of the numbers of fiber bundles/c.s. and fiber cells/bundle expressed as fiber bundle and fiber cell areas in the cross section in flax stem of the six genotypes as affected by seeding rates under salinity stress are presented in Table (37).

Data showed that, the number of fiber bundles per cross section and number of fiber cells/bundle appeared to be higher in (B) treatment than in (A) one.

The greatest number of fiber bundles/c.s. was obtained by S. 355, (B) (29.33) followed by Giza 7, (B) (28.33); S. 297, (B) (26.67); S. 2419 (B) (25.97); S. 341, (B) (24.00) and Giza 8, (B) (23.66), but the lowest numbers of this character were found in S. 2419 (18.67); Giza 8 (20.33); S. 341 (21.00) and S. 355 (21.68) under (A) treatment.

Meanwhile, the number of cells per bundle revealed that Giza 7 (B) ranked first and recorded the highest mean value (27.33) followed by S. 341, (B) (25.00); S. 2419, (B) (24.35); S. 297, (B) (24.00) and Giza 8, (B) (22.67). On the other hand, the lowest number of cells/bundle occured in S. 355, (A) (16.67); S. 2419, (A) (17.00); Giza 8, (A) (18.33) and S. 355, (B) (19.33).

Table (37): Mean values of the number of fiber bundles/c.s and fiber celles/bundle as fiber bundle and fiber cell areas in the cross section of flax stems of the six genotypes as affected by seeding rates under salinity stress.

Genotypes \ Characters		No. of Fiber bundles/c.s	No. of Fiber cells/bundle	Fiber bundle area (mm^2)	Fiber cell area (mm^2)
S.355	A	21.68	16.67	07.769	0.466
	B	29.33	19.33	05.711	0.295
S.341	A	21.00	19.66	07.643	0.389
	B	24.00	25.00	06.492	0.260
Giza 7	A	22.67	21.65	05.144	0.238
	B	28.33	27.33	06.500	0.230
Giza 8	A	20.33	18.33	10.383	0.566
	B	23.66	22.67	07.653	0.338
S.2419	A	18.67	17.00	09.412	0.553
	B	25.97	24.35	06.216	0.255
S.297	A	23.00	21.00	07.647	0.364
	B	26.67	24.00	06.047	0.252

For fiber bundle area (mm^2), the maximum mean values were observed in all flax genotypes under the lower seeding rate in (A) treatment except with Giza 7 variety where the two estimates of this character were approximately equal for (A) and (B) treatments.

In this connection, Giza 8, (A) (10.383 mm^2) recorded the greatest area followed by S. 2419, (A) (9.412 mm^2); S. 355, (A) (7.769 mm^2) and Giza 8, (B) (7.653 mm^2). On the other hand, Giza 7, (A) (5.144 mm^2) was recorded the lowest fiber bundle area followed by S. 355, (B) (5.711 mm^2) and S. 297, (B) (6.047 mm^2).

In relation to fiber cell area (mm^2), this trait has no great importance in indicating either fiber fineness or fiber coarseness, which means that the lower fiber cell area is mainly due to more fiber fineness and the opposite is true.

Results illustrated that the mean values for this character were higher in their estimates under the lower seeding rate in (A) treatment than under (B) treatment in the six flax genotypes. The newly released Giza 7 variety had the smallest fiber cell area under the two seeding rates i.e., (B) (0.230 mm^2) and (A) (0.238 mm^2).

Moreover, the arrangement of the genotypes in regard to their mean values was followed in a desending order as: S. 297, (B) (0.252 mm^2); S. 2419, (B) (0.255 mm^2); S. 341, (B) (0.260 mm^2); S. 355, (B) (0.295); Giza 8, (B) (0.338 mm^2); S. 297, (A) (0.364 mm^2) and S. 341, (A) (0.389 mm^2). The flax genotypes which recorded greater fiber cell area under the lower seeding rate were S. 355 (0.466 mm^2); S. 2419 (0.553 mm^2) and Giza 8 (0.566 mm^2). Varietal differences in anatomical manifestations were mentioned by Tihvinakij (1968), Balaskova and Tihvinskij (1969); Tikhomiroova (1973); Abo-El-Soad *et al.* (1974); El-Shimy (1975); Refai (1975); Hella (1983); Hella *et al.* (1989); El-Shimy *et al.* (1993) and El-Sweify (1993).

Generally, it could be concluded that the flax genotype S. 341 when sown by the highest seeding rate (80 kg per feddan)under soil salinity condition, yielded maximum estimates for fiber index as well as fiber yield per plant followed by Giza 7 under seeding rate of 80 kg per feddan in spite of the lower values in fiber area (mm^2) per cross section. This superiority may be due to the more technical stem length for both genotypes.

Meanwhile, Giza 7; Giza 8 and S. 297 when sown by the lowest seeding rate (60 kg seeds per fed), produced the lowest fiber index values under salinity stress. Moreover, Giza 7 variety when sown with 60 or 80 kgs seeds per fed. was superior over the remaining flax genotypes i.e., S. 355; S. 341; Giza 8; S. 2419 and S. 297 in relation to fiber cell area (mm^2), which led to more fiber fineness.

Therefore, the newly released Giza 7 flax variety is still a popular variety for the growers and manufactures for its fiber quantity and quality when it is sown at the rate of 80 kg seeds per feddan.

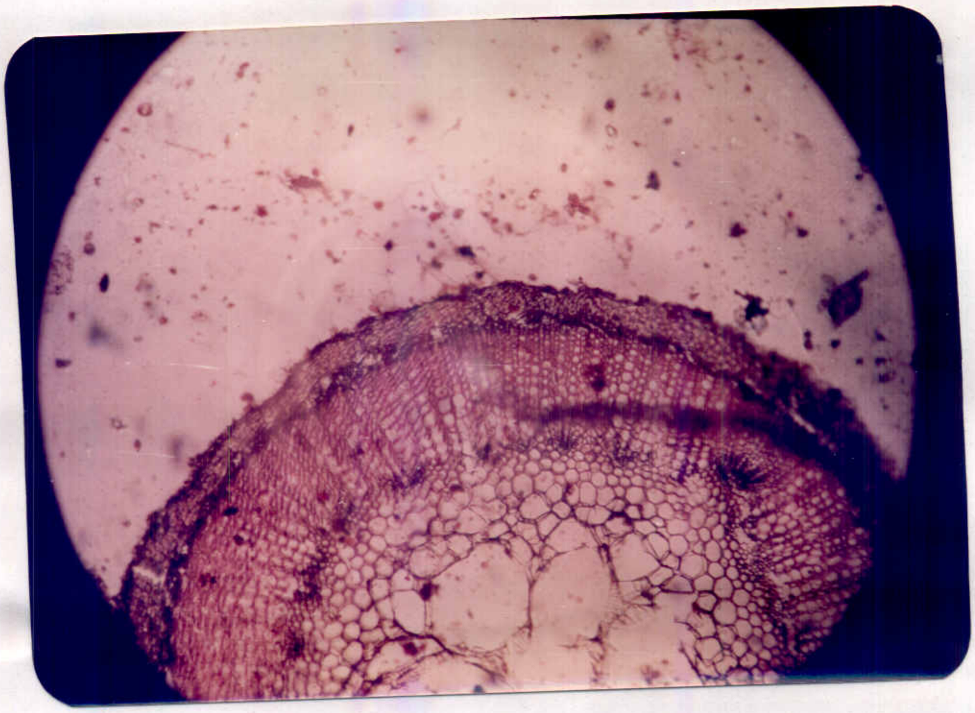


Figure (1): Cross section at the middle region of flax stem (X 52) for S. 355 as affected by 60 kg seeds per feddan.

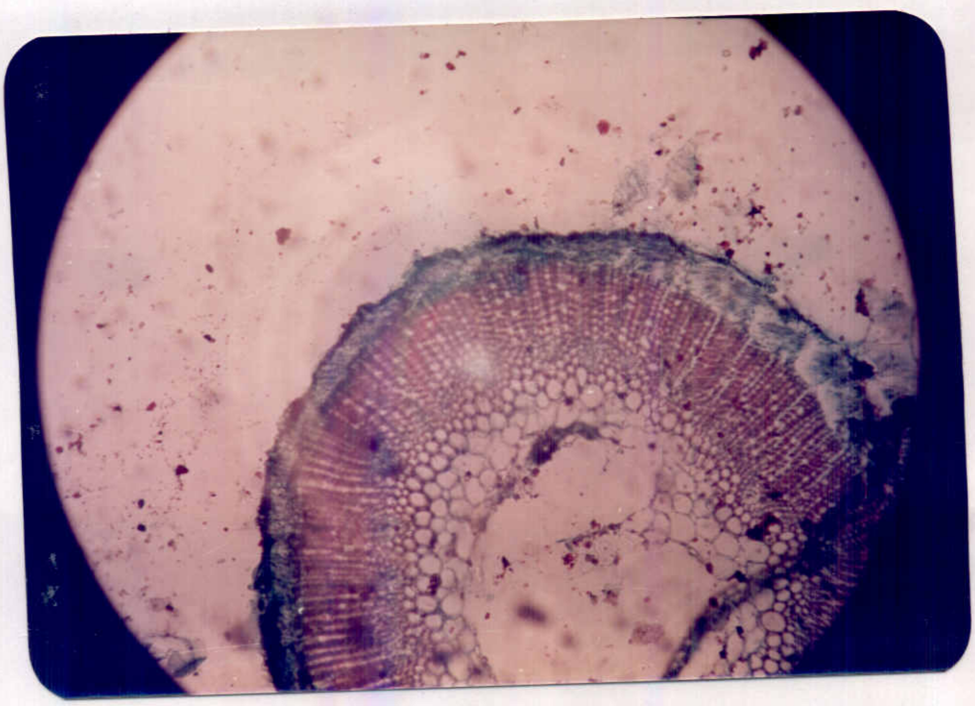


Figure (2): Cross section at the middle region of flax stem (X 52) for S. 355 as affected by 80 kg seeds per feddan.

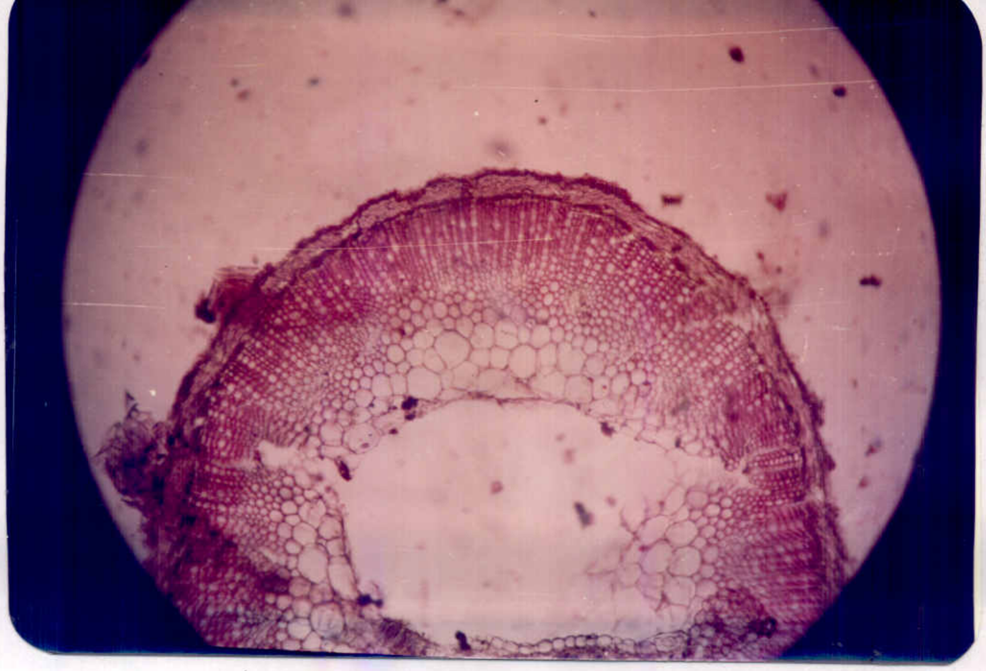


Figure (3): Cross section at the middle region of flax stem (X 52) for S.341as affected by 60 kg seeds per feddan.

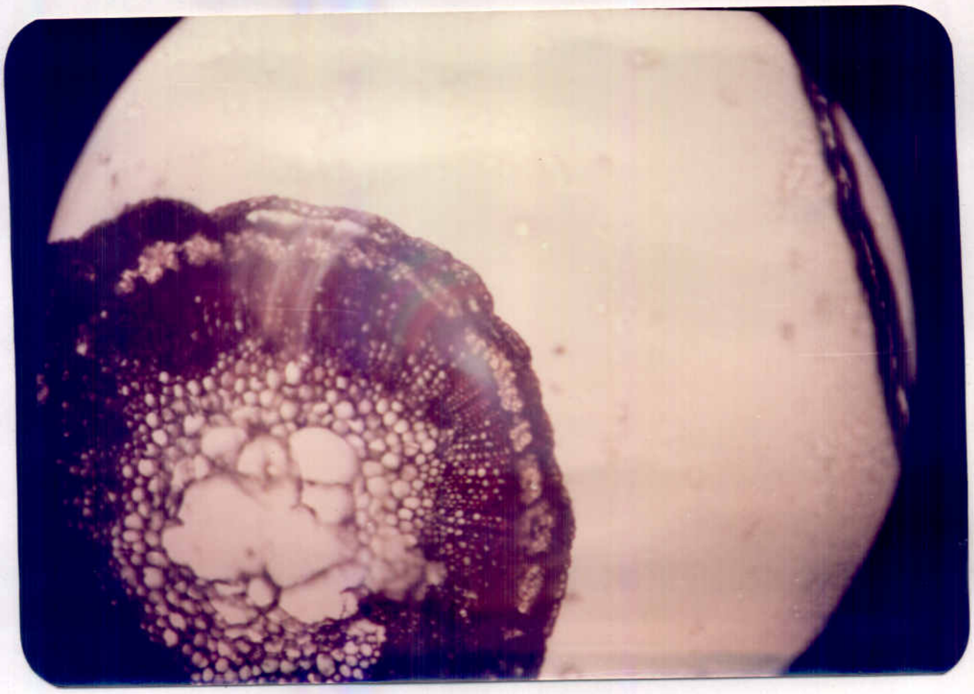


Figure (4): Cross section at the middle region of flax stem (X 52) for S. 341 as affected by 80 kg seeds per feddan.

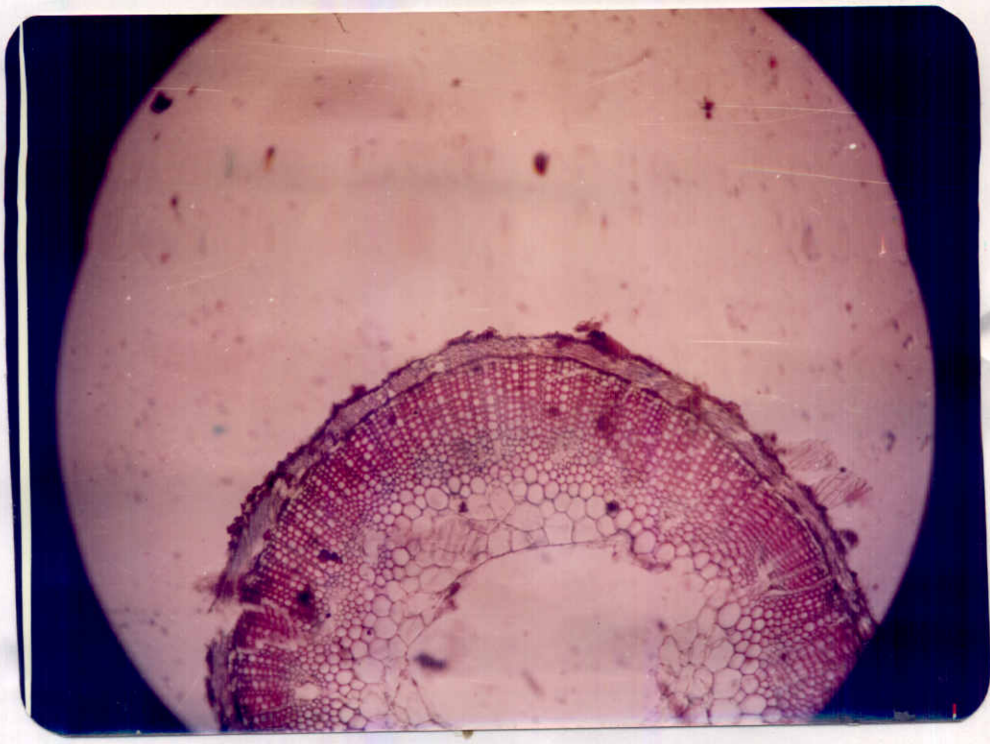


Figure (5): Cross section at the middle region of flax stem (X 52) for Giza 7 as affected by 60 kg seeds per feddan.

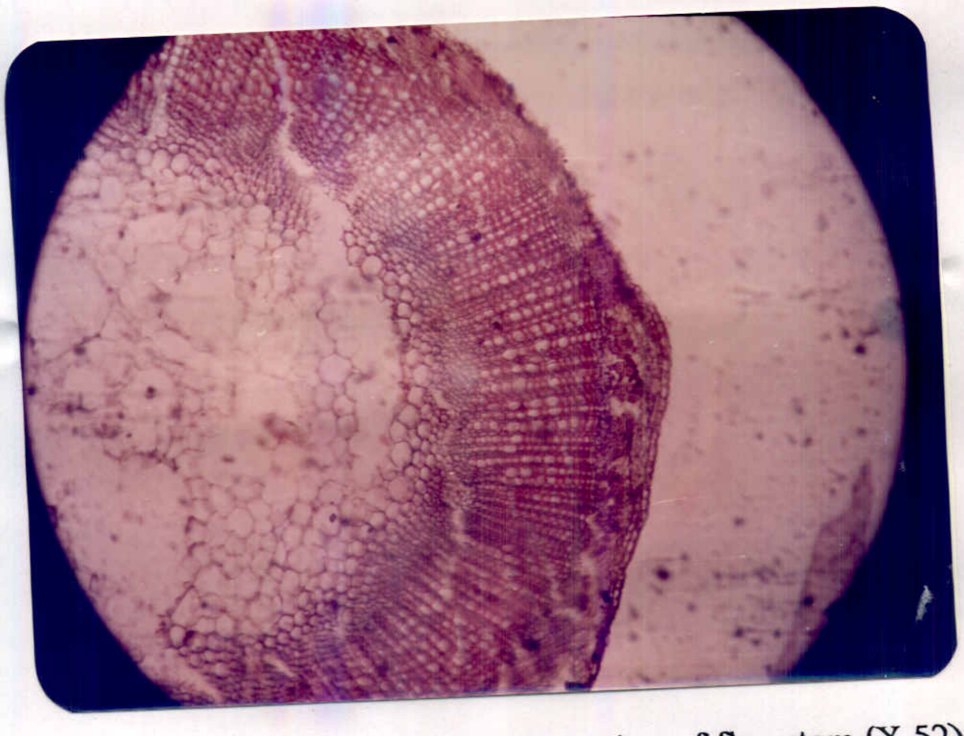


Figure (6): Cross section at the middle region of flax stem (X 52) for Giza 7 as affected by 80 kg seeds per feddan.

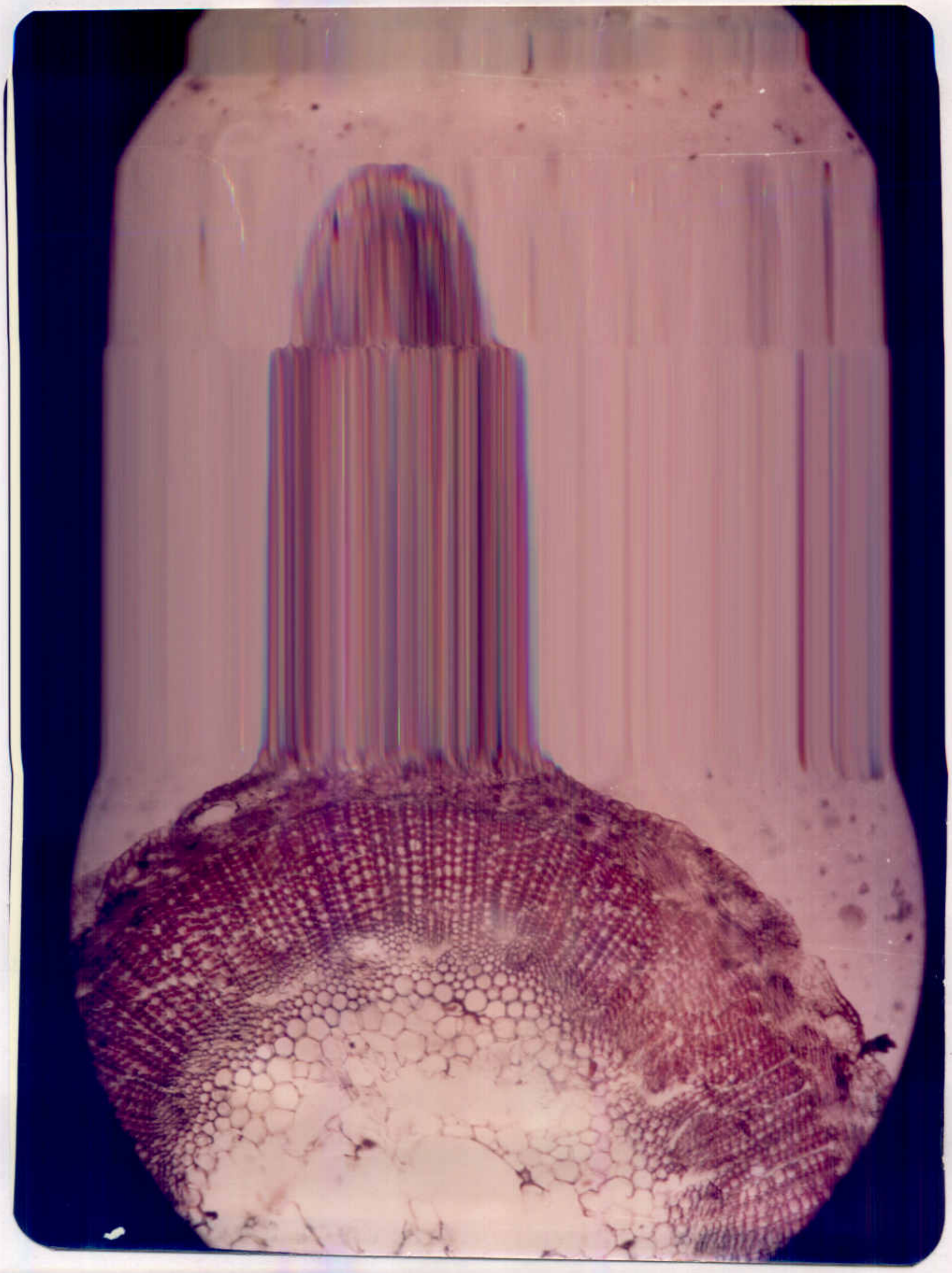
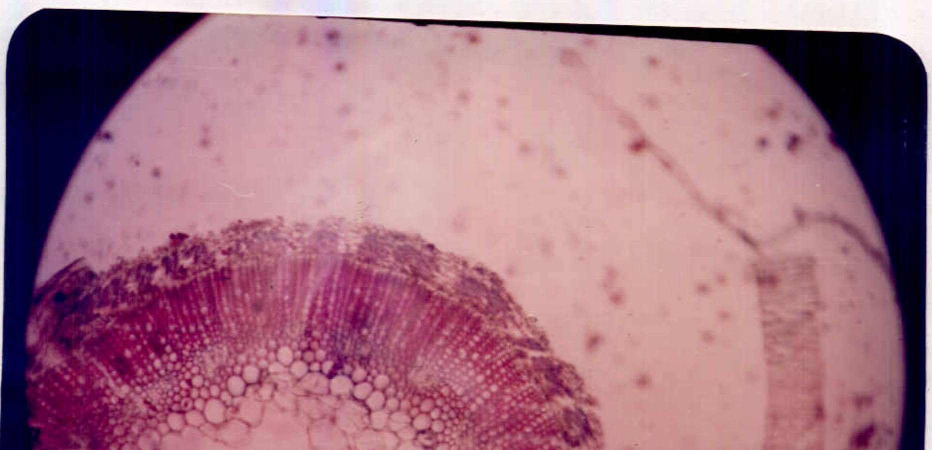


Figure (7): Cross section at the middle region of flax stem (X 52) for Giza 8 as affected by 60 kg seeds per feddan.



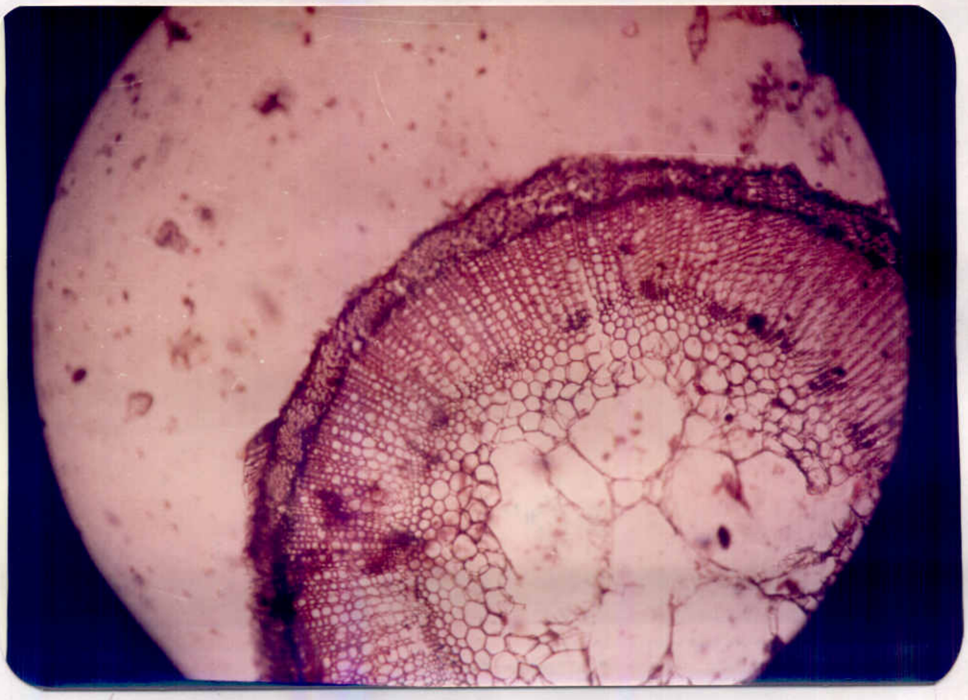


Figure (9): Cross section at the middle region of flax stem (X 52) for S. 2419 as affected by 60 kg seeds per feddan.

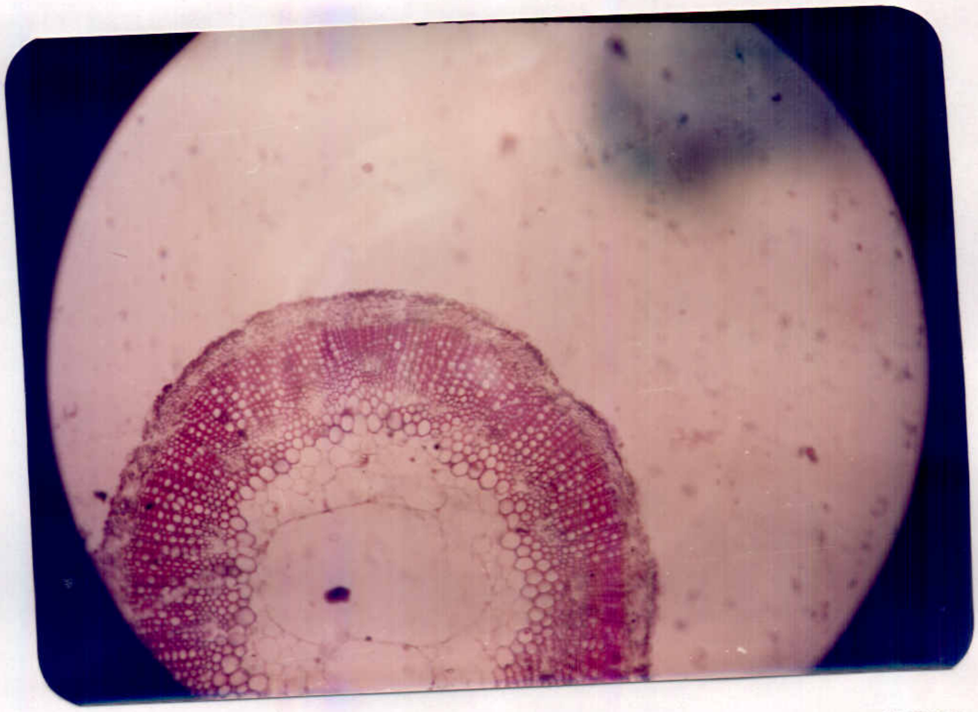


Figure (10): Cross section at the middle region of flax stem (X52) for S.2419 as affected by 80 kg seeds per feddan.

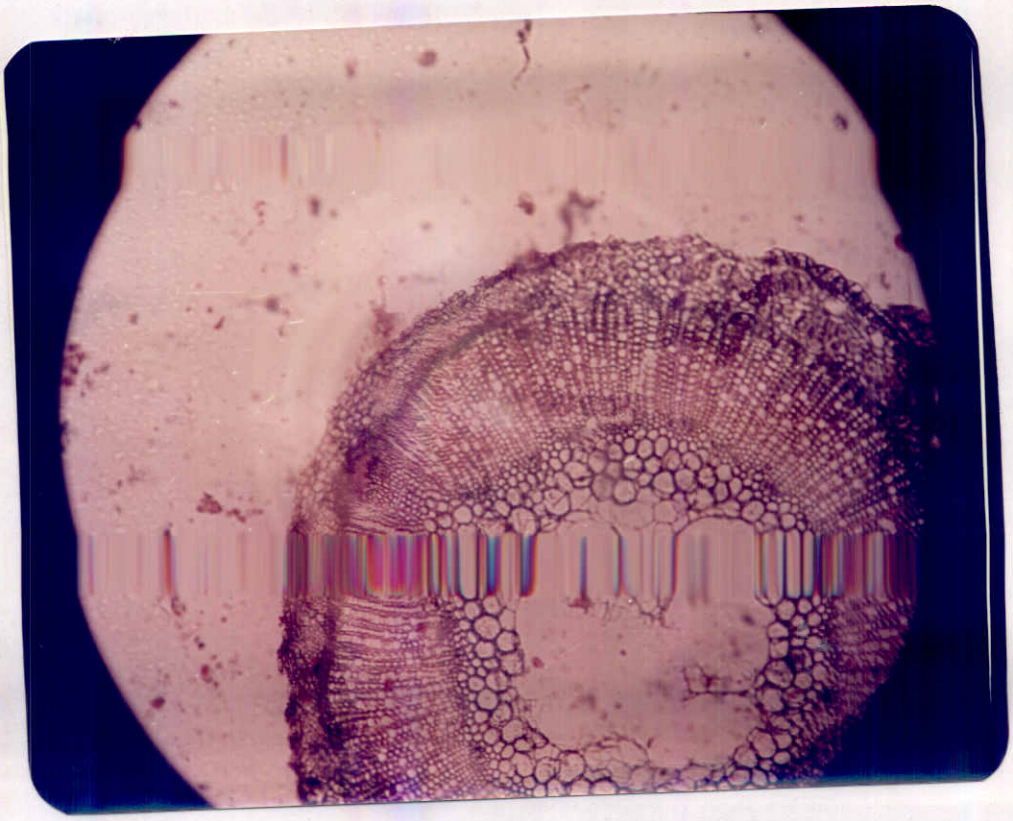


Figure (11): Cross section at the middle region of flax stem (X52) for S. 297 as affected by 60 kg seeds per feddan.

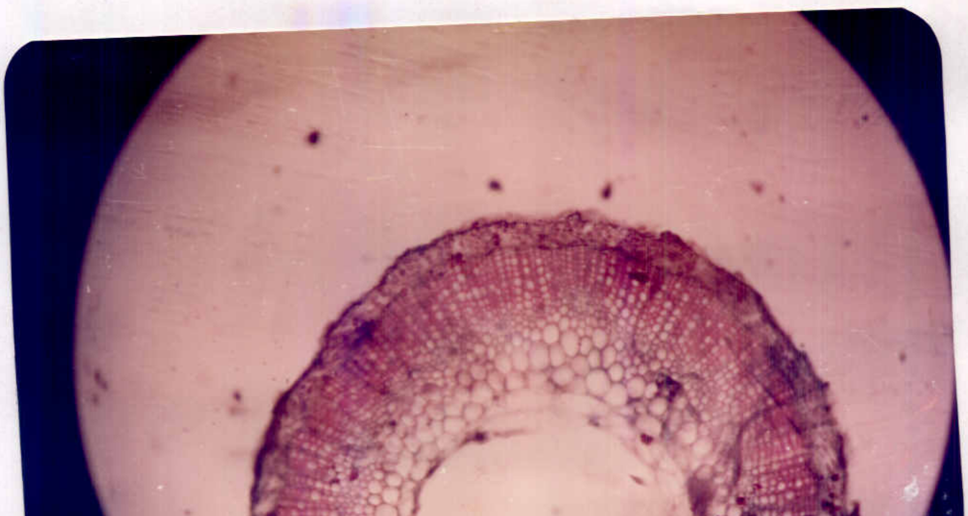


Figure (12): Cross section at the middle region of flax stem (X52) for S. 297 as affected by 80 kg seeds per feddan.