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HALF DIALLEL ANALYSIS OF TOMATO FOR YIELD AND SOME FRUIT TRAITS UNDER SALINITY AFFECTED SOIL CONDITIONS

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ABSTRACT

The aim of this research was to identify the best tomato (Solanum lycopersicum L.) genotypes for hybrids production under Egyptian desert conditions. The tomato genotypes (6 parents and their 15 crosses) were evaluated in season 2023/2024 at two locations. The first was Ras-Sudr station, Desert Research Center (DRC), South Sinai; the second was Alsaalihia zone, El-Sharkia governorate. The experimental design was randomized complete block design with three replicates. The results indicated that the mean squares due to genotypes were highly significant for all studied traits in both locations. GCA was larger than SCA for most studied traits, this indicate that additive gene effects were more important than non-additive gene effects in the inheritance of these traits under the two locations. P_1 line had the greatest GCA effects for most traits followed by P_5 line and then P_6 line. Cross $P_5 \times P_6$ had positive and highly significant values of SCA effects for yield per plant, in the two locations. The high salinity of the irrigation water in the first location led to a decrease in yield per plant by 28.13 and 30.56% for the average of the parents and hybrids, respectively, compared to the second location, which was irrigated with low salinity irrigation water. Therefore, when planting the land affected with salinity, choosing prefers tomato hybrids with high productivity under these lands.

Key words: ***Solanum lycopersicum, Performance, Gene action, Combining ability.***

INTRODUCTION

Tomato is the most important vegetable crop grown in Egypt for fresh consumption and processing. It is an accepted fact, that tomato yield, like other plants, decreases under different levels of salinity conditions. Qaryouti *et al* (2007) had reported that the total yield of tomato (Durinta F_1) is significantly reduced at salinity equal and above 5 dSm^{-1} and a 7.2% yield reduction per unit increase in salinity. Also, Magan *et al* (2008) reported that tomato total and marketable fresh fruit yield decreased significantly with increasing salinity. In addition, Bustomi *et al* (2014) indicated that tomato yield decreased as EC of nutrient solution increased from 3 to 5 dS m^{-1} due to increase of salinity stress.

The general combining ability effects represent the additive gene action, while the specific combining ability effects represent the non-additive gene action. Bayomi (2002) indicated that additive gene effects appeared to be relatively more important than the non-additive gene effects for most studied characters. Mondal *et al* (2009) also reported that both additive and non-additive gene action were operative for the control of fruits/plant, fruit weight, locules /fruit and diameter of fruit. Al-Daej (2018) reported that the magnitude of additive variance was more pronounced for all characters of fruit quality. Singh *et al* (2021) indicated that specifying non-additive genetic variance control all studied characters. Bayomi (2024) reported that additive and non-additive gene action were observed for yield per plant.

After the success of the Plant Breeding and Conservation Program of Desert Research Center (DRC), in evaluating many tomato genotypes under Egyptian desert conditions, it is now working on producing distinctive hybrids of tomato that tolerate different environmental conditions in arid and semi-arid regions and that are economically productive. The program focuses on areas irrigated by saline water with Egyptian deserts. The objective of this study was the evaluation of 21 genotypes of tomato (6 parents +15 F_1crosses) under the land affected with salinity for combining ability of yield and some fruit traits.

MATERIALS AND METHODS

Six genotypes of tomato were obtained from Plant Breeding and Conservation Program of Desert Research Center (DRC). They were 6 parents [STel7/1/3(P_1), SK_2-5/2/3 (P_2), SC_{1-0}-5/2/3 (P_3), SS_{5-1}-7/1/3(P_4), SR_2 -7/1/3(P_5) and SA_1-7/2/3 (P_6)]. Half diallel crosses were done among these parents during 2023 summer season under a greenhouse in Saint Catherine to produce the F_1 seeds.

The evaluation trial was set up during the winter season 2023/2024 in two locations. The first location (L_1) was Ras-Sudr station, Desert Research Center (DRC), South Sinai (soil was sandy loam and irrigation water salinity was 6.1dSm^{-1}). The second location (L_2) was Alsaalihia zone, El-Sharkia governorate (soil was sandy loam and irrigation water salinity was 1.65dSm^{-1}).

Tomato seeds were planted in the nursery greenhouse. Transplanting done with the seedlings were 30 days old in the field on 15th October 2023 in the two locations. The tomato genotypes (6 parents and their 15 F_1crosses) were grown in a randomized complete blocks design with three replications in 100 cm × 50 cm spacing keeping 15 plants in each plot. A drip irrigation system was used. Normal agricultural treatments were applied. Yield per plant (kg), average fruit weight (g), fruit length (cm), fruit diameter (cm), number of locules/fruit and total soluble solids percentage (TSS% determined by using Hand Refractometer and expressed as percentage of the juice) were recorded from five randomly selected plants from each genotype in a plot.

Statistical analysis: Statistical procedures used in this study were done according to the variance for a randomized complete blocks design as outlined by **Cochran and Cox (1957)**. The treatment means were compared using least significant difference test at 5% and 1% levels of significance**.** In order to estimate the different genetic parameters in terms of additive and dominance genetic variances, the F1 hybrids were analyzed according to the analysis of the half-diallel crosses mating system as outlined by **Griffing (1956),** method (2) model (II).

RESULTS AND DISCUSSION

The results of analysis of variance of all genotypes are presented in Table 1. Tests of significance indicated that the mean squares due to genotypes were highly significant for all studied traits in both locations; it becomes statistically valid for the required diversity for the success of the planned crosses. These results agreed with many investigators such as Metwally *et al* (1996); Kumar *et al* (2015); Savale *et al* (2017); Bayomi *et al* (2019); Sheded *et al* (2022) and Bayomi (2024).

Table 1. Mean squares from analysis of variance of tomato genotypes for all studied traits under the two locations.

SOV	df	Mean squares					
		Yield/plant		Fruit weight		Fruit length	
		L_1	L_2	L_1	L_2	L_1	L_2
Replications	2	4.98	0.63	1327.34	4326.34	0.33	0.34
Genotypes	20	0.85**	1.16**	135.49**	786.15**	0.69**	0.75**
Error	40	0.07	0.04	12.65	35.81	0.02	0.10
SOV	**df**	**Fruit diameter**		**No of locules/fruit**		**T.S.S%**	
		L_1	L_2	L_1	L_2	L_1	L_2
Replications	2	0.38	0.63	0.32	0.01	0.09	0.23
Genotypes	20	0.65**	0.53**	2.23**	3.21**	0.51**	0.49**
Error	40	0.02	0.16	0.27	0.20	0.02	0.09

****: Significant at the 0.01 level of probability. L_1= Ras-Sudr station, L_2= El-Sharkia.**

Mean performances of tomato genotypes (6 parents and their 15 crosses) for yield per plant (kg), average fruit weight (g), fruit length (cm), fruit diameter (cm), number of locules/fruit and total soluble solids percentage (T.S.S%) traits of the two locations (Ras-Sudr station L_1 and Alsaalihia zone L_2) are presented in Table (2). The results indicate clearly that, in two locations, the P_1 and P_6 produced the highest yield per plant with values of 2.6, 2.6, 3.7 and 3.9 kg in the first and second location, respectively. However, P3 produced the lowest yield per plant (1.6 and 2.8 kg) in two locations, respectively. In the first location, the crosses 1 x 6 and 5 x 6 produced the highest yield per plant with values of 3.1 and 3.3 kg, respectively. In the second location, the crosses 1 x 5, 1 x 6 and 2 x 6 produced the highest yield per plant. In general all hybrids including P_1 had good values for yield per plant in the two locations. The cross 5 x 6 was good for yield per plant in the two locations. In the two locations F_1 crosses produced higher yield per plant than parents. Bayomi *et al* (2019) reported that the total fruit yield per plant ranged from 1.22 to 2.05kg. Many investigators reported that F_1 crosses produced higher yield than parents (Peter and Rai 1978; Sherif and Hussein 1992; Hegazi *et al* 1995; Youssef 1997 and Bayomi, 2024). In the first location, mean performances the F_1 crosses recorded higher value of fruit weight than parents. While, in the second location had antonym. The P_1 and P_6 recorded the largest fruit weight with values of 82.9, 83, 126.3 and 131.2 g in the first and second location, respectively. While, P_3 recorded the smallest fruit weight (65.8 and 91.7g) in two locations. In the first location, the cross 1 x 6 recorded the highest fruit weight with a value of 89g. However, in the second location, the cross 2 x 6 recorded the highest fruit weight (135g). P_6 and cross 2 x 6 recorded good average fruit weight in the two locations. In general must hybrids including P_1 and P_6 had the largest fruit weight. Kumar *et al* (2015) reported that fruit weight ranged from 53.0 to 149 g. Bayomi *et al* (2019) reported that fruit weight ranged from 52.5 to 152.7 g. This result is inconformity by Metwally *et al* 1996 and Bayomi, 2024. In the two locations, mean performances the F_1 crosses recorded highest value of fruit length than parents. The P_6 recorded the highest fruit length with values of 4.7 and 6.2 cm in the first and second location, respectively. In the first location, the crosses 1 x 6 and 2 x 6 recorded the highest fruit length with values of 4.8 and 4.8 cm, respectively. In the second location, the crosses 2 x 6 and 5 x 6 recorded the highest fruit length. P_6 and cross 5 x 6 recorded good average fruit length in the two locations. Sheded *et al* (2022) reported that fruit length ranged from 1.1 to 5.8 cm. In the two locations, mean performances parents recorded highest value of fruit diameter than the F_1 crosses. The P_1 recorded the highest fruit diameter with values of 5.7 and 6.7 cm in the first and second location, respectively. However, P3 recorded the lowest fruit diameter (4.1 and 5.3 cm) in the two locations. In the two locations, the crosses 1 x 4 recorded the highest fruit diameter with values of 5.5 and 6.6 cm, respectively. P_6 and cross 5 x 6 were recorded good average fruit diameter in the two locations. Sheded *et al* (2022) reported that fruit length ranged from 0.97 to 9.3 cm. In the two locations, mean performances of parents and crosses recorded equal values of average number of locules per fruit. The P_6 recorded the highest number of locules per fruit with values of 5.3 in the two locations. However, P3 recorded the lowest number of locules per fruit (2.0 and 2.0) in two locations. In the $L_1$and L_2 locations, the cross 1 x 6 recorded a number of locules per fruit with values of 5.0 and 5.3, respectively. However, the cross 3 x 5 recorded the lowest number of locules per fruit (2.7 and 2.0) in two locations. These results agreed with those of Kumar *et al* (2015), Bayomi *et al* (2019), Sheded *et al* (2022) and Bayomi (2024). In the two locations, mean performances the F_1 crosses recorded higher value of total soluble solids (T.S.S. %) than parents. The P_5 recorded the highest total soluble solids with values of 7.5 and 5.4% in the first and second location, respectively. In the first location, the cross 5 x 6 recorded the highest total soluble solids with values 7.6%. In the second location, the crosses 2 x 4, 2 x 6 and 4 x 6 recorded the highest total soluble solids. Bayomi *et al* (2019) indicated that total soluble solids ranged from 3.1 to 4.9%. Bayomi (2024) indicated that total soluble solids ranged from 4.3 to 6.9%.

Table 2. Mean performance of tomato genotypes for all studied traits under the two locations.

Genotypes	Yield/plant (g)		Fruit weight (g)		Fruit length (cm)		Fruit diameter(cm)		No of locules		T.S.S %	
	L_1	L_2	L_1	L_2	L_1	L_2	L_1	L_2	L_1	L_2	L_1	L_2
P_1	2.6	3.7	82.9	126.3	4.2	5.9	5.7	6.7	4.3	4.0	6.6	4.7
P_2	2.5	3.3	76.0	105.3	4.0	5.0	5.1	6.0	3.7	3.7	6.5	4.0
P_3	1.6	2.8	65.8	91.7	3.4	5.4	4.1	5.3	2.0	2.0	7.0	5.0
P_4	2.2	3.0	75.2	106.3	3.9	5.0	5.6	6.7	4.7	5.3	6.4	4.3
P_5	2.5	3.5	75.2	121.7	4.5	5.4	5.6	6.3	2.7	2.7	7.4	5.4
P_6	2.6	3.9	83.0	131.2	4.7	6.2	5.2	6.1	5.3	5.3	7.3	4.7
Mean	**2.3**	**3.2**	**76.5**	**113.8**	**4.1**	**5.5**	**5.2**	**6.2**	**3.8**	**3.8**	**6.9**	**4.7**
1×2	3.0	4.1	87.9	109.2	4.1	5.2	5.4	6.1	4.5	4.1	6.4	4.9
1×3	2.7	4.0	82.7	112.9	4.0	5.2	5.0	6.1	3.4	3.5	7.2	4.2
1×4	2.9	4.1	85.2	128.4	4.6	4.9	5.5	6.6	4.8	5.4	6.5	4.4
1×5	3.0	4.3	85.9	118.6	4.6	5.8	5.3	5.8	3.6	3.2	7.4	5.1
1×6	3.1	4.3	89.0	123.7	4.8	5.4	5.1	6.1	5.0	5.3	7.2	5.0
2×3	1.8	3.2	75.7	87.9	3.7	5.4	4.9	5.9	3.2	3.0	7.1	4.3
2×4	1.5	3.0	63.7	97.0	3.4	5.2	4.7	5.8	3.4	3.3	6.3	5.3
2×5	2.8	4.3	82.9	128.3	4.6	6.3	4.7	6.5	3.2	2.7	7.4	5.2
2×6	2.9	4.3	86.3	135.0	4.8	6.4	5.1	7.1	4.7	4.4	7.0	5.3
3×4	2.2	3.0	76.3	93.5	3.5	5.3	5.1	5.8	4.4	3.9	7.2	4.5
3×5	2.7	3.4	79.6	103.7	4.1	5.8	4.6	5.8	2.7	2.0	7.4	4.4
3×6	1.5	3.2	74.1	91.8	3.6	5.8	4.7	5.9	4.3	3.7	7.4	4.7
4×5	2.1	2.4	75.4	80.0	4.6	5.4	4.1	5.9	3.3	3.4	7.1	4.8
4×6	2.2	2.6	80.5	100.3	4.6	5.9	4.5	6.6	3.9	4.7	6.8	5.3
5×6	3.3	4.2	84.7	122.3	4.7	6.7	4.6	6.1	3.4	3.7	7.6	4.7
Mean	**2.5**	**3.6**	**80.7**	**108.8**	**4.2**	**5.7**	**4.9**	**6.1**	**3.8**	**3.8**	**7.0**	**4.8**
LSD 0.05	**0.45**	**0.32**	**5.87**	**9.88**	**0.20**	**0.51**	**0.25**	**0.66**	**0.85**	**0.75**	**0.20**	**0.51**
LSD 0.01	**0.60**	**0.43**	**7.85**	**13.21**	**0.27**	**0.69**	**0.34**	**0.89**	**1.14**	**0.99**	**0.27**	**0.68**

L_1= Ras-Sudr station, L_2= El-Sharkia.

Mean of parents and hybrids in two location and decreasing percentage of yield per plant because of salinity are illustrated in Fig 1. The results indicate that, the high salinity of the irrigation water in the first location led to a decrease in yield per plant by 28.13 and 30.56% for the average of the parents and hybrids, respectively, as compared to the second location, which is irrigated with low salinity irrigation water. Therefore, when planting under salinity conditions, choosing prefers tomato hybrids with high productivity. While, the results illustrated in Fig 2 indicate that, the high salinity of the irrigation water in the first location led to an increase in percentage of total soluble solids by 46.81 and 45.83% for the average of the parents and hybrids, respectively, as compared to the second location, which is irrigated with low salinity irrigation water.

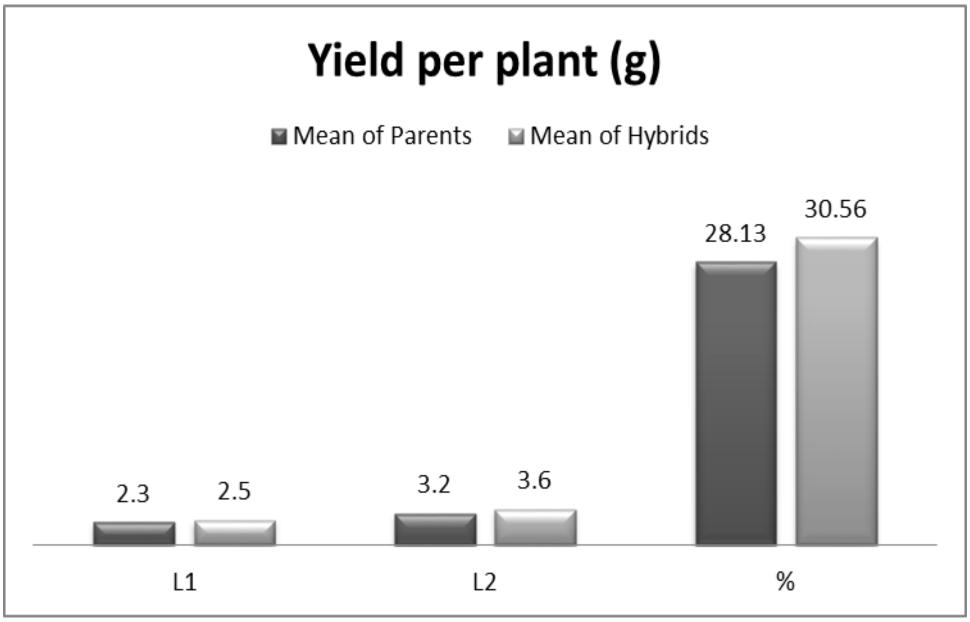

Fig 1. Mean of parents and their hybrids in the two locations and decreasing percentage of yield per plant.

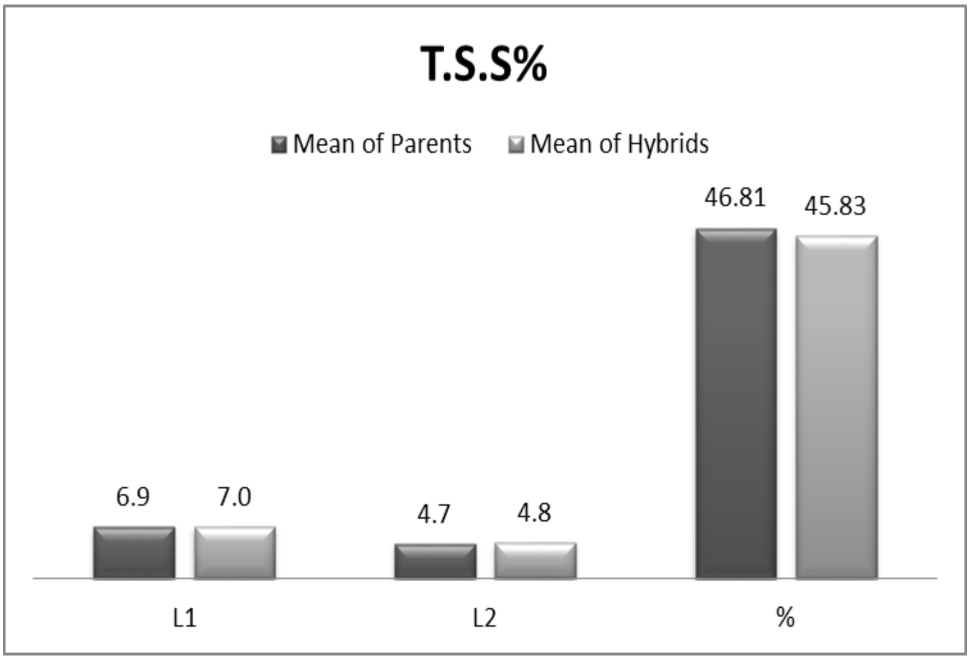

Fig 2. Mean of parents and their hybrids in the two locations and increase percentage of total soluble solids (T.S.S.).

Mean squares due to general (GCA) and specific (SCA) combining ability are presented in Table 3. Tests of significance indicated that the mean squares of general and specific combining ability were significant for yield per plant, average fruit weight, fruit length, fruit diameter, number of locules/fruit and total soluble solids percentage traits in both locations. This suggested that additive and non-additive gene effects were important in the inheritance of those traits. GCA was larger than SCA for most studied traits; this indicates that additive gene effects were more important than non-additive gene effects in the inheritance of these traits under the two locations. This result is in agreement with many investigators such as Bayomi (2002), Mondal *et al* (2009), Singh *et al* (2021) and Bayomi (2024). They reported that mean squares of both general and specific combining ability were significant.

Table 3. Mean squares due to general and specific combining ability for all studied traits under the two locations.

SOV	df	Mean squares					
		Yield/plant		Fruit weight		Fruit length	
		L_1	L_2	L_1	L_2	L_1	L_2
GCA	5	0.59**	0.88**	104.29**	586.09**	0.70**	0.57**
SCA	15	0.18**	0.22**	25.45**	154.04**	0.07**	0.14**
Error	40	0.02	0.01	4.22	11.94	0.01	0.03
SOV	**df**	**Fruit diameter**		**No of locules**		**T.S.S %**	
		L_1	L_2	L_1	L_2	L_1	L_2
GCA	5	0.35**	0.31**	2.32**	3.76**	0.58**	0.12**
SCA	15	0.17**	0.13*	0.22*	0.17**	0.04**	0.18**
Error	40	0.01	0.05	0.09	0.07	0.01	0.03

***and ** indicate significant at 0.05 and 0.01 probability levels, respectively. L1= Ras-Sudr station, L2= El-Sharkia.**

The estimated values of general combining ability (GCA) effects of parental lines, which assisted in the selection of better parents regarding suitable breeding programs, are presented in Table 4. For yield per plant, in the two locations, P_1 line had the greatest GCA effects followed by P_5 line and then P_6 line. However, P_2, P_3 and P_4 lines were poor combiners for yield per plant, in the two locations, except P_2 in the second location which had positive GCA effects. Concerning average fruit weight, in the two locations, P_1 line had the greatest GCA effects followed by P_6 line and then P_5 line. While, P_2, P_3 and P_4 lines were poor combiners for average fruit weight, in the two locations. Regarding fruit length, P_6 and P_5 lines had the greatest GCA effects. While, P_1 line had positive GCA effects in the first location. However, P_2, P_3 and P_4 lines were poor combiners for fruit length, in the two locations. Concerning fruit diameter, in the two locations, P_1 line had the greatest GCA effects followed by P_4 line and then P_2 line. While, P_6 line had positive GCA effects in the second location. For number of locules/fruit, in the two locations, P_6 line had the greatest GCA effects followed by P_4 line and then P_1 line. However, P_2, P_3 and P_5 lines were poor combiners for number of locules/fruit, in the two locations. Concerning total soluble solids percentage, in the two locations, P_5 line had the greatest GCA effects then P_6 line.

Specific combining ability (SCA) effects of different cross combinations are presented in Table 5. For yield per plant, in the two locations, only one cross ($P_5 \times P_6$) had positive and highly significant values of SCA effects. However, eight crosses had positive and significant or highly significant values of SCA effects. Concerning average fruit weight, in the two locations, seven crosses had positive or significant or highly significant values of SCA effects. Regarding fruit length in the two locations, six crosses had positive or significant or highly significant values of SCA effects. Concerning fruit diameter, in the two locations, three crosses had positive and significant or highly significant values of SCA effects. For number of locules/fruit, in the two locations, six crosses had positive and significant or highly significant values of SCA effects. Concerning total soluble solids percentage, in the two locations, five crosses had positive and significant or highly significant values of SCA effects. In general, the crosses $P_2 \times P_5$ and $P_2 \times P_6$ had good values of SCA effects for most studied traits. This finding is in agreement with that reported by Bayomi (2002), Mondal *et al* (2009), Singh *et al* (2021) and Bayomi (2024).

Table 4. General combining ability (gi) effects of the six parents for all studied traits under the two locations.

Parents	Yield/plant		Fruit weight		Fruit length		Fruit diameter		No of locules		T.S.S%	
	L_1	L_2	L_1	L_2	L_1	L_2	L_1	L_2	L_1	L_2	L_1	L_2
P1	0.34**	0.43**	5.03**	9.23**	0.13**	-0.10	0.35**	0.12	0.40**	0.39**	-0.16	-0.03
P2	-0.03	0.08*	-0.75	-0.46	-0.11	-0.09	0.02	0.06	-0.19	-0.19	-0.24	-0.04
P3	-0.38	-0.31	-4.53	-12.31	-0.48	-0.12	-0.30	-0.37	-0.60	-0.80	0.14**	-0.16
P4	-0.24	-0.47	-3.10	-7.50	-0.11	-0.31	0.03	0.12	0.29**	0.63**	-0.30	-0.06
P5	0.20**	0.08*	0.33	3.08**	0.28**	0.19**	-0.03	-0.06	-0.66	-0.77	0.36**	0.18**
P6	0.12*	0.20**	3.02**	7.98**	0.30**	0.43**	-0.07	0.14	0.64**	0.74**	0.20**	0.10
LSD (gi) 0.05	0.10	0.07	1.34	2.25	0.05	0.12	0.06	0.15	0.19	0.17	0.05	0.12
LSD (gi) 0.01	0.14	0.10	1.79	3.02	0.06	0.16	0.08	0.20	0.26	0.23	0.06	0.15

*** and ** indicate significant at 0.05 and 0.01 probability levels, respectively. L1= Ras-Sudr station, L2= El-Sharkia.**

Table 5. Specific combining ability (Sij) effects of 15 F_1 tomato crosses for all studied traits under the two locations.

Cross	Yield/plant		Fruit weight		Fruit length		Fruit diameter		No of locules		T.S.S %	
	L_1	L_2	L_1	L_2	L_1	L_2	L_1	L_2	L_1	L_2	L_1	L_2
1×2	0.26	0.09	4.18*	-9.77	-0.09	-0.21	0.02	-0.23	0.30	0.16	-0.21	0.26
1×3	0.29*	0.37**	2.69	5.78	0.12	-0.14	-0.01	0.17	-0.19	0.13	0.17**	-0.38
1×4	0.31*	0.60**	3.79*	16.44**	0.34**	-0.25	0.13	0.17	0.25	0.64**	-0.09	-0.25
1×5	-0.03	0.22*	1.07	-3.95	0.02	0.14	0.03	-0.44	0.06	-0.20	0.19**	0.17
1×6	0.16	0.13	1.47	-3.78	0.14	-0.53	-0.20	-0.28	0.16	0.36	0.12	0.15
2×3	-0.25	-0.14	1.54	-9.60	0.08	0.02	0.23**	0.07	0.04	0.21	0.15*	-0.25
2×4	-0.69	-0.11	-11.9	-5.31	-0.56	-0.03	-0.37	-0.53	-0.62	-0.88	0.14*	0.62**
2×5	0.20	0.54**	3.88*	15.47**	0.25**	0.56**	-0.24	0.36**	0.09	-0.15	0.24**	0.28
2×6	0.35*	0.49**	4.52*	17.24**	0.37**	0.49**	0.13	0.79**	0.26	0.11	0.07	0.42**
3×4	0.40**	0.20*	4.48*	3.07	-0.08	0.17	0.41**	-0.10	0.85**	0.29	0.34**	-0.09
3×5	0.43**	0.09	4.33*	2.72	0.06	0.13	-0.09	0.09	0.10	-0.21	-0.08	-0.37
3×6	-0.69	-0.20	-3.87	-14.07	-0.42	-0.14	0.11	-0.01	0.46	-0.06	0.01	-0.06
4×5	-0.35	-0.78	-1.34	-25.82	0.25**	-0.05	-0.86	-0.34	-012	-0.20	0.06	-0.13
4×6	-0.17	-0.70	1.07	-10.45	0.17**	0.18	-0.48	0.23	-0.89	-0.48	-0.08	0.51**
5×6	0.53**	0.35**	1.84	1.04	-0.12	0.47**	-0.26	-0.15	-0.44	-0.08	0.03	-0.40
LSD (Sij) 0.05	0.28	0.20	3.68	6.19	0.13	0.32	0.16	0.42	0.54	0.46	0.13	0.32
LSD (Sij) 0.01	0.38	0.27	4.92	8.28	0.17	0.43	0.21	0.56	0.72	0.62	0.17	0.42

***and ** indicate significant at 0.05 and 0.01 probability levels, respectively. L1= Ras-Sudr station, L2= El-Sharkia.**

CONCLUSIONS

Plant breeding and conservation program of Desert Research Center is working to identify the best tomato genotypes for hybrids production under Egyptian desert conditions. The mean squares due to genotypes were highly significant for all studied traits in both locations. Mean performances the F_1 crosses produced higher yield per plant than parents in the two locations. The high salinity of the irrigation water in the first location led to a decrease in yield per plant by 28.13 and 30.56% for the average of the parents and hybrids, respectively, compared to the second location, which is irrigated with low salinity irrigation water. Therefore, when planting under salinity conditions, choosing prefers tomato hybrids with high productivity. GCA was larger than SCA for most studied traits; this indicates that additive gene effects were more important than non-additive gene effects in the inheritance of these traits under the two locations. P_1 line had the greatest GCA effects followed by P_5 line and then P_6 line. Cross $P_5 \times P_6$ had positive and highly significant values of SCA effects for yield per plant, in the two locations. In general, good line definition can be by its high mean performance for most traits and also by its positive and significant general and specific combining ability effects

REFERENCES

Al-Daej, I. M. (2018). Line×tester analysis of heterosis and combining ability in tomato (*Lycopersicon esculentum* Mill.) fruit quality traits.Pak. J. Biol. Sci. 21: 224-231.

Bayomi, K.E.M (2002). Heterosis and gene action in varietal crosses of tomato under North Sinai conditions. M.Sc. Thesis, Fac. of Envi. Agri. Sci. El-Arish, Suez Canal Univ., Egypt.

Bayomi, K.E.M (2024). Line×tester analysis for estimation of combining ability in tomato. Egyptian Journal of Plant Breeding 28 (2):201-213.

Bayomi, K.E.M., A. Abdel-Baset, S.M.A. Nasar and A.M.A. Al-Kady (2019). Evaluation of tomato genotypes productivity under North Sinai and Toshka conditions. Egyptian Journal of Plant Breeding 23 (6):1095-110.

Bustomi, R.A.R., S. Mstr, D. Suhandy and A. Tusi (2014). The effect of EC levels of nutrient solution on the growth, yield, and quality of tomatoes (*Solanum Lycopersicum*) under the hydroponic system. J. Agric Eng. Biotechnol. 2(1): 7-12.

Cochran, W.C. and G.M. Cox (1957). Experimental design. 2nd ed., John Willey and Sons, New York, USA.

Griffing, B. (1956). Concept of general and specific combining ability in relation to diallel crossing systems. Aust. J. Biol. Sci. 9: 463-493.

Hegazi, H.H., H.M. Hassan, A.G. Moussa and M.A.E. Wahb-Allah (1995). Heterosis and heritability estimation for some characters of some tomato cultivars and their hybrid combinations. Alex. J. Agric. Res. 40(2): 265-276.

Kumar, S., P. H. R. Gowda and N. M. Mallikarjuna (2015). Evaluation of selected F_6 tomato lines for extended shelf life. SABRAO J. Breed. Genet. 47 (4): 326-334.

Magan J.J., M. Gallardo, R.B. Thompson and P. Lorenzo (2008). Effects of salinity on fruit yield and quality of tomato grown in soil-less culture in greenhouses in Mediterranean climatic conditions. Agric. Water Manag. 95: 1041-1055.

Metwally, E.I., A. El-Zawily, N. Hassan and O. Zanata (1996). Inheritance of fruit set and yield of tomato under high temperature conditions in Egypt. 1st Egypt-Hung. Hort. Conf., Vol. I: 112-122.

Mondal, C., S. Sarkar and P. Hazra (2009). Line × tester analysis of combining ability in tomato (*Lycopersicon esculentum* Mill.). J. Crop and Weed, 5(1): 53-57.

Peter, K.V. and B. Rai. (1978). Heterosis as a function of genetics distance in tomato. Indian J. Gent. 38(2): 173-178.

Qaryouti, M.M., W. Qawasmi, H. Hamdan and M. Edwan (2007). Influence of NaCl salinity stress on yield, plant water uptake and drainage water of tomato grown in soilless culture. Acta Horticulturae 747: 539-544.

Savale, S.V., A.I. Patel and P.R. Sante (2017). Study of heterosis over environments in tomato (*Solanum lycopersicum* L.). Int. J. Chem. Stud. 5: 284-289.

Sheded, M. Noha, T. Shehata, S. M. Ahmad, M. Refaat and M. Bekhit (2022). Half diallel analysis of some quantitative traits in tomato under drought stress conditions. Annals of Agric. Sci., Moshtohor 60(2), 431 – 444.

Sherif, T.H.I. and H.A. Hussein (1992). A genetic analysis of growth and yield characters in the tomato (*Lycopersicon esculentum* Mill) under the heat stress of late summer in upper Egypt. Assuit. J. Agric. Sci. 23: 3-28.

Singh, S., A.K. Singh, B.K. Singh,V. Singh and K. Shikh (2021). Line × tester analysis for yield and component traits in tomato (*Solanum lycopersicum* L.). J. of Pharmacognosy and Phytochemistry 10(1): 2044-2049.

Youssef, S.M.S. (1997). Studies on some intervarietal crosses and hybrid vigor in tomato. M.Sc. Thesis, Ain Shams Univ., Egypt.

تحليل الهجن التبادلية النصف دائرية للمحصول وبعض خصائص الثمار فى الطماطم تحت ظروف الأراضى المتأثرة بالملوحة

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يهدف هذا البحث الى تحديد أفضل التراكيب الوراثية من الطماطم لإنتاج الهجن لتناسب ظروف الصحارى المصرية . تم تقييم ٢١ تركيب وراثى من الطماطم (٦ اباء و١٥ هجين) بموقعين الاول محطة بحوث رأس سدر- مركز بحوث الصحراء بجنوب سيناء والثانى بمنطقة الصالحية- محافظة الشرقية خلال موسم النمو ٢٠٢٣-٢٠٢٤. التصميم الاحصائى المستخدم كان القطاعات الكاملة العشوائية من ثلاث مكررات. أشارت النتائج الى وجود تباينات معنوية بين التراكيب الوراثية لجميع الصفات بكلا الموقعين. كانت تأثيرات القدرة العامة على التآلف أكبر من تأثيرات القدرة الخاصة على التآلف فى معظم الصفات تحت الدراسة. وهذا يشير الى أن تأثير فعل الجين المضيف كان أكثر أهمية من تأثير فعل الجين الغير مضيف فى وراثة تلك الصفات فى كلا الموقعين. كانت تأثيرات القدرة العامة على التآلف للاب P_1 اكبر لمعظم الصفات يلية P_5 ثم P_6 . سجل الهجين $P_5 \times P_6$ أعلى قيم موجبة ومعنوية لتأثيرات القدرة الخاصة على التآلف لصفة محصول النبات فى كلا الموقعين. أدت ملوحة مياة الرى العالية بالموقع الاول الى إنخفاض إنتاجية النبات بنسبة ٢٨,١٣ و٣٠,٥٦ % لمتوسطى الاباء والهجن على التوالى مقارنة بالموقع الثانى المروى بمياة أقل فى مستوى الملوحة. لذلك، عند زراعة الأراضى المتأثرة بظروف الملوحة يفضل إختيار هجن الطماطم ذات الإنتاجية العالية تحت ظروف هذه الأراضى.

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