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STUDIES ON PRODUCTION OF SOME LOCAL TOMATO HYBRIDS

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ABSTRACT

This work was conducted to produce some local tomato hybrids which show high productivity and high quality to meet the desires of consumer and farmer and to lessen the amount of seeds imported from other countries at high prices . The genetic materials used in the present study included 5 cultivars of tomato , this cultivars namely : (1) Marglobe , (2) Peto 86 , (3) Super strain B , (4) Super marmande and (5) Floradade . Plants from each variety were selfed pollinated for three generations to obtain an inbred line from each variety . The work was carried out during two successive years . In 2001 , a half diallel cross was performed among the five cultivars of tomato (excluding reciprocals) to produce 10 F_1 hybrid seeds . In 2002 the five parents and 10 F_1's were evaluated during the summer season . The obtained results indicated that heterosis over the better parent gave significant values in most crosses for plant height, number of branches, earliness, number of fruits per plant, early yield per plant and total soluble solids.

The good combiner parental cultivar and best hybrid combination for each character were estimated according to the best GCA and SCA values . Concerning general combining ability , it was found that Super marmande cultivar was the best combiner for plant height , number of branches , fruit weight , number of locules / fruit and T.S.S . Peto 86 cultivar was the best combiner for earliness, number of fruits / plant , early yield / plant , fruit shape index and flesh thickness . Marglobe cultivar appeared to be the best combiner for fruit set percentage , whereas Floradade was the best combiner for marketable yield / plant . Concerning specific combining ability , Super strain B x Floradade was found to be the best cross for plant height . The cross Super strain B x Super marmande appeared to be the best cross for number of branches / plant , fruit set % and number of fruits / plant . The cross Peto 86 x Floradade was the best combination for earliness . The cross Mrglobe x Peto 86 appeared to be the best combination for early yield / plant and marketable and total yield / plant . It was found also that the cross Peto 86 x Super strain B showed the best cross for both fruit weight and fruit shape index . The cross Marglobe x Super marmande was the best combination for flesh thickness , whereas Marglobe x Floradade cross was the best combination for number of locules / fruit . The cross Peto 86 x Super marmande reflected the best combination for T.S.S .

Additive gene effects appeared to be more important than non additive gene effects as reflected on the high estimated of GCA variances relative to those of SCA variances for each of earliness and fruit shape index . Whereas it was found that non-additive gene effects appeared to play important roles than additive effects for plant height , number of branches , fruit set % , number of fruits , early yield , marketable yield , total yield , fruit weight , flesh thickness , number of locules / fruit and T.S.S .Therefore this study may help in improving tomato through hybridization and selection .

INTRODUCTION

Tomato (*lycopersicon esculentum Mill*.) is considered the most important vegetable crops in Egypt as well as all over the world. The area of production increases from year to another to meet the demand increment of consumers. So the area devoted for production in 2002 was 454988 feddans,

produced about 6777875 tons. The average of productivity, per unit area, seemed to be low. So this work was carried out to obtain some local tomato hybrids through intervarietal crosses , comparing these hybrids with their parents in order to choose the most promising ones to be replaced in cultivation instead of the open pollinated cultivars and imported hybrids . In this.respect , Abd EL-Rahim (1989) found, on tomato that heterosis was present for plant height and number of branches per plant with a value of 51.0% and 5.1% from high parent, respectively.

On other side Dod and Kale (1992) evaluated 66 F_1 hybrids of tomato. They observed pronounced heterosis for yield / plant, days to first harvest, number of fruits / plant and plant height.

Sidhu and Singh (1993) evaluated 55 different hybrids between 11 varieties of tomato, they obtained heterosis values ranged from 23.8% to 71.7%.

Suresh et al (1995) studied seven tomato lines and 21 F1 hybrids among them. They observed greatest heterosis over superior parents for average fruit weight (30.8%), fruit number (143.1%), early yield (41.6%) and total yield (72.2%).

Abd Allah (1995) evaluated 45 crosses of tomato for fruit quality and the results revealed that 19 out of 45 crosses exhibited significant heterosis over high parents for average fruit weight ranged from 48.2 to 32.9 %.

Youssef (1997) found on tomato, that all the produced hybrids gave negative heterosis for fruit weight.

Abdel-Ati et al (2000) evaluated some F1 hybrids of tomato over two successive seasons. Their results revealed that 8 out of 21 hybrids showed positive heterosis for fruit weight.

Hassan et al (2000 a) found that the 21 F_1's evaluated hybrids of tomato exhibited negative heterosis over better parent in T.S.S content except the hybrids castle Rock X vFNT, caloirvil X oxheart and Pakmor-B X VFNT which showed insignificant positive heterosis.

Amin *et al.* (2001) reported that the estimated heterosis values of tomato for TSS was 47.79 to 20.92% relative to mid parents and hight parent, respectively.

Also to study the nature of inheritance heterosis as well as gene action of some yield components and fruit quality characteristics . In this respect , Metwally *et al.* (1990) found on tomato that general and specific combining ability were found highly significant.

Ghobary (2004) obtained 15 F_1 hybrids of tomato . He obtained high GCA for plant height , fruit weight and number of locules per fruit .Such study may help in improving tomato through hybridization and selection .

MATERIALS AND METHODS

This study was conducted at El-Baramoon horticultural Research farm, Dakahlia Governorate during two summer seasons of 2000 and 2001. Inbred lines of five tomato cultivars namely; Marglobe,peto 86, super strain B, super marmande and floradade were used . These cultivars differed greatly in some characters and also in their pedigree as presented in table A.

Table (A): General characters of the five tomato cultivars used in the study.

Cultivar	Character				
	Growth habit	Fruit weight	Fruit shape	Maturity	Source
Marglobe	Determinate	medium	round	medium	Fito (Italy)
Peto 86	Determinate	medium	oval	Early	Petoseed (USA)
Super Strain B	Determinate	medium	deep-globe	medium	Asgrow (USA)
Super Marmande	Determinate	large	oblate	medium	Peto seed (USA)
Floradade	Determinate	large	square	late	Asgrow (USA)

Seeds of the cultivars were sown in the nursery on 10th January 2000 in seedling trays. The trays were kept under low tunnel. All the recommended practices to obtain tomato well developed transplants of high quality were followed. Transplanting was carried on the 14th of March 2000 at El-Baramoon Horticultural Research farm. Half diallel crosses were made between these parents to obtain ten single cross hybrids. According to the formula mentioned by Briggs and Knowles (1967) as follow:

Number of single hybrids = (without reciprocal crosses) $\frac{n(n-1)}{2}$

Where: n= number of parental cultivars. Ten crosses were made as follows:

1- Marglope x Peto 86
2- Marglope x Super Strain B
3- Marglope x Super Marmande
4- Marglope x Floradade
5- Peto 86 x Super Strain B
6- Peto 86 x Super Marmande
7- Peto 86 x Floradade
8- Super Strain B x Super Marmande
9- Super Strain B x Floradade
10- Super Marmande x Floradade

Red ripe of fruits from each cross were harvested and the F_1 seeds were extracted from the fruits by the fermentation methods for 2-3 days.

A nursery was conducted on 15th January to produce transplants of the parents and their F_1 hybrids. On the 8th march 2001, transplants of the 15 entries (5 parents and 10 hybrids) were cultivated in a field trial in private farm, west of Nobaria, EL-Behira Governorate for evaluation studies. A randomized complete block design with four replicates was adapted. Each replicate contained 15 experimental plots. Each experimental plot consisted of two rows of 4.5 meter long and 1 meter wide. The plants were spaced at 30 cm apart on one side ridge. The plot of each genotype contained 30 plants. Standard fertilization, standard pesticides treatments and cultural practice for tomato production were used according to the recommendations of ministry of agriculture. Characters evaluated for hybrids produced and their parents were plant height, number of branches, number of days to flowering, set fruit %, fruits number / plant, marketable yield / plant, total yield / plant,

early yield / plant, average fruit weight , fruit shape index , flesh thickness, number of locules / fruit and T.S.S % .

Analysis of data was done by IBM computer using anova program for statistical analysis. The differences among means for all traits for significance according to Cochran and Cox (1957). Estimates of heterosis of better parents were determined for each cross as follows: heterosis over better parent: H (F_1, B.P) %= (F_1 – B.P/B.p) x100.

The values of general combining ability (GCA) and specific combining ability (SCA) effects were estimated according to Griffing (1956) model II of methods II . The standard errors (S.E) of estimated general and specific combining ability effects were obtained .

RESULTS AND DISCUSSION

1- Yield components :

1:1- Plant height :

It is clear from Table (1) that Super marmande cultivar shows the highest significant value for plant height among the parents, followed by Marglobe cultivar, while Peto 86 and Super strain B did not differ significantly from each other and recorded the lowest values

All tested hybrids except Marglobe x Peto 86 gave the highest significant values for plant height over the better parent for each hybrid. Concerning heterosis , all obtained hybrids gave positive values of heterosis except Marglobe x Peto 86 hybrid. These results coincide with those of Ahmed et al .(1988) and Abd El-Rahim (1989). These contradictory results could be due to the genetic constituent of each cultivar used in each study.

1:2- Number of branches per plant :

With respect to number of branches, all tested hybrids except Marglobe x Peto 86 , Marglobe x Super marmande and Peto 86 x Super marmande hybrids gave the highest significant values for number of branches over the better parent for each hybrid . These results suggest that high number of branches per plant seemed to involve partial dominance or even over dominance in it's inheritance over low number . These results are in confirmity with those of Wahb Allah (1995).Concerning heterosis , most F_1 hybrids gave positive values of heterosis. These results are in agreement with those of Abd El-Rahim (1989) Singh et.al (1995) and Hegazi et.al . (1995) .

1:3- Earliness (days from seedling to flowering):

It is evident from Table (1) that from 10 F_1 hybrids seven ones showed earliness that tended to be deviated towards their respective earlier parents .In this connection the F_1 hybrid Peto 86 x Super strain B was the earliest one and showed high negative heterosis followed by Peto 86 x Floradade hybrid then Peto 86 x Super marmande hybrid . from 10 F_1 hybrids seven ones showed significant heterosis over the better parents with negative values . The negative values indicate that seven crosses were earlier than the better parent .These results are in agreement with those obtained by Dod and Kale .(1992) and Hatem (1994) .

1:4- Fruit set percentage

Data in Table (1) show that the Floradade cultivar had the highest fruit set percentage, while Peto 86 cultivar had the lowest fruit set percentage. However, F_1 crosses did not differ significantly than the parents . The cross Peto 86 x Floradade had the highest fruit set percentage.Three hybrids out of ten hybrids showed heterosis over the better parent .

1:5- Number of fruits per plant :

Among all tested genetic populations , the hybrids Peto 86 x Floradade and Super strain B x Super marmande produced the significant highest number of fruits per plant (81.4 fruits / plant).

Concerning heterosis, eight out of 10 F_1 hybrids exhibited positive heterosis over the high parents. Super strain B x Super marmande showed the highest value (42.8 %).

1:6-Early yield per plant :

Table (1) shows that four out of the 10 F_1 's reflected a superiority in early yield , since they produced significantly more early yield than their respective higher parents, these hybrids were Marglobe x Peto 86 , Peto 86 x Floradade, Super strain B x Super marmande and Super strain B x Floradade. These results reflected the presence of various degree of dominance and over dominance , controlling the inheritance of early yield character. Similar results were reported by Wahb Allah (1995) and Youssef (1997).

Seven hybrids out of ten hybrids showed positive heterosis over the better parent. The hybrid Peto 86 x Floradade gave the highest heterosis value (57.1 %). These results agree with those reported by Youssef (1997).

1:7- Marketable yield and total yield per plant :

It is noticed from Table (1) that three out of the 10 hybrids reflected a superiority in marketable yield and total yield , since they produced more marketable and total yield than their respective higher parents .

Among all compared genotypes , Peto 86 x Super strain B gave the highest marketable and total yield , followed by Marglobe x Peto 86 and Peto 86 x Floradade . These three hybrids did not differ significantly .

Positive heterosis was shown in the three mentioned hybrids , when estimated with the high parents .The heterosis values ranged from 22.5 and 14.3 % in Peto 86 x Super strain B to 5.4 and 1.6 % for Peto 86 x Floradade for marketable and total yield respectively.These findings coincide with those of Hegazi et al .(1995) and Youssef (1997).

II- Fruit quality:

2:1- Fruit weight :

From Table (2) , it is noticed that all obtained F_1 hybrids produced an average fruit weight that tended to be too close to the smaller fruited parents . These results indicate clearly, the partial dominance of small fruit weight over large fruits .These results are in agreement with those of Youssef (1997) . However , the obtained results did not confirm with those of Wahb Allah (1995). These contradictory results could be due to the different genetic constituent of each cultivar used in the study . The hybrid Marglobe x Super marmande showed the highest value for all tested hybrids.

The F_1 hybrids did not reflect any heterosis over the high parents . these results are in confirmity with those of Youssef (1997).

2:2- Fruit shape index:

It is noticed that most of F_1 hybrid values tended to be around between their respective parents (Table 2).. Similar findings were reported by Youssef (1997) . Estimating heterosis for such trait, it's clear that there is no heterosis . These results generally , coincide with those of Abd Allah (1995) , Hegazi et al . (1995) and Youssef (1997).

2:3- Flesh thickness :

Data in Table (2) show that Peto 86 and Super strain B cultivars had the largest values of flesh thickness . The cross Marglobe x Peto 86 had the largest value of flesh thickness , while other crosses had equal values of flesh thickness . Heterosis over the better parent was absent in all crosses .

2:4- Number of locules per fruit :

It is evident from Table (2) that the parents used in the present study had a large variation in number of locules per fruit in their fruits as Peto 86 cultivar had the lowest value of number of locles per fruit (2.9) ,while Super marmande cultivar had the highest value of number of locules per fruit (9.6) . Four hybrids , Marglobe x Super strain B , Marglobe x Floradade , Peto 86 x Super strain B and Super strain B x Floradade , showed insignificant differences between each of them and their respective higher parents . This general trend indicate that the high number of locules per fruit reflected the partial or complete dominance .These results agree with those reported by Youssef (1997) . The hybrid Peto 86 x Super strain B had the lowest value of number of locules per fruit among all hybrids .Concerning , heterosis , no hybrid reflect any heterosis when estimated with the high parents except the hybrid Marglobe x Floradade gave positive heterosis for this trait . These contradictory results could be due to the various cultivars used in producing hybrids .

2:5- Total soluble solids .

Table (2) cleared that fruits of five hybrids contained total soluble solids that tended to be either closer or even higher than their respective higher parents , without significance . This trend indicates that high T.S.S contents reflected the complete dominance over the low contents . Further more , cases of over dominance were also noticed in the other five crosses , Marglobe x Super strain B , Marglobe x Super marmande , Marglobe x Floradade , Peto 86 x Super marmande and Super strain B x Super marmande .These hybrids exceeded significantly their respective higher parents. These results coincide with those of Youssef (1997). The cross Peto 86 x Super marmande showed the highest value of total soluble solids (6.8 %) . Estimating heterosis for such trait , most of the hybrids exhibited positive heterosis over the high parents . The F_1 hybrid Peto 86 x Super marmande gave the highest value heterosis (44.7 %).Similar findings were reported by Hegazi et al (1995) and Youssef (1997) .

III- General and specific combining abilities :

It is known that high GCA of a particular parent means that this parent is a good combiner in hybrid combinations to predict the best hybrids . A high

SCA of a particular combination means that the parents of this cross can combine well to produce hybrid with a superior general performance .

3:I- Yield components .

3:1:1- Plant height :

It is clear from Table (3) that the highest estimated positive value of GCA effects was found for the parent Super marmande cultivar , which produced the highest significant value relative to all studied parents. On the other hand , Peto 86 showed the highest significant negative GCA value .

The highest estimated positive value for SCA effects , was reflected by the cross Super strain B x Floradade followed by each of Peto 86 x Super marmande and Marglobe x Floradade . On the contrary , the highest negative estimates for SCA was reflected by the cross Peto 86 x Floradade .

3:1:2- Number of branches per plant :

It is evident from Table (3) that Super marmande cultivar gave the highest significant positive GCA value , followed by Super strain B cultivar . On the other hand , Peto 86 showed the highest significant negative GCA value .

The highest estimated positive value for SCA effects , was the cross Super strain B x Super marmande , followed by Super strain B x Floradade with significant differences . While the highest negative value for SCA was estimated for the cross Marglobe x Super marmande .

3:1:3- Earliness (days from seedling to flowering):

It is clear from Table (3)that Peto 86 cultivar showed negative GCA value , which reflected earliness of flowering . On the other hand , Floradade cultivar gave the highest positive GCA value , followed by Marglobe cultivar , with significant differences .

Concerning SCA effects , the highest negative value was estimated for the cross Peto 86 x Floradade . On the contrary , the cross Marglobe x Super strain B gave the highest positive SCA value of all studied genotypes .

3:1:4- Fruit set percentage :

The highest estimated positive value of GCA effects was found for the parent Marglobe cultivar (Table 3). While the highest estimated positive SCA value was the cross Super strain B x Super marmande .

3:1:5- Number of fruits per plant :

Data presented in Table (3) show that the highest positive GCA value was found for Peto 86 cultivar . While the highest SCA value effect was the cross Super strain B x Super marmande .

3:1:6- Early yield per plant :

From Table (3) it is clear that Peto 86 cultivar gave the highest positive GCA value . While , the cross Marglobe x Peto 86 gave the highest positive SCA value , followed by Super strain B x Super marmande .

3:1:7- Marketable yield and total yield :

From Table (3) it is evident that Floradade cultivar gave the highest positive GCA value for the marketable yield per plant . While the cross Marglobe x Peto 86 gave the highest positive SCA value for marketable and total yield per plant .

4:II- Fruit quality :

4:2:1- Fruit weight :

From Table (4) , it is noticed that the highest positive GCA value was found for Super marmande cultivar . While the cross Peto 86 x Super strain B gave the highest positive SCA value .

4:2:2- Fruit shape index .

Data in Table (4) show that the highest estimated positive value of GCA for fruit shape index was found for Peto 86 cultivar . While the cross Peto 86 x Super strain B gave the highest positive SCA value .

4:2:3- Flesh thickness :

It is clear from Table (4) that Peto 86 cultivar gave the highest positive GCA value for the flesh thickness per fruit .While the cross Marglobe x Super marmande gave the highest positive SCA value for the flesh thickness per fruit .

4:2:4- Number of locules per fruit :

Data in Table (4) reflect that the highest estimated positive value of GCA , for number of locules per fruit was found for Super marmande cultivar . Concerning SCA effects , the highest positive value , was found to be that of the cross Marglobe x Floradade , followed by Peto 86 x Floradade .The differences between all positive values were significant .

Table (4): Estimations of G.C.A*. and S.C.A. on quality characteristics of five tomato cultivars and their F_1 hybrids.**

Genotypes	Fruit weight	Fruit shape index	Flesh thick-ness	No. of locules /fruit	T.S.S %
	G.C.A.				
Margloble	3.0	-0.06	-0.01	0.69	0.19
Peto 86	-9.93	0.11	0.03	-1.37	-0.11
Super strain B	3.93	0.06	0.2	-0.50	-0.12
Super Marmande	4.64	-0.09	-0.02	1.07	0.32
Floradade	-1.63	-0.03	-0.02	0.11	-0.29
SE gi	1.40	0.0	0.0	0.01	0.00
	S.C.A.				
Margloble x Peto 86	-1.13	-0.07	0.02	-0.30	-0.20
Margloble x Super strain B	-6.54	-0.11	0.0	0.22	1.24
Margloble x Super Marmande	0.81	0.11	0.04	-0.10	0.23
Margloble x Floradade	-4.03	-0.03	-0.03	0.92	1.11
Peto 86 x Super strain B	5.49	0.12	-0.02	0.31	-0.69
Peto 86x Super Marmande	-6.99	-0.04	0.01	-1.03	1.45
Peto 86 x Floradade	4.12	-0.05	0.01	0.44	-0.02
Super strain B x Super Marmande	-9.27	-0.01	-0.0	-0.96	0.66
Super strain B x Floradade	-10.81	0.04	-0.05	0.31	-0.53
Super Marmande x Floradade	-7.22	0.07	-0.0	-2.03	-0.29
SE sij	9.32	0.002	0.0002	0.05	0.03

***G.C.A. =general combining ability.**
****S.C.A. =specific combining ability.**

4:2:5- Total soluble solids :

It is clear from Table (4) that Super marmande cultivar gave the highest positive value of GCA , for total soluble solids followed by Marglobe cultivar . Concerning SCA effects , the highest positive value was found of the cross Peto 86 x Super Marmande , followed by the cross Marglobe x Super strain B

Estimates of gene effects:

The estimated values of total variance components of the various studied characters are presented in Table (5) . It is clear from the Table that GCA variances were higher than those for SCA variances for each of earliness and fruit shape index , indicating that the additive gene effects appeared to be relatively more important than non additive gene effects for both characters.

. Concerning another characters , it was found that non - additive gene effects appeared to play important roles than additive effects for these traits , as reflected on the high estimates of SCA variances than GCA variance . These results coincide with those of Hassan et al (1995), Bayomy (2002) and Ghobary (2004).

Table (5) : Estimates of total variance components for the studied characters of five parents and their hybrids

characters	σ^2_{gca}	σ^2_{sca}	σ^2_{e}
Plant height	13.495	667.712	6.645
No. of branches / plant	0.018	0.403	0.180
Earliness NDF	9.211	4.165	5.554
Fruit set %	0.942	6.529	13.698
No. of fruits / plant	6.405	85.793	70.364
Early yield / plant	0.045	0.344	0.077
Marketable yield / plant	0.060	0.473	0.374
Total yield / plant	0.049	0.461	0.364
Fruit weight	25.898	64.042	48.914
Fruit shape index	0.006	0.004	0.002
Flesh thickness	0.0004	0.0007	0.0010
No. of locules / Fruit	0.768	1.162	0.237
TSS %	0.066	0.859	0.141

Where : σ^2_{gca} = General combining ability variance .
σ^2_{sca} = Specific combining ability variance .
σ^2_{e} = Environmental variance .

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دراسات على إنتاج بعض هجن الطماطم المحلية

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أجريت هذه الدراسة بهدف إنتاج بعض الهجن المحلية التي تتفق مع ذوق المستهلك وإحلالها محل الهجن التي تستورد بذورها سنويا من الخارج بأسعار باهظة وذلك خلال الموسم الصيفي المبكر عامي ٢٠٠١، ٢٠٠٢ وذلك في المحطة البحثية بالبرامون-بمحافظة الدقهلية.واستخدم في هذه الدراسة خمسة أصناف من الطماطم هي :

Marglobe , Peto 86 ,Super strain B , Super marmande and Floradade

وتم إجراء التهجين في اتجاه واحد بين هذه الأصناف وتم الحصول على عشرة هجن تم تقييمهم في مزرعة خاصة بغرب النوبارية – محافظة البحيرة مع آبائها في تجربة ذات قطاعات كاملة العشوائية من أربعة مكررات واحتوت كل مكررة على ١٥ قطعة تجريبية وكانت أهم النتائج المتحصل عليها هي :

١- كانت الاختلافات بين التراكيب الوراثيه معنوية لمعظم الصفات تحت الدراسة .
٢- كانت قوة الهجين عند حسابها على أساس الأب الأفضل معنوية لمعظم الهجن لصفات ارتفاع النبات ، عدد الأفرع للنبات ، التبكير ، عدد الثمار للنبات ، والإنتاج المبكر للنبات والمواد الصلبة الذائبة الكلية – بينما كانت قوة الهجين غائبة لمعظم صفات الجودة وهي وزن الثمرة ، دليل شكل الثمرة ، سمك اللحم ، وعدد الحجرات الموجودة بالثمرة . ولكن غياب قوة الهجين على أساس الأب الأفضل لم يمنع من وجود هجن متفوقة عن الأب الأكبر .
٣- أظهرت النتائج بصورة عامة أن القيم المقدرة للقدرة العامة والخاصة على التآلف معنوية لمعظم الصفات المدروسة
٤- أظهرت النتائج أن الصنف Super marmande تميز بأفضل قدرة عامة على التآلف بالنسبة لصفات ارتفاع النبات ، عدد الأفرع ، متوسط وزن الثمرة ، عدد الحجرات بالثمرة والمواد الصلبة الذائبة الكلية . بينما تميز الصنف Peto 86 بأفضل قدرة عامة على التآلف بالنسبة لصفات التبكير وعدد الثمار للنبات والإنتاج المبكر للنبات ودليل شكل الثمرة وسمك اللحم . وتميز الصنف Marglobe بأفضل قدرة عامة على التآلف لصفة نسبة العقد بينما تميز الصنف Floradade بأفضل قدرة عامة على التآلف بالنسبة لصفة الإنتاج الصالح للتسويق .
٥- بالنسبة للقدرة الخاصة على التآلف تميز الهجين Super strain B x Floradade بأفضل قدرة خاصة على التآلف بالنسبة لارتفاع النبات بينما تميز الهجين Super strain B x Super marmande بأفضل فدرة خاصة على التآلف بالنسبة لصفات عدد الأفرع للنبات ونسبة العقد وعدد الثمار للنبات . وتميز الهجين Peto 86 x Floradade بأفضل قدرة خاصة على التآلف في صفة التبكير – بينما تميز الهجين Marglobe x Peto 86 بأفضل قدرة خاصة على التآلف في صفات الإنتاج المبكر والإنتاج الصالح للتسويق والإنتاج الكلي . وتميز أيضا الهجين Peto 86 x Super strain Bبأفضل قدرة خاصة على التآلف لصفتي متوسط وزن الثمرة ودليل شكل الثمرة . وتميز الهجين Marglobe x Super marmande بأفضل قدرة خاصة على التآلف لصفة سمك اللحم بينما تميز الهجين Marglobe x Floradade بأفضل قدرة خاصة على التآلف لصفة عدد الحجرات بالثمرة . وتميز الهجين Peto 86 x Super marmande بأفضل قدرة خاصة على التآلف لصفة المواد الصلبة الذائبة الكلية .
٦- أظهرت الدراسة أيضا أن التأثير الغير مضيف كان اكبر من التأثير المضيف لكل الصفات المدروسة ماعدا صفتي التبكير ودليل شكل الثمرة .

Table (1): Mean performances and heterosis percentages of the F_1 's relative to their better parent of the five tomato cultivars and their hybrid combinations, for the yield components.

Genotypes	Plant height cm		No. of branches/plant		Earliness (days from seedling to flowering)		Fruit set %		No. of fruits / plant		Early yield/plant kg		Marketable yield /plant kg		Total yield /plant kg	
	Mean	H %	Mean	H%	Mean	H%	Mean	H%	Mean	H%	Mean	H%	Mean	H%	Mean	H%
Margloble	65.6		6.8		27.0		92.0		56.5		2.5		5.0		5.5	
Peto 86	50.2		6.8		16.5		89.1		71.0		2.1		3.9		4.4	
Super strain B	53.9		6.6		26.8		90.2		52.5		2.2		4.9		5.6	
Super Marmande	85.5		7.4		27.0		89.5		57.0		1.9		5.7		6.3	
Floradade	60.4		6.8		31.5		92.2		62.3		2.0		5.6		6.2	
Margloble x Peto 86	57.0	-13.1	6.5	-4.4	25.3	-6.3	90.6	-1.5	76.9	8.3	3.6	44.0	5.9	18.0	6.3	14.6
Margloble x Super strain B	93.2	42.1	7.6	11.8	31.3	15.9	84.1	-8.6	51.3	-9.2	2.1	-16.0	4.0	-20.0	4.9	-12.5
Margloble x Super Marmande	101.6	18.8	6.9	-6.8	31.8	17.8	88.9	-3.4	58.0	1.8	2.3	-8.0	4.7	-17.5	5.4	-14.3
Margloble x Floradade	105.1	60.2	7.4	8.8	29.5	-6.4	92.1	-0.1	60.0	-3.7	2.1	-16.0	4.5	-19.6	5.0	-19.4
Peto 86 x Super strain B	64.9	20.4	7.1	4.4	19.0	-29.1	92.3	2.3	74.2	4.5	2.4	9.1	6.0	22.5	6.4	14.3
Peto 86x Super Marmande	118.0	38.0	7.3	-1.4	21.5	-58.1	87.9	-1.8	72.6	2.3	2.6	23.8	4.9	-14.0	5.5	-12.7
Peto 86 x Floradade	61.1	1.2	6.9	1.5	20.5	-34.9	93.2	1.1	81.4	14.7	3.3	57.1	5.9	5.4	6.3	1.6
Super strain B x Super Marmande	107.9	26.2	8.8	18.9	25.0	-7.4	91.7	1.7	81.4	42.8	3.2	45.5	5.6	-1.8	6.1	-3.2
Super strain B x Floradade	130.1	115.4	8.5	25.0	.29.0	-7.9	90.5	-1.8	80.4	29.1	3.1	40.9	5.5	-1.8	6.3	1.6
Super Marmande x Floradade	106.9	25.0	8.1	9.5	31.5	0.0	83.7	-9.2	62.8	0.8	2.4	20.0	5.2	-8.8	5.5	-12.7
L.S.D. at 5%	8.0	-	0.83	-	4.62	-	7.25	-	16.44	-	0.54	-	1.18	-	1.06	-

H% = Heterosis percentage.
- = No heterotic effect

Table (2): Means performances and heterosis percentages of the F_1's relative to their better parent of the five tomato cultivars and their hybrid combinations, for the fruit quality characteristics.

Genotype	Fruit weight (gm)		Fruit shape index		Flesh thickness cm		No. of Locules/fruit		T.S.S %	
	Mean	H %	Mean	H %	Mean	H %	Mean	H %	Mean	H %
Margloble	97.8		0.8		0.6		6.4		4.3	
Peto 86	65.7		1.2		0.7		2.9		4.6	
Super strain B	104.7		1.0		0.7		4.4		4.5	
Super Marmande	106.9		0.6		0.5		9.6		4.7	
Floradade	92.0		0.8		0.6		6.0		4.4	
Margloble x Peto 86	78.3	-19.9	0.9	-25%	0.7	0.0	4.4	-31.3	5.0	8.7
Margloble x Super strain B	86.7	-17.2	0.8	-20	0.6	-14.3	5.8	-9.4	6.4	42.2
Margloble x Super Marmande	94.8	-11.3	0.8	0.0	0.6	0.0	7.0	-27.1	5.8	23.4
Margloble x Floradade	83.7	-14.4	0.8	0.0	0.6	0.0	7.0	9.4	6.1	38.6
Peto 86 x Super strain B	85.8	-18.1	1.1	-8.3	0.6	-14.3	3.8	-13.6	4.2	-8.7
Peto 86 x Super Marmande	74.0	-30.8	0.9	-25.0	0.6	-14.3	4.0	-58.3	6.8	44.7
Peto 86 x Floradade	78.9	-14.2	0.9	-25.0	0.6	-14.3	4.4	-26.7	4.7	2.2
Super strain B x Super Marmande	85.6	-19.9	0.9	-10.0	0.6	-14.3	5.0	-47.9	6.0	27.7
Super strain B x Floradade	77.8	-25.7	1.0	0.0	0.6	-14.3	5.2	-13.3	4.2	-6.7
Super Marmande x Floradade	82.1	-23.2	0.8	0.0	0.6	0.0	4.4	-54.2	4.8	2.1
L.S.D at 5%	13.71	-	0.08	-	0.06	-	0.96	-	0.74	-

H% = Heterosis percentage.

- = No heterotic effect

Table (3) : Estimates of G.C.A.* and S.C.A. on yield components of five**

Genotypes	Plant height	No. of branches	Earliness (days from seedling to flowering)	Fruit set %	No. of fruits / plant	Early yield/ plant	Marketable yield /plant	Total yield /plant
	G.C.A							
Margloble	-2.3.5	-0.26	2.08	28.85	-5.73	0.01	-0.26	-0.23
Peto 86	-14.74	-0.34	-5.42	0.41	6.83	0.12	-0.07	-2.92
Super strain B	-0.10	0.20	0.08	-0.02	-0.99	0.01	0.01	-2.92
Super Marmande	14.41	0.30	0.94	0.0	-1.52	-0.11	0.13	-2.92
Floradade	2.77	0.10	2.33	0.66	1.40	-0.04	0.19	-2.85
SE gi	0.48	0.01	0.16	0.39	2.01	0.01	0.01	0.01
	S.C.A							
Margloble x Peto 86	-10.05	-0.18	2.39	-0.35	9.25	0.94	1.03	0.95
Margloble x Super strain B	11.56	0.33	2.89	-5.67	-8.55	-0.47	-0.95	-0.65
Margloble x Super Marmande	5.46	-0.40	2.54	0.25	-1.33	-0.09	-0.35	-0.20
Margloble x Floradade	20.60	0.28	-1.11	1.64	-2.19	-0.37	-0.70	-0.60
Peto 86 x Super strain B	-4.40	-0.01	-1.86	1.41	1.82	-0.32	0.87	0.72
Peto 86x Super Marmande	34.27	0.01	-0.21	-1.87	0.72	0.11	-0.28	-0.18
Peto 86 x Floradade	-11.01	-0.14	-2.61	1.63	6.62	0.63	0.65	0.52
Super strain B x Super Marmande	9.46	0.99	-2.21	3.13	17.39	0.79	0.34	0.19
Super strain B x Floradade	43.35	0.95	0.39	0.15	13.42	0.69	0.17	0.31
Super Marmande x Floradade	5.60	0.37	2.04	-5.61	-3.66	-0.03	-0.27	-0.56
SE sij	3.17	0.03	1.06	2.84	13.40	0.02	0.07	0.06

tomato cultivar and their F_1 hybrids.
***G.C.A. =general combining ability.**
****S.C.A. =specific combining ability.**