BREEDING OF NEW EGYPTIAN WATERMELON GIZA TYPE F_1 HYBRID

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Abstract

These experiments were conducted during the summer seasons of 2012 -2013 to produce some superior hybrid Giza type of watermelon suitable for Egyptian cultivation. 3 cultivars of watermelon as testers i.e. (Giza 1, New Hampshire, and Sugar Baby) as male parents, and crossed with 7 lines i.e. (L 63 , L70 , L 84, L85 , L84g , L. 84s and L.79) were used as female parents using a factorial mating design. All possible crosses were executed in a factorial mating design in the summer season of 2012 and 2013 to produce seeds of 21 F_1 crosses. The obtained results could be summarized as follows: The genetic differences among the genotypes (parents, crosses and parents vs. crosses) were highly significant for all studied traits. In most crosses heterosis over the better parent were significant or highly significant with positive values for vegetative traits and yield components, while it was significant or highly significant with negative values for earliness traits .The mean squares of general combining ability and specific combining ability were highly significant for most traits indicated that both additive and non-additive gene effects were important in the inheritance of these traits .we obtained a good hybrids from Giza type vigorous plant growth with early maturity fruiting growing period is 75-80 days. , high total yield and sweetness (TSS 12%) compared with check hybrid. It is suitable for cultivation in facility watermelon planting regions of Egypt.

Key words : watermelon(*Citrulluslanatus*) ,heterosis, combining ability and Giza type hybrids.

1– INTRODUCTION

1.1. Vegetative traits

1.1.1. Stem length

El-Mighawry*et al.* (2001) using a complete diallel crosses mating design among five watermelon (Giza.1, Giza.21, Charleston Gray, Crimson sweet and Dulzera). They found that main stem length was influenced by both the additive and non-additive gene action and showed complete dominance. On the other hand, the heritability estimates in narrow sense was low. Omran (2003) found, on watermelon, that heterosis over both mid and better parents were highly significant with positive values.The GCA mean square of stem length was not significant for parental lines and testers. SCA mean squares were highly significant also the heritability values were high in both broad and narrow senses. Abd El-Salam and El-Ghareeb (2007) and

Omran*et al.* (2012) they found that , on watermelon, that the GCA and SCA were significant effects for main stem length.

1.1.2. Number of branches.

El-Mighawry *et al.* (2001) used a complete diallel crosses mating design among five watermelon (Giza.1, Giza.21 Charleston Gray, Crimson Sweet and Dulzera). They found that number of branches plant^{-1} was influenced by both the additive gene action and showed complete dominance. Omran (2003) reported, on watermelon, that heterosis over the mid-parents and better parent were highly significant with positive effects over better-parent for number of branches plant^{-1}. Mean square of general combining ability (GCA) was not significant while specific combining ability (SCA) was highly significant for number of branches plant. Abd El-Salam and El-Ghareeb (2007) mated, on watermelon, that general combining ability (GCA) and specific combining ability (SCA) had highly significant effects on number of branches per plant. The ratio, GCA/SCA exceeded (1) indicating the importance of additive gene effects in the inheritance. Moreover, the importance of non-additive effect in the expression of this trait.

2. YIELD AND ITS COMPONENTS.

2.1. Number of fruits/plant .

Mohanty (2000), on pumpkin, reported that the mean squares due to general (GCA) and specific combining ability (SCA) effects were significant for number of fruits plant. Estimates of GCA effect showed that only one parent was a good general combiner for all characters. However, the cross combination one cross only was considered as the best specific combiner for yield. Saad (2003) who worked on squash calculated total number of fruits plant and found that hybrids exceeded the means of F_1 hybrids negatively exceeded the better parent with highly significant heterotic value. GCA and SCA were highly significant. She showed that non-additive genetic variance was larger than additive genetic variance.Abd El-Salam and El-Ghareeb (2007) recorded, on watermelon, that GCA and SCA effects were highly significant. Moreover, they showed the importance of non-additive effect in the expression for number of fruit plant.

2.2. Fruits weight.

Omran (2003) found, on watermelon, that fruit weight plant for crosses out of 15 ones exhibited highly significant positive heterotic effects over better parents. The GCA mean squares of the parental lines and testers for this trait were not significantly different. However, the mean squares of SCA for this traits was highly significant. Abd El-Salamand El-Ghareeb (2007) recorded, on watermelon, highly significant GCA and

SCA effects. The ratio of GCA/SCA exceeded one indicating the importance of general combining ability than SCA and the predominance of additive gene effect in the inheritance for fruit weight plant.

2. 3. Days to first ripe fruit.

Brar and Amrik (1977) concluded, on watermelon, that the maximum heterosis over the earlier parent for number of day to maturity was estimated as 4.88%.Salim (1989) showed that, on watermelon, both GCA and SCA mean squares were highly significant .The GCA / SCA ratio was estimated as 2.30, indicating that the additive components of genetic variance are about 2.3 times higher than the non-additive components for number of days from sowing to fruit maturity. Khereba *et al.* (2007) mated, on watermelon, that parental evaluation of inbred line Sugar Baby produced a high early yield, also, they found that hybrids Giza1×Sugar Baby, Sugar Baby × Peacock and Charleston Gray × Klondike produced high early yield were not significant different the check hybrid Aswan and also from the parental lines Kodhi and Sugar Baby. Only one hybrid, i.e., Charleston Gray× Klondike exhibited significant positive higher-parent heterosis for early yield.

2.4. Total soluble solid percent (T.S.S. %).

It is recognized that in watermelon cultivars, sugar content is a major components of quality and flavor (Leskovar*etal.*, 2004) .Amrik*etal.* (1977) showed that both additive and dominant genetic variances were important for total soluble solids (T.S.S.) of watermelon fruit. Abd El-Hafez (1983), onwatermelon,found that total soluble solids showed heterosis, complete dominance of high over low content in 31% of the crosses, negative heterosis and complete dominance was encountered in 29.0% of the crosses. He added that this character had a tendency towards the female parent in about 43.0% of the crosses, where as it was towards the male parent in 29.0%. He also suggested that for obtaining a fruit with better quality it is preferred to use the good parent as maternal in watermelon. Abd El-Hafez *et al.* (1985) revealed the absence of dominance in the inheritance of TSS percentage for cross Kaho × Lebby in watermelon and its reciprocal. El-Mighawry *et al.* (2001) studied, on watermelon, the genetic behavior of some fruit characteristics. The results indicated the importance of both dominance and additive effect for total soluble solids. Souza *et al.* (2001) found that T.S.S. % of triploid watermelon fruit was high (11%) in many hybrids, compared with the diploids cultivars (10%). Omran (2003) showed that, on watermelon, heterosis over the better parent was found in three crosses.Abd El-Salam and El-Ghareeb (2007) found, on watermelon, that total soluble solids recorded in significant GCA and SCA effects. The additive component (D) is positive and highly significant for this trait, indicating that additive effect is important in the inheritance for this trait.Khereba *et al.* (2007) reported, on watermelon, better parent heterosis, only 5 out of 40 evaluated hybrids significant surpassed their better parents in fruit TSS with a range from 6.1% to 12.2% with the hybrid Kodhi × Charleston Gray having the highest estimate.

The objective of this study was to determine the Heterosis and Combining ability in Giza type watermelon hybrids and obtain a good hybrids competitive to foreign hybrids.

3. MATERIALS AND METHODS

The genetic materials used in the present study included 3 cultivars of watermelon as testers i.e. (Giza1, New Hampshire, and Sugar Baby) as male parents, And crossed with 7 lines i.e. (L 63 , L70 , L 84, L85 , L84g , L.84s and L.79) from my program for obtained lines of segregation my hybrids .were used as female parents using a factorial mating design . All possible crosses were executed in a factorial mating design in the summer season of 2012 to produce seeds of 21 F_1.

All these genotypes were cultivated and evaluated under Egyptian cultivation in a preliminary experiment in summer season of 2013. All genotype were selected visually according to their good performance levels and quality traits to be continued in the breeding program as parents.

3.1. Experimental design:

The experimental design used was a randomized complete block design with three replications each replicate consisted of 22 plots (3 Testers and 7 Lines as parents, 21 F_1 hybrids + one check hybrid Giza 17 F_1) each plot was one ridge of 10 meters in length and 2 meters width so the plot area was 20 m^2, the distance between plants was 1 m. apart, each plot contained 10 plants (one plant per hill). The seeds were sown on March 15^{th} 2013 to evaluation trial at El-Nubaria region, Egypt.

3.2. Data recorded

3.2.1. Vegetative traits:

For studying the differences between genotypes in the plant performance, three plants were uprooted from each plot after 60 days from sowing and the following data were recorded: Main stem length (cm). and Number of branches /plant.

3.2.2. Yield and its components:

-Number of fruits/plant.This trait was calculated as the average number of fruits counted on the plants. Average fruit weight (kg.) /plant :This trait was calculated as the average weight fruits/plant .Earliness (days to ripe the first fruit) ; this trait was measured as the number of days from sowing to the appearance of the first ripe fruit for three plants/plot .Total yield kg /plant This trait was calculated as the average total yield (kg). /plant .Total soluble solids (T.S.S. %) :The total soluble solids were determined by hand refractometer on five fruits from each entry at each picking polar and equatorial dimensions were obtained (A.O.A.C.1980).

3.3. Statistical analyses:

3.3.1. The estimates of heterosis:

A regular analysis of variance of a Complete Randomized Block Design was conducted. LSD was used for the comparison between all genotypes means. Line x tester analysis was done to provide the information about general and specific combining ability effects (Kempthorne 1957).

Estimates of heterosis:

The amount of heterosis was expressed as the percentage deviation of F_1 mean performance from better parent (BP%) average values as follows:

$$\text{Heterosis over better parent (\%)} = \frac{\overline{F}_1 - \overline{BP}}{\overline{BP}} \times 100$$

Appropriate L.S.D. values were calculated to test the significance of these heterotic effects according to the following formulae:

L.S.D. for better parent heterosis

$$(\overline{F}_1 - \overline{BP}) = \sqrt[t]{\frac{2Ms_e}{r}} \times t_{0.05} \text{ and } t_{0.01}$$

Where:

Ms_e : The mean squares of experimental error from the analysis of variance.

r : The No. of replications.

4. RESULTS AND DISCUSSION

The results will be presented as follows:

4.1. The performance of parents and their F_1.

Performance of each parent and each hybrid was investigated and compared with the other genotypes and the check hybrid Giza 17 F_1.The following characters were studied.

4.1.1. Vegetative traits:

4.1.1.1. Stem length:

Data (Table, 1) show that population means of F_1 hybrids exceeded the means of parents for stem length. The cross 6x2 (260 cm.) gave the tallest plants. These results are in agreement with those obtained on watermelon by El- Mighawry *et al.* (2001), Omran (2003) ,Abd El-Salam and El-Ghareeb (2007) and Omran, *et al.* (2012) which indicated that the means of F_1 crosses had higher values for main stem length than their parent and other hybrids means.

4.1.1.2. Number of branches:

Data (Table, 1) show that in general F_1 plants produced more number of branches plant than their parents .The crosses 4x1,6x1, 6x3, 8x3 and 9x3 (5.7) were high number of branches plant .These results agree with Thakur and Nandpuri (1974), Abd El-Salam (1998) and Omran (2003) who reported, on watermelon, that heterosis over the better parent were highly significant with positive effects over better-parent for number of branches.

4.1.2. Yield and its components:

4.1.2.1. Number of fruits:

Data (Table, 1) show that each of parents, crosses 6x1(4.8) and 5x2,6x3 , 7x3 (4.3) had the highest number of fruits /plant .The tester No.3 (Sugar Baby cv.) (4), and line No.5 (L. No.70) (3.7) had the highest number of fruits /plant .Therefore crosses including its had the highest number of fruits / plant.

4.1.2.2. Fruit weight.

Data (Table, 1) show that each of the check hybrid and the mean of all crosses had the highest average fruit weight compared with, the parents means. The cross 5x1 was the highest value (8.7 kg.) and the second value of cross 8x1 (7.7 kg.) and 3x4 (7.4) .

4.1.2.3. Total yield :

Data (Table,1) show that the highest yield was produced by the crosses 4x3 , 4x1,and 8x1 was high yielded (26.0, 25.0, and 25.2 kg. /plant , respectively) than the check hybrid Giza 17, F_1 (19.5 kg./plant) for total yield /plant . In this concern, Omran (2003) ,Abd EL-Salam and EL-Ghareeb (2007) and Omran *et al.* (2012) reported that F_1 plants produced more total yield than their parents. The superiority of F_1 plants was due to hybrid vigor.

4.1.2.4. No. of days to maturity:

Data (Table,1) show that, the crosses 9x1 (73 day) and 7x3 (75 day) had earlier than the other crosses and check hybrid (Giza 17) . These results are in the same trend with that obtained by Lippert and Legg (1972) where they found significant heterosis for days to 1 days to 1^{st} ripe fruit in muskmelon.

ripe fruit in muskmelon.

4.1.2.5. Total soluble solids percentage :

Data (Table, 1) show that of total soluble solids percentage (TSS%) in the fruit juice of crosses 4x1 , 6x1 , 8x1 and 10x1 had the highest value (12 %).Heterosis for total soluble solids in watermelon had been reported byNandpuri *et al.* (1974) and Bansal_*et al.* (2002) .

Table (1): Means for vegetative plant and yield and its components in the F_1 generation after a (3 x 7) factorial crosses and their parents in watermelon (during the summer season of 2013).

Genotypes	Stem length (cm.)	No. of branches/ plant	No. of fruits/ plant	Average of fruit weight Kg.))	Total yield /plant Kg.))	No. of days to maturity	TSS %
Testers							
1- Giza 1	211.7	5.0	3.0	5.3	15.9	92.6	11.8
2- New Hampshier	189.3	3.3	3.3	2.6	8.58	82.3	11.3
3- Sugar Baby	177.3	4.2	4.0	4.0	16.0	75.0	11.7
Lines							
4- Line 63	222	4.5	3.3	5.3	17.49	82.0	11.3
5- Line 70	124	3.0	3.7	1.7	16.0	71.0	10.8
6- Line 84	244	4.5	3.3	5.7	21.0	83.3	11.3
7- Line 84g	243	4.0	3.3	5.7	18.8	81.0	11.7
8- Line 85	180	3.3	3.3	3.3	16.0	73.3	11.3
9- Line 84 s	228	4.1	3.0	5.3	16.0	81.0	11.0
10 - Line 79	212	3.7	2.7	4.3	16.0	81.7	10.5
Hybrids							
4X1	245.0	5.7	3.3	7.6	25.0	83.3	12.0
4X2	208.7	4.7	4.0	5.2	20.6	84.0	11.0
4X3	226.0	4.7	3.5	7.4	26.0	84.0	11.3
5X1	250.0	5.0	2.7	8.7	23.5	80.0	11.3
5X2	233.7	4.7	4.3	4.7	20.2	84.0	11.0
5X3	241.3	5.0	3.7	5.4	20.0	80.0	11.3
6X1	252.0	5.7	4.8	4.5	21.7	83.3	12.0
6X2	260.0	5.3	3.5	5.3	18.6	85.0	11.7
6X3	236.3	5.7	4.3	2.3	11.7	75.0	11.3
7X1	250.0	5.3	3.0	4.7	23.5	85.0	11.3
7X2	250.0	5.3	4.0	5.8	23.3	84.7	11.0
7X3	200.0	4.7	4.3	3.7	15.9	75.0	11.0
8X1	220.0	4.7	3.3	7.7	25.2	80.0	12.0
8X2	240.0	5.3	3.4	6.1	20.7	77.7	11.7
8X3	243.0	5.7	3.3	6.9	22.6	81.3	11.3
9X1	209.0	5.0	3.0	5.1	15.4	73.0	11.3
9X2	215.0	4.7	3.3	6.5	21.3	83.3	11.0
9X3	249.3	5.7	4.0	5.1	20.3	84.0	11.0
10X1	242.3	5.3	3.8	3.7	14.2	84.0	12.0
10X2	230.0	4.7	3.3	5.8	19.2	80.0	11.7
10X3	224.3	4.7	3.0	5.5	16.5	84.0	11.3
Chick hybrid, Giza 17	245	4.3	3.2	6.1	19.5	83.1	11.2
LSD (p=0.05)	2.3	1.9	1.9	1.9	2.0	2.1	1.8
LSD (p=0.05)	3.0	2.5	2.4	2.6	2.8	3.0	2.5

4.2. Heterosis.

Heterosis is the superiority of F1 hybrid over its parents in a given characteristic.Theheterotic effects are calculated as a deviation from better-parent (B.P.) values for the individual cross. Breeding practices are not aim at the superiority of a cross over its parents, but at the superiority of a cross over a given standard cultivar in a given condition. Thus, in the breeding programs, the superiority of the new F1 hybrids over the standard cultivars must be ensured. Estimates of heterosis for all traits are presented in (Tables, 2).

4.2.1. Vegetative traits.

4.2.1.1. Stem length.

Data (Table, 2) show that 7 crosses from 21 ones exhibited highly significant positive heterotic effects over the better parent, while the other crosses had negative or non significant values of heterosis over the better parent.Omran (2003) and Abd El-Salam and El-Ghareeb (2007) reported heterosis over better parent for main stem length.

4.2.1.2. Number of branches:

Data (Table, 2) show that 16 crosses had highly significant positive values of heterosis over the better parent .This is in agreement with the results obtained by Thakur and Nandpuri (1974),Abd El-Salam (1998),El-Meghawry *et al.* (2001) and Omran (2003) on watermelon.

4.2.2. Yield and its components :

4.2.2.1. Number of fruits.

Data (Table, 2) show that 10 F_1 crosses were superior to their better parent for number of fruits / plant. Therefore, heterosis over the better parent was positive with highly significant values. The highest value was 58.89 % resulted from the cross 6x1. Similar results were obtained by Abd El-Raheem and El-Maghawry (1991) on melon and El-Mighawry *et al.* (2001a) on muskmelon , Omran 2003 and Omran *et al.* (2012) on watermelon.

4.2.2.2. Fruits weight.

Fruit yield is the most important economic consideration in watermelon production. Data (Table, 2) show that 13crosses exhibited highly significant positive values heterosis over the better parent. These values ranged from 2.5 to 57.23 % for the crosses 5x3 and 8x1, respectively. The present results are in agreement with Omran (2003) on watermelon.

4.2.2.3 Total yield:

The average of heterosis estimates for total yield /plant over the best parent were positive and highly significant for most of the studied crosses (18 crosses) and ranged from 8.10 % to 83.42 % to the crosses 9X3 and 8X1, respectively (Table 2). Omran *et al.,* (2008) found significant heterosis for total yield in seedless watermelon. Nath and Dutta (1970), and Kale and Seshadri (1988) detected heterosis in watermelon for yield related traits in some crosses of Indian lines with exotic cultivars.

Table 2 . Heterosis (%) over the best parent for various traits in watermelon.

Genotype	Stem length	No. of branches	No. of fruits/ plant	Average of weight fruit	Total yield /plant	No. of days to maturity	TSS %
Crosses							
4X1	10.36	13.33	1.01	44.03	42.94	-10.01	1.69
4X2	-1.11	-6.67	8.11	-2.52	29.00	-9.29	-6.78
4X3	-7.38	-6.67	-5.41	30.41	23.75	-9.29	-3.95
5X1	2.88	0.00	-19.19	52.05	22.28	-13.61	-3.95
5X2	10.74	-6.67	31.31	41.41	26.31	-9.29	-6.78
5X3	5.85	0.00	22.22	2.52	25.00	-13.61	-3.95
6X1	18.87	13.33	58.89	-14.47	35.42	-10.01	1.69
6X2	17.12	18.52	6.06	0.63	6.06	3.28	3.24
6X3	25.04	71.72	17.12	-10.26	-26.23	-8.87	0.29
7X1	2.46	18.52	-9.09	-18.13	11.85	2.04	0.29
7X2	2.88	33.33	21.21	1.17	23.89	2.88	-5.98
7X3	5.82	41.41	31.31	11.11	0.06	-8.87	-2.65
8X1	-3.51	13.82	6.06	57.23	83.42	-2.79	6.19
8X2	13.21	44.14	4.04	41.86	29.98	-5.63	3.24
8X3	9.46	25.93	-16.67	29.56	29.43	-1.17	-3.13
9X1	-0.95	19.05	-25.00	27.50	79.37	-2.67	-3.13
9X2	-11.89	3.70	-16.67	14.62	1.40	-7.56	-5.98
9X3	2.61	34.92	0.00	-10.53	8.10	-6.58	-5.98
10X1	14.85	26.98	-5.83	-6.67	30.30	6.67	2.56
10X2	0.88	11.11	-16.67	10.06	33.89	4.94	-0.28
10X3	5.82	11.11	-25.00	28.68	16.28	-2.08	-3.13
LSD(p=0.05)	6.74	0.91	1.87	1. 82	1.70	2.96	0.73
LSD(p=0.01)	8.96	1.21	2.48	2.42	2.27	3.94	0.97

4.2.2.4. Noumber of days to maturity :

Data (Table, 2) show that three F1 hybrids exhibited highly significant negative heterosis over better parent for earliness (No. of days to mature).These desirable estimates ranged from -1.17 to -13.61 . Similar results were observed by Omran *et al.,* (2008) on seedless watermelon and , Brar and Amrik (1977) and Khereba *et al.* (2007) on watermelon.

4.2.2.5. Total soluble solids percentage :

Positively highly significant values of heterosis over better parent were observed in five F_1 hybrids for total soluble solids (TSS) and ranged from 1.69 % to 6.19 % to the crosses (4X1 and 6x1) and 8X1, respectively (Table 2). Heterosis for total soluble solids in watermelon had been reported by Nandpuri *et al.,* (1974), Banasal *et al.,* (2002)and Omran *et al.,* (2008).

4.3. Combining ability:

The factorial mating design used in this study makes it possible to obtain estimates for the different genetic parameters required for judging further breeding programs, general and specific combining ability effects are of these parameters. The results of the analysis of variance and mean squares of the factorial mating design for most of the traits are shown in Tables (3, 4 and 5). The variance of the crosses was partitioned into: (1): main effects of lines and testers as indicators for general combining ability and (2) interaction of lines x testers as indicator for specific combining ability (Verma et al. (2000).

The results of analysis of variance and mean squares of all genotypes (parents and crosses) are presented in Tables 3. Tests of significance indicated that the mean squares of genotypes (parents and crosses) were significant or highly significant for most studied traits .The variance of crosses was partitioned into the main effect of lines and testers as the indicators of general combining ability, and interaction of line x testers as indicators of specific combining ability (Bond 1967).

Table 3 : Analysis of variance and mean squares of factorial mating design (Line x Tester analysis) for various characters in watermelon.

Sources	Df.	Stem length (cm.)	No. of branches	No. of fruits/ plant	average fruit weight	Total yield /plant	No. of days to maturity	TSS %
Treatments	30	2425.4**	1.5**	0.8**	7.8 **	71.1**	62.9**	0.4**
Crosses	20	827.4**	0.5**	0.9 **	5.9 *	43.0 **	43.9**	0.4**
Barents	9	4028.2**	1.4	0.4 *	34.7 **	63.2 **	111.7**	0.5**
B.vs.cr	1	19958.3**	23.6**	2.2 **	6.0 **	704.0 **	1.7	0.3**
Lines	2	270.3**	0.1	0.8 **	11.4**	80.6 **	77.5**	0.02
Tester	6	1292.7**	0.7**	0.8 **	5.5	76.6 **	32.7**	0.6**
LXT	12	687. 7**	0.5**	0.9 **	0.2	19.9 **	43.96**	0.4**
Error	60	17.0	0.3	0.4	5.9	1.1	3.3	0.2

*, ** significant at the 0.05 and 0.01 levels, respectively.

4.3.1. Vegetative traits.

4.3.1.1. Stem length

Data presented in Table (3) show that both GCA and SCA were highly significant. Results in Table (4) show that Giza1 had the greatest GCA effects followed by sugar baby, line 84g and line 63. These genotype could be considers as good combiners. Concerning crosses, data in Table (5) show that only 7 crosses out of 21 ones showed significant or highly significant positive values for SCA effects. The highest value was reflected by the crosses 6x2 and 5x2.

4.3.1.2. Number of branches per plant :

Data in Table (3) clear that GCA and SCA most values were highly significant . Concerning GCA effects, results in Table (4) show that New Hampshire cv. recorded the highest values of GCA effects followed by line 63.Therefore, these parents had a good combiners for this trait. Estimates of SCA effects for crosses showed that out of 21 only 7 crosses positive value of SCA effects, while the other crosses had negative or non significant values of SCA effects (Table ,5).

4.3.2. Yield and its components :

4.3.2.1. Number of fruits per plant :

Data presented in Table (3 and 4) show that GCA and SCA were highly significant . Line 85 had the greatest GCA value followed by Giza 1 . The cross 10 x 1 only had highly significant and positive values of SCA effects

4.3.2.2. Average fruit weight :

Both GCA and SCA were most significant (Table 3). The estimates of GCA effects of lines and testers indicated that Giza 1 recorded the highest value of GCA followed by line 63 and L 84g were good combiners for this trait. Therefore, these parents were good combiners for this trait .The estimates of SCA effects for crosses showed that only 4 crosses out of 21 crosses had highly significant positive value of SCA effects, while the other crosses had negative or non significant values.

Table 4.Estimation of general combining ability(GCA) effects for various characters in parental lines and testers of watermelon.

Parents	Stem length	No. of branches	No. of fruits / plant	average fruit weight	Total yield /plant	No. of days to maturity	TSS %
Testers							
1- Giza 1	2.1	-0.06	0.13	0.58	2.13	2.05	0.02
2- New Hampshier	2.05	0.08	0.10	-0.47	-0.40	-0.29	0.02
3- Sugar Baby	-4.14	-0.02	-0.23	-0.11	-1.73	-1.76	-0.03
Lines							
4- Line 63	14.76	0.44	-0.24	0.97	1.83	2.60	0.25
5- Line 70	-16.57	0.00	0.15	-1.44	-4.31	-3.29	-0.19
6- Line 84	- 4.24	-0.22	-0.35	0.57	3.37	1.38	-0.19
7- Line 84g	15.21	0.22	-0.07	0.87	1.98	-0.51	-0.30
8- Line 85	- 9.24	-0.22	0.52	-1.62	-3.46	-0.95	-0.08
9- Line 84 s	- 4.13	-0.33	-0.13	0.89	1.22	1.05	0.25
10 - Line 79	4.21	0.11	0.11	-0.25	-0.62	-0.29	0.25
Testers							
LSD(p=0.05)	1.80	0.24	0.27	0.21	0.46	0.79	0.19
LSD(p=0.01)	2.39	0.32	0.42	0.28	0.61	1.05	0.26
Lines							
LSD(p=0.05)	2.8	0.37	0.42	0.32	0.70	1.21	0.30
LSD(p=0.01)	3.7	0.49	0.56	0.43	0.93	1.61	0.40

Total yield : 4.3.2.3.

The analysis of variance for total yield per plant is presented in Table (3). Highly significant differences for GCA and SCA indicated that both additive and non-additive genetic variances are important in the inheritance of total yield. Data listed in Table (4) revealed that Line 84 had greatest GCA effect for total yield followed by Giza1 . Therefore, these parents were good combiners for this trait.

The estimates of SCA effects for crosses showed that 7 crosses had positive and significant value of SCA effects.

Table 5. Estimation of specific combining ability (SCA) effects for some various characters in the F_1 generation of watermelon.

Genotype	Stem length	No. of branches	No. of fruits/ plant	Average of fruit weight	Total yield /plant	No. of days to maturity	TSS %
Crosses							
4X1	-6.43	0.18	-0.18	0.44	0.81	-1.94	0.32
4X2	8.62	-0.30	0.01	-0.81	-3.12	2.06	-0.02
4X3	-2.19	0.13	0.18	0.37	2.31	-0.13	-0.30
5X1	-11.43	-0.38	0.10	0.39	2.59	4.62	-0.24
5X2	16.29	0.48	0.45	-1.40	-3.79	-2.05	0.10
5X3	-4.86	-0.10	-0.55	1.01	1.20	-2.57	0.14
6X1	-6.43	-0.16	0.10	0.64	0.27	-0.05	0.10
6X2	17.62	0.37	-0.38	-1.08	0. 30	3.26	0.10
6X3	-11.19	-0.21	0.29	0.43	-0.57	-3.24	-0.19
7X1	-1.87	-0.27	-1.02	1.58	-1.34	-2.16	0.21
7X2	-1.83	-0.08	0.34	-0.28	1.49	4.84	-0.13
7X3	3.70	0.35	0.68	-1.3	-0.15	-2.69	-0.08
8X1	6.24	-0.16	0.06	0.07	1.31	2.29	-0.35
8X2	-27.38	-0.30	0.09	0.11	-0.46	-4.38	-0.35
8X3	21.14	0.46	-0.15	-0.18	-0.85	2.10	0.70
9X1	8.79	0.29	0.04	-1.68	-3.58	-3.71	-0.35
9X2	-12.49	-0.19	-0.10	2.27	4.14	-1.38	0.32
9X3	3.70	-0.10	0.06	-0.59	-0.56	5.10	0.03
10X1	11.13	0.51	0.91	-1.44	-0.07	0.95	0.32
10X2	-0.83	0.03	-0.40	1.18	1.45	-2.38	-0.02
10X3	-10.30	-0.54	-0.50	0.26	-1.38	1.43	-0.30
LSD(p=0.05)	4.76	0.64	0.73	0.56	1.20	2.09	0.51
LSD(p=0.01)	6.34	0.86	0.96	0.75	1.60	2.79	0.69

4.3.2.4. Number of days to maturity

Data in Tables (3) illustrated that GCA and SCA were highly significant , except B.vs.cr was insignificant value . Concerning GCA effects, results in Table (4) clear that parent which had negative and significant value of GCA effects is considered a good combiner. In contrast, the parent which had positive and significant or non significant value of GCA effect is considered a late parent (poor combiner) . Line No.5 (Line 70) possessed highly significant negative value of GCA effect followed by Tester No.3 (Sugar Baby cv.).Therefore, these parents could be considered as good parents for earliness. On the other hand, the rest parents were poor general combiners, because they had positive or non significant GCA effects values .

Regarding SCA effects, data presented in Table (5) revealed that from 21 crosses only 8 crosses exhibited significant or highly significant negative values of SCA .

4.3.2.5.Total soluble solid

Analysis of variance for TSS presented in Table (3) showed highly significant differences for GCA and SCA ,except Lines.

Results in Table (4) show that Line No.4 (Line 63) and L.No.9 (Line 84g) had the greatest GCA effects .These lines were good combiners for TSS because they had positive significant GCA effects values (Table4).

Out of 21 crosses, 1 cross was highly significant positive SCA values (Table 5) .

CONCLUSION

we obtained a good 3 hybrids from Giza type 4x3 ,4x1 and 8x1 have a characters 26.0, 25.0, and 25.2 kg. /plant , respectively for total yield /plant and vigorous plant growth with early maturity fruiting growing period, high total yield and TSS (11.5- 12.0 %), compared with check hybrid Giza 17, F_1.We have 3 crosses highly significant positive heterotic effects over the better parent.

LITERATURE CITED

1. Bond, DA (1967). Combining ability of bean (Viciafaba L.) inbred. J. Agric. Sci Camb. 68: 179-485.
2. Kempthorne O (1957). An introduction to genetic statistics.John Wiley and Sons, Inc New York (NY, USA), 545 pp.
3. Abd El-Hafez, A. A. (1983). Types of dominance of fruit characteristics in various F_1 hybrids in watermelon, (*Citrulluslanatus*Thunb.). Acta Agronomica Academiae Scientiarum Hungaricae, 32 (1/2): 107-114.
4. Abd El-Hafez, A.A, A. K. Gaafer and A. M. M. Allam. (1985). Inheritance of flesh colour, seed cracks and total soluble solids in watermelon and their genetic relations.II. Quantitative character and the association between various characters. ActaAgron. Acad. Sci. Hungaricae, 34: (1/2) 84-89.
5. Abd El-Raheem, A. A. and A. El-Mighawry (1991). Genetic analysis of yield and earliness in an intervarietal cross of melon (*Cucumismelo*L.). J. Agric. Res. Tanta Univ., 12 (4):88-108.
6. Abd El-Salam, M. M. (1998). Genetical and physiological studies on watermelon.Ph. D.Thesis (Vegetable crops), Suez Canal Univ.
7. Abd El-Salam, M. M. and I. M. El-Ghareeb (2007). Utilization of some genetic parameters in the development of agronomic traits in watermelon. Egypt. J. Plant Breed. 11(2): 759-773.
8. Amirk, S. S.; J. S. Brar and S. P. S. Gill (1977). Mode of inheritance of earliness and quality characters in watermelon. (Plant, Breed.Abast, 49, 8499).

9. O. A. C. (Association Official Agricultural Chemistry) (1980). Washington, D. C. 10th ed. USA.
10. Bansal R, Sooch BS, Dhall RK (2002). Heterosis in watermelon [Citrulluslanatus. (Thunb.) Mansf.]. Environ Ecol 20: 976-979
11. Bond, DA (1967). Combining ability of bean (Viciafaba L.) inbred. J. Agric. Sci. Camb. 68: 179-485.
12. Brar, J. S. and S. S. Amrik (1977). Heterosis and combining ability of earliness and quality characters watermelon (Citrulluslanatus (Thnub.)Mansf.). Part. J. Res., Punjab Agric. Univ., 14 (3) 272-278. (C.F. Plant Breed. Abstr. 49: No. 6472).
13. El-Mighawry, A.; A. A. Kamooh; M. Abd El-Salam and S. S. Gaman (2001). Inheritance studies of some economic characters in watermelon. J. Agric. Sci. Mansoura Univ., 26 (7):4159-4170.
14. Kale PB, Seshadri VS (1988). Studies on combining ability in watermelon (Citrullus lanatus (Matsumara) Nakai). PunjabraoKrishiVidyapeeth Research J 12: 45-48
15. Kempthorne O (1957). An introduction to genetic statistics.John Wiley and Sons, Inc. New York (NY, USA), 545 pp.
16. Khereba, A. H.; K. E. A. Abdel-Ati., M. M. Saleh.and R. R. A. El-Hawagry. (2007). Developing and evaluation of new watermelon hybrids and their heterosis.Egpyt.Pl. Breed. 11(2): 899-923.
17. Leskovar, D. I., H. Bang, K. M. Crosby, N. Maness, J. A. Franco. and P. Perkins-Veazie. (2004). Lycopene, carbohydrates, ascorbic acid and yield components of diploid and triploid watermelon cultivars are affected by deficit irrigation. Hort. Sci. Biotechnology. 79(1): 75-81.
18. Mohanty, B. K. (2000). Combining ability for yield and its components in pumpkin.Indian. J. Genet., 60(3): 373-379.
19. Omran, S.A. 2003.Tetraploid Watermelon Induction and Production of Seedless Watermelon F1 Hybrids Seeds .Ph.D. Thesis, Faculty of Agriculture, Tanta University, Kafr El-Sheikh, Egypt.
20. Omran, S. A., T. A. Shalaby and E. M. Khalel, (2008) . Heterosis and combining ability in triploid watermelon hybrids.J.Agric.Res.Kafr-El-SkeikhUniv.34(3)759-771.
21. Omran, S. A. ;W. A. E. Ramadan and Y. A. M. Mostafa (2012). heterosis and combining ability In watermelon hybrids.J. Plant Production, Mansoura Univ., Vol. 3 (12): 3139 – 3148.
22. Salim, A. M. (1989). Genetical and physiological studies in watermelon. M. Sc. Thesis, Fac. Agric., Minufiya Univ.
23. Souza, F. F; M. A. Queirz and R. C. Souza Dias (2001). Seedless watermelon development evaluation of hybrid experimental triploid of watermelon. (http//www. Biotecnologia.Com .br/bio/9_hi).

تربية هجين بطيخ مصرى جديد طراز الجيزة

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أجريت هذه الدراسة خلال الفترة من 2012 حتى عام 2013م لإنتاج هجين متفوق من البطيخ طراز جيزه المناسب للزوق المصرى .استخدمت في هذه الدراسة ٣أصناف كشاف (Testers) كأباء من البطيخ هي :جيزة 1، نيوهامبشير و شوجر بيبى و 7 سلالات من البطيخ (Lines) كأمهات L 63 و L.79 و L. 84s و L84g و L85 و L 84 و L70 تم إجراء التهجين بطريقة line x tester لإنتاج 21 هجين فى عام 2012.

تم تقييم الهجن الناتجة والأباء بالإضافة الى هجين جيزه 17 للمقارنه خلال الموسم الصيفى لعام 2013م فى تجربة حقلية بإستخدام القطاعات كاملة العشوائية فى ثلاث مكررات .إشتمل التقييم على صفات طول الساق ، عدد الأفرع وعدد الثمار لكل نبات ، متوسط وزن الثمرة ، عدد الأيام حتى نضج أول ثمرة ، المحصول الكلى للنبات ونسبة المواد الصلبة الذائبة .

ويمكن تلخيص أهم النتائج المتحصل عليها كالتالي :

كانت الاختلافات بين التراكيب الوراثية عالية المعنوية لجميع الصفات تحت الدراسة .

- كانت قوة الهجين محسوبة على أساس الأب الأفضل عالية المعنوية وذات قيما موجبة لمعظم صفات النمو الخضرى وصفات المحصول ومكوناتة بينما كانت عالية المعنوية وذات قيما سالبه لمعظم صفات التبكير.
- كانت قيم القدرة العامة والقدرة الخاصة على التآلف عالية المعنوية لكل الصفات تحت الدراسة مما يعنى بأن كل من التأثير المضيف وغير المضيف للجين مهما في وراثة مثل هذه الصفات.
- تم الحصول على 3هجن متفوقه من طراز جيزه وهى 4x3 و 8x1 و 4x1 فى قوه النمو والتفريع والمجصول الكلى ومكوناته والتبكير ونسبه السكريات الكليه بالمقارنه بالهجين التجارى.