RESULTS AND DISCUSSION

The present study was carried out to investigate the heterosis and combining ability for some agronomic characters, i.e. tasseling and silking ear and plant heights, leaf area, leaf angle, ear husk, stem diameter, number of ears/ plant, ear length, ear diameter, number of rows/ ear, number of kernels/ row, 100- kernel weight, shelling percentage and grain yield/ plant in some inbred lines of maize (*Zea mays* L.) by means of diallel cross system. To achieve this target, half diallel of F_1 and F_2 crosses was studied.

The combined analysis was done between two seasons in F_1 data for all the studied traits except for leaf area, leaf angle, ear height, plant height and shelling percentage, whereas the homogeneity test of errors variance was significant for the exceptional traits.

F_1 generation :

Analysis of variance, means and heterosis :

The analysis of variance for each of the two seasons as well as the combined analysis for the studied traits is presented in Table (6). Seasons mean squares were significant for all traits, indicating an overall differences between the two seasons. Also, the mean values in the first season were significantly higher for grain yield per plant, number of ears per plant, 100- kernel weight, ear height, plant height, stem diameter, husk of ear, leaf area and leaf angle than those in the

Table (6): Observed mean squares from ordinary analysis of variance for growth and yield characteristics in both seasons as well as the combined analysis in the F_1 generation.

S.O.V	d.f		Tasseling date			Silking date			Ear height (cm)		Plant height (cm)		Leaf area cm^2		Leaf angle	
	S_1	Comb	S_1	S_2	Comb.	S_1	S_2	Comb.	S_1	S_2	S_1	S_2	S_1	S_2	S_1	S_2
Season(s)		1			1.55**			173146.2**								
Rep./ S	2	4	4.17	4.13	4.15	5.58	1.16	3.37	4.44	3.44	334.0	1.5	330	498	35.70	3.34
Genotype(G)	35	35	38.66**	8.09*	31.22**	27.36**	11.78**	36.30**	2946.8**	2499.75**	12432.3**	9075.7**	49377.2**	18241.5**	47.52**	22.92**
Parents (P)	7	7	3.09	8.57	10.31**	10.71**	21.79**	23.31**	392.41**	465.37**	2279.6**	1587.3**	12246.7**	13228.0**	11.49	17.20**
Cross (F_1)	27	27	15.20**	6.74	12.90**	8.83**	8.56**	10.56**	358.48**	166.76**	577.9**	603.6**	16153.5**	17780.1**	27.61**	22.36**
P vs F_1	1	1	915.53**	41.10**	672.07**	644.22**	28.68**	472.28**	90711.9**	79731.3**	403568.6**	290240**	1206329**	65792**	837.49**	79.28**
G x S		35			15.53**			12.84**								
P x S		7			2.14			9.19**								
F1 x S		27			9.04**			6.83**								
P vs F1 x S		1			284.55**			200.62**								
Error	70	140	2.56	4.51	3.53	2.84	1.04	1.94	14.60	3.06	189.56	3.56	145.37	698.34	12.31	1.46

S_1 and S_2 : the first and second season

* and ** significant at 0.05 and 0.01 levels of probability, respectively.

Table (6). Cont.

S.O.V	d.f		Stem diameter (cm)			No. of ears/ plant			Ear husk (cm)			Ear length (cm)			Ear diameter (cm)		
	S_1	Comb	S_1	S_2	Comb.	S_1	S_2	Comb.	S_1	S_2	Comb.	S_1	S_2	Comb.	S_1	S_2	Comb.
Season(s)		1			206.18**			52.28**			429.59**			12391**			636.82**
Rep./ S	2	4	0.03	0.07	4.72	0.01	0.001	0.02	4.15	0.08	2.12	0.47	6.13	3.30	0.13	0.12	0.12
Genotype(G)	35	35	0.22**	0.12	0.20**	0.06**	0.07**	0.09**	1.92**	1.94**	1.83**	25.14**	15.89	32.78**	3.38**	0.49	1.75**
Parents (P)	7	7	0.12**	0.18	8.14**	0.01	0.003	0.01	0.28	1.67**	0.96*	22.13**	3.45	17.43**	0.01	0.05	0.05
Cross (F_1)	27	27	0.25**	0.11	0.27**	0.06*	0.07**	0.07	1.54**	1.96**	1.94**	11.53**	3.41	6.76*	0.90**	0.60	0.76**
P vs F_1	1	1	0.32**	0.16	0.46**	0.65**	0.56**	1.20**	23.84**	3.09**	4.88**	413.80**	429.07	842.80**	93.78**	0.44	40.69**
G x S		35			0.14**			0.05*			2.03**			7.95**			2.12**
P x S		7			0.21**			0.01			0.99*			8.16			0.04
F1 x S		27			0.13**			0.06*			1.56**			8.19**			0.75**
P vs F1 x S		1			0.01			0.01			22.05**			0.07			53.52**
Error	70	14	0.03	0.14	0.09	0.03	0.02	0.02	0.54	0.22	0.38	3.75	4.67	4.21	0.33	0.38	0.36

S_1 and S_2 : the first and second season
* and ** significant at 0.05 and 0.01 levels of probability, respectively.

Table (6): Cont.

S.O.V	d.f		No. of kernels/ row			No. of rows/ ear			Weight of 100 kernel (g)			Shelling percentage		Grain yield/ plant 15.5% (g)		
	S_1	Comb	S_1	S_2	Comb.	S_1	S_2	Comb.	S_1	S_2	Comb.	S_1	S_2	S_1	S_2	Comb.
Season(s)		1			51917.5*			6507.48**			23180.9**					641173**
Rep./ S	2	4	45.65	45.33	45.52	1.82	12.88	7.35	85.52	116.91	101.22	46.13	0.25	22.88	36.75	29.81
Genotype(G)	35	35	52.75**	54.35**	84.30**	16.68**	14.89**	29.68**	27.52*	38.43**	33.50**	84.04*	48.62**	5689.7**	3243.6**	8225.2**
Parents (P)	7	7	30.23	46.22**	59.16**	7.99**	18.43**	22.96**	22.85	27.92	21.79	20.12	89.66**	585.9**	492.9*	1057.49*
Cross (F_1)	27	27	37.51**	12.77	27.14*	2.67*	1.37	2.61	29.48*	41.18*	37.55**	102.18*	23.00**	1987.8**	427.3*	1574.57**
P vs F_1	1	1	621.60**	1233.9**	1803.65**	455.66**	355.12**	807.63**	7.13	37.95	6.07	41.81	452.45**	141355.7**	98538.2**	237968*
G x S		35			22.79*			1.89			32.45**					707.74**
P x S		7			17.28			3.47			28.98					21.49
F1 x S		27			23.41*			1.44			33.10**					840.54**
P vs F1 x S		1			51.94			3.14			39.01					1925.84**
Error	70	14	18.32	11.64	14.98	1.62	1.99	1.80	14.79	16.66	15.73	39.46	1.93	151.6	223.64	187.62

S_1 and S_2 : the first and second season

* and ** significant at 0.05 and 0.01 levels of probability, respectively.

second one. While, the other traits, the mean values in the second season were higher than those in the first one.

Significant genotypes mean squares were detected for all traits in separate season as well as the combined analysis except for ear diameter in the second season, indicating the wide diversity between the parental materials used in this study. Significant genotypes by seasons interaction mean squares were detected for all traits except number of rows per ear, indicating that the tested genotypes varied from each other, and ranked differently from season to another. For the number of rows per ear, insignificant genotypes by season interaction mean squares was detected, revealing that the genotypes responded to seasonal change by nearly similar magnitude.

Significant inbred lines mean squares were showed in all traits except number of ears per plant, and 100- kernel weigh in both seasons as well as the combined analysis, number of kernels per row, shelling percentage,. leaf angle and ear husk in the first season, ear height, tasseling date and stem diameter in the second season (Table 6). Insignificant mean squares of interaction between parental inbred lines and seasons were detected for all traits except silking date, stem diameter and ear husk. This result may revealed the high repeatability of the parental inbred lines under different seasons. The mean performance of tested eight inbred lines as each season and as an average over two seasons are presented in Table (7). The parental inbred line M 105g showed the lowest mean value for lea f angle. However, the parental line 110B gave the highest one for this trait.

Table (7): Genotypes mean performance for growth and yield characteristics in 1995 and 1996 seasons.

Genotype	Tasseling date (day)			Silking date (day)			Ear height (cm)	
	S_1	S_2	Comb	S_1	S_2	Comb	S_1	S_2
110B	65.33 b-c	64.00 b-f	64.67 b-g	71.33 a	68.00 df	69.67 bc	82.02 no	88.32 l
72	65.33 b-c	66.33 a-c	65.83 b-d	67.33 b-d	70.67 bc	69.00 cd	71.28 p	71.28 n
27	65.00 b-c	64.67 b-f	64.83 b-f	68.33 a-c	65.00 g	66.67 e-i	87.22 n	87.22 l
101	66.33 a-c	64.00 b-f	65.17 b-f	67.00 b-f	66.00 fg	66.50 e-i	67.12 po	67.45 o
70B	65.67 a-c	66.00 a-d	65.83 b-d	66.67 b-f	68.33 df	67.00 df	52.61 q	52.61 o
105g	68.33 a	69.00 a	68.67 a	70.67 a	72.67 a	71.67 a	63.55 o	63.55 p
36	67.00 ab	65.33 a-f	66.17 b-c	69.33 ab	70.67 bc	70.00 a-c	79.93 o	79.93 m
106i	67.00 ab	67.00 ab	67.00 ba	71.00 a	71.33 ab	71.17 ab	64.48 o	64.48 p
110B x 72	57.00 i-n	61.67 f	59.33 i-n	61.67 h-k	63.00 h	62.33 e-i	153.00 b	132.67 ij
x 27	59.99 e-k	65.00 a-f	62.00 h-k	62.67 g-j	70.67 bc	66.67 e-k	136. 37 h-l	131.00 j
x 101	60.67 e-h	65.67 a-f	63.17 e-j	64.00 f-j	66.00 df	66.00 e-k	130.67 k-l	133.00 h-j
x 70B	59.67 e-j	63.67 b-f	61.67 h-m	63.67 f-j	68.33 df	66.00 e-k	130.10 k-l	127.00 k
x 105g	61.33 d-f	65.67 a-f	63.50 d-i	64.33 d-i	69.00 c-f	66.67 e-i	136.33 h-l	127.00 k
x 36	60.67 e-h	66.33 a-c	63.50 d-i	63.00 g-j	69.00 c-f	66.00 e-k	132.00 j-l	126.00 k
x 106i	60.33 e-h	62.00 d-f	61.17 i-n	64.67 d-i	65.00 g	64.83 i-m	129.40 l	145.00 d
72 x 27	55.67 i-n	62.67 c-f	59.17 mn	61.33 i-k	66.00 fg	63.67 i-o	143.27 d-h	131.33 j
x 101	60.00 e-i	64.00 b-f	62.00 h-k	63.33 g-j	68.33 df	65.83 f-k	140.67 gh	145.33 cd
x 70B	57.67 h-n	64.33 b-f	61.00 i-n	61.33 i-k	68.00 df	64.67 j-m	154.00 b	137.00 fg
x 105g	59.00 e-k	64.33 b-f	61.67 h-m	60.67 g-j	68.33 df	65.50 g-l	144.00 c-g	138.67 ef
x 36	56.33 k-n	66.33 a-c	61.33 i-n	65.67 j-k	69.00 c-f	64.83 i-m	141.67 e-h	153.00 a
x 106i	62.00 d-f	64.67 b-f	63.33 d-j	62.00 c-g	68.00 df	66.83 e-h	139.87 g-i	136.00 f-h
27 x 101	58.00 g-m	62.00 df	60.00 k-n	60.67 h-j	65.00 g	63.50 m-o	150.33 b-d	131.67 j
x 70B	55.00 m-n	66.00 a-d	60.50 kn	62.00 jk	69.33 cd	65.00 h-m	151.00 bc	136.67 fg
x 105g	56.67 j-n	64.00 b-f	60.33 k-n	63.67 h-j	68.00 df	65.00 h-m	130.87 kl	138.67 ef
x 36	60.33 e-h	62.00 df	61.17 i-n	64.67 f-j	65.09 g	64.33 k-n	148.00 b-f	149.00 b
x 106i	60.67 e-h	64.00 b-f	62.33 f-k	63.33 d-i	67.67 df	66.17 e-k	133.13 i-l	148.67 b
101 x 70B	60.33 e-h	63.00 b-f	61.67 h-m	64.33 g-j	67.33 df	65.33 g-m	143.33 d-h	148.00 bc
x 105g	60.67 e-h	66.33 a-c	63.50 d-i	58.67 d-i	69.00 c-f	66.67 e-i	150.33 b-d	141.70 f
x 36	54.67 f-l	63.33 b-f	59.00 n	62.00 k	67.00 ef	62.83 no	137.33 g-k	136.00 f-h
x 106i	58.33 d-g	63.33 b-f	60.83 j-n	64.00 h-j	67.33 d-f	64.67 j-m	137.02 g-k	139.00 e-f
70B x 105g	61.00 h-n	65.67 a-f	63.33 d-j	62.33 f-j	69.33 cd	66.67 e-i	140.87 f-h	135.00 g-i
x 36	57.67 c-d	66.00 a-d	61.83 h-l	66.67 g-j	68.00 df	65.17 h-m	148.13 b-f	133.00 h-j
x 106I	63.89 e-h	64.67 b-f	64.28 c-h	64.33 b-f	69.00 c-f	67.83 d-f	138.83 g-j	124.00 k
105g x 36	60.67 d-f	63.67 b-f	62.17 g-k	65.00 d-i	69.33 cd	66.83 e-h	143.67 d-h	141.00 f
x 106I	61.67 e-i	66.67 a-c	64.17 c-h	65.00 d-h	69.33 cd	67.17 e-g	108.10 m	135.33 g-i
36 x 106I	60.00 e-h	63.67 b-f	61.83 h-l	63.67 f-j	68.33 df	66.00 e-k	168.33 a	141.20 f
TWC 310	58.33 d-g	63.00 bf	60.66 jn	63.00 g-j	65.33 g	69.16 j-m	162.00 a	128.67 k
S.C. 10	61.66 h-n	65.66 a-f	63.66 d-i	65.66 d-i	60.03 i	62.84 e-i	167.66 a	151.00 a
G2	61.00 h-n	63.33 bf	62.16 g-k	66.00 g-j	65.66 g	65.83 h-m	161.00 a	147.00 bc

Table (7): Cont.

Genotype	Plant height (cm)		Leaf area		Leaf angle		Stem diameter (cm)	
	S1	S2	S1	S2	S1	S2	S1	Comb
110B	178.98 h	169.98 o	428.49 r	568.27 i-m	23.64 f-j	24.00 c-g	2.47 b-g	2.32 a
72	132.66 ij	123.66 s	464.92 o	539.57 mn	25.05 d-j	20.87 h-l	2.55 b-d	2.31 a
27	165.48 h	156.00 p	566.22 o-p	481.37 o	22.78 f-j	20.33 i-l	2.05 h	2.08 a
101	124.22 i-k	119.67 t	580.00 o	646.13 f-i	21.02 i-j	21.73 g-j	2.33 b-h	2.20 a
70B	100.00 k	103.00 v	435.00 24 r	559.70 i-n	23.87 e-j	22.53 f-i	2.10 g-h	2.13 a
105g	136.98 i	132.67 r	546.50 p	643.00 f-j	20.02 j	17.73 m-o	2.25 c-h	2.06 a
36	108.33 j-k	151.00 u	548.09 p	647.40 f-h	21.32 h-j	19.00 i-o	2.13 f-h	2.15 a
106i	114.00 i-k	115.00 t	447.04 or	667.53 f-g	25.42 d-j	17.00 o	2.03 h	2.37 a
110B x 72	294.67 a-c	279.67 a	826.75 b	644.03 f-j	29.33 a-f	19.40 k-n	2.63 b	2.44 a
x 27	274.67 c-f	276.33 bc	656.46 n	774.53 a-c	28.00 a-h	18.70 i-o	2.57 bc	2.37 a
x 101	274.67 c-f	282.00 a	653.22 n	546.13 j-l	26.67 c-j	18.60 i-o	2.12 gh	2.12 a
x 70B	279.67 b-f	259.67 g	754.91 g-h	733.90 bc	32.00 a-d	20.80 h-l	2.24 c-h	2.20 a
x 105g	255.33 f-g	247.33 jk	707.70 k-m	658.73 f-g	25.80 d-j	25.07 b-f	2.37 b-h	2.32 a
x 36	282.17 a-f	260.00 g	778.76 e-f	543.63 mn	30.00 a-f	24.30 b-f	2.20 c-h	2.24 a
x 106i	287.67 a-d	274.00 cd	691.30 m	780.90 ab	33.33 a-c	23.70 c-g	2.50 b-f	2.40 a
72 x 27	245.27 g	260.00 g	713.50 j-l	788.33 ab	30.00 a-f	23.40 d-g	2.17 e-h	2.19 a
x 101	274.00 c-f	250.33 ij	759.15 i-j	685.57 d-f	31.33 a-d	23.13 e-h	2.20 c-h	2.50 a
x 70B	278.33 c-f	249.67 ij	825.60 b	658.77 f-g	27.33 b-i	25.77 bc	2.21 c-h	2.20 a
x 105g	278.33 c-f	270.00 f	805.32 b-d	553.44 i-n	31.33 a-d	17.37 no	2.53 b-f	2.39 a
x 36	307.67 a	248.33 jk	814.86 b-c	597.50 h-l	30.00 a-f	24.13 ce	2.56 b-d	2.35 a
x 106i	286.93 a-d	254.33 h	881.34 a	597.60 i-l	34.00 ab	22.27 f-i	2.24 c-h	2.34 a
27 x 101	276.33 c-f	259.00 g	795.79 c-f	682.23 d-f	31.33 a-d	22.47 f-i	2.33 b-h	2.38 a
x 70B	286.00 a-d	245.33 kl	769.20 f-g	702.03 c-f	25.67 d-j	25.67 b-d	2.40 b-h	2.06 a
x 105g	283.13 a-d	279.33 ab	697.04 i-m	682.00 d-f	30.00 a-f	26.47 ab	2.51 b-f	2.35 a
x 36	269.33 c-g	271.00 df	888.91 a	584.83 k-m	25.33 d-j	17.07 o	2.30 b-h	2.22 a
x 106i	254.67 fg	265.67 f	659.93 n	516.83 n-o	34.67 a	20.40 i-l	2.06 h	2.17 a
101 x 70B	292.00 a-c	242.67 i	887.75 a	586.67 k-m	30.00 a-f	22.40 f-i	2.21 c-h	2.18 a
x 105g	288.33 a-d	252 00 hi	764.52 f-g	782.73 ab	29.00 a-g	27.87 a	2.40 b-h	2.34 a
x 36	263.00 d-g	276.33 bc	669.18 n	665.10 f-g	33.33 a-c	23.03 f-h	2.31 b-h	2.23 a
x 106i	285.33 a-d	265.33 f	659.52 n	708.40 c-f	30.67 a-f	24.53 b-f	2.27 b-h	2.34 a
70B x 105g	306.67 ab	228.83 n	799.50 c-f	620.00 g-k	34.00 ab	21.67 g-k	2.37 b-h	2.35 a
x 36	275.33 c-f	248.33 jk	740.50 h-i	717.30 cd	25.67 d-j	19.73 j-m	2.23 c-h	2.21 a
x 106I	279.17 c-f	249.00 ij	667.31 n	635.67 f-j	29.33 a-f	23.77 c-g	2.19 d-h	2.20 a
105g x 36	283.67 a-d	266.33 f	791.84 d-f	570.62 k-m	27.33 b-i	22.93 e-g	2.31 b-h	2.33 a
x 106I	285.53 a-d	236.67 m	825.95 b	662.97 f-g	30.67 a-f	23.47 c-g	2.30 b-h	2.20 a
36 x 106I	287.07 a-d	242.33 i	719.87 j-k	566.80 im	22.33 g-j	20.80 h-l	3.63 a	2.15 a
TWC 310	281.33 a-d	244.67 i	717.68 j-l	569.10 km	31.66 ad	15.86 o	2.15 e-h	2.13 a
S.C. 10	287.66 a-d	278.66 b-c	914.00 a	872.93 a	30.66 af	25.40 ab	2.09 h	2.06 a
G2	314.60 a	267.00 f	869.32 ab	694.11 d-f	27.33 bi	22.73 eg	2.08 h	2.11 a

Table (7): Cont.

Genotype	No. of ears/ plant			Ear husk			Ear length (cm)		
	S_1	S_2	Comb	S_1	S_2	Comb	S_1	S_2	Comb
110B	1.01 c	1.00 f	1.00 f	2.57 fg	2.47 f-k	2.52 h-j	11.25 h	13.46 hi	12.35 f
72	1.00 c	1.00 f	1.00 f	2.22 g	4.40 a	3.31 b-h	18.38 a-d	15.83 c-i	17.11 cd
27	1.00 c	1.00 f	1.00 f	2.82 e-g	3.53 a-f	3.18 b-i	11.82 h	12.67 i	12.25 f
101	1.00 c	1.00 f	1.00 f	2.25 g	2.20 g-l	2.23 j	13.52 f-h	14.00 g-i	13.76 e-f
70B	1.00 c	1.00 f	1.00 f	2.50 fg	3.93 ab	3.22 b-h	12.22 g-h	14.47 f-i	13.34 f
105g	1.04 c	1.07 e-f	1.03 e-f	2.98 d-g	3.60 a-d	3.29 b-h	11.04 h	15.67 c-i	13.35 f
36	1.07 bc	1.04 e-f	1.04 e-f	2.98 d-g	3.27 b-f	3.12 c-j	16.99 b-f	15.00 d-i	15.99 d-f
106i	1.07 bc	1.07 e-f	1.07 d-f	2.83 e-g	2.80 d-h	2.81 e-j	14.00 f-h	14.33 f-i	14.17 e-f
110B x 72	1.07 bc	1.27 b-f	1.17 b-f	3.33 c-g	3.27 b-f	3.30 b-h	20.53 ab	18.33 a-f	19.43 a-c
x 27	1.33 a-c	1.13 d-f	1.23 b-f	3.00 d-g	2.67 e-j	2.83 d-j	18.77 a-d	20.53 ab	19.65 a-c
x 101	1.27 a-c	1.40 b-e	1.33 b	3.30 c-g	1.40 l	2.35 i-j	21.07 a	18.40 a-f	19.73 a-c
x 70B	1.27 a-c	1.00 f	1.13 b-f	3.20 c-g	4.20 a	3.70 b-d	19.80 a-c	18.40 a-f	19.10 a-c
x 105g	1.07 c	1.13 d-f	1.10 c-f	4.60 a-c	2.50 f-k	3.55 b-f	19.73 a-c	19.80 a-c	19.77 a-c
x 36	1.00 e	1.00 f	1.00 f	3.27 c-g	3.20 b-f	3.23 b-h	18.60 a-d	18.87 a-d	18.73 a-d
x 106i	1.27 a-c	1.13 d-f	1.20 b-f	5.73 a	4.40 a	5.07 a	17.80 a-f	18.72 a-f	18.21 a-d
72 x 27	1.27 a-c	1.13 d-f	1.20 b-f	4.33 b-d	2.97 c-g	3.65 b-f	15.47 d-g	20.28 ab	17.87 a-d
x 101	1.07 bc	1.00 f	1.03 e-f	4.10 b-f	2.32 f-k	3.22 b-h	14.40 f-h	19.67 a-c	16.93 c-d
x 70B	1.20 a-c	1.20 c-f	1.20 b-f	3.40 b-g	2.47 f-k	2.93 d-j	19.19 a-d	19.67 a-c	19.40 a-c
x 105g	1.40 ab	1.00 f	1.20 b-f	4.80 ab	2.93 c-g	3.87 bc	16.20 c-f	19.29 a-c	17.74 a-d
x 36	1.20 a-c	1.27 b-f	1.23 b-f	4.80 ab	2.53 f-k	3.67 b-f	18.53 a-d	19.97 a-c	19.25 a-c
x 106i	1.26 a-c	1.33 b-d	1.30 bc	3.30 c-g	3.07 b-g	3.18 b-i	17.73 a-f	19.33 a-c	18.53 a-d
27 x 101	1.07 bc	1.13 d-f	1.10 c-f	3.80 b-f	4.20 a	4.00 b	18.33 a-d	19.33 a-c	18.83 a-d
x 70B	1.20 a-c	1.33 b-d	1.27 b-d	4.53 a-c	2.67 e-j	3.60 b-f	17.13 b-f	19.67 a-c	18.40 a-d
x 105g	1.20 a-c	1.27 b-f	1.23 b-f	4.07 b-f	2.87 c-g	3.47 b-g	19.27 a-d	18.83 a-c	18.80 a-d
x 36	1.20 a-c	1.20 c-f	1.20 b-f	3.00 d-g	3.73 a-c	3.37 b-g	20.80 ab	19.67 a-c	20.23 ab
x 106i	1.00 c	1.27 b-f	1.13 b-f	3.33 c-g	3.27 b-f	3.30 b-h	16.95 b-f	19.40 a-c	18.18 a-d
101 x 70B	1.13 bc	1.13d-f	1.13 b-f	3.27 c-g	2.73 d-i	3.00 c-j	17.83 a-f	17.47 a-h	17.65 bd
x 105g	1.07 bc	1.13 d-f	1.10 c-f	3.17 c-g	1.87 i-l	2.52 hj	19.13 a-d	21.00 ab	20.07 ab
x 36	1.07 bc	1.20 c-f	1.13 b-f	4.60 a-c	2.53 f-k	3.57 b-f	17.83 a-f	19.13 a-d	18.48 a-d
x 106i	1.33 a-c	1.67 a	1.50 a	3.00 d-g	4.40 a	3.70 b-d	20.45 ab	19.00 a-d	19.73 a-c
70B x 105g	1.47 a	1.10 d-f	1.28 bc	4.50 a-c	3.57 a-f	4.03 b	18.87 a-d	16.89 b-h	17.88 a-d
x 36	1.27 a-b	1.00 f	1.13 b-f	3.80 b-f	1.93 h-l	2.87 d-j	19.78 a-c	20.67 ab	20.23 ab
x 106I	1.07 bc	1.47 b	1.27 bd	3.60 b-g	1.67 kj	2.63 g-j	12.33 g-h	19.80 a-c	16.07 d-f
105g x 36	1.40 ab	1.27 b-f	1.33 ab	3.00 d-g	2.47 f-k	2.73 f-j	20.00 a-c	21.33 a	20.67 a
x 106I	1.00 c	1.13 d-f	1.07 d-f	3.30 c-g	2.67 d-j	2.98 d-j	18.92 a-d	18.13 a-g	18.53 a-d
36 x 106I	1.47 a	1.13 d-f	1.30 bc	3.53 b-g	1.80 l	2.67 g-j	18.67 a-d	17.47 a-h	18.07 a-d
TWC 310	1.00 c	1.09 ef	1.04 ef	2.93 d-g	2.73 d-i	2.88 d-j	22.48 a	25.00 a	23.74 a-d
S.C. 10	1.20 ac	1.29 b-f	1.24 bc	3.40 c-g	3.53 af	3.46 b-j	18.14 a-d	22.73 a	20.43 ab
G2	1.00 c	1.00 f	1.00 f	2.60 f-g	2.80 d-i	2.70 f-j	17.93 a-f	15.53 d-i	16.73 d-f

Table (7): Cont.

Genotype	Ear diameter (cm)		No. of kernels/ row			No. of rows/ ear		
	S_1	Comb	S_1	S_2	Comb	S_1	S_2	Comb
110B	2.19 d	3.03 f	33.13 e-g	30.96 f-g	32.05 g-j	10.55 i-k	13.47 a	12.01 f
72	2.22 d	3.22 d-f	35.01 a-f	33.25 e-f	34.13 e-j	7.13 m	8.66 cd	7.90 h-i
27	2.23 d	3.25 d-f	27.77 f-g	25.50 g	26.64 k	9.26 kl	10.0 bc	9.63 g
101	2.26 d	3.30 e-f	32.16 c-g	28.20 f-g	30.18 j-k	11.66 h-j	12.96 a	12.31 d-f
70B	2.18 d	3.25 d-f	30.79 d-g	31.72 d-g	31.25 h-k	8.67 k-m	8.00 cd	8.33 g-i
105g	2.25 d	3.19 d-f	30.69 d-g	30.80 f-g	30.75 i-k	8.00 l-m	7.39 d	7.69 h-i
36	2.31 d	3.26 d-f	32.28 c-g	38.57 a-c	35.42 b-j	7.12 m	7.12 d	7.12 i
106i	2.15 d	3.18 d-f	24.95 g	28.37 f-g	26.37 k	10.00 j-k	8.09 cd	9.05 g-h
110B x 72	4.40 a-c	4.20 ab	42.15 ab	39.33 a-c	40.73 ab	15.0 a-d	13.47 a	14.23 a-c
x 27	3.73 c	3.97 a-d	30.33 a-f	39.33 a-c	39.13 a-f	14.80 a-f	14.40 a	14.60 a-c
x 101	4.83 a-c	4.48 ab	38.47 a-f	39.70 a-c	39.08 a-f	15.47 ab	14.30 a	14.88 ab
x 70B	4.67 a-c	3.70 b-f	39.33 a-d	40.13 ab	39.73 a-d	12.67 e-m	13.07 a	12.87 c-f
x 105g	5.20 a	4.63 a	43.20 a	41.33 ab	42.27 a	13.87 a-g	14.19 a	14.00 a-f
x 36	5.27 a	4.57 a	32.13 c-g	38.00 a-d	35.06c-j	13.20 c-h	13.20 a	13.20 a-f
x 106i	4.30 a-c	3.98 a-d	42.50 ab	38.45 a-c	40.48 a-c	13.53 a-h	12.53 a	13.03 b-f
72 x 27	4.50 a-c	4.47 ab	31.80 c-g	39.57 a-c	35.68 b-i	14.80 a-f	14.20 a	14.50 a-c
x 101	4.73 a-c	4.57 a	30.13 f-g	40.30 ab	35.22 b-j	13.53 a-h	14.67 a	14.10 a-d
x 70B	4.60 a-c	4.40 a-b	38.13 a-f	43.00 a	40.57 a-c	15.27 a-c	13.27 a	14.27 a-c
x 105g	4.60 a-c	4.40 ab	33.53 c-f	36.87 a-f	35.20 b-j	13.87 a-g	14.40 a	14.13 a-d
x 36	4.40 a-c	4.25 ab	32.53 c-g	41.75 a-b	37.14 a-g	14.00 a-g	13.63 a	13.82 a-f
x 106i	4.67 a-c	4.52 ab	35.80a-f	36.50 a-f	36.15 b-h	12.46 f-h	14.53 a	13.50 a-f
27 x 101	4.67 a-c	4.43 ab	40.00 a-c	39.50 a-c	39.75 a-d	15.60 a	14.40 a	15.00 a
x 70B	4.53 a-c	4.52 ab	36.40 a-c	40.00 a-c	38.20 a-f	14.07 a-g	14.80 a	14.43 a-c
x 105g	4.67 a-c	4.40 ab	37.60 a-f	36.40 a-f	37.00 a-g	14.27 a-g	13.60 a	13.93 a-f
x 36	3.83 b-c	3.28 c-f	38.00 a-f	40.41 ab	39.20 a-f	12.60 f-h	14.47 a	13.53 a-f
x 106i	3.97 b-c	4.13 ab	38.00 a-f	40.00 a-c	39.00 a-f	13.60 a-h	14.27 a	13.92 a-f
101 x 70B	4.20 a-c	4.14 ab	34.50 b-f	39.10 a-c	36.80 a-g	14.48 a-g	14.27 a	14.38 a-c
x 105g	4.82 a-c	4.55 a	37.93 a-f	40.57 ab	39.25 a-f	13.48 b-h	13.47 a	13.43 a-f
x 36	4.00 bc	4 12 ab	33.00 c-g	36.10 a-f	34.59 d-j	13.00 d-h	13.56 a	13.28 a-f
x 106i	4.67 a-c	4.60 a	40.33 a-c	36.67 a-f	38.50 a-f	15.60 a	14.47 a	15.03 a
70B x 105g	4.67 a-c	4.21 ab	37.50 a-f	36.48 a-f	36.99 a-g	14.27 a-g	13.10 a	13.68 a-f
x 36	4.63 a-c	4.17 ab	31.00 d-g	41.60 ab	36.30 b-h	14.53 a-f	13.33 a	13.93 a-f
x 106I	2.37 d	3.33 c-f	35.73 a-f	41.70 ab	38.72 a-f	12.33 g-i	12.00 ab	12.17 c-f
105g x 36	4.93 ab	4.57 a	37.60 a-f	38.23 a-d	37.92 a-f	14.27 a-g	13.97 a	14.12 a-d
x 106I	4.60 a-c	4.58 ab	37.20 a-f	36.80 a-f	37.00 a-g	13.20 c-h	13.60 a	13.40 a-f
36 x 106I	4.57 a-c	4.07 a-c	32.40 e-g	35.00 a-f	33.70 f-j	14.07 a-g	13.93 a	14.00 a-f
TWC 310	5.00 a	4.70 a	38.00 a-f	43.28 a	40.64 a-d	12.00 h-j	12.00 ab	12.00 c-f
S.C. 10	5.16 a	4.79 a	38.90 a-f	41.00 ab	39.95 a-f	12.00 h-j	12.00 ab	12.00 c-f
G2	4.83 a-c	4.71 a	31.00 d-g	35.33 a-f	33.16 e-g	12.20 g-i	12.36 a	12.28 d-f

Table (7): Cont.

Genotype	Weight of 100- kernel (g)			Shelling percentage		Grain yield/ plant 15.5 %		
	S_1	S_2	Comb.	S_1	S_2	S_1	S_2	Comb
110B	28.00 a-f	24.56 b-h	26.28 a-f	77.08 a-g	79.50 f-h	95.33 n	90.69 g-h	93.01 m
72	28.04 a-f	24.88 b-h	26.46 a-f	79.15 a-f	72.05 m	66.22 op	63.27 i	64.75 no
27	24.11 a-f	18.00 g-h	21.06 e-f	77.37 a-g	80.58 d-f	58.84 op	59.49 i	59.16 n-o
101	23.73 a-f	21.40 c-h	22.57 c-f	73.55 a-g	66.54 n	74.74 o	75.02 hi	74.88 n
70B	27.19 a-f	20.40 d-h	23.80 b-f	77.02 a-g	74.71 i	63.39 op	56.10 i	59.75 n-o
105g	27.69 a-f	20.00 f-h	23.85 b-f	75.43 a-g	79.74 e-h	65.20 op	56.63 i	58.91 n-o
36	23.10 a-f	27.00 a-f	25.05 a-f	70.20 c-g	68.50 n	55.39 op	53.80 i	54.59 o
106i	20.77 f	24.20 b-h	22.40 c-f	70.83 b-g	78.57 f-i	50.59 o	55.33 i	52.96 o
110B x 72	25.29 a-f	17.00 h	21.15 e-f	75.76 a-g	80.56 d-f	170.83 c-f	124.95 e-f	147.89 c-i
x 27	24.50 a-f	25.00 b-h	24.75 a-f	78.05 a-g	82.64 cd	189.35 a-c	141.07 a-f	165.21 bc
x 101	26.50 a-f	20.00 f-h	23.25 c-f	83.29 ab	77.88 f-j	197.47 ab	147.23 a-f	172.35 ab
x 70B	26.40 a-f	28.40 a-d	27.40 a-b	73.74 a-g	83.72 bc	163.75 d-g	133.89 b-f	148.82 c-i
x 105g	29.55 a-f	22.60 c-h	26.08 a-f	72.92 a-g	77.72 g-k	185.21 a-d	127.82 c-f	156.52 b-f
x 36	30.00 ab	29.15 a-c	29.58 a	57.26 h	79.60 e-h	133.91 h-m	131.42 b-f	132.67 h-l
x 106i	23.80 a-f	24.00 b-h	23.90 b-f	75.96 a-g	78.04 f-j	169.20 c-f	123.70 e-f	146.45 d-i
72 x 27	22.00 d-f	24.00 b-h	23.00 c-f	76.19 a-g	77.53 h-k	132.79 h-m	146.83 a-f	139.81 f-j
x 101	22.57 b-f	26.30 a-f	24.43 a-f	72.80 a-g	77.76 g-k	114.14 m-n	124.49 e-f	119.32 k-l
x 70B	22.04 c-f	23.52 b-h	22.78 c-f	73.57 a-g	80.43 d-g	155.57e-h	127.59 d-f	141.58 f-j
x 105g	21.00 f	21.06 c-h	21.00 e-f	66.17 g-h	83.19 b-c	137.40 h-m	153.48 ab	145.44 d-i
x 36	25.00 a-f	31.12 ab	28.00 a-c	69.84 d-g	81.57 c-f	140.84 h-l	123.62 e-f	132.23 i-l
x 106i	20.95 f	19.00 f-h	19.98 f	68.74 f-g	78.11 f-i	119.69 i-m	113.90 f-g	116.79 i
27 x 101	21.30 f	24.13 b-h	22.72 c-f	82.93 a-c	76.59 i-k	150.94 f-j	134.45 b-f	142.69 f-j
x 70B	23.50 a-f	23.20 b-h	23.35 b-f	79.23 a-f	85.25 ab	144.70 g-k	139.55 a-f	142.12 f-j
x 105g	27.90 a-f	20.00 f-h	23.95 b-f	74.23 a-g	86.56 a	177.16 b-e	125.62 e-f	151.39 c-h
x 36	21.00 f	22.10 c-h	21.55 d-f	75.90 a-g	79.24 e-i	121.59 k-m	139.76 a-f	130.67 i-l
x 106i	24.97 a-f	23.00 b-h	23.99 b-f	73.13 a-g	75.40 j-l	133.91 h-m	141.30 a-f	137.61 j-k
101 x 70B	29.90 ab	22.89 c-h	26.39 a-f	73.78 a-g	79.84 e-h	171.65 c-f	151.65 a-d	161.65 b-d
x 105g	30.70 a	22.00 c-h	26.35 a-f	72.58 a-g	83.40 b-c	175.56 b-e	151.98 a-c	163.77 b-d
x 36	24.00 a-f	26.50 a-f	24.95 a-f	69.54 f-g	79.37 e-h	114.64 mn	135.84 b-f	125.24 j-l
x 106i	23.90 a-f	26.00 b-g	21.30 a-f	82.35 a-d	79.88 f-h	205.31 a	162.21 a	183.76 a
70B x 105g	22.47 b-f	20.12 f-h	28.90 e-f	71.16 b-g	78.88 f-i	165.03 d-f	155.04 ab	160.03 b-f
x 36	24.00 a-f	33.80 a	27.10 ab	72.28 a-g	80.12 d-h	128.41 f-m	124.62 e-f	126.52 j-l
x 106I	29.80 a-c	24.40 b-h	24.42 a-d	73.18 a-g	81.47 c-f	149.67 f-j	132.95 b-f	140.86 f-j
105g x 36	21.46 f	27.37 a-f	24.42 a-f	81.07 a-f	80.31 d-g	166.89 c-g	145.41 a-e	156.12 b-g
x 106I	26.37 a-f	23.50 b-h	24.94 a-f	67.65 a	78.30 f-i	126.46 j-m	135.85 b-f	131.16 i-l
36 x 106I	21.00 f	21.30 c-h	21.15 e-f	67.65 f-h	75.28 k-l	134.52 h-m	125.15 e-f	129.83 i-l
TWC 310	29.40 a-c	25.00 b-g	26.96 a-f	79.33 af	80.84 d-g	126.51 i-m	118.71 f-g	122.61 j-l
S.C. 10	27.92 a-f	24.00 b-h	25.96 a-f	80.00 af	80.84 d-g	149.85 fj	154.04 ab	151.94 c-h
G2	30.45 a-c	25.46 b-g	27.95 ab	76.18 a-g	79.51 f-h	114.03 lm	101.19 gh	107.61 lm

Generally, the inbred lines manifested narrow leaf angles and their leaf angles are close to each other. The parental inbred lines 110B and 70 B gave the lowest mean values for leaf area. While, the parental inbred line 101H had the highest mean value for leaf area.

The parental lines 105g and 106i behaved as the latest for tasseling and silking dates. Meanwhile, the parental inbred lines 27 and 101 H behaved as the earliest inbreds in both seasons as well as the combined analysis.

The parental inbred lines 70 B gave the lowest mean values for ear and plant height in both seasons. However, the parental inbred line 110B had the highest mean values for both traits.

The parental line 72 had the highest mean value for ear hudk, but without significant superiority over those of inbred lines 27, 70 B and, 105g. However, the parental inbred line 101H had the lowest one for this trait.

The parental inbred lines 110B and 101H gave the highest number of row/ ear. However, this inbred line 36 had the lowest one for this trait. While, the parental inbred lines 72 and 36 gave the highest mean values for number of kernels per row. However, the inbred lines 27 and 106i expressed the lowest ones for this trait.

The parental inbred lines 110B, 72 and 36 recorded heavier 100 kernel weight. However, both inbred lines 27 and 106i showed the lowest ones. Also, the parental inbred lines 72 and 36 had the highest mean values for ear length. While, the parental inbred lines 110B, 27 and 105g gave the highest shelling percentage .

The parental inbred line 110B was the first in grain yield per plant and the inbred line 101H was the second one for grain yield per plant.

Hybrid mean squares were significant for all cases except number of rows per plant in the second season and the combined analysis, number of kernels per row, ear length, ear diameter, tasseling date, and stem diameter (Table 6), revealing overall differences between these hybrids. Significant interaction between F_1 hybrids and seasons were detected for al traits except number of rows per ear, indicating that these hybrids behaved some what differently from season to another. For the exceptional trait, insignificant mean squares for interaction between hybrids and season was detected, revealing that the hybrids were suspected to environmental change by nearly similar magnitude.

Mean performance of parental inbred lines and their F_1 hybrids SC 10, TWC 310 and Giza 2 at each season as well as the combined over both season as well as the combined over both season are presented in Table (7). The crosses were earlier in flowering than parents, a favrourable situation only if the goal is to develop early maturity hybrids to avoid damage by borers or other environmental adverse conditions. The parental combinations that incorporated earliness in silking and tasseling dates are plants of those F_1 hybrids 101 H x 72, 72 x 27 and 27 x 101 H.

The choice between taller plants with highest ear and shorter plants with reduced ear height depends on the breeder objective. All F_1 combinations manifested taller plants with high- set ears on the culm. Exceptions are those crosses 110 B x 105 g and 105 g x 106i. Also, the crosses 110B x 70B, 110B x 101H, 110B x 36, 110B x 105g and 105g x 106i gave the lowest mean values of ear height.

The highest values for leaf area were recorded by crosses 110B x 72, 110B x 70B, 110B x 106i, 72 x 70B, 72 x 106i, 27 x 101H, 27 x 70B, 27 x 36, 101H x 70B, 101H x 105g, and 105g x 106i and SC 10 in the combined analysis. The high values for leaf area is the important trait to obtain the high grain yield. The lowest value for this trait was recorded by hybrid 27 x 106i.

A narrow leaf angle (upright leaf) is preferable than wide lead angle and this character was manifested by some of the hybrids. Indeed, all F_1 hybrids had greater leaf angle than inbreds. The two best combinations 27 x 36 and 36 x 106i reflected leaf angle similar to either parents and they are not even compatible with the best inbred 105g that had a leaf angle of (18.88).

The highest values for stem diameter were detected in crosses 72 x 27 and 10B x 72. The high value for stem diameter is the most important trait for lodging resistance in maize.

The two crosses 110B x 105g, 110B x 36 as well as TWC 310 and SC 10 gave the highest ear diameter in the first season. Also, the previous hybrids and cross 101H x 106i and Giza 2 gave the highest ear diameter in the combined analysis.

The two hybrids 101H x 106i and 105g x 36 had the highest number of ears per plant in the combined analysis. Twenty five hybrids gave the high mean values for number of rows per ear in the combined analysis. The highest number of rows per ear was recorded by cross 101H x 106i followed by cross 27 x 101H.

The cross 110B x 105g had the highest number for kernels per row in the combined analysis. Also, the three crosses 110B x 72, 110B x 106i, 72 x 70B as well as the TW 310 gave high number of kernels per row in the combined analysis.

Non of the hybrids had significantly superiority over the check varieties for shelling percentage. While, the three crosses 27 x 70B, 101H x 106i and 105g x 106i gave insignificant superiority over the check varieties for this trait.

Both crosses 110B x 36 and 70B x 105g gave the highest mean values for 100- kernel weight in the combined analysis.

For grain yield per plant, the six hybrids 101H x 106i, 101H x 105g, 27 x 105, 110B x 105g, 110B x 101H and 110B x 27 had significant superiority over the check varieties in the first season. Non of the hybrids had significant superiority over the check varieties in the second season. While, the cross 10H x 106i gave the highest grain yield per plant in the second season. In the combined analysis, the two crosses 110B x 101H and 101H x 106i had significant superiority over the check varieties (Table 7). The fluctuation of hybrids from season to another were detected for most traits. These results would be due to significant of interaction between hybrids as season (Table 6).

Heterosis:

Mean squares for parents vs. hybrids as an indication to average heterosis over all crosses was significant for all traits except 100-kernel weight in both seasons as well as the combined analysis, and stem diameter and shelling percentage in the second and first season, respectively (Table 6). F_1 mean values were significantly higher than parental means for all traits.

Insignificant interaction mean squares between parents vs. crosses and season were detected for all traits except for ear diameter, tasseling date, silking date , ear husk and grain yield per plant. This results indicated that the heterotic effects were not affected by seasonal changes. For the exceptional traits significant interaction mean squares were detected for parents vs. crosses by season, revealing that the heterotic effects were not affected by seasonal changes.

Heterosis expressed as the percentage deviation of F_1 performance from its mid- parents value and better parent average value for all traits studied at both seasons and an average over the two seasons are presented in Table (8).

For tasseling and silking dates, the hybrids tended to deviate towards earliness in both seasons. Earliness, if found in corn is

Table (8): Percentage mid parent heterosis (MP) better parent (BP) in season 1995 and 1996.

Traits	Tasseling date						Silking date					
	MP			BP			MP			BP		
Crosses	S_1	S_2	Comb.	S_1	S_2	Comb.	S_1	S_2	Comb.	S_1	S_2	Comb.
110B x 72	-12.75**	-5.37*	-9.07**	-12.75**	3.65	-9.87**	-11.06**	-9.14**	-10.10**	-8.41**	-7.35**	-10.52**
x 27	-9.46**	1.04	-4.25**	-9.23**	1.56	-4.37*	-10.26**	6.27**	-2.20*	-8.29**	8.72**	-4.30
x 101H	-7.85**	2.60	-2.70	-7.14**	2.60	-3.06	-7.47**	1.49	-3.06**	-4.48*	3.03*	-5.25
x 70B	-8.91**	-2.05	-5.49**	-8.67**	-0.52	-6.32**	-7.73**	0.24	-3.77**	-4.50*	0.49	-5.25
x 105g	-8.23**	-1.25	-4.75**	-6.12**	2.60	-7.51	-9.39**	-1.99	-5.66**	-8.96**	1.47	-6.97**
x 36	-8.31**	2.58	-2.93*	-7.14**	3.65	-4.02	-10.43**	-0.48	-5.49**	-9.14**	1.47	-5.71**
x 106i	-8.82**	-5.34*	-7.09**	-7.65**	-3.13	-8.71**	-9.13**	-6.70**	-7.93**	-8.92*	-4.41**	-8.89**
72 x 27	-14.58**	-4.33	-9.44**	-14.36**	-3.09	-10.12**	-9.58**	-2.70**	-6.14**	-8.90*	1.54	-7.72**
x 101H	-8.86**	-1.79	-5.34**	-8.16**	0.00	-5.82**	-5.71**	0.00	-2.83**	-5.47**	3.54**	-4.58
x 70B	-11.96**	-2.77	-7.34**	-11.43**	-2.53	-7.34**	-8.46**	-2.16*	-5.25**	-8.00**	-0.49	-6.27**
x 105g	-11.72**	-4.93*	-8.30**	-9.39**	-3.02	-10.19**	-9.18**	-4.65**	-6.87**	-6.93**	-3.30**	-8.60**
x 36	-14.86**	0.76	-7.07**	-13.77**	1.53	-7.30**	-11.22**	-2.36*	-6.71**	-9.90**	-2.36*	-7.38**
x 106i	-6.30**	-3.00	-4.64**	-5.10*	-2.51	-5.47*	-5.06**	-4.23**	-4.64**	-2.47	-3.77**	-6.08**
27 x 101H	-11.67**	-3.63	-7.69**	-10.77**	-3.13	-7.92**	-8.37**	-0.76	-4.63**	-7.46**	0.00	-4.74**
x 70B	-15.82**	1.02	-7.40**	-15.39**	2.06	-8.10**	-10.12**	4.00**	-3.11**	-9.00**	6.67**	-3.70*
x 105g	-15.00**	-4.24	-9.61**	-12.82**	-1.03	-12.13**	-10.79**	-1.21	-6.02**	-9.27**	4.62**	-9.29*
x 36	-8.59**	-4.62*	-6.62**	-7.18**	-4.12	-7.55**	-7.51**	-4.18**	-5.85**	-6.83**	0.00	-8.10**
x 106i	-8.08**	-2.79	-5.45**	-6.67**	-1.03	-6.97*	-7.18**	-0.73	-3.99**	-5.37**	4.10**	-7.02
101H x 70B	-8.58**	-3.08	-5.85**	-8.12**	-1.56	-6.32**	-5.24**	0.25	-2.49**	-5.00*	2.02	3.21*
x 105g	-9.90**	-0.25	-5.11**	-8.54**	3.65	-7.52	-6.54**	-0.48	-3.50**	-3.98	4.55**	-6.97
x 36	-17.99**	-2.06	-10.15**	-17.58**	-1.04	-10.82**	-13.94**	-1.95	-7.94**	-12.44**	1.52	-10.24**
x 106i	-12.50**	-3.31	-7.94**	-12.06**	-1.04	-9.20**	-10.15**	-1.94	-6.05**	-7.46**	2.02	-9.13*
70B x 105g	-8.96**	-2.72	-5.82**	-7.11**	-0.51	-7.76*	-6.80**	-1.66	-4.19**	-4.00	1.46	-6.31
x 36	-13.07**	0.51	-6.31**	-12.18**	1.02	-6.54**	-8.33**	-2.16*	-5.21**	-6.50**	-0.49	-6.91**
x 106i	-3.69*	-2.76	-3.22*	-2.71	-2.02	-4.07	-3.15**	-1.19	-2.16**	0.00	0.98	-4.68
105g x 36	-10.35**	-5.21*	-7.78**	-9.45**	-2.55	-9.46**	-8.10**	-3.26**	-5.65**	-7.21**	-1.89	-6.73**
x 106i	-8.87**	-1.96	-5.41**	-7.96**	-0.50	-6.54**	-8.24**	-3.70**	-5.95**	-8.02**	-2.80*	-6.27**
36 x 106i	-10.45**	-3.78	-7.13**	-10.45**	-2.55	-7.71**	-9.26**	-3.76**	-6.49**	-8.17**	-3.30**	-7.25**

* and ** significant at 0.05 and 0.01 levels of probability, respectively.

Table (8): Cont.

Traits	Ear height (cm)				Plant height (cm)				Leaf area (cm^3)			
	MP		BP		MP		BP		MP		BP	
Crosses	S_1	S_2	S_1	S_2	S_1	S_2	S_1	S_2	S_1	S_2	S_1	S_2
110B x 72	99.61**	66.25**	114.64**	91.18**	89.11**	90.48**	122.12**	126.16**	85.08**	16.27**	77.83**	13.33**
x 27	61.16**	49.25**	66.26**	50.19**	59.48**	69.54**	65.98**	77.14**	31.99**	47.58**	15.94**	36.30**
x 101H	75.23**	70.77**	94.68**	97.18**	81.18**	94.72**	121.11**	135.65**	29.54**	-1.82	12.62**	-7.74**
x 70B	93.27**	80.23**	147.29**	141.39**	100.49**	90.25**	179.67**	152.10**	74.80**	30.13**	73.45**	29.15**
x 105g	87.31**	67.25**	114.52**	99.84**	61.62**	63.45**	86.40**	86.43**	45.17**	8.77**	29.49**	2.45**
x 36	63.01**	49.78**	65.14**	57.63**	96.42**	62.00**	160.47**	72.19**	59.49**	-10.56**	42.09**	-16.03**
x 106i	76.66**	89.79**	100.68**	124.87**	96.37**	92.29**	152.34**	138.26**	57.92**	26.38**	54.64**	16.98**
72 x 27	80.78**	65.72**	100.99**	84.24**	64.53**	85.94**	84.88**	110.25**	38.39**	54.43**	26.01**	46.11**
x 101H	103.28**	109.52**	109.57**	115.46**	113.33**	105.76**	120.57**	109.19**	39.55**	15.64**	25.71**	6.10
x 70B	148.61**	121.16**	192.72**	160.40**	139.26**	120.30**	178.33**	142.39*	83.45**	19.86**	77.60**	17.70**
x 105g	113.61**	105.69**	126.59**	118.20**	106.45**	110.67**	106.55**	111.06**	59.24**	-6.40**	47.36**	-13.93**
x 36	87.38**	102.37**	98.75**	114.64**	155.33**	80.83**	184.01**	78.72**	60.88**	0.69	48.67**	-7.69*
x 106i	106.05**	100.35**	116.91**	110.91**	132.17**	113.13**	151.17**	121.16**	93.28**	-1.00	89.57**	-10.49**
27 x 101H	94.81**	70.26**	123.97**	95.21**	90.77**	87.91**	122.45**	116.43**	38.85**	21.02**	37.20**	5.59
x 70B	115.98**	95.48**	187.01**	159.72**	115.46**	89.45**	186.00**	138.19**	53.62**	34.87**	35.85**	25.43**
x 105g	73.60**	83.95**	105.93**	118.20**	87.22**	93.53**	106.70**	110.55**	25.29**	21.31**	23.11**	6.07
x 36	77.08**	78.28**	85.16**	86.41**	96.73**	76.55**	148.62**	79.47**	59.55**	3.62	56.99**	-9.66**
x 106i	75.52**	96.01**	106.46**	130.56**	82.24**	96.06**	123.39**	131.01**	30.26**	-10.03	16.55**	-22.58**
101H x 70B	139.43**	146.54**	172.43**	181.32**	160.46**	117.96**	192.00**	135.60**	74.88**	-2.70	53.05**	-9.20**
x 105g	130.10**	116.34**	136.55**	122.97**	120.77**	99.74**	121.84**	99.72**	35.73**	21.44**	31.81**	21.14**
x 36	86.79**	84.56**	104.60**	101.63**	126.18**	104.19**	142.77**	104.73**	18.64**	2.84	15.37**	2.94
x 106i	108.24**	110.72**	112.50**	115.57**	139.55**	126.14**	150.29**	130.72**	28.43**	7.85**	13.70**	6.12**
70B x 105g	142.54**	132.44**	167.76**	155.61**	158.81**	94.20**	169.69**	122.16**	62.87**	3.10	46.29**	-3.58
x 36	123.53**	100.69**	181.56**	109.28**	164.32**	95.54**	167.00**	141.09**	50.63**	18.85**	35.12**	10.80**
x 106i	137.14**	111.80**	162.90**	165.01**	156.23**	128.44**	161.84**	141.75**	51.27**	3.59	49.27**	-4.77
105g x 36	100.26**	96.54**	126.07**	121.87**	131.27**	87.78**	161.85**	100.74**	44.68**	-11.56**	44.89**	-11.86**
x 106i	68.87**	111.41**	70.10**	109.87**	127.54**	91.12**	150.47**	105.80**	66.26**	1.18	51.13**	-0.68
36 x 106i	133.13**	95.55**	161.05**	118.98**	158.23**	82.21**	159.98**	110.72**	44.68**	-13.79**	31.34**	-15.09**

* and ** significant at 0.05 and 0.01 levels of probability, respectively.

Table (8): Cont.

Traits	Leaf angle				Stem diameter				No. of ears/ plant					
	MP		BP		MP		BP		MP			BP		
Crosses	S_1	S_2	S_1	S_2	S_1	Comb.	S_1	Comb.	S_1	S_2	Comb.	S_1	S_2	Comb.
110B x 72	20.47	-13.52**	24.07	-7.03	4.72	5.37	3.01	5.48	6.31	26.67**	16.47*	5.96	26.67*	16.32*
x 27	20.64	-15.64**	22.93	-8.03	13.86*	7.73	4.32	2.53	32.89**	13.33	23.13**	32.45*	13.33	22.96**
x 101H	19.42	-18.66**	26.88	-14.42**	-11.81*	-5.98	-14.19	-8.15*	26.25*	40.00**	33.11**	25.83	40.00**	32.94**
x 70B	34.69**	-10.60**	35.38**	-7.67	-1.83	-1.16	-9.19	-4.83	26.25*	0.00	13.15	25.83	0.00	12.99
x 105g	18.17	20.13**	28.86	41.35**	0.57	6.10	-3.78	0.43	6.31	9.68	8.02	5.96	6.25	6.80
x 36	33.45**	13.02**	40.43**	27.89**	-4.35	0.37	-10.81	-2.89	-2.12	-1.81	-1.96	-3.54	-3.54	-2.91
x 106i	35.89**	15.61**	40.99**	39.41**	11.28*	2.49	1.35	1.70	22.19*	-9.68	15.94*	18.75	6.25	13.21
72 x 27	25.44*	13.54**	31.71*	15.09**	-5.87	-0.27	-15.03*	-4.86*	26.67*	13.33	20.00**	26.67**	13.33	20.00*
x 101H	36.03*	8.61*	49.08**	10.03*	-9.90*	10.99	-13.73*	8.70*	6.67	0.00	3.33	6.67	0.00	3.33
x 70B	11.73	18.74**	14.50	28.72**	-4.88	-0.83	-13.33*	-4.28	20.00	20.00*	20.00**	20.00	20.00	20.00*
x 105g	39.02**	-10.02*	56.49**	-2.01	5.48	9.66	-0.65	4.06	40.00**	-3.26	18.03*	40.00**	-6.25	16.51*
x 36	29.39*	21.07**	40.41*	27.02**	9.32	5.49	-0.39	2.32	17.84	24.39**	21.11**	15.76	22.19*	19.74*
x 106i	34.73**	17.61**	37.68**	30.98**	-1.97	0.18	-12.03	-0.78	21.94*	29.03**	25.48**	18.13	25.00*	22.33**
27 x 101H	43.10**	6.82	49.08**	6.90	6.38	11.07	0.00	8.45	6.67	13.33	10.00	6.67	13.33**	10.00
x 70B	10.04	19.75**	12.69	26.30**	15.66*	-2.18	14.47	3.29	20.00	33.33**	26.67**	20.00	33.33**	26.67**
x 105g	-40.19**	39.05**	49.84**	49.26**	16.56**	13.70	11.39	13.06	20.00	22.58*	21.31**	20.00	18.75*	19.74*
x 36	14.91	-13.22**	18.41	-10.17	9.87	4.72	12.01	3.10	17.84	17.84*	17.84*	15.76	15.76	16.51
x 106i	43.87**	9.29*	52.91**	20.00**	0.82	-2.47	0.16	-8.12	-3.23	22.58*	9.68	-6.25	18.75*	6.92
101H x 70B	33.66**	1.21	42.75**	6.60	-0.08	0.58	5.56	-0.61	13.33	13.33	13.33	13.33	13.33	13.33
x 105g	41.33**	41.22**	44.84**	57.15**	4.65	10.19	6.51	7.01	6.67	9.68	8.20	6.67	6.25	6.80
x 36	57.48**	13.09**	58.57**	21.11**	3.43	2.30	-1.00	1.60	4.75	17.84*	11.29	2.89	15.76	10.03
x 106i	32.09**	26.87**	45.98**	44.31**	3.98	2.41	-2.86	-0.99	29.03*	61.29**	45.16**	25.00	56.25**	41.51**
70B x 105g	54.91**	7.62	69.82**	22.18**	8.81	12.14	12.88	10.25	46.67	6.45	26.23**	46.67	3.13	24.60**
x 36	13.59**	-4.98	20.40	3.80	5.44	3.07	6.36	2.71	24.39*	-1.80	11.29	22.19	-3.54	10.02
x 106i	19.02	20.24**	20.62	39.81**	6.39	-2.33	6.13	-6.92	3.23*	41.94**	22.58**	0.00	37.50*	19.50*
105g x 36	32.24**	24.86**	33.60*	-29.30**	5.17	10.69	2.37	8.37	37.48**	20.44**	28.82**	35.05*	18.75	29.45**
x 106i	20.31	35.13**	53.20**	38.04**	7.48	-0.53	2.07	-6.78	-3.23	6.25	1.59	-.25	6.25	.63
36 x 106i	-4.42	15.56**	-4.73	22.35**	74.68**	39.38**	70.31**	33.48	39.46**	7.77	23.61**	37.50**	6.25	22.64

* and ** significant at 0.05 and 0.01 levels of probability, respectively.

Table (8): Cont.

Traits	Husk of ear (cm)						Ear length (cm)					
	MP			BP			MP			BP		
Crosses	S_1	S_2	Comb.	S_1	S_2	Comb.	S_1	S_2	Comb.	S_1	S_2	Comb.
110B x 72	39.18	-4.85	17.24	29.53	-25.76*	1.89	28.60**	25.19*	31.93**	11.72	15.81	13.65
x 27	11.32	-11.11	-0.11	-6.38	-24.53*	10.0	62.72**	57.16**	59.77**	58.77**	52.55**	59.76**
x 101H	36.74	-40.00*	-1.60	-28.24	-43.24**	-6.74	70.12**	34.01*	51.14**	55.82**	31.43*	44.04**
x 70B	26.23	31.25**	29.03**	24.35	6.78	14.91	68.70**	31.77*	48.67**	62.03**	27.19*	43.61**
x 105g	65.57**	-17.58	22.17*	54.19**	-30.56**	17.9	77.11**	35.96**	53.80**	75.46**	26.38*	48.62**
x 36	17.65	11.63	14.59	9.62	-2.04	3.53	31.80**	32.58*	31.17**	9.50	25.78*	17.82*
x 106i	112.22**	67.09**	89.94**	102.59**	57.14**	80.43**	41.01**	33.97**	37.32**	27.14*	29.89*	29.14*
72 x 27	72.19**	-25.21**	23.50	54.21*	-32.58	10.27	2.43	42.29**	21.78**	30.85*	28.09*	26.74**
x 101H	83.45**	-29.29**	26.23	81.95**	-46.97**	-16.72	-9.72	30.52*	9.73	-21.65*	22.97*	-0.98
x 70B	44.27*	-40.80**	-2.07	36.18	-43.94**	-3.48	25.05*	29.83*	27.43**	4.10	24.24*	13.45
x 105g	84.62**	-26.67**	27.17	60.59**	-33.33**	16.92	10.14	22.47*	16.52*	-11.86	21.84	3.76
x 36	84.73**	-33.91**	24.02	61.07**	-42.42**	10.88	4.81	29.53*	16.32**	0.83	26.13*	12.57
x 106i	30.78	-14.82	7.97	16.61	-30.30**	-6.93	9.53	28.19*	18.53**	-3.52	22.13**	8.38
27 x 101H	49.90*	46.51**	48.10**	34.91	18.87	25.78*	44.70**	44.98**	44.84**	35.60**	38.10**	37.47**
x 70B	70.64**	-28.57**	21.08	60.95**	-32.20**	11.80	42.54**	44.95**	43.82**	40.21**	35.94**	38.35**
x 105g	40.23*	-19.63*	7.22	36.31	-20.37	7.47	68.59**	29.40*	46.89**	63.00**	17.02	41.35
x 36	3.51	9.80	6.91	0.67	5.66	3.97	44.41**	42.15**	43.30**	22.45*	31.11*	27.25**
x 106i	18.06	3.16	10.18	17.79	-7.55	3.77	31.29**	43.69**	37.63**	21.07	35.35**	28.90**
101H x 70B	37.54	-10.87	10.26	30.84	-30.51**	-6.83	38.57**	22.72	30.24**	31.90**	20.74	32.71**
x 105g	20.94	-35.63**	-8.79	6.15	-48.15**	-23.40*	55.83	41.57**	48.03**	41.52**	34.04**	46.47**
x 36	75.80**	-7.32	33.33**	54.36**	-22.45	11.36	16.91**	31.95*	24.24**	4.98	27.56*	16.25**
x 106i	18.03	76.00**	46.78**	6.01	57.14**	27.05*	48.62**	34.12**	41.26**	46.07**	32.56*	39.89**
70B x 105g	64.23**	-5.31	29.98*	50.84*	-9.32	12.47*	62.25**	12.08	33.93**	54.39**	7.79	34.42**
x 36	38.77*	-46.30**	-3.55	27.52	-50.85**	25.16*	35.47	40.27**	37.88**	16.46	37.78**	27.20**
x 106i	35.17	-50.50**	-7.66	27.21	-57.63**	-10.87*	-5.92**	37.50**	16.81*	-11.91	36.87**	13.95
105g x 36	0.62	-28.16**	-14.78	0.56	-31.48**	16.06*	42.74**	39.13**	40.85**	17.74	36.17**	29.98**
x 106i	13.53	-16.67	-1.59	10.62	-25.93	-7.52	51.11**	20.89	34.64**	35.12**	15.74	31.38**
36 x 106i	21.63	-40.66**	-10.19	18.57	-44.90**	-14.42	20.48	19.09	19.81*	9.80	16.44	13.63

* and ** significant at 0.05 and 0.01 levels of probability, respectively.

Table (8): Cont.

Traits	Ear diameter (cm)				No. of kernels/ row					
	MP		BP		MP			BP		
Crosses	S_1	S_2	S_1	S_2	S_1	S_2	Comb.	S_1	S_2	Comb.
110B x 72	99.85**	34.54**	98.50**	31.25**	23.67**	22.51**	23.11**	20.35*	18.30*	19.45*
x 27	69.18**	26.46**	67.66**	23.96*	25.89**	41.45**	33.38**	15.71	28.97**	22.14*
x 101H	117.39**	41.80**	113.86**	40.10**	17.83	34.21**	25.62**	16.11	28.22**	21.98*
x 70B	113.58**	17.12	113.41**	15.63	23.07*	28.06**	25.54**	18.72	26.54**	24.02*
x 105g	134.59**	49.06**	131.45**	49.46**	35.38**	33.84**	34.63**	30.40**	33.49**	31.92*
x 36	134.25**	5.40**	127.99**	42.71**	-1.75	9.31	3.95	-3.02	-1.47	-0.95
x 106i	98.16**	28.43**	96.65**	28.50**	46.34**	29.61**	37.89**	28.28**	24.18**	26.23*
72 x 27	102.55**	38.22**	102.10**	37.86**	1.31	34.71**	17.45**	-9.17	19.01*	4.56
x 101H	111.47**	40.23**	109.44**	38.80**	-10.18	31.16**	9.52	-13.93	21.20*	3.18
x 70B	109.09**	35.21**	107.52**	33.74**	15.91	32.38**	24.09**	8.92	29.32**	18.86*
x 105g	106.12**	37.36**	104.75**	37.50**	2.08	15.12*	8.52	-4.22	10.88	3.14
x 36	94.40**	31.50**	90.48**	30.92*	-3.30	16.27*	6.80	-7.07	8.25	4.86
x 106i	113.58**	41.29**	110.53**	41.15**	19.41	18.47*	18.93**	2.26	9.77	5.92
27 x 101H	108.02**	35.51**	106.49**	34.75**	33.49**	47.11**	39.93**	24.38**	40.07**	30.11**
x 70B	105.59**	38.16**	103.59**	37.29**	24.32*	39.82**	31.98**	18.22	26.12*	22.24*
x 105g	108.64**	36.72**	107.72**	37.50**	28.64**	29.31*	28.97**	22.52*	18.18*	20.35*
x 36	68.99**	1.00	65.95**	1.03	26.57*	26.15*	26.35**	17.73*	4.78	11.24
x 106i	81.13**	28.49**	78.14**	28.96*	44.15**	48.52**	46.36**	36.84**	41.01**	38.17**
101H x 70B	89.05**	25.73**	85.84**	29.43**	9.61	30.52**	19.81**	7.28	23.28*	17.76*
x 105g	114.50**	40.29**	113.86**	42.19**	20.71*	37.51**	28.85**	17.95*	31.71**	27.85**
x 36	75.06**	25.67**	73.16**	25.13	2.69	8.14	5.46	2.50	-6.40	-2.28
x 106i	111.48**	42.12**	106.49**	43.75**	41.23**	29.64**	35.46**	25.40	29.26**	27.36**
70B x 105g	110.69**	29.85**	107.72**	31.51**	21.99*	16.72*	19.33**	21.79	15.03	18.41**
x 36	106.23**	27.29**	100.58**	26.65*	-1.69	18.38**	8.89	-3.96	7.87	2.48
x 106i	7.61	3.07	6.87	1.32	28.20*	38.81**	33.70**	16.04	31.48**	23.89**
105g x 36	116.53**	41.71**	113.56**	40.51**	19.43*	10.24	14.61*	16.49	-0.86	7.05
x 106i	106.09**	42.41**	104.75**	42.11**	33.71**	24.39**	28.91**	21.21*	19.48*	20.52*
36 x 106i	104.63**	26.46**	97.69**	27.08*	3.23	4.58	8.57	0.38	-9.25	-4.86

* and ** significant at 0.05 and 0.01 levels of probability, respectively.

Table (8): Cont.

Traits	No. of rows/.ear						Weight of 100- kernel (g)					
	MP			BP			MP			BP		
Crosses	S_1	S_2	Comb.	S_1	S_2	Comb.	S_1	S_2	Comb.	S_1	S_2	Comb.
110B x 72	69.65**	21.72*	43.01**	42.18**	0.00	18.53	-9.74	-31.23**	-19.81*	-9.81	-31.67*	-19.91*
x 27	49.42**	22.73**	34.95**	40.28**	6.93	21.59**	-5.97	17.48	4.57	-12.50	1.79	-5.53
x 101H	39.28**	8.22	22.40**	32.65**	6.19	21.01**	2.45	-12.97	-4.80	-5.36	-18.57	-11.96
x 70B	31.83**	21.74*	26.51**	20.06*	-2.97	7.20	-4.33	26.24*	9.44	-5.71	15.64	4.96
x 105g	49.51**	35.53**	42.11**	31.44*	4.95	16.64*	6.12	1.44	4.04	5.54	-7.98	-0.48
x 36	49.41**	28.24*	38.02**	25.12*	-1.98	9.97	17.42	13.07	15.24	7.14	7.96	12.88
x 106i	31.71**	16.28	23.81**	28.28**	-6.93	8.58	-2.40	-1.56	-1.98	-15.00	-2.28	-8.78
72 x 27	80.56**	52.20**	65.46**	59.83**	42.00**	51.04**	-15.63	11.94	-3.19	-21.54	-3.54	-12.21
x 101H	43.95**	35.68**	39.53**	16.00	13.17	14.61	-12.82	13.66	-0.32	-19.52	5.71	-7.45
x 70B	93.25**	59.26**	75.81**	76.15**	53.20**	71.89**	-20.19*	3.89	-9.34*	-21.40*	-5.47	-13.71
x 105g	83.26**	79.44**	81.29**	73.33**	66.28**	81.20**	-24.64*	-6.15	-16.39	-25.11*	-15.35	-20.34
x 36	96.45**	72.79**	84.02**	96.26**	57.43**	77.14**	-2.23	19.97	8.95**	-10.84*	15.26	6.29
x 106i	45.45**	73.53**	59.33**	24.60*	67.82**	49.30**	-14.16	-22.58	-18.38	-25.29	-23.63	-24.34
27 x 101H	49.14**	25.44**	36.74**	33.79**	11.11	21.95**	-10.95	22.49	4.15	-11.66	12.76	0.96
x 70B	56.94**	64.44**	60.70**	51.91**	48.00**	50.35**	-8.38	20.83	4.13	-13.57	13.73	-1.48
x 105g	65.32**	56.41**	60.85**	54.07**	36.00*	45.14**	7.72	5.26	6.68	0.76	0.00	0.63
x 36	53.85**	69.00**	61.59**	36.07**	44.67**	40.97**	-11.04	-1.78	-6.52	-12.90	-18.15	-13.97
x 106i	40.88**	57.73**	49.04**	35.67**	42.67**	44.97**	11.28	9.01	10.18	3.57	-4.96	6.70
101H x 70B	42.51**	36.16**	39.29**	24.21*	10.11	16.88*	17.44	9.52	13.87	9.97	12.21	11.37
x 105g	36.32**	32.35**	34.30**	14.92	3.91	9.21	19.41	6.28	13.55	10.87	2.80	10.74
x 36	38.45**	35.06**	36.70**	11.49	4.63	7.97	2.50	9.50	6.06	1.14	-1.85	0.80
x 106i	44.04**	37.45**	40.80**	33.79**	11.63	22.22**	7.42	14.04	10.77	0.72	7.44	10.89
70B x 105g	71.20**	70.24**	70.74**	64.62**	63.75**	64.86**	-18.11	-0.40	-10.60*	-18.85	-1.37	-10.53
x 36	84.12**	76.37**	80.33**	67.69**	66.67**	67.87**	-4.55	42.62**	18.33	-11.73	25.19*	15.37
x 106i	32.14**	49.16**	40.02**	23.33*	48.33**	34.59**	24.27*	9.42	17.11	9.60	0.83	14.35
105g x 36	88.71**	92.51**	90.57**	78.33**	88.99**	85.75**	-15.50	16.47	-0.13	-22.50	1.37	-2.54
x 106i	46.67**	75.71**	60.10**	32.00**	68.11**	48.23**	8.83	6.34	7.64	-4.78	-2.89	4.77
36 x 106i	64.33**	83.21**	73.21**	40.67**	72.23**	54.87**	-4.26	-16.80	-11.01	-9.09	-21.11	-15.57

* and ** significant at 0.05 and 0.01 levels of probability, respectively.

Table (8): Cont.

Traits	Shelling percentage				Grain yield/ plant 15.5 % (g)					
	MP		BP		MP			BP		
Crosses	S_1	S_2	S_1	S_2	S_1	S_2	Comb.	S_1	S_2	Comb.
110B x 72	-3.02	6.32**	-4.29	1.33	111.49**	62.32**	87.50**	79.21**	37.78**	59.01**
x 27	1.01	3.26**	0.89	3.95	145.64**	87.87**	117.14**	98.63**	55.57**	77.63**
x 101H	10.58	6.65**	8.06	-2.04	132.22**	77.70**	105.32**	107.15**	62.34**	85.31**
x 70B	-4.29	8.58**	-4.33	5.31**	106.33**	82.42**	94.85**	71.77**	47.64**	60.01**
x 105g	-4.37	-2.39	-5.39	-2.54	136.65**	73.54**	106.05**	94.29**	40.95**	68.28**
x 36	-24.79**	7.56**	-25.71**	0.12	77.71**	81.92**	79.77**	40.48**	44.92**	42.64**
x 106i	2.72	-1.26	-1.44	-1.84	131.91**	69.43**	100.66**	77.49**	36.40**	57.46**
72 x 27	-2.64	1.59	-3.74	-3.79	112.35**	139.21**	125.66**	100.51**	132.06**	115.95**
x 101H	-4.66	12.22**	-8.03	7.93**	61.94**	80.05**	70.91**	52.54**	65.95**	59.35**
x 70B	-5.79**	9.62**	-7.06	7.67**	140.04**	113.77**	27.44**	134.91**	101.66**	118.69**
x 105g	-14.39	9.61**	-16.40*	4.32**	115.65**	156.03**	135.23**	107.48**	142.59**	124.65**
x 36	-9.50	16.07**	-11.76	13.21**	131.63**	111.20**	121.61**	112.68**	95.39**	104.25**
x 106i	-8.34	3.72**	-13.16*	-0.59	104.93**	92.08**	98.45**	80.73**	80.02**	80.40**
27 x 101H	9.90	4.12**	7.19	-4.95**	125.98**	99.92**	112.91**	101.94**	79.23**	9.57**
x 70B	2.64	9.80**	2.41	5.81**	136.76**	141.44**	139.03**	54.93**	134.57**	137.90**
x 105g	-2.85	7.99**	-4.06	7.43**	195.17**	116.37**	156.43**	189.48**	111.17**	155.91**
x 36	-0.50	6.31**	-1.90	-1.66	112.89**	146.73**	129.74**	106.65**	134.93**	120.88**
x 106i	-1.31	-5.25**	-5.47	-6.43**	144.75**	146.13**	145.46**	127.59**	137.52**	132.60**
101H x 70B	-2.00	13.05**	-4.21	6.87**	148.53**	131.32**	140.15**	129.66**	102.16**	115.88**
x 105g	-2.57	14.02**	-3.29	4.58**	158.29**	130.90**	144.82**	134.89**	102.60**	118.71**
x 36	-6.50	17.55**	-7.52	15.86**	76.19**	110.92**	93.47**	53.38**	81.08**	67.26**
x 106i	14.07*	10.06**	11.96	1.64	227.63**	148.90**	187.49**	174.68**	116.23**	145.40**
70B x 105g	-6.64	2.14	-7.60	-1.09	164.91**	175.06**	169.73**	160.33**	173.79**	167.88**
x 36	-5.03	11.89**	-6.16	7.25**	116.22**	126.79**	121.30**	102.57**	122.13**	111.78**
x 106i	-1.01	6.30**	-4.99	3.69*	162.63**	137.00**	149.96**	136.10**	135.36**	135.79**
105g x 36	7.46	8.35**	7.48	0.71	186.20**	163.36**	175.09**	172.61**	156.78**	165.02**
x 106i	15.65*	-1.08	12.13	-1.81	126.26**	142.69**	134.48**	106.64**	139.91**	122.64**
36 x 106i	-7.35	2.38*	-10.04	-4.18**	153.88**	129.37**	141.44**	142.87**	126.20**	137.83**

* and ** significant at 0.05 and 0.01 levels of probability, respectively.

favourable for escaping destructive injuries caused by Sesamia cretica, Ledi chill simplec But, and Pyrausta nubilialis Hb.

For tasseling date, twenty eight hybrids in the first season and the combined analysis and five hybrids in the second season, expressed significant negative heterotic effects relative to mid- parent value. Also, twenty seven and twenty three crosses, exhibited significant negative heterotic effects relative to better parent in first season and the combined analysis, respectively.

For silking date, twenty eight, eleven and twenty eight crosses expressed significant negative heterotic effects relative to mid- parent value in the first, second season and the combined analysis, respectively. However, twenty four, six and nineteen hybrids exhibited significant negative heterotic effects relative to better- parent in the same order.

Significant negative heterotic effects for earliness was previously reported by Mohamed (1984), Kumar (1994), Shieh (1994), Altinbas (1996) and Motawea (1997). On the other hand, Beck *et al.* (1991) found that heterosis for days to silking was generally low.

For ear and plant heights, all hybrids expressed significant positive heterotic effects relative to mid- parent value or better parent in both seasons. Positive heterotic effects for ear height, was reahced by Mourad (1978), Mohmed (1984), Abo- Dheaf (1987) and Motawea (1997). Positive heterotic effects for plant height was reached by

Mohamed (1979), Nawar *et al.* (1980), Abd- El- Sattar (1992) and Motawea (1997), and Turgut *et al.*, (1995) .

For leaf angle, seventeen and eighteen hybrids exhibited significant positive heterotic effects relative to mid- parent value in the first and second seasons, respectively. While, nineteen and twenty hybrids gave significantly positive heterotic effects relative to better parent in the same order. However, one and four crosses expressed significant negative heterotic effects relative to mid- parent value in the first and second seasons, respectively. While, cross 110B x 101H had significant negative heterotic effects relative to better parent in the second season.

For leaf area, twenty eight and fourteen hybrids exhibited significant positive heterotic effects relative to mid- parent value in the first and second seasons, respectively. While, twenty eight and ten crosses had significant positive heterotic effects relative to better parent in the same order.

With respect to ear husk, the two crosses 110B x 106i and 101 H x 106i gave the desirable heterotic effects relative to mid- parent value or better parent in the combined analysis.

For number of ears/ plant, twelve, thirteen and seventeen hybrids expressed significant positive heterotic effects to mid- parent in the first, second season and the combined analysis over them, respectively. While, five, ten and fourteen hybrids from the previous crosses exhibited significant positive heterotic effects relative to better parent in the same order.

For ear length and ear diameter, number of rows/ ear, and number of kernels/ row, most parental combinations had significant positive heterotic effects relative to mid- parent or better parent in both seasons and the combined analysis over them.

Concerning ear diameter, twenty seven and twenty five hybrids had significant positive heterotic effects relative to mid- parent or better parent in the first season and combined analysis, respectively.

Significant positive heterotic effects for ear diameter was reached before by (Yasien, 1977; Mourad, 1978; Mohamed, 1979; and Motawea, 1997).

For number of rows/ ear, all hybrids exceeded significantly mid- parent value in both seasons and the combined analysis. While, twenty five , fifteen and twenty two crosses had significant positive heterotic effects relative to better parent in the first, second season as well as the combined analysis, respectively. These results are in agreement with the findings of Mohamed (1979), Nawar *et al.* (1980), Mohamed (1984) and Motawea (1997).

For number of kernels/ row, sixteen, twenty four, and twenty one hybrids had significant positive heterotic effects relative to mid- parent value in the first, second seasons as well as the combined analysis, respectively. Also, eleven, eighteen and seventeen hybrids had significant positive heterotic effects relative to better- parent in the same order. The cross 110H x 106i gave the highest desirable heterotic effects for this trait. Significant positive heterotic effects for number of kernels/ row was reached before by Yasien (1977), Mohamed (1979) and Motawea (1997).

For shelling percentage, the two crosses 101H x 106i and 105g x 106i in the first season and twenty one in the second one had significant positive heterotic effects relative to mid- parent value. While, twelve crosses gave significant positive heterotic effects relative to better parent in the second season.

Concerning grain yield per plant, all crosses significantly exceeded the respective mid- parent or better parent in each seasons as well as the combined analysis. The crosses 70B x 105g , 105g x 36, 27 x 105 g and 101 H x 106i had the most desirable heterotic effects for grain yield per plant. These hybrids exhibited heterosis for three of more of traits contributing grain yield. The heterotic magnitude, however, differed from season to another and from case to case. This finding agrees with general trend where the expression of heterosis for a complex trait could be explained on the basis of component interaction, as the numerical value recorded for a complex trait is always a function of its components. It could be concluded that these crosses would be efficient and prospective in corn breeding programs for improving grain yield per plant. Significant positive heterotic effects relative to higher yielding parent were also reached before by El- Rouby and Galal (1972), Beck *et al.* (1991), Kumar (1994), Mufti and Rao (1995) and Motawea (1997).

Heterosis of grain yield per plant expressed as the percentage deviation of F_1 mean performance from Giza 2, TWC 310 and SC 10 in both seasons as well as the combined analysis are presented in Table (9).

Nineteen, twelve, and twenty five crosses significantly outyielded (heterotic effects) Giza-2 in the first, second seasons as well as the combined analysis, respectively.

Seventeen, seven and seventeen hybrids significantly outyielded TWC 310 in the first , second as well as the combined analysis, respectively. The other crosses exhibited insignificant heterotic effects relative to TWC 310.

Eight and three hybrids expressed significantly positive heterotic effects (outyielded) relative to SC 10 in the first season as well as the combined analysis, respectively. Meanwhile, fourteen, nineteen and seventeen crosses had insignificant useful heterotic effects relative to SC 10 in the first, second as well as the combined analysis, respectively, revealing that a hybrid program based on these material would be useful after testing under different locations and years. The three crosses 110B x 101H, 101H x 105g and 101H x 106i outyielded the check SC 10 by 14.34 % in the combined analysis. Hence, it could be concluded that these crosses offer possibility for improving grain yield of maize. Many investigators reported high heterosis for yield in maize, i.e. Borov (1966), El- Rouby and Galal (1972), El- Hosary *et al.* (1990a), Abd-El- Sattar (1992) and Motawea (1997).

Table (9): Percentage of heterosis over check varieties Giza 2, T.W.C. 310 and S.C. 10 for grain yield.

Genotype	SC 10			T.W.C. 310			Giza 2		
	S_1	S_2	Comb	S_1	S_2	Comb	S_1	S_2	Comb
110B x 72	14.00*	-18.38*	2.26	35.03**	5.26	20.62**	49.81**	11.77	30.98**
x 27	26.36**	-7.85	9.07	49.67**	18.84	34.74**	66.05**	26.19*	46.32**
x 101	31.78**	-3.83	13.78*	56.09**	24.02*	40.57**	73.17**	31.70**	52.64**
x 70B	9.28	-12.54	-1.75	29.43**	12.79	21.38**	43.60**	19.77	31.81**
x 105g	23.60**	-16.51*	-3.33	46.40**	7.67	27.66**	62.42**	14.34	38.62**
x 36	-10.64	-14.15	-12.41*	5.85	10.71	8.21	17.43	17.56	17.50*
x 106i	12.91	-19.20*	-3.31	33.74**	4.20	19.44**	48.38**	10.65	29.71**
72 x 27	-11.38	-4.09	-7.70	4.96	23.68*	14.03*	16.45	31.34**	23.82**
x 101	-23.83**	-18.68*	-21.12**	-9.78	4.87	-2.68	0.10	11.36	5.68
x 70B	3.82	-16.66*	-6.53	22.97*	7.47	15.47*	36.47**	14.13	25.39**
x 105g	-8.31	0.25	-3.98	8.60	29.29*	18.62	20.50*	37.29**	28.81**
x 36	-6.01	-19.25*	-12.70*	11.33	4.14	7.85	23.51**	10.58	17.11*
x 106i	-20.13**	-25.60**	-22.90**	-5.40	-4.06	4.75	4.96	1.89	3.44
27 x 101	0.73	-12.17	-5.80	19.31*	13.26	16.38**	32.37**	20.27	26.38**
x 70B	-3.44	-8.84	-6.17	14.37**	17.55	15.91*	26.90**	24.83*	25.87**
x 105g	18.23**	-17.94*	-0.05	40.04**	5.82	33.47**	55.26**	12.37	34.08**
x 36	-18.86**	-8.71	-13.73	-3.89	17.73	6.58	6.63	25.02*	15.14*
x 106i	-10.64	-7.71	-9.15*	5.85	19.02	12.23	17.43	26.40*	21.88**
101 x 70B	14.55*	-0.94	6.72	35.68**	27.75*	31.84**	50.53**	35.66**	43.17**
x 105g	17.16*	-0.73	8.12**	38.77**	28.03*	33.57**	53.96**	35.95**	45.05**
x 36	-23.50**	-11.27	-17.32**	-9.39	14.43	2.15	0.54	21.51	10.92
x 106i	37.01**	5.96	21.13**	62.28**	36.64**	49.87**	80.05**	45.10**	62.75**
70B x 105g	10.13	1.27	5.65	30.45**	30.60**	30.52**	44.73**	38.69**	41.73**
x 36	14.31*	-18.60*	-16.47**	1.50**	4.98	3.19	12.61	11.48	12.05*
x 106I	-0.12	-13.79	-7.02	18.30*	11.23	14.89*	31.26**	18.12	24.75**
105g x 36	11.34	-5.02	3.08	31.87**	22.49	27.34**	46.31**	30.07**	38.28**
x 106I	-15.61**	-11.26	-13.41	-0.04	14.45	6.97	10.90	21.52	16.16
36 x 106I	-10.23	-18.25	-14.29**	6.33	5.42	5.89	17.97*	11.95	14.99*
X	149.85	153.09	151.47	126.51	118.71	122.61	114.03	111.79	112.91

* and ** significant at 0.05 and 0.01 levels of probability, respectively.

Prediction of double cross yield :

Prediction of double cross yield helps the plant breeder to choose the best double cross in hybrids maize program. Mohamed (1984) and others reported good correlation between the prediction and the actual double cross yield.

In this investigation 210 double crosses will be obtained. The results indicated that the best ten double crosses were : (110B x 101H)(106i x 105g), (110B x 70 B)(101H x 105g), (101H x 110 B)(105g x 106i), (101H x 110B)(106i x 105g), (70B x 101H)(105g x 110B), (101H x 110B)(70B x 106i), (101H x 110B)(106i x 27), (110B x 110H)(27 x 105g), (27 x 70B)(105g x 110B), and (110B x 36)(105g x 101H). These double crosses gave 169.1, 162.64, 162.63, 161.69, 161.24, 160.17, 159.52, 157.05, 156.36 and 152.56 (g) grain yield per plant in the combined analysis, respectively. However, SC 10 and TWC 310 gave 151.94 and 122.61 (g) of grain yield per plant in the combined analysis.

Hence, it could be concluded that these previous double crosses offer a possibility for increasing grain yield of maize. The single cross gave the highest grain yield was the best hybrid for using as females in production of double crosses.

Combining ability

F_1 generation :

The observed mean squares for combining ability in each season and their combined data for the studied traits are shown in Table (10). The mean squares associated with general combining ability (GCA) were significant for all the studied traits except ear length in the second season, number of ears/ plant , leaf angle and ear husk in the first season, and number of ears/ plant, number of kernels/ row and ear diameter in the combined analysis. Specific combining ability (SCA) variances were significant for all characters under study.

It is evident that nonadditive type of gene action was the more important part of the total genetic variability for ear length in the second season, number of ears per plant, leaf angle and ear hudk in the first season, and number of ears per plant, number of kernels per row and ear diameter in the combined analysis. For the other studied traits, both additive and non additive gene effects were involved in determining the performance of single cross progeny. Also, when GCA/ SCA ratio was used, it was found that grain yield per plant, number of rows per ear, ear length in both seasons as well as the combined analysis, plant height, ear height, leaf area and number of kernels per row in both seasons number of ears per plant, leaf angle and ear husk in the second season, ear length, ear diameter, tasseling date and silking date in the first season and ear length, tasseling date and ear husk in the combined analysis exhibited low GCA/ SCA ratios of less than unity, indicating the predominance of nonadditive

Table (10): Observed mean squares for general and specific combining ability in the F_1 generation.

S.O.V	d.f		Tasseling date (day)			Silking date (day)			Ear height (cm)		Plant height (cm)		Leaf area (cm^2)		Leaf angle	
	S1	Comb	S_1	S_2	Comb	S_1	S_2	Comb	S_1	S_2	S_1	S_2	S_1	S_2	S_1	S_2
G.C.A	7	7	7.61**	3.87*	9.14*	7.76**	6.94**	11.26**	140.14**	94.90**	172.8*	809.9**	5093.5**	2158.2**	8.2	2.99**
S.C.A	27	27	14.21*	2.40*	10.72*	9.46**	3.17	8.14**	1192.80**	1017.84**	5136.9**	3579.2**	19300.5**	7061.0**	17.7**	8.82**
G.C.A. x year		7			2.34			3.43**								
S.C:A x year		27			5.89*			4.49**								
Error	70	140	0.85	1.50	1.17	0.95	0.35	0.65	4.87	1.02	63.19	1.19	48.46	232.78	4.10	0.49
G.C.A/ S.C.A			0.54	1.61	0.85	0.82	2.19	1.38	0.12	0.09	0.03	0.27	0.26	0.31		0.34

* and ** significant at 0.05 and 0.01 levels of probability, respectively.
GCA and SCA : general and specific combining ability, respectively.

Table (10): Cont.

S.O.V	d.f		Stem diameter (cm)		No. of ears/ plant			Husk of ear (cm)			Ear length (cm)			Ear diameter (cm)	
	S1	Comb	S_1	Comb.	S_1	S_2	Comb	S_1	S_2	Comb	S_1	S_2	Comb	S_1	Comb.
G.C.A	7	7	0.29**	0.077**	0.005	0.016**	0.008	0.11	0.32**	0.29*	3.86**	1.01	3.51*	0.25*	0.22
S.C.A	27	27	0.08**	0.061**	0.256**	0.025**	0.034*	0.77*	0.73**	0.69**	9.51**	6.24**	12.78**	1.34**	0.68**
G.C.A. x year		7		0.003			0.012			0.14			1.35		0.26*
S.C.A x year		27		0.001			0.017*			0.81**			2.98*		0.82**
Error	70	140	0.011	0.03	0.009	0.005	0.007	0.18	0.07	0.13	1.25	1.56	1.40	0.11	0.12
G.C.A/ S.C.A			3.580	1.20		0.64			0.45	0.42	0.41		0.28	0.18	

* and ** significant at 0.05 and 0.01 levels of probability, respectively.
GCA and SCA : general and specific combining ability, respectively.

Table (10): . Cont.

S.O.V	d.f		No. of kernels/ row			No. of rows/ ear			Weight of 100 kernel (g)			Shelling percentage		Grain yield/ plant 15.5% (g)		
	S1	Comb	S_1	S_2	Comb	S_1	S_2	Comb	S_1	S_2	Comb	S_1	S_2	S_1	S_2	Comb
G.C.A	7	7	14.41*	10.08*	9.94	2.06**	3.57**	5.23**	13.98*	22.81**	14.72**	26.46*	22.54**	1221.94**	182.50*	1081.46*
S.C.A	27	27	18.37**	20.13**	32.64**	6.43**	5.31**	11.06**	7.97*	10.31*	10.28**	29.40**	14.62**	2065.10**	1305.88**	3156.83**
G.C.A. x year		7			14.55**			0.40			22.07**					322.99**
S.C.A x year		27			5.86			0.69			8.00					241.15**
Error	70	140	6.11	3.88	4.99	0.54	0.66	0.60	4.93	5.55	5.24	13.15	0.64	50.53	74.55	62.54
G.C.A/ S.C.A			0.78	0.50		0.32	0.07	0.47	1.75	2.21	1.43	0.76	1.54	0.59	0.14	.34

* and ** significant at 0.05 and 0.01 levels of probability, respectively.
GCA and SCA : general and specific combining ability, respectively.

gene effects for these traits. For 100- kernels weight in both seasons and the combined analysis, shelling percentage in both seasons, silking date in the second season as well as the combined analysis, stem diameter in the first season as well as the combined analysis and tasseling date in the second season, high GCA/ SCA ratios which exceeded the unity were detected, indicating that additive and additive x additive types of gene action were more important than non additive effects in controlling these cases. The genetic variance was previously reported to be mostly due to additive types of gene action for earliness (Sotcenko, 1970; Mohamed, 1979; Hassaaballa *et al.* 1980; Mohamed, 1984, Nawar and El- Hosary, 1985a, Salem *et al.* 1986; El- Hosary 1988(b and c); Badr, 1989; El- Hosary, 1989; Mahmoud, 1989; El- Hosary *et al.* 1990a; Abd El- Dattar, 1992; Nawar *et al.* 1995 (a and b), ear height (El- Hosary, 1986; Salem *et al.* 1986; Abo- Dheaf, 1987; El- Hosary, 1987; El- Hosay, 1988 (a and b); Badr, 1989; El- Hosary, 1989; El- Hosary *et al.* 1990a, Altinbas, 1996 and Motawea, 1997), Plant height (El- Hosary, 1985 and 1986; Salem *et al.* 1986; El- Hosary, 1987; El- Hosary, 1988 (a and b); El- Hosary *et al.* 1990a; Nawar *et al.* 1995 (a and b) and Motawea, 1997, leaf area (Abd- El- Sattar, 1992; and Nawar *et al.* 1995 (a and b), ear husk (El- Hosary, 1988a; El- Hosary *et al.* (1990a and Abd El- Sattar, 1992, stem diameter (Mahajan and Khehra, 1991), number of ears per plant (Abo- Dheaf, 1987; Mahmoud, 1989; El- Hosary *et al.* 1990a and Motawea, 1997; ear length, Salem *et al.* 1986; and El- Hosary *et al.* 1990a, for ear diameter (Mahmoud, 1989 and El- Hosary *et al.* 1990a), for number of rows per ear (Abo- Deaf 1987, Mahmoud, 1989; and

El- Hosary *et al.* 1990a), for number of kernels per row (Salem *et al.* 1986, and El- Hosary *et al.* 1990a), for 100 kernel weight (Salem *et al.* 1986; Mahmoud, 1989 and El- Hosary 1990a), for grain yield per plant (El- Rouby and Galal, 1972; Salem *et al.* 1986, and El- Hosary *et al.* 1990a).

The non additive genetic variance was previously reported to be most prevalent for earliness (El- Hosary, 1985 and 1988a and Reddy and Agrowal, 1992), ear height (Kalsy and Sharma, 1970; Mohamed, 1984; El- Hosary, 1985 and 1988a), leaf area (Mahajan and Khehra, 1991), ear husk (El- Hosary, 1985), ear length and ear diameter (Hajkhan, 1970), plant and ear height (Mourad, 1978, Dhillon and Singh 1976), number of rows/ ear and number of kernels/ row (El-Absawy, 1990), 100 kernel weight and grain yield per plant (Mokbel, 1988, Mohamed, 1979 and Ssurinder *et al.*, 1992).

The mean squares of interaction between season and general combining ability were significant for ear diameter, silking date and grain yield per plant, revealing that the magnitude of additive and additive x additive types of gene action varied from one season to another. For other traits, non significant interaction between GCA and season were detected indicating that additive and additive x additive types of gene action were not influenced by the seasonal conditions.

The mean squares of interaction between season and SCA were significant for all traits under study except stem diameter, number of rows per row, number of kernels per row and 100- kernel weight.

Such results indicated that nonadditive effects influenced by seasonal changes (Hajkhan, 1970, Mourad, 1978, Mahmoud, 1984, and El-Hosary, 1985 and 1988a).

Estimates of GCA effects g_i for individual parental inbred liens in each trait in both seasons as well as the combined analysis are presented in Table (11). The parental inbred line 106i gave significant negative g_i effects for silking date in both seasons as well as the combined analysis and for tasseling date in the first season and the combined analysis, indicating that this inbred line could be considered as good combiner for developing early genotype.

The parental line 36 followed by inbred line 106i considered outstanding combiners towards reducing leaf angle. The parental inbred lines were inconsistent g_i effects for leaf area. The parental inbred lines 72 and 36 gave significant positive g_i effects in the first season, whereas it gave significant negative g_i effects in the second season. Also, the inbred lines 110B and 106i gave significant negative g_i effects in the first season. Meanwhile, it gave significant positive or insignificant effects in the second one.

The parental inbred line 27 showed significant negative g_i effects for tasseling and silking dates in both seasons as well as the combined analysis, indicating that this inbred line could be considered as good combiner for developing early genotypes. Earliness of inflorescence is required for early maturing season to escape corn pests. These inbred could be candidates for early maturing corn. While, the parental inbred line 105g gave positive and significant g_i

Table (11): Estimation of general combining ability effects for F_1 generation.

Traits (F_1)		Tasseling date			Silking date			Ear height (cm)		Plant height (cm)		Leaf area (cm^2)	
Parent		S_1	S_2	Comb.	S_1	S_2	Comb.	S_1	S_2	S_1	S_2	S_1	S_2
110 B	g_i	0.21	-0.38	-0.08	0.72*	-0.41*	0.15	-1.53*	-0.59	8.43**	14.12**	-37.20**	10.58*
	Mean	65.33	64.00	64.67	71.33	68.00	6967	82.02	88.32	178.98	169.98	428.49	568.27
72	g_i	-0.89**	-0.11	-0.50	-0.82**	-0.10	-0.46*	3.18**	1.24**	0.74*	-1.80	22.83**	-15.82**
	Mean	65.33	66.33	65.83	67.33	70.67	69.00	71.28	71.28	132.66	123.66	464.92	539.57
27	g_i	-1.19**	-0.68	-0.94**	-0.58*	-1.14**	-0.86**	4.02**	3.73**	-0.21	9.10**	1.52	-6.90
	Mean	65.00	64.67	64.83	68.33	65.00	66.67	87.22	87.22	165.48	156.00	566.22	481.37
101	g_i	-0.19	-0.61	-0.40	-0.78*	-0.91**	-0.85**	-0.33	0.54	-2.04**	-1.07	2.11	23.65**
	Mean	66.33	64.00	65.17	67.00	66.00	66.50	67.12	67.45	124.22	119.67	580.04	646.13
70 B	g_i	-0.07	0.36	0.15	-0.42	0.29	-0.06	-1.57*	-5.83**	-3.03**	-14.82**	1.73	1.12
	Mean	65.67	66.00	65.83	66.67	68.33	67.50	52.61	52.86	100.00	103.00	435.24	559.70
105 g	g_i	1.04**	1.26**	1.15**	0.85**	1.46**	1.15**	-4.59**	-1.97**	3.25**	-3.19	18.68**	5.39
	Mean	68.33	69.00	68.67	70.67	72.67	71.67	63.55	63.55	136.98	132.67	546.51	643.00
36	g_i	-0.29	0.03	-0.13	-0.45	0.39*	-0.03	5.18**	3.49**	-3.75**	3.70	20.21**	-22.19**
	Mean	67.00	65.33	66.17	69.33	70.67	70.00	79.93	79.93	108.33	151.00	548.09	647.40
106i	g_i	1.37**	0.13	0.75*	1.48**	0.43*	0.95**	-4.36**	-0.60*	-3.37**	-6.04*	-29.88**	4.16
	Mean	67.00	67.00	67.00	71.00	71.33	71.17	64.48	64.48	114.00	115.00	447.04	667.53
L.S.D. 0.05 (g_i-g_i)		0.82	1.09	1.18	0.87	0.52	0.71	1.96	0.90	7.07	0.97	6.20	13.58
L.S.D. 0.01 (g_i-g_i)		1.09	1.45	1.57	1.15	0.70	0.95	2.61	1.20	9.42	1.29	8.25	18.08
R		0.736*	0.913**	0.868**	0.88**	0.930**	0.912**	0.63	0.766**	0.833*	0.955**	0.54	0.31

* and ** significant at 0.05 and 0.01 levels of probability, respectively.

r : correlation coefficient between parental mean performance and its GCA effects.

Table (11): Cont.

Traits (F1)		Leaf angle		Stem diameter (cm)		No. of ears/ plant	Husk of ear (cm)		Ear length (cm)		Ear diameter	No. of kernels/ row	
Parent		S_1	S_2	S_1	Comb.	S_2	S_2	Comb.	S_1	Comb.	S_1	S_1	S_2
110 B	G_i	-0.05	-0.05	0.05	0.01	-0.033	-0.005	-0.009	0.29	-0.30	0.11	2.43**	0.36
	Mean	23.64	2.47	2.47	2.32	1.00	2.47	2.52	11.25	12.35	2.19	33.13	30.96
72	g_i	1.05	-0.08	0.06	0.04**	-0.020	-0.174*	0.130	0.29	0.38	0.06	-0.39	0.86
	Mean	25.05	20.87	2.55	2.31	1.00	4.40	3.31	18.38	14.11	2.22	35.01	33.25
27	g_i	-0.23	-0.32	-0.06*	-0.07**	0.005	0.28**	0.140	-0.55	-0.32	-0.13	-0.23	-0.84
	Mean	22.78	20.33	2.05	2.08	1.00	3.53	3.18	11.82	12.25	2.23	27.77	25.50
101	g_i	0.15	0.75**	-0.06	-0.01	0.026	-0.28**	-0.240*	0.03	-0.07	0.08	0.07	-0.69
	Mean	21.02	21.73	2.33	2.20	1.00	2.20	2.23	13.52	13.76	2.26	32.16	28.20
70 B	g_i	-0.12	0.68**	-0.10	-0.09**	-0.016	0.05	0.003	-0.65*	-0.42	-0.17	-0.38	1.03
	Mean	23.87	22.53	2.10	2.13	1.00	3.93	3.22	12.22	13.34	2.18	30.79	31.72
105 g	g_i	-0.47	0.23	0.02	-0.02	-0.023	-0.06	0.06	-0.16	0.05	2.23*	0.79	-0.69
	Mean	20.02	17.73	2.25	2.06	1.07	3.60	3.29	11.04	13.35	2.25	30.69	30.80
36	g_i	-1.63**	-0.080**	-0.07*	0.04**	-0.026	-0.19*	-0.08	1.24**	0.80*	0.06	-1.67*	1.30*
	Mean	21.32	19.00	2.13	2.15	1.04	3.27	3.12	16.99	15.99	2.31	32.28	38.57
106i	g_i	1.29*	-0.51**	0.02	0.09**	0.086**	0.02	0.00	-0.50	-0.40	-0.23*	-0.62	-1.33*
	Mean	25.42	17.00	2.03	2.73	1.07	2.80	2.81	14.00	14.17	2.15	24.95	28.37
L.S.D. 0.05	(g_i-g_i)	1.80	0.62	0.09	0.04	0.68	0.15	0.32	0.99	1.06	0.29	2.20	1.75
L.S.D. 0.01	(g_i-g_i)	2.39	0.82	0.13	0.05	0.08	0.19	0.42	1.32	1.41	0.38	2.93	2.33
	r	0.73	0.53	0.436	0.74*	0.373	0.667	0.765*	0.591	0.638	0.588	0.21	0.822*

* and ** significant at 0.05 and 0.01 levels of probability, respectively.
r : correlation coefficient between parental mean performance and its GCA effects.

Table (11): Cont.

Traits (F_1)		No. of rows/ ear			Weight of 100 kernel (g)			Shelling percentage		Grain yield/ plant 15.5% (g)		
Parent		S_1	S_2	Comb.	S_1	S_2	Comb.	S_1	S_2	S_1	S_2	Comb
110 B	g_i	0.36	0.64*	0.50*	1.84**	0.23	1.04	0.03	0.95**	19.98**	2.88	11.43**
	Mean	10.55	13.47	12.01	28.00	24.56	26.28	77.08	79.50	95.33	90.69	93.01
72	g_i	-0.28	-0.02	-0.15	-0.87	-0.12	-0.50	-0.95	-0.64**	-9.69**	-4.13	-6.91**
	Mean	7.13	8.66	7.90	28.04	24.88	26.46	79.15	72.05	66.22	63.27	64.75
27	g_i	0.22	0.45	0.33	-1.02	-1.55*	-1.29	2.35*	1.47**	-3.24	0.49	-1.38
	Mean	9.26	10.00	9.63	24.11	18.00	21.06	77.37	80.58	58.84	59.49	59.16
101	g_i	0.84**	0.94**	0.89**	0.27	-0.24	0.02	1.35	-2.19**	7.86**	7.52**	7.69**
	Mean	11.66	12.96	12.31	23.73	21.40	22.57	73.55	66.50	74.74	75.02	74.88
70 B	g_i	-0.11	-0.58*	-0.35	0.89	0.42	0.65	.01	0.94**	0.50	-0.61	-0.06
	Mean	8.67	8.00	8.33	27.19	20.40	23.80	77.02	74.71	63.39	56.10	59.75
105 g	g_i	-0.29	-0.46	-0.38	1.20*	-1.63*	-0.26	0.27	1.81**	5.55*	2.58	4.06
	Mean	8.00	7.39	7.69	27.69	20.00	23.85	75.43	79.74	61.20	56.63	58.91
36	g_i	-0.61**	-0.53*	-0.57*	-1.10	3.24**	1.07	-2.69*	-1.72**	-14.90**	-4.93	-9.92**
	Mean	7.12	7.12	7.12	23.10	27.00	25.05	70.20	68.50	55.39	53.80	54.59
106i	g_i	-0.13	-0.42	-0.27	-1.13	-0.34	-0.73	-0.36	-0.61*	-6.06**	-3.79	-4.93*
	Mean	10.00	8.09	9.05	20.77	24.20	22.49	70.83	78.57	50.59	55.33	52.96
L.S.D. 0.05 (g_i-g_i)		0.65	0.72	0.69	1.98	2.10	2.04	3.23	0.71	6.33	7.68	7.04
L.S.D. 0.01 (g_i-g_i)		0.87	0.96	0.92	2.63	2.79	2.71	4.30	0.95	8.42	10.23	9.37
r		0.909*	0.397**	0.941**	0.673	0.806*	0.617	0.419	0.874**	0.831*	0.589	0.795*

* and ** significant at 0.05 and 0.01 levels of probability, respectively.

r : correlation coefficient between parental mean performance and its GCA effects.

effects indicating a sheer tendency towards delayed tasseling and silking dates.

For plant height, the three parents M 72, M 70B and M 106i regardless of significance and negative g_i effects for the trait, indicating favourable combining ability towards reducing plant height. Two of the above, namely the inbreds 70B and 106i gave significant and negative g_i estimates for plant height are coupled with negative and significant of g_i effects for ear height as well. That is, both inbreds would tend to reduce plant or ear heights in their hybrid combinations or produced in short inbred lines.

Moshtohor 27 expressed significant positive g_i effects for ear husk in the second season, number of kernels and shelling percentage in both seasons. None of the parental inbred lines gave significant desirable g_i effects for stem diameter. The parental inbred line 105g had considerable significantly positive g_i effects for ear diameter in the first season (Table 10).

The parental inbred line m 36 seems to be the best combiner for ear length in the firs and the combined analysis, number of kernels/ row and 100 kernel weight in the second season.

The parental line 106, gave significant g_i effects for ear number of ear per plant in the second season (Table 10). While, the parental line 101 seems to be good combiner for number of rows per ear in both seasons as well as the combined analysis.

The parental inbred lien 101H in both seasons as well as the combined analysis and 110B in the first season as well as the combined analysis had considerable significantly positive g_i effects for grain yield per plant, and proved to be good combiners in this respect. While, inbred line M 36 appeared to be the poorest combiner for grain yield per plant. It is worthnoting that the inbred line which possessed high g_i effects for grain yield per plant might show the same for one or more of the traits contributing grain yield.

In most traits, the values of g_i effects were mastly differed from season to another. This finding coincided with that reached above where significant GCA by season mean squares were detected (Table 9).

Significant correlation coefficient values between the parental performance and its g_i effects were obtained for number of rows per ear, tasseling and silking dates in both seasons as well as the combined analysis, plant height in both seasons, grain yield in the first season and the combined analysis, number of kernels per row, 100- kernel weight, shelling percentage and ear height in the second season, and stem diameter and ear husk in the combined analysis (Table 10). This finding indicates that intrinsic performance of parental inbred lines gave a good index of their g_i effects. Therefore, selection with the tested parental inbred lines for initiating any proposed breeding program could be practiced either on mean performance or g_i effects basis with similar efficiency. For other cases, insignificant coefficient values were obtained between the two variable . It could be concluded that the non- additive type of gene action had the greatest role in the expression of these cases which are in complete agreement with the findings reached above in Table (10).

Specific combining ability effects whenever significant SCA variances were obtained (Table 12).

For tasseling date, twelve, four and six hybrids exhibited significantly negative S_{ij} effects in the first, second season and the combined analysis, respectively. Also, fifteen, three and seven crosses expressed significant negative S_{ij} effects for silking date in the same order. Also, the results indicated that the two crosses 110B x 106i and 101 H x 36 gave the highest desirable S_{ij} effects in both seasons as well as the combined for tasseling and silking dates.

For ear height and plant height, all crosses expressed significant positive S_{ij} effects except cross 110B x 36 in both seasons and cross 105g x 106i in the first season for ear height and both crosses 110B x 105g and 72 x 27 in the first season for plant height. The exceptional crosses gave desirable S_{ij} effects for both traits.

For leaf area, nineteen and thirteen hybrids exhibited significant positive S_{ij} effects in the first and second seasons, respectively. The crosses 110B x 70B, 110B x 106i, 72 x 70B, 27 x 101, 27 x 70B, 101 x 70B, 101 x 105 g and 70B x 36 gave the highest S_{ij} effects in both seasons for this trait. It is apparent that inbred line 70 B is capable to illicit high leaf area in its combinations and inbred line 36 (the second lowest leaf angle) would induce a incorporated good leaf area and

Table (12): Estimation of specific combining ability effects for F_1 generation.

Traits	Tasseling date			Silking date			Ear height (cm)		Plant height (cm)		Leaf area (cm^2)		Leaf angle	
F_1 crosses	S_1	S_2	Comb.	S_1	S_2	Comb.	S_1	S_2	S_1	S_2	S_1	S_2	S_1	S_2
110B x 72	-3.12**	-2.49*	-2.81**	-2.62**	-4.60**	-3.61**	26.10**	9.33**	38.55**	36.49**	141.33**	8.98	0.23	-2.57**
x 27	-0.83	1.41	0.29	-1.86*	4.10**	1.12	8.64**	5.18**	19.51**	22.26**	-7.64	130.6**	0.18	-3.04**
x 101H	-0.16	2.01*	0.93	-0.32	1.20*	0.44	7.28**	10.40**	21.33**	38.09**	-11.48*	-78.39**	-1.53	-4.20**
x 70B	-1.28	-0.96	-1.12	-1.02	0.33	-0.35	7.96**	10.73**	27.33**	29.51**	90.59**	81.91**	4.06*	-1.94**
x 105g	-0.73	0.14	-0.29	-1.62*	-0.17	-0.90	17.21**	6.87**	-3.29	5.54**	26.43**	2.47	-1.78	2.78**
x 36	-0.06	2.04*	0.99	-1.66*	0.90	-0.38	3.11	0.41	30.55**	11.32**	95.96**	-85.05**	3.57*	3.05**
x 106i	-2.05**	-2.39*	-2.22*	-1.92*	-3.14**	-2.53**	10.01**	23.50**	35.67**	35.06**	58.59**	125.87**	3.99*	-2.15**
72 x 27	-3.06**	-1.19	-2.12*	-1.66*	-0.87	-1.26*	10.82**	3.68**	-2.21	21.85**	-10.64	170.7**	1.08	1.80**
x 101H	0.27	0.08	0.18	0.55	1.23**	0.89	12.57**	20.87**	28.35**	22.35**	4.41	37.45**	2.03	0.47
x 70B	-2.18**	-0.56	-1.37	-1.82*	-0.30	-1.06	27.15**	18.91**	33.68**	35.44**	101.32**	33.18**	-1.71	3.16**
x 105g	-1.96**	-1.46	-1.71	-1.76*	-1.14*	-1.45	20.17**	16.71**	27.40**	44.14**	64.02**	-76.42**	2.65	-4.78**
x 36	-3.29**	1.78	-0.76	-2.46**	0.60	-0.93	8.06**	25.59**	63.74**	15.59**	72.03**	-4.68	2.47	3.02**
x 106i	0.72	0.01	0.37	0.61	-0.44	0.09	15.80**	12.68**	42.02**	31.32**	188.59**	-31.12*	3.55*	0.86
27 x 101H	-1.42	-1.36	-1.39	-1.02	-1.07*	-1.05	21.40**	4.71**	31.64**	20.12**	92.38**	25.20*	3.32*	0.04
x 70B	-4.55**	1.68	-1.44	-2.72**	2.06**	-0.33	23.31**	16.08**	42.30**	20.20**	66.16**	67.53**	-2.08	3.30**
x 105g	-3.99**	-1.22	-2.61*	-2.66**	-0.44	-1.55	6.20**	14.23**	33.16**	42.57**	-22.95**	43.23**	2.61	4.56**
x 36	1.01	-1.99*	-0.49	0.31	-2.37**	-1.03	13.56**	19.10**	26.36**	27.35**	167.40**	-26.36**	-0.91	-3.81**
x 106i	-0.31	-0.09	-0.20	-0.62	0.26	-0.18	8.22**	22.86**	11.31	31.75**	-11.45*	-120.7**	5.51**	-0.77
101H x 70B	-0.21	-1.40	-0.80	0.14	-0.17	-0.01	19.99**	30.60**	50.13**	27.70**	184.20**	78.39**	1.87	-1.03
x 105g	-0.99	1.04	0.03	-0.12	0.33	0.10	30.01**	20.44**	40.18**	25.40**	43.94**	113.40**	1.23	4.89**
x 36	-5.66**	-0.07	-3.19**	-4.49**	-0.60	-2.55**	7.24**	9.28**	21.85**	42.85**	-52.93*	23.35	6.71**	1.09**
x 106i	-3.65**	-0.82	-2.23*	-3.09**	-0.30	-1.70**	16.46**	16.37**	43.80**	41.59**	-12.50**	40.30**	1.13	2.29**
70B x 105g	-0.78	-0.59	-0.69	-0.82	-0.54	-0.68	21.79**	20.11**	59.51**	15.99**	79.30**	-26.80*	6.49**	-1.25*
x 36	-2.78**	0.98	-0.90	-1.19	-0.80	-0.99	19.28**	12.66**	35.18**	28.60**	18.86**	98.09**	-0.69	-2.15**
x 106i	1.78*	-0.46	0.66	1.21	0.16	0.69	19.52**	7.75**	33.63**	39.01**	-4.33	-9.89	0.06	1.59**
105g x 36	-0.89	-2.26*	-1.57	-0.46	-0.64	-0.55	17.84**	16.80**	37.24**	34.97**	53.17**	-52.87**	1.33	1.51**
x 106i	1.55*	0.64	-0.45	-1.72**	-0.67	-1.20	-8.19**	15.22**	38.72**	15.04**	137.37**	13.13	1.75	1.75**
36 x 106i	-1.88*	-1.12	-1.50	-1.76*	-0.60	-1.18	42.27**	15.63**	47.26**	13.82**	29.75**	55.46**	-5.43**	0.11
L.S.D. 0.05 (S_{ij}- S_{ik})	2.47	3.27	2.89	2.59	1.57	2.15	5.89	2.69	2.91	21.22	18.59	40.73	5.41	1.86
L.S.D. 0.05 (S_{ij}- S_{kl})	3.29	4.36	3.86	3.46	2.09	2.86	7.84	3.59	3.87	28.26	24.75	54.24	7.20	2.48
L.S.D. 0.01 (S_{ij}- S_{ik})	2.32	3.08	2.73	2.45	1.48	2.02	5.55	2.54	2.74	20.01	17.52	38.40	5.10	1.75
L.S.D. 0.01 (S_{ij}- S_{kl})	3.09	4.11	3.64	3.26	1.97	2.69	7.39	3.38	3.65	26.64	23.33	51.14	6.79	2.33

Table (12): Cont.

Trait	Stem diameter (cm)		No. of ears/ plant			Husk of ear			Ear length (cm)			Ear diameter (cm)	
F_1 crosses	S_1	Comb.	S_1	S_2	Comb.	S_1	S_2	Comb.	S_1	S_2	Comb.	S_1	Comb.
110B x 72	0.18*	0.09*	-0.08	0.17**	.04	-0.26	0.14	-0.06	2.63**	0.07	1.35	0.26	0.14
x 27	0.25**	0.14**	0.21*	0.01	0.11	-0.51	-0.57**	-0.54	1.70*	2.82**	2.26*	-0.21	0.06
x 101H	-0.22*	-0.17**	0.17*	0.25**	0.21*	-0.01	-1.28**	-0.65*	3.44**	0.76	2.09*	0.68*	0.40
x 70B	-0.05	-0.01	0.11	-0.11*	-0.00	-0.30	1.20**	0.47	2.84**	0.79	1.82	0.76**	-0.14
x 105g	-0.04	0.04	-0.10	0.04	-0.02	0.92**	-0.40	0.26	2.29**	1.73	2.01*	0.90**	0.53
x 36	-0.26**	-0.10*	-0.17*	-0.10	-0.13*	-0.27	0.44*	0.08	-0.25	0.70	0.22	1.14**	0.67*
x 106i	0.09	0.01	0.11	-0.08	0.02	2.25**	1.42**	1.84**	0.69	1.11	0.90	0.46	0.09
72 x 27	-0.17*	-0.07*	0.12	-0.01	0.06	0.73*	-0.45*	0.14	-1.59	1.75	0.08	0.60*	0.39
x 101H	-0.14	0.18**	-0.05	-0.16**	-0.11	0.69*	-0.52*	0.09	-3.23	1.01	-1.11	0.63*	0.31
x 70B	-0.09	-0.04	0.02	0.08	0.05	-0.16	-0.71**	-0.44	2.18*	1.25	1.71	0.74**	0.39
x 105g	0.11	0.08*	0.22	-0.11*	0.05	1.03**	-0.14	0.44	-1.24	0.40	-0.42	0.34	0.13
x 36	0.09	-0.02	0.01	0.16**	0.09	1.17**	-0.41	0.38	-0.31	0.98	0.34	0.31	0.20
x 106i	-0.17*	-0.08*	-0.08	0.11*	0.10	-0.28	-0.09	-0.18	0.62	1.02	0.82	0.87**	0.46
27 x 101H	0.11	0.17**	-0.04	-0.06	-0.04	0.47	1.24**	0.86**	1.54	1.42	1.48	0.76**	0.34
x 70B	0.23**	-0.06	0.04	0.19**	0.11	1.05**	-0.62**	0.22	1.02	1.79	1.40	0.87**	0.66*
x 105g	0.21*	0.15**	0.04	0.13*	0.08	0.38	-0.32	0.03	2.66**	-0.01	1.33	0.61*	0.28
x 36	-0.05	-0.05	-0.03	0.06	0.05	-0.55	0.68**	0.07	2.80**	1.23	2.01*	-0.05	-0.62
x 106i	-0.24**	-0.014**	-0.15*	0.02	-0.07	-0.17	0.01	-0.08	0.68	1.63	1.16	0.36	0.27
101H x 70B	0.03	-0.01	0.00	-0.03	-0.02	-0.02	0.01	-0.01	1.14	-0.34	0.40	0.33	0.11
x 105g	0.09	0.09*	-0.07	-0.03	-0.05	0.33	-0.75**	-0.55	1.96*	2.74**	2.35*	0.56*	0.25
x 36	-0.49	-0.09**	-0.07	0.04	-0.02	1.25**	0.04	0.64**	-0.74	0.77	0.01	-0.10	0.04
x 106i	-004	-0.03	0.21**	0.40**	0.30**	-0.30	1.69**	0.70*	3.61**	1.30	2.46*	0.85**	0.52
70B x 105g	0.11	0.17**	0.27**	-0.02	0.13*	0.85*	0.62**	0.73*	2.37**	-1.35	0.51	0.64*	0.16
x 36	-0.08	-0.03	0.07	-0.11*	-0.02	0.29	-0.88**	-0.30	1.88*	2.33*	2.11*	0.78**	0.33
x 106i	-0.06	-0.09**	-0.12	0.24**	0.06	0.14	-1.36*	-0.61*	-3.83**	2.14*	-0.85	-1.23**	-0.50
105g x 36	-0.13	0.02	0.20	0.16**	0.18**	-0.72*	-0.25	-0.48	1.61	2.54*	2.08*	0.68*	0.47
x 106i	-0.08	-0.16**	-0.19*	-0.09	-0.14*	-0.37	-0.26	-0.31	2.26*	0.01	1.14	0.63*	0.43
36 x 106i	1.20**	0.72**	0.27**	-0.83**	0.10	0.01	-0.99**	-0.49	0.61	-0.76	-0.07	0.77**	0.18
L.S.D. 0.05	0.29	0.12	0.25	0.19	0.22	1.13	0.73	0.95	2.98	3.33	3.16	0.88	0.92
(S_{ij}- S_{ik}) L.S.D. 0.05	0.38	0.16	0.34	0.25	0.30	1.51	0.97	1.27	3.97	4.44	4.21	1.17	1.22
(S_{ij}- S_{ik}) L.S.D. 0.01	0.27	0.11	0.24	0.18	0.21	1.07	0.69	0.90	2.81	3.14	2.98	0.83	0.87
(S_{ij}- S_{ik}) L.S.D. 0.01	0.36	0.15	0.32	0.24	0.28	1.42	0.91	1.20	3.74	4.18	3.97	1.11	1.15
(S_{ij}- S_{ik})													

Table (12): Cont.

Trait / F_1 crosses	No. of kernels/ row S_1	No. of kernels/ row S_2	No. of kernels/ row Comb.	No. of rows/ ear S_1	No. of rows/ ear S_2	No. of rows/ ear Comb.	Weigh of 100 kernel (g) S_1	Weigh of 100 kernel (g) S_2	Weigh of 100 kernel (g) Comb.	Shelling percentage S_1	Shelling percentage S_2	Grain yield/ plant 15.5% (g) S_2	Grain yield/ plant 15.5% (g) S_1	Grain yield/ plant 15.5% (g) S_2
110B x 72	4.76*	0.87	2.81	2.03**	-0.01	1.01	-0.53	-6.77**	-3.65*	2.14	1.40*	27.14**	5.91	16.52*
x 27	0.80	3.17*	1.98	1.33*	0.47	0.90	-1.17	2.66	0.75	1.13	1.38*	39.22**	17.40*	28.31**
x 101H	0.62	2.78	1.70	1.38*	-0.13	0.63	-0.46	-3.66	-2.06	7.37*	0.27	36.30**	16.53*	26.38**
x 70B	1.95	1.50	1.73	-0.48	0.16	-0.16	-1.18	4.09*	1.46	-0.84	2.98**	9.87	11.33	10.60
x 105g	4.64*	4.42**	4.53*	0.90	1.11	1.01	1.74	0.34	1.04	1.92	-3.90**	26.28**	2.07	14.18*
x 36	-3.97*	-0.91	-2.44	0.56	0.25	0.40	4.41*	2.02	3.21	-14.6**	1.52*	-4.56	13.17	4.31
x 106i	5.35**	2.18	3.76*	0.41	-0.54	-0.07*	-1.76	0.44	-0.66	1.76	-1.15	21.88**	4.31	13.10*
72 x 27	-2.91	2.30	-0.30	1.97**	0.92	1.45*	-0.95	2.01	0.53	0.25	-2.15**	12.32*	30.17**	21.25**
x 101H	-4.88*	2.88	-1.00	0.08	0.90	0.49	-1.68	2.99	0.66	-2.14	1.75**	-17.43**	0.80	-8.31
x 70B	3.58	3.87*	3.72*	2.77**	1.02	1.89**	-2.82	-0.44	-1.63	-0.04	1.28*	31.36**	12.03	21.69**
x 105g	-2.20	-0.55	-1.38	1.55**	2.03**	1.79**	-4.10*	-0.85	-2.47	-7.69**	3.17**	8.14	34.74**	21.44**
x 36	-0.74	2.34	0.80	2.00**	1.33	1.67**	2.12	4.34*	3.23	-1.05	5.08**	32.04**	12.38	22.21**
x 106i	1.47	-0.27	0.60	-0.02	2.12**	1.05	-1.90	-4.21*	-3.05	-4.49	0.51	2.04	1.52	1.78
27 x 101H	4.83*	3.78*	4.30*	1.65**	0.16	0.91	-2.79	2.26	-0.27	4.69	-1.54*	12.92*	6.15	9.54
x 70B	1.68	2.57	2.13	1.06	2.09**	1.57*	-1.21	0.68	-0.27	2.33	3.99**	14.05*	19.37**	16.71**
x 105g	1.71	0.69	1.20	1.45*	0.77	1.11	2.96	-0.48	1.24	-2.94	4.43**	41.46**	2.26	21.86**
x 36	4.57*	2.70	3.64*	0.10	1.70**	0.90	-1.73	-3.25	-2.49	1.70	0.64	6.34	23.90**	15.12*
x 106i	3.52	4.93**	4.22*	0.58	1.39*	0.98	2.28	1.23	1.75	-3.40	-4.31**	9.83	24.30**	17.06**
101H x 70B	-0.53	1.52	0.50	0.86	1.06	0.96	3.90*	-0.95	1.47	-2.12	2.23**	29.84**	24.44**	27.17**
x 105g	1.73	4.70**	3.22	-0.04	0.14	0.05	4.46*	0.20	2.33	-3.58	4.92**	28.75**	21.59**	25.17**
x 36	-0.66	-1.76	-1.21	-0.12	0.30	0.09	-0.02	-0.17	-0.09	-3.66	4.43**	-11.71*	12.95	0.62
x 106i	5.54**	1.44	3.49	1.99**	1.09	1.55*	-0.09	2.91	1.41	6.82*	3.81**	70.11**	38.18**	54.15**
70B x 105g	1.76	-1.10	0.33	1.77**	1.29*	1.53*	-4.38*	-2.33	-3.36	-3.66	-2.74**	25.58**	32.77**	29.18**
x 36	-2.28	2.03	-0.13	2.36**	1.60*	1.98**	-0.64	6.48**	2.92	0.42	2.04**	9.42	9.86	9.64
x 106i	1.39	4.77**	3.08	-0.32	0.15	-0.09	5.20**	0.66	2.93	-1.01	2.28**	21.84**	16.15*	18.99**
105g x 36	3.14	0.38	1.76	2.28**	2.11**	2.19**	-3.41	2.10	-0.66	8.96**	1.36*	42.80**	27.46**	35.13**
x 106i	1.69	1.58	1.64	0.72	1.63*	1.18**	1.53	1.81	1.67	10.13**	-1.76**	-6.42	16.76*	5.17
36 x 106i	-0.65	-2.21	-1.43	1.91**	2.03	1.97**	-1.62	-5.26**	-3.44	-3.84	-1.24*	22.09**	13.57*	17.83**
L.S.D. 0.05 $(S_{ij}-S_{ik})$	6.61	5.26	5.96	1.96	2.17	2.07	5.93	6.29	6.11	9.68	2.14	18.98	23.05	21.11
L.S.D. 0.05 $(S_{ii}-S_{ij})$	8.80	7.00	7.94	2.61	2.89	2.76	7.90	8.38	8.14	12.89	2.85	25.27	30.70	28.11
L.S.D. 0.01 $(S_{ij}-S_{ik})$	6.22	4.96	5.62	1.85	2.05	1.95	5.59	5.93	5.76	9.13	2.02	17.89	21.73	19.91
L.S.D. 0.01 $(S_{ii}-S_{ik})$	8.28	6.60	7.49	2.46	2.73	2.60	7.44	7.90	7.67	12.13	2.69	23.83	28.94	26.51

good leaf angle, a characteristic that is required in hybrid corn. However, the cross 110B x 101 H has significant negative S_{ij} effects for leaf area. The cross 36 x 106i in the first season and nine crosses in the second season exhibited significant negative S_{ij} effects for leaf angle. These significant negative S_{ij} effects gave more upright leaf. Duncan (1971) reported that neither greater leaf area per se or narrow leaf angle are enough to make use of light and that a combination of leaf area are enough to make use of light and that a combination of leaf area index of five is provide yield benefits due to improved light penetration in the canopy.

Five and eight crosses expressed significant S_{ij} effects for stem diameter in the first season and the combined analysis, respectively. The cross 36 x 106i had the highest desirable S_{ij} effects .

With respect to ear husk, nine, seven and five crosses showed significant positive S_{ij} effects in the first, second season and the combined analysis, respectively. The cross 110B x 106i gave the highest S_{ij} effects for this traits. This cross could be considered as the best one for increasing ear husk in the genotypes.

Seventeen and two crosses exhibited significant positive S_{ij} effects for ear diameter in the first and the combined analysis, respectively. The two crosses 110B x 36 and 27 x 72B had the highest desirable S_{ij} effects in the first season and the combined analysis.

Twelve, five and eight hybrids exhibited significant S_{ij} effects for ear length in the first, second season as well as the combined analysis, respectively. The both crosses 110B x 27 and 101 x 105g had the highest desirable S_{ij} effects for ear length in both seasons and the combined analysis.

For number of ears per plant, five, nine and four hybrids expressed significant positive S_{ij} effects in the first, second as well as the combined analysis, respectively. The two crosses 110B x 101 H and 101 H x 106i had significant S_{ij} effects in both seasons and the combined analysis for this trait.

Fourteen, eleven and eleven hybrids exhibited significant S_{ij} effects for number of rows per ear in the firs, second season and the combined analysis, respectively. The crosses 72 x 36 , 70 B x 105g , 70B x 36 and 36 x 106i gave the highest S_{ij} effects for number of rows per ear in both seasons and the combined analysis.

Six, seven and six crosses expressed significant positive S_{ij} effects for number of kernels per row in the first season and the highest desirable S_{ij} effects in both seasons and the combined analysis.

For 100- kernel weight, four and three parental combinations showed significant positive S_{ij} effects in the first and second season, respectively.

For shelling percentage, four and seventeen crosses exhibited significant positive S_{ij} effects in the first and second season, respectively. The two crosses 101h x 106i and 105g x 36 had the highest desirable S_{ij} effects in both seasons.

Regarding grain yield per plant, eighteen, fifteen and twenty parental combination showed significantly positive S_{ij} effects in the first, second season and their combined analysis, respectively. In conclusion, the best combinations were: 110B x 27, 110B x 101H, 72 x 27, 27 x 70B, 101H x 70B, 101H x 105g, 101 H x 106i, 70B x 105g, 105g x 36 and 36 x 106i in both seasons and the combined analysis. It could be the best combinations , where it had significant positive S_{ij} effects for grain yield per plant as well as most of the yield components over the two seasons.

In these crosses showing high specific combining ability involving only one good combiner, such combinations would show with desirable transgressive segregates, providing that the addditive genetic system present in the good combiner as well as the complementary and epistatic effects present in cross, act in the same direction to reduce undesirable plant characters and maximize the character in view. Therefore, the previous crosses might be of prime importance in breeding program for traditional breeding procedures.

In most traits, the values of S_{ij} effects were mostly differed from season to another. This finding coincide with that reached above where significant SCA by season mean squares were detected (Table 10).

Association study

1- Simple phenotypic correlation :

Simple correlation coefficient between grain yield/ plant and each of its characters, i.e. number of ears per plant, number of rows/ ear, number of kernels/ row, 100- kernel weight, leaf area and plant height were computed on the 28 hybrids in both seasons and the combined analysis (Tables 13 and 14). The phenotypic association between these characters was also included.

Significant positive phenotypic correlation coefficients values were detected between grain yield and each of number of ears per plant, number of rows per ear, number of kernels per row and plant height in both seasons as well as the combined analysis. Also, significant positive phenotypic correlation coefficient values were detected between grain yield and leaf area in the first season and the combined analysis. This result indicates that selection for one or more of these characters would be accompanied by high grain yield/ plant. Generally, these correlations indicate that the association values between grain yield and other traits were different from season to another. The significant hybrid x season interaction for grain yield would suggest that selection of genotypes will be varied form sesaon to another. Although it is difficult to prove the need for repeat breeding program at more seasons. The present results are in agreement with those obtained by Mohamed (1984), El- Hosary *et al.* (1989), Sary *et al.* (1990) and Abdel- Sattar (1992) for number of rows per ear and number of kernels per row. El- Marakby (1964), Shaher

Table (13): Simple correlation coefficient among seven characters for F1 generation in season 1995 above diagonal and 1996 below diagonal.

Trait	No. of ears/ plant	No. of rows/ ear	No. of kernels/ row	100- kernel weight	Leaf area	Plant height	Grain yield/ plant
No. of ears/ plant	1	0.528**	0.249	-0.494*	0.423*	0.534*	0.528**
No. of rows/ ear	0.378**	1	0.535**	-0.172	0.714**	0.871**	0.863**
No. of kernels/ row	0.362*	0.561**	1	0.144	0.454**	0.572**	0.773**
100- kernel weight	-0.097	0.075	0.379*	1	-0.189	0.048	0.139
Leaf area	0.110	0.195	0.384*	0.338	1	0.846**	0.613**
Plant height	0.487**	0.831**	0.767**	0.140	0.300	1	0.845**
Grain yield/ plant	0.479**	0.87**	0.715**	0.133	0.292	0.907**	1

Table (14): Simple correlation coefficient among seven characters for the combined analysis.

Trait	No. of ears/ plant	No. of rows/ ear	No. of kernels/ row	100- kernel weight	Leaf area	Plant height	Grain yield/ plant
No. of ears/ plant	1						
No. of rows/ ear	0.497**	1					
No. of kernels/ row	0.651**	0.595**	1				
100- kernel weight	0.173	-0.231	-0.038	1			
Leaf area	0.766**	0.636**	0.892**	0.062	1		
Plant height	0.603**	0.409*	0.644**	0.074	0.752**	1	
Grain yield/ plant	0.811**	0.694**	0.893**	0.104	0.919**	0.644**	1

(1982), Eraky *et al.* (1983), and Abdel- Sattar (1992) for number of kernels per row and Mohamed and Yasien (1977) and Abdel- Sattar (1992) for number of rows/ ear.

Significant positive correlation coefficients were detected between plant height and each of number of ears per plant, number of rows/ ear, number of kernels/ row and leaf area in the first season and the combined analysis. While, significant correlation coefficients between plant height and the three first previous characters were obtained in the second season.

Significant positive correlation values were found between leaf area and each of number of ears/ plant, number of rows/ ear and number of kernels/ row in the first season as well as the combined analysis. However, significant positive correlation value was obtained between leaf area and number of kernels per row in the second season.

Significant negative correlation value was found between 100-kernel weight and number of ears per plant in the first season. This result indicates that selection for prolific plants would be due to decreasing 100- kernel weight. However, significant positive correlation value was detected between 100- kernel weight and number of kernel per row. Moreover, insignificant correlation coefficients were obtained between 100- kernel weight and each of number of ears/ plant, number of rows/ ear and number of kernels per row in the first, second season as well as the combined analysis (Table 14).

Significant positive correlation coefficients were obtained between number of kernels and each of number of ears/ plant and number of rows per ear in the first and second season as well as the combined analysis, except correlation values between number of kernels/ row and number of ears per plant in the first season. Also, significant positive correlation coefficient values were detected between number of rows per ear and number of ears per plant in both seasons and their combined .

Path coefficient analysis :

To calculate path coefficient, simple correlation coefficients were made between all possible pairs of the following characters: grain yield per plant, number of ears per plant, number of rows per ear, number of kernels/ row, 100- kernel weight, leaf area, and plant height (Tables 13 and 14). Partitioning of simple correlation coefficients between grain yield / plant and the previous characters in both seasons as well as the combined analysis are presented in Table (15).

Number of rows per ear had a high and positive direct effect on yield by value of 0.404, 0.412 and 0.153 in the first, second season and the combined analysis, respectively. Also, its indirect effects are important through number of kernels per row in the first season and the combined analysis. While, other indirect effects were not important.

Number of kernels per row had a positive direct effect on yield in both seasons as well as the combined analysis. Also, indirect

Table (15): Partitioning of simple correlation coefficients between grain yield and some other yield components in the two seasons and combined analysis (F1 generation).

#	Source	Correlation S_1	S_2	Comb
1	Grain yield vs number of ears/ plant			
	Direct effect	0.090	0.065	0.290
	Indirect effect via number of rows/ ear	0.213	0.155	0.076
	Indirect effect via number of kernels/ row	0.099	0.045	0.242
	Indirect effect via leaf area	-0.120	--	0.250
	Indirect effect plant height	0.245	0.212	-0.050
	Total	0.527	0.477	0.811
2	Grain yield vs. number of rows/ ear			
	Direct effect	0.404	0.412	0.153
	Indirect effect via number of ears/ plant	0.047	0.024	0.144
	Indirect effect via number of kernels/ row	0.214	0.070	0.221
	Indirect effect via leaf area	-0.202	--	0.207
	Indirect effect plant height	0.399	0.363	-0.032
	Total	0.862	0.869	0.693
3	Grain yield vs. number of kernels/ row			
	Direct effect	0.401	0.125	0.373
	Indirect effect via number of ears/ plant	0.022	0.023	0.188
	Indirect effect via number of rows/ ear	0.216	0.231	0.091
	Indirect effect via leaf area	-0.128	--	0.291
	Indirect effect plant height	0.262	0.212	-0.005
	Total	0.773	0.714	0.893
4	Grain yield vs. leaf area.			
	Direct effect	-0.284	--	0.327
	Indirect effect via number of ears/ plant	0.038	--	0.222
	Indirect effect via number of rows/ ear	0.288	--	0.097
	Indirect effect via number of kernels/ row	0.182	--	0.332
	Indirect effect plant height	0.388	--	-0.059
	Total	0.612	--	0.919
5	Grain yield vs. plant height			
	Direct effect	0.459	0.437	-0.079
	Indirect effect via number of ears/ plant	0.048	0.031	0.174
	Indirect effect via number of rows/ ear	0.351	0.342	0.062
	Indirect effect via number of kernels/ row	0.229	0.095	0.240
	Indirect effect leaf area	-0.240	---	0.245
	Total	0.847	0.905	0.642

effects are important through number of rows/ ear and plant height in both seasons. While, small indirect effect through other cases.

Leaf area had a large direct effects on grain yield in the combined analysis. Also, indirect effects are important through number of ears/ plant and number of kernels / row in the combined analysis and through number of rows/ ear in the first season.

Plant height had a high and positive direct effects on yield in both seasons. Also, its indirect effects are important through number of kernels per row in the first season and the combined analysis. While. Other indirect effects were not important.

Number of kernels per row had a positive direct effect on yield in both seasons as well as the combined analysis. Also, indirect effects are important through number of rows/ ear and plant height in both seasons. While, small indirect effect was important through other cases.

Leaf area had a large direct effect on grain yield in the combined analysis. Also, indirect effects were important through number of ears/ plant and number of kernels/ row in the combined analysis and through number of rows/ ear in the first season.

Plant height had a high and positive direct effects on yield in both seasons. Also, its indirect effects were important through number of rows/ ear in both seasons, and number of kernels per row in the first season and the combined analysis, and through leaf area in the combined analysis.

Number of ears per plant had a low direct effect on yield in both seasons. While, direct effect of this trait was important in the combined analysis. Also, its indirect effect was important through number of rows/ ear in both seasons and through leaf area in the combined analysis.

Leaf area had a high and positive direct effect on yield in the combined analysis. Also, its indirect effect was important through number of kernels per row in the first season and the combined analysis, and through number of rows/ ear and plant height in the first season.

The coefficients of determination were calculated for the direct and indirect effects of the factors studied, transformed into percentages in order to evaluate these factors according to their importance as sources of variation in plant yield. Results are presented in descending order shown in Table (16). The results revealed that the most important sources of variation for plant yield were : the direct effects of plant height and number of rows/ ear in the first and second seasons followed by direct effect of number of kernels per row in the first season and the combined analysis then by direct effect of leaf area in the first season and the combined analysis and number of ears per plant in the combined analysis/

Table (16): The components in percent for grain yield variation in F1 generation and combined analysis.

#	Source of variation	Coefficient of determination			Percentage contributed		
		S1	S2	Comb	S1	S2	Comb
1	Number of ears/ plant	0.0081	0.0042	0.0841	0.81	0.42	8.41
2	Number of rows/ ear	0.1632	0.1697	0.0234	16.32	16.97	2.34
3	Number of kernels/ row	0.1608	0.0156	0.1391	16.08	1.56	13.91
4	Leaf area	0.0807	--	0.1069	8.07		10.69
5	Plant height	0.2107	0.1909	0.0062	21.07	19.09	0.62
6	Number of ears/ plant x number of rows/ ear	0.0384	0.0202	0.0441	3.84	2.02	4.41
7	Number of ears/ plant x number of kernels/ row	0.0180	0.0059	0.1408	1.80	0.59	14.08
8	Number of ears/ plant x leaf area	-0.0216		0.1453	-2.16		14.53
9	Number of ears/ plant x plant height	0.0441	0.0277	-0.0276	5.41	2.77	-2.76
10	Number of rows/ ear x number of kernels/ row	0.1733	0.0578	0.0679	17.33	5.78	6.79
11	Number of rows/ ear x leaf area	-0.1638	--	0.0636	-16.38		6.36
12	Number of rows/ ear x plant height	0.3230	0.0270	-0.0099	32.30	2.70	-0.99
13	Number of kernels/ row x leaf area	-01034		0.2176	-10.34		21.76
14	Number of kernels/ row x plant height	0.2106	0.0838	-0.0380	21.06	8.38	-3.80
15	Leaf area x plant height	-0.2206		-0.0389	-22.06		-3.89
	Residual	0.0785	0.3972	0.0754	7.85	39.72	7.54
	Total	1.000	1.000	1.000	100.00	1.000	1.00

In the first season, the direct effect for the four traits (number of rows/ ear, number of kernels per row, leaf area and plant height) accounted for approximately 61.54 %. While, the direct effect for number of rows per ear and plant height accounted for approximately 35.41% in the second season. Moreover, the direct effect of number of ears per plant, number of kernels per row and leaf area accounted for approximately 33.01 %. Other important sources of grain yield were the indirect effects of number of rows/ ear x number of kernels / row and number of kernels per row x plant height in the first season, number of kernels per row x plant height in the second season, and number of ears per plant x number of kernels per row , number of ears per plant x leaf area and number of kernels per row x leaf area in the combined analysis (Table 15). Such apparent contradiction in results could be attributed to seasonal effects on genotypes . In this connection, Sary *et al.* (1990) found that the most important sources of variability in plant yield were the direct effect of number of kernels per row and its indirect effect through number of rows/ ear and through 100- kernels weight. These three sources alone accounted for approximately 82.18 % and 63.03 % at the early and late planting dates, respectively.

In this connection, Mohamed (1984) reported that the most important sources of variation in plant yield was the direct effect of number of kernels /row and its indirect effect through weight of 100-kernel, since these sourc3es alone accounted for approximately 63.5 % and 67.4 % of grain yield variation in they early and late seasons, respectively. El- Hosary *et al.* (1989) found that the most important sources of variation for plant yield (71.63 %) in the first set were : direct effect of 100- kernel weight, direct effect of number of rows/ ear, and indirect effect of number o kernels per row through 100- kernels weight . While, in the second set, the main sources of variation (61.88 %) were : direct effect of number of rows/ ear, direct effect of number of kernels per row and the indirect effect of number of row/ ear via number of kernels / row.

F_2 generation :

Results in Table (17) showed that the analysis of variance for the studied traits. Mean squares for genotypes were significant for all traits except number of ears per plant. Parent mean squares were significant for all traits except 100- kernel weight and ear diameter. Also, hybrids mean squares were significant for all traits except number of rows/ ear and number of kernels/ row . While, parents vs crosses mean squares were significant for all traits except 100- kernel weight and leaf area . Such results indicated that the tested genotypes varied from each other. F_2 mean values were significantly higher than parental inbred lines mean values for all traits except ear length and ear husk where the parental means were significantly higher than F_2 mean values Table (18).

Results in Table (18) showed that mean performance in the F_2 . With the exception of 100- kernel weight , plant height and ear height, non of the F_2 hybrids surpassed the better check variety for all traits . For the exceptional traits all crosses exhibited short plant and

Table (17): Observed mean squares from ordinary analysis of variance for growth and yield characteristics in the F_2 generation.

S.O.V	d.f	Tasseling date	Silking date	Ear height (cm)	Plant height (cm)	Leaf area (cm2)	Leaf angle	Stem diameter (cm)	No. of ears/ plant	Husk of ear	Ear length (cm)	Ear diameter (cm)	No. of kernels/ row	No. of rows/ ear	Weight of 100 kernel	Shelling percentage	Grain yield/ plant (g)
Blocks	2	0.64	0.86	2.56	0.50	4394	2.79	0.06	0.001	0.21	0.19	0.14	28.1	7.94	10.4	4.16	44.7
Genotypes	35	4.17**	7.11**	1729.6**	6073.9**	14974.9**	20.4**	2.75**	0.01	0.85**	5.6**	2.69**	36.1*	11.1**	47.5**	33.5**	1035.6**
Parents	7	8.57**	16.22**	465.4**	1597.61**	10775.7**	51.9**	3.56**	0.02	1.89**	12.4**	0.25	46.2*	18.4**	11.09	37.9**	457.9**
Crosses	27	2.77	4.55**	495.6**	907.2**	16471.9**	12.7**	2.63**	0.01	0.27**	3.8**	2.8**	28.3	1.72	57.6**	33.1**	1071.2**
P. vs C.	1	11.10*	12.46**	43897.3**	176910.**	3952.0	5.62*	0.27**	0.09	9.30**	4.0*	16.1**	117.2*	213.3**	29.3	15.7**	4119.3**
Error	70	2.37	0.63	3.73	4.16	3319.8	0.96	0.04	0.03	0.13	0.71	0.13	20.3	1.41	25.07	3.4	31.5

* and ** Significant at 0.05 and 0.01 levels of probability, respectively.

Table (18): The genotypes mean performance for growth and yield characteristics in average over the two experiments in the F2 generation.

Genotypes	Tasseling date	Silking date	Ear height (cm)	Plant height (cm)	Leaf area cm^2	Leaf angle	Stem diameter	No. of ears/ plant
110B	64.00	68.0	88.3	170.3	480.9	23.3	3.5	1.00
72	66.33	72.6	71.3	123.7	546.2	19.	3.4	1.00
27	64.67	67.0	87.2	156.0	463.9	20.3	2.1	1.00
101	64.00	69.5	67.5	119.7	629.9	25.4	3.0	1.00
70B	66.00	70.0	52.6	103.0	546.6	29.1	2.2	1.00
105g	69.00	74.30	63.6	132.7	580.4	17.7	1.2	1.07
36	65.33	69.0	79.9	151.0	607.2	19.3	2.1	1.04
106i	67.00	71.0	64.5	115.0	602.7	17.0	1.4	1.07
110B x 72	66.76	69.8	115.8	225.9	513.8	20.3	2.2	1.20
x 27	68.33	70.3	118.1	215.1	554.3	19.7	2.2	1.06
x 101	66.67	68.0	137.5	236.0	652.5	20.2	2.3	1.07
x 70B	66.67	69.2	124.1	234.3	533.1	21.6	2.0	1.03
x 105g	66.67	68.8	120.1	231.2	553.3	20.8	2.2	1.21
x 36	67.17	68.5	139.9	250.8	554.5	19.5	2.2	1.02
x 106i	66.50	68.8	111.5	213.3	426.6	23.6	4.4	1.10
72 x 27	66.17	68.8	126.4	234.5	632.5	19.8	2.3	1.02
x 101	65.33	69.8	123.8	233.0	568.3	19.6	2.2	1.00
x 70B	66.50	69.0	130.5	238.6	501.2	2.9	2.3	1.10
x 105g	66.83	68.7	134.8	250.1	473.0	17.1	2.3	1.00
x 36	65.76	68.5	127.6	234.0	299.3	19.6	2.4	1.12
x 106i	67.83	70.8	102.5	205.2	456.8	24.4	2.1	1.13
27 x 101	66.67	69.3	124.8	216.5	522.6	20.7	2.3	1.11
x 70B	64.33	67.3	113.1	220.0	502.5	22.3	2.2	1.01
x 105g	64.75	67.3	112.5	247.5	555.1	23.8	2.3	1.05
x 36	67.67	73.00	124.2	244.2	613.5	19.8	2.5	1.15
x 106i	66.67	68.83	134.2	258.4	591.5	22.4	2.2	1.05
101 x 70B	65.50	68.00	148.4	260.3	664.2	18.5	2.1	1.11
x 105g	65.67	68.67	113.2	244.6	585.3	21.4	2.0	1.07
x 36	65.50	68.83	98.5	200.0	575.8	19.5	2.3	1.13
x 106i	67.50	70.67	106.2	224.0	564.7	21.3	2.2	1.14
70B x 105g	67.00	69.17	96.9	191.5	584.1	22.3	2.2	1.09
x 36	66.00	70.33	115.4	225.4	546.4	19.6	2.2	1.14
x 106I	66.83	69.17	127.1	254.9	501.5	26.7	2.2	1.19
105g x 36	6783	69.17	124.5	238.1	555.6	18.7	2.2	1.04
x 106I	67.67	71.17	98.4	215.6	490.5	19.6	2.2	1.10
36 x 106I	67.17	70.83	120.9	232.3	619.9	20.3	2.3	1.18
r	-0.02	0.13	0.19	0.01	0.03	0.05	.09	0.22
310 x	65.33	68.33	139.4	278.1	609.8	24.3	2.2	1.17
L.S.D 0.05 (S_{ij}- S_{ik})	2.20	1.29	3.14	3.32	93.83	1.61	0.30	0.28
L.S.D 0.01 (S_{ij}- S_{ik})	3.34	1.71	4.19	4.42	125.13	2.13	0.04	0.37

* and ** Significant at 0.05 and 0.01 level of probability, respectively.

r correlation coefficient between mid- parent and F1 mean performance.

Table (18): Cont.

Genotypes	Husk of ear (cm)	Ear length (cm)	Ear diameter (cm)	No. of kernels/ row	No. of rows/ ear	Weight of 100- kernel (g)	Shelling percentage	Grain yield/ plant
110B	2.47	10.8	3.87	30.9	13.5	24.6	79.5	90.7
72	4.40	14.5	4.15	33.3	8.7	24.9	72.1	63.3
27	4.17	9.3	4.33	25.5	10.0	24.1	79.9	59.5
101	2.20	12.0	4.22	28.2	13.0	22.9	71.3	75.0
70B	3.93	14.5	3.92	31.7	8.0	26.1	74.7	56.31
105g	3.27	10.0	3.62	30.8	7.4	27.4	79.7	56.6
36	2.93	14.0	3.57	38.6	8.1	21.3	78.5	53.8
106i	3.47	12.7	3.67	28.4	12.5	25.9	78.6	65.3
110B x 72	2.87	12.4	3.79	24.6	12.3	19.0	82.2	65.8
x 27	2.55	12.3	63.67	26.0	12.4	30.0	76.8	88.7
x 101	2.46	12.9	2.27	29.8	13.1	23.2	81.2	79.8
x 70B	2.62	12.5	2.25	29.9	13.3	25.3	79.6	88.5
x 105g	2.44	12.0	2.20	27.5	13.1	18.0	77.4	65.8
x 36	2.54	12.6	4.65	32.9	13.3	28.5	78.3	102.5
x 106i	2.27	8.9	2.68	20.6	13.1	20.0	78.9	57.1
72 x 27	2.30	13.3	4.37	30.8	13.9	21.8	76.4	87.6
x 101	2.53	13.6	4.13	29.6	14.5	22.0	75.9	79.2
x 70B	2.40	11.3	2.27	27.1	12.2	30.0	75.9	96.2
x 105g	3.54	12.5	4.20	26.1	12.7	30.9	79.6	91.7
x 36	2.57	11.4	2.63	30.5	12.9	23.5	74.8	86.9
x 106i	2.59	10.3	4.20	26.7	12.2	22.0	70.3	72.2
27 x 101	2.57	12.3	3.50	27.4	12.4	22.0	68.8	71.1
x 70B	2.57	10.1	3.00	28.5	13.2	23.8	77.8	83.8
x 105g	2.67	10.4	2.33	29.6	12.6	24.0	74.9	83.7
x 36	2.65	12.9	4.36	30.9	13.5	29.9	75.2	101.3
x 106i	2.40	12.9	3.01	27.2	12.5	16.0	76.0	54.9
101 x 70B	2.53	11.5	4.57	29.5	13.2	27.0	74.2	101.4
x 105g	3.27	11.4	2.62	28.9	13.1	20.0	75.7	68.9
x 36	2.94	11.9	3.98	26.8	9.9	25.5	76.2	66.8
x 106i	2.37	11.8	3.22	25.9	13.3	24.7	77.3	83.6
70B x 105g	2.57	9.8	2.59	24.6	12.9	17.0	76.8	48.8
x 36	2.61	11.7	2.80	29.1	13.1	23.0	76.7	86.4
x 106I	2.82	12.6	4.39	32.3	13.8	17.0	74.8	67.1
105g x 36	2.57	11.2	4.41	30.2	13.3	27.3	73.3	98.6
x 106I	3.31	12.4	2.70	19.4	13.2	26.6	71.8	61.5
36 x 106I	2.64	10.3	2.50	27.5	12.2	17.0	67.8	64.8
r	-0.03	-0.06	.08	0.27	-0.14	-0.23	0.03	-0.21
310 x	7.52	14.3	4.16	31.9	12.0	21.4	80.0	143.2
L.S.D 0.05 (S_{ij}- S_{ik})	0.58	1.37	0.28	7.34	1.93	8.15	3.01	9.14
L.S.D 0.01 (S_{ij}- S_{ik})	0.77	1.83	0.38	9.69	2.56	10.86	4.01	12.19

* and ** Significant at 0.05 and 0.01 level of probability, respectively.

r correlation coefficient between mid- parent and F1 mean performance.

short ear heights except the cross 101H x 70 B for ear height where it gave the highest ear position. Also, the crosses 110B x 2, 72 x 70B, 72 x 105g and 27 x 36 surpassed the best check variety.

Remain heterosis :

Results on remain heterosis are presented in Table (19). Results show that positive remain heterosis relative to mid- parent was manifested by several F_2 combinations for all traits.

For tasseling date, non of the hybrids has significant negative remain heterosis effects relative to mid- parent or better parent. While, fourteen and two hybrids gave significant negative remain heterosis effects relative to mid- parent and better parent, respectively. Hence, it could be concluded that these crosses are valuable in breeding for earliness.

For ear and plant height, all parental combinations showed significant positive remain heterosis effects relative to mid- and better parent.

For leaf angle, seven and thirteen hybrids had significant positive remain heterotic effects relative to mid- and better parent, respectively. While, eleven and three crosses exhibited significant negative remain heterotic effects in the same order. The cross 101h x 70 B had the highest desirable values for this trait.

For leaf area, three crosses showed significant positive heterotic effects relative to mid- parent. While, none of the hybrids

Table (19): Percentage of remain heterosis in the F_2 generation for the studied traits .

Trait / Cross	Tasseling date		Silking date		Ear height (cm)		Plant height (cm)		Leaf area (cm^2)	
	MP	BP	MP	BP	MP	BP	MP	BP	MP	BP
110B x 72	2.30	4.17*	-0.66	2.70**	45.10**	62.44**	53.74**	82.73**	0.05	-5.94
x 27	6.22**	6.77*	4.20**	4.98**	34.51**	35.29**	31.86**	37.91**	17.33*	15.26
x 101H	4.17*	4.17*	-1.09	0.00	76.47**	103.78**	62.79**	97.23**	17.48*	3.58
x 70B	2.56	4.17*	0.24	1.72*	76.08**	135.82**	71.47**	127.45**	3.77	-2.46
x 105g	0.25	4.17*	-3.05**	1.23	58.19**	89.01**	52.64**	74.30**	4.27	-4.66
x 36	3.87	4.95*	0.00	0.74	65.21**	73.87**	56.13**	66.11**	1.91	-8.68
x 106i	1.53	3.91	-0.96	1.23	45.88**	72.84**	49.51**	85.46**	-21.26**	-29.21**
72 x 27	1.02	2.32	-1.39*	2.74**	59.52**	77.35**	67.69**	89.62**	25.24**	15.80
x 101H	0.26	2.08	-1.71**	0.48	78.46**	83.52**	91.51**	94.70**	-3.37	-9.79
x 70B	0.50	0.76	-3.27**	-1.43	110.64**	147.95**	110.55**	131.67**	-8.28	-8.31
x 105g	-1.23	0.75	-6.32**	-5.42**	99.98**	112.13**	95.16**	102.26**	16.03	-18.51**
x 36	-0.25	0.51	-3.25**	-0.73	68.73**	78.97**	70.39**	89.23**	-48.10**	-50.70**
x 106i	1.75	2.26	-1.35*	-0.24	51.04**	58.99**	71.96**	78.43**	-19.96**	-23.71**
27 x 101H	3.63*	4.17*	1.59	3.48**	61.42**	85.07**	57.06**	80.90**	-4.46	-17.05**
x 70B	-1.53	0.52	-1.70**	0.50	61.83**	115.05**	69.92**	113.63**	-0.55	-8.07
x 105g	-3.12	0.13	-4.49**	0.50	49.24**	77.04**	71.48**	86.56**	6.30	-4.37**
x 36	4.10*	4.64*	7.35**	8.96**	48.61**	55.38**	59.06**	61.70**	14.56	1.05
x 106i	1.27	3.09	-0.24	2.74**	76.86**	108.04**	90.72**	124.71**	10.91	-1.86*
101H x 70B	0.77	2.34	-2.51**	-2.16**	147.17**	182.01**	133.76**	152.67**	12.91	5.44
x 105g	-1.25	2.60	-4.30**	-1.20	72.81**	78.11**	93.88**	104.40**	-3.28	-7.08
x 36	1.29	2.34	-0.60	-0.24	33.66**	46.03**	47.80**	67.14**	-6.91	-8.59
x 106i	3.05	5.47**	0.59	1.68*	60.97	64.67**	90.94**	94.82**	-8.38	-10.36
70B x 105g	-0.74	1.52	-3.94**	-1.20	66.88**	84.22**	62.52**	85.42**	3.66	0.64
x 36	0.51	1.02	1.20*	1.93*	74.19**	81.65**	77.46**	118.82**	-5.29	-10.01
x 106i	0.50	1.26	-1.89**	-1.19	117.01**	143.86**	133.86**	147.49**	-12.72	-16.78*
105g x 36	0.99	3.83	-3.26**	0.24	73.53**	95.89**	67.89**	79.48**	-6.44	-8.50
x 106i	-0.49	0.99	-1.84**	0.34	53.70**	95.89**	74.08**	87.45**	-17.08**	-18.61*
36 x 106i	1.51	2.81	1.19*	2.66**	67.43**	87.48**	74.62**	101.95**	2.48	2.09

Table (19): Cont.

Trait / Cross	Leaf angle MP	Leaf angle BP	Stem diameter (cm) MP	Stem diameter (cm) BP	Husk of ear (cm) MP	Husk of ear (cm) BP	Ear length (cm) MP	Ear length (cm) BP	Ear diameter (cm) MP	Ear diameter (cm) BP
110B x 72	-5.44	-3.79	1.44	-13.41**	-16.51*	-34.85*	-1.63	-14.21**	-5.45	-8.68
x 27	-9.77**	-3.10	-12.70**	-15.57**	-23.12**	-38.70*	22.01**	13.77*	-10.19	-15.31
x 101H	-17.24**	-13.54**	-30.15**	-35.14**	5.29	-0.41	12.93*	7.25	-43.75**	-46.01**
x 70B	-17.71**	-7.46*	50.17**	-25.90**	-18.02*	-33.31**	-1.07	-13.68**	-42.10**	-42.47**
x 105g	1.38	17.43**	-6.36**	-10.79**	-14.77	-25.20**	15.68**	11.43	-41.14**	-43.02**
x 36	-8.53*	0.93	-29.49**	-38.00**	-5.80	-13.30	1.67	-9.98*	25.20**	20.35**
x 106i	16.89**	38.65**	44.13**	1.03**	-23.60*	-34.62**	-23.62**	-29.26**	-28.76**	-30.60**
72 x 27	-0.57	1.48	-17.24**	-32.94**	-46.30**	-47.73**	11.48*	-8.36	3.03	0.84
x 101H	-12.92**	0.15	-32.50**	-36.47**	-23.43**	-42.58**	2.31	-6.51	-1.36	-2.13
x 70B	-5.90*	17.26**	18.49**	-33.24**	-42.48**	-45.53**	-21.97**	-22.00**	-43.72**	-45.30**
x 105g	-8.19*	-3.50	-23.45**	-33.53**	-7.74	-19.62	2.07	-13.77**	-41.83**	-45.54**
x 36	0.60	1.14	38.67**	0.09**	-30.00**	-41.67**	-20.33**	-96.39**	-31.75**	-36.55**
x 106i	33.74**	43.71**	-34.57**	25.07**	-34.07**	-41.06**	-24.27**	-29.06**	-45.33**	-48.51**
27 x 101H	-9.36**	1.62	-13.33**	-15.40**	-19.37**	-38.40**	15.61**	2.78	-47.45**	-48.15**
x 70B	-9.85**	9.69*	28.00**	-23.47	-36.46**	-38.24**	-15.19**	-30.27**	-46.67**	-49.23**
x 105g	25.27**	34.46**	51.52**	10.43	-28.25**	-36.00**	7.64*	4.07	-41.32**	-35.54**
x 36	-0.10	2.48	18.48**	18.48	-25.35**	-36.40**	10.38**	-8.00	10.30	0.54
x 106i	19.91**	31.65**	24.85**	10.08	-37.12**	-42.40**	16.77**	1.42	-46.08**	-50.23**
101H x 70B	-32.35**	-27.36**	-17.05**	-36.68**	-17.39*	-35.59**	12.99	-20.47**	12.38*	8.38
x 105g	-0.57	20.92**	1.52**	-15.58**	19.76*	0.20	3.18	-5.42**	-33.22**	-37.95**
x 36	-12.79**	0.93	-9.80**	-23.50**	14.42	0.11	-8.18	-14.74**	2.36	-5.53
x 106i	0.36	25.17**	2.29**	-16.23**	-16.24	-31.54*	-4.08	-6.61	-43.43**	-47.12**
70B x 105g	-4.91	25.66**	30.35	-23.51	-28.52**	-34.58**	-19.86**	-32.28**	-41.97**	-44.17**
x 36	-18.99**	1.55	4.67	-32.62	-23.98*	-33.64**	-17.59**	-18.98**	-40.22**	-42.89**
x 106i	15.81**	57.12**	27.27	-8.31	-23.78*	-28.31**	-7.25	-13.09**	15.87*	12.17
105g x 36	0.81	5.36	32.72	-3.36	-17.20*	-21.43*	-6.86	-20.17**	22.82**	21.92
x 106i	12.61**	15.06**	75.59	10.28**	-1.78	-4.62	9.27	-2.24	-38.88**	-39.27**
36 x 106i	11.93**	19.59**	31.21	5.17	-17.60	-32.97*	-22.50**	-26.19**	-37.33**	-38.18**

Table (19): Cont.

Trait	No. of kernels/ row		No. of rows/ ear		Weight of 100 kernel (g)		Shelling percentage		Grain yield/ plant (g)	
Cross	MP	BP	MP	BP	MP	BP	MP	BP	MP	BP
110B x 72	-23.27*	-25.91	12.56	-7.53**	-23.14	-23.63	8.44	3.36	-14.55**	-27.47**
x 27	-7.91	-16.03	4.94	-8.57**	23.23	22.15	-3.69	-3.93*	18.17**	-2.15
x 101	0.68	-3.81	-6.26	-8.02	-2.09	-5.52	7.61	2.09	-3.65	-11.98*
x 70B	-4.74	-5.88	23.60**	-1.49	-0.08	-3.06	3.17	0.06	20.54**	-2.44
x 105g	-11.08	-11.31	25.40**	-2.90**	-30.68**	-34.24*	-2.84*	-2.99	-10.72**	-27.49*
x 36	-5.22	-14.56	29.57**	-0.97**	24.29	16.04	-0.87	-1.49	41.83**	12.98**
x 106i	-30.49**	-33.41	21.20**	-2.99**	-20.79	-22.90	-0.19	-0.77	-34.51**	-43.67**
72 x 27	4.87	-7.35	49.91**	39.87*	-11.05	-12.39	0.57	-4.38*	42.69**	38.42
x 101	-3.74	-11.05	24.70**	4.01**	-7.89	-11.58	5.93	5.41*	14.83*	5.84
x 70B	-16.57	-18.50	46.02**	40.45**	17.65	14.86	3.48	1.64	61.66**	52.04**
x 105g	-18.62	-21.61	58.42**	46.81**	18.20	12.82	4.81	-0.24	52.89**	44.86**
x 36	-15.15	-20.99*	64.51**	49.89**	1.78	-5.55	-0.60	-4.69*	48.58**	37.46**
x 106i	-13.50	-19.85	45.27**	40.49**	-13.42	-15.19	-6.65	-10.45**	12.27	10.51
27 x 101	1.90	-2.98	8.05	-4.30	-6.42	-8.83	-9.06	-13.94**	5.67	-5.27
x 70B	-0.53	-10.28	46.15**	31.53**	-5.27	-8.88	0.68	-2.60	44.93**	40.80**
x 105g	4.96	-4.07	44.72**	25.23	-6.80	-12.31	-6.20	-6.30**	44.19**	40.72**
x 36	-3.27	-19.65*	57.98**	35.23**	31.81*	24.08*	-5.03*	-5.87**	146.74**	134.94**
x 106i	0.88	-4.22	38.46**	25.23	-36.09*	-38.32	-4.08*	-4.89*	-12.04	-15.97*
101 x 70B	-1.57	-7.03	26.05**	1.93*	10.18	3.37	1.63	-0.67	54.65**	35.16**
x 105g	-2.16	-6.29	28.68**	1.03*	-20.41	-26.93	0.19	-5.09**	4.66	-8.17
x 36	-19.68*	-30.48	-1.33	-23.56**	15.41	11.40	1.65	-2.99	3.78	-10.90
x 106i	-8.54	-8.81	25.89**	2.24*	1.17	-4.78	3.13	-1.61	19.08	11.34
70B x 105g	-21.39	-22.52	68.25**	61.83**	-36.44**	-3789*	-0.54*	-3.68	-13.51	-18.24**
x 36	-17.21	-24.56	73.06**	63.54**	-2.99	-11.95	0.12	-2.30	57.22**	53.98**
x 106i	7.42	-1.75	71.91**	70.95	-34.69*	-34.92*	-2.44*	-4.84*	10.46	2.66
105g x 36	-13.03	-21.79	82.63**	79.30**	12.35	-0.11	-7.32	-8.05**	78.58**	74.12**
x 106i	-34.33*	-36.93	70.33**	62.96**	-0.21	-2.81	-9.32	-9.99**	0.77	-5.94
36 x 106i	-17.94	-28.79	60.64**	51.01**	-28.03	-34.46*	-13.71	-13.75	8.83	-0.77

had significant positive remain heterotic effects relative to better parents. However, four and six hybrids showed significant negative remain heterotic effects relative to mid – and better parent, respectively.

For ear length, seven an one hybrids has significant positive remain heterotic effects relative to mid and better parent, respectively.

For husk of ear twenty two and twenty one hybrids had significant negative remain heterotic effects relative to mid and better parent, respectively.

For plant and ear height, all crosses had significant positive heterotic effects relative to mid- parent and better parent, respectively.

For leaf area the cross (110B x 27) and (72 x 27) gave the desirable remain heterotic effects for mid- parents.

For ear diameter the cross (70B x 106i), (105g x 36) and (110B x 36) gave the desirable remain heterotic effects relative to mid-parent.

For stem diameter, fourteen and four hybrids had significant positive remain heterotic effects relative to mid- and better parent, respectively.

Concerning leaf angle the crosses 110B x 101H, 110B x 70b and 101H x 70B gave the desirable remain heterotic effects relative to mid and better parent , respectively.

Concerning number of rows per ear twenty three and sixteen hybrids had significant positive remain heterotic effects relative to mid- and better parent, respectively.

Concerning number of kernels per row four and three hybrids had significant negative remain heterotic effects relative to mid- and better parent, respectively.

For weight of kernel the cross (27 x 36) gave desirable remain heterotic effects relative to mid and better parent, respectively.

For shelling percentage the crosses (110B x 105g), (27 x 36) and (70B x 106i) gave significant negative remain heterotic effects relative to mid- and better parent, respectively.

Concerning grain yield per plant, fifteen and nine hybrids expressed significant positive remain heterotic effects relative to mid- and better parent, respectively.

Inbreeding depression

Results of inbreeding depression (I.D) in F_2 generation for all traits are presented in Table (20).

For tasseling and silking dates, most hybrids showed significant negative I.D. percentage, indicating that the mean values in the F_1 were the earliest than F_2. These results are in agreement with findings of Pena and Arellano (1991) for tasseling date and Motawea (1997) for both traits.

Table (20): Percentage of inbreeding depression in the F_2 generation for the studied traits.

Trait / Crosses	Tasseling date	Silking date	Ear height (cm)	Plant height (cm)	Leaf area (cm^2)	Leaf angle	Stem diameter (cm)	Husk of ear	Ear length (cm)	Ear diameter (cm)	No. of kernels/ row	No. of rows/ ear	Weight of 100 kernel	Shelling percentage	Grain yield/ plant (g)
110B x 72	-16.96**	-13.23**	24.32**	23.31**	37.85**	30.88**	16.73**	13.81**	39.41**	15.20**	41.0**	17.0**	24.0**	8.0**	61.49**
x 27	-15.20**	-12.22**	13.42**	21.67**	15.56**	29.64**	14.39**	15.00**	34.57**	1.60	32.0**	16.0**	-22.0**	1.0	53.13**
x 101	-0.09**	-6.25**	-5.18**	14.06**	0.11	24.37**	-7.07	25.45**	38.91**	53.00**	22.0**	19.0**	12.0**	2.0*	59.57**
x 70B	-11.73**	-8.63**	4.63**	16.23**	29.37**	32.53**	-10.27**	18.12**	36.82**	51.82**	24.0**	4.0**	4.0	7.0**	45.97**
x 105g	-8.70**	6.99**	11.89**	9.43**	21.81**	19.30**	7.17**	46.95**	39.03**	57.92**	36.0**	5.0**	39.0**	6.0**	64.49**
x 36	-10.71**	8.73**	-5.28**	11.10**	28.80**	34.96**	6.00**	22.32**	32.25**	11.76**	-2.0	-10.0**	5.0	36.0**	23.48**
x 106i	-10.22**	-6.43**	13.87**	25.85**	38.28**	29.28**	-7.40**	60.90**	49.66**	37.67**	51.0**	30.0**	15.0**	-75.96**	69.80**
72 x 27	-18.86**	-13.85**	11.76**	4.39**	11.34**	33.93**	-5.06**	46.88**	14.09**	2.88	3.0	5.0**	0.9	-0.28	34.05**
x 101	-8.88**	-10.26**	11.99**	14.96**	22.06**	26.90**	1.81**	38.29**	5.83**	12.68**	1.0	36.0**	2.0	-4.0*	30.44**
x 70B	-15.31**	-12.50**	15.27**	14.26**	39.30**	37.39**	2.71**	29.41**	40.87**	50.65**	28.0**	20.0**	36.0**	-3.0*	38.16**
x 105g	-13.27**	-9.57**	6.38**	10.13**	4.01**	45.38**	10.67**	26.25**	22.83**	8.69**	22.0**	8.0**	47.0**	-2.0**	33.29**
x 36	-16.58**	12.90**	9.95**	23.94**	63.26**	34.80*	10.16**	46.45**	38.74**	40.22**	6.0*	7.0**	6.0	-7.0**	38.25**
x 106i	-9.40**	-7.96**	26.70**	28.33**	47.82**	28.14**	4.46**	21.51**	41.96**	10.06**	25.0**	2.0**	5.0	-2.0	38.24**
27 x 101	-14.94**	-11.82**	16.96**	21.65**	34.33**	33.83**	3.43**	32.36**	32.73**	25.05**	31.6**	20.0**	-3.0	17.0**	52.92**
x 70B	-16.96**	-10.97**	25.07**	23.06	34.67**	13.12**	8.33**	43.26**	41.03**	33.77**	21.0**	6.0**	-1.0	1.0	41.11**
x 105g	-14.25**	-8.56**	14.02**	12.58**	20.36**	20.53**	7.17**	34.39**	45.97**	50.10**	34.0**	11.0**	13.0	-0.87	52.74**
x 36	-12.16**	-14.65**	16.08**	9.34**	30.98**	21.79**	-8.69**	11.66**	38.07**	-13.83**	18.0**	-7.0**	-42.0**	-1.17	16.61
x 106i	-9.88**	-6.43**	-76.61**	1.47	10.37**	35.44**	-4.85**	27.92**	24.18**	24.18**	28.5**	7.0**	35.0**	-3.94*	59.00**
101 x 70B	-8.56**	-7.37**	-3.51**	10.87**	25.18**	38.50**	-3.16**	22.62**	35.38**	-8.80**	14.0**	8.0**	9.0*	-0.58	40.93**
x 105g	-8.24**	-6.32**	24.70**	15.16**	23.43**	26.06**	-9.50**	-3.15**	40.66**	45.75**	23.0**	2.0	34.0**	-4.0**	60.75**
x 36	-19.80**	-17.45**	28.27**	23.94**	13.95**	70.83**	0.43**	36.08**	33.03**	0.50	18.0**	23.0**	-6.0	-9.0**	41.69**
x 106i	-15.72**	-13.98**	22.50**	14.47**	14.38**	30.61**	1.76**	21.00**	42.15**	31.05**	35.0**	15.0**	-3.0	6.0**	59.30**
70B x 105g	-9.83**	-8.07**	31.19**	37.55**	26.93**	34.47**	7.59**	42.88**	48.01**	44.54**	34.0**	9.0**	24.0**	-7.0**	97.72**
x 36	-14.44**	-12.88**	22.06**	18.14**	26.22**	23.52**	-0.45**	31.31**	40.64**	39.52**	6.0	9.0**	4.0	-6.0**	32.72**
x 106i	-4.60*	-3.74**	8.48**	7.02**	24.844**	8.96**	-2.28**	21.66**	-1.70	-88.40**	9.0	-12.0**	42.0**	2.0	55.19**
105g x 36	-11.80**	-7.57**	13.35**	16.05**	29.84**	31.65**	5.19**	14.33**	44.10**	10.54**	18.0**	7.0**	-27.0**	9.0**	40.19**
x 106i	-9.72**	-9.49**	8.98**	24.50**	40.61**	36.22**	3.04**	-0.30	34.56**	41.30**	47.0**	15.0**	0.87	15.0**	51.40**
36 x 106i	-11.95**	-11.24**	28.18**	19.79**	13.88**	8.95	37.46**	25.14**	44.67**	45.30**	15.0**	13.0**	19.0**	-1.07	51.81**

* and ** significant at 0.05 and 0.01 levels of probability, respectively.

For plant and ear heights, leaf area and leaf angle, all parental combinations showed significant positive I.D. percentage .

Nineteen, twenty two, twenty six , twenty three, twenty three, thirteen, nine, and twenty seven hybrids exhibited significant positive I.D. percentage for stem, diameter, ear diameter, ear length, ear husk, number of rows/ ear, number of kernels per row, 100- kernel weigh, shelling percentage and grain yield per plant, respectively.

II- Combining ability

Analysis of variance for combining ability as outlined by Girffing's (1956) method –2 model- 1 in the F_2 data is presented in Table (21).

General and specific combining ability mean squares were significant for all traits except GCA for 100- kernel weight and SCA for tasseling date.

It is evident that additive type of gene action was the more important part in the total genetic variability for tasseling date. However, nonadditive gene action was the more important part in the total variability for 100- kernel weight. For the other studied traits, both additive and non- additive gene effects were involved in determining the performance of single cross progeny. High GCA/ SCA ratios which exceeded the unity were detected for number of kernels per row, ear length, leaf angle, leaf area, silking date, ear husk and shelling percentage . Such results indicated that additive and

Table (21): Observed mean squares for general and specific combining ability for growth and yield characteristics in the F_2 generation.

S.O.V	d.f	Tasseling date	Silking date	Ear height (cm)	Plant height (cm)	Leaf area (cm^2)	Leaf angle	Stem diameter (cm)	Husk of ear	Ear length (cm)	Ear diameter (cm)	No. of kernels/ row	No. of rows/ ear	Weight of 100 kernel	Shelling percentage	Grain yield/ plant (g)
GCA	7	2.25*	2.95**	186.78**	234.26**	5793.4**	12.51**	0.79**	0.31**	2.04**	0.53**	20.54**	2.14**	6.06	16.71**	303.93**
SCA	28	1.17	2.23**	673.97**	2472.2**	4791.3**	5.35**	0.95**	0.28**	1.81**	0.99**	9.92*	4.09**	18.69**	9.79**	355.52**
Error	70	0.79	0.21	1.24	1.39	1106.6	0.32	0.01	0.04	0.24	0:04	6.78	0.47	8.36	1.14	10.51
GCA/SCA		1.92	1.33	0.28	0.09	1.21	2.34	0.84	1.11	1.12	0.53	2.07	0.52	–	1.71	0.85

* and ** Significant at 0.05 and 0.01 levels of probability, respectively.

additive x additive types of gene action were more important than nonadditive effects in controlling these traits. For other traits: stem diameter, ear diameter, plant height, number of rows/ ear, and grain yield per plant, the ratio of GCA/ SCA was less than unity, revealing that nonadditive type of gene action was important than additive one for controlling these traits. This finding coincided with that already reached from the combining ability analysis in the F data (Table 10).

The genetic expectation for the F_2 are the same as F_1 except that the dominance component in the F_2 SCA is 25% in the F_1 (Meredith, 1984). SCA mean squares of low magnitude, although still highly significant could be noticed for most traits.

Estimates of general combining ability effects (g_i) for individual parents in F_2 generation are shown in Table (22). Results indicated that the parental inbred line M,. 110B seemed to be the best combiner for silking date , stem diameter, shelling percentage, number of rows/ ear and grain yield per plant. M 72 expressed desirable significant g_i effects for plant height, leaf angle, ear husk and ear length. M. 27 showed desirable g_i effects for silking date and grain yield per plant. While, the inbred line M. 101H had significant desirable g_i effects for silking and tasseling dates, plant height, leaf area, stem diameter, ear diameter, ear length and number of grains per row. The parental line M. 70B expressed significant negative g_i effects for ear and plant heights and silking date. The parental inbred line M. 105g gave desirable g_i effects for ear height, leaf angle, and ear husk. The parental inbred line M. 36 expressed significant desirable g_i effects for

Table (22): Estimates of general combining ability effects in the F_2 generation.

Parent	Traits	Tasseling date	Silking date	Ear height (cm)	Plant height (cm)	Leaf area (cm2)	Leaf angle	Stem diameter (cm)	Husk of ear	Ear length (cm)	Ear diameter (cm)	No. of kernels/ row	No. of rows/ ear	Weight of 100 kernel	Shelling percentage	Grain yield/ plant (g)
110B	g_i	-0.09	-0.60**	5.64**	6.07**	-16.33	0.29	0.35**	-0.26**	0.15	0.05	-0.35	0.80**	0.01	2.85**	3.42**
	X	64.00	68.00	88.32	170.31	480.93	23.33	3.50	2.47	10.79	3.87	30.96	13.47	24.56	79.50	90.69
72	g_i	0.01	0.52**	1.78**	-1.80**	-37.29**	-0.67**	0.42**	0.23**	0.70**	0.11	0.51	-0.15	0.59	-0.54	1.70
	X	66.33	72.60	71.28	123.66	546.23	19.53	4.40	4.40	14.50	4.15	33.25	8.66	24.88	72.05	63.27
27	g_i	-0.36	-0.65**	4.16**	6.15**	-1.35	-0.02	-0.30**	0.08	-0.39**	0.12*	-0.54	0.17	0.27	0.10	3.92**
	X	64.67	67.00	87.22	156.00	463.92	20.33	2.11	4.17	9.34	4.33	25.50	10.00	24.13	79.91	59.49
101H	g_i	-0.67*	-0.32*	0.11	-3.29**	47.99**	0.25	0.15**	-0.22**	0.26	0.17**	-0.26	0.48**	-0.29	-1.28**	1.17
	X	64.00	69.50	67.45	119.67	629.92	25.40	3.00	2.20	12.00	4.22	28.20	12.96	22.89	71.34	75.02
70B	g_i	-0.27	-0.34*	-2.55**	-5.57**	1.29	2.27**	-0.13**	0.07	0.18	-0.08	0.75	-0.12	0.23	0.05	-0.51
	X	66.00	70.00	52.61	103.00	546.59	29.13	2.17	3.93	14.49	3.92	31.72	8.00	26.12	74.71	56.10
105g	g_i	0.69*	0.46**	-5.86**	-0.27	4.44	-1.02**	-0.21**	0.17**	-0.71**	-0.33**	-0.90	-0.32	0.55	0.42	-5.73**
	X	69.00	74.00	63.55	132.67	580.40	17.73	1.19	3.27	10.00	3.62	30.80	7.39	27.37	79.74	56.63
36	g_i	0.01	0.16	2.38**	4.01**	6.60	-1.37**	0.01	-0.09	0.33*	0.29**	2.84**	-0.63**	0.43	-0.54	6.41**
	X	65.33	69.00	79.93	151.00	607.18	19.33	2.11	2.93	14.00	3.57	38.57	7.12	21.30	78.50	53.80
106i	g_i	0.66*	0.68**	-5.66**	-5.30**	-5.35	0.28	-0.28**	0.01	-0.22	-0.33**	-2.05**	-0.24	-1.79**	-1.07**	-10.36**
	X	67.00	71.00	64.48	115.00	602.66	17.00	1.36	3.47	12.67	3.67	28.37	8.09	25.94	78.57	65.33
L.S.D. 0.05 (g_i - g_j)		0.79	0.08	0.99	1.10	29.61	0.51	0.09	0.09	0.43	0.18	2.32	0.60	2.57	0.95	2.88
L.S.D. 0.05 (g_i - g_j)		1.05	0.11	1.32	1.40	39.42	0.67	0.12	0.14	0.58	0.24	3.09	0.81	3.43	1.27	3.84
r		0.84**	0.83**	0.83**	0.98**	0.54	0.79*	0.93**	0.88**	0.83*	0.44	0.82*	0.97**	-0.14	0.49	0.11

* and ** Significant at 0.05 and 0.01 levels of probability, respectively.

r : correlation coefficient between parental mean performance and its GCA effects.

leaf angle , ear length, number of kernels/ row and grian yield per plant. However, the parental inbred line M. 106i had significant negative g_i effects for ear and plant heights. Form the previous results it could be concluded that the results revealed good match between estimates derived from F_1 and F_2 generations for most traits.

Significant correlation coefficient values between the parental performance and tis g_i effects were obtained for tasseling and silking dates, ear and plant heights, stem diameter, leaf angle, ear length, number of kernels/ row and number of rows/ ear. This finding indicated that intrinsic performance of parental inbred liens gave a good index of their g_i effects . Such results might add another proof to both types of genetic variance to be important on these traits and coincides with the findings reached above (Table 18).

Specific combining ability effects were only computed whenever significant SCA variances were obtained (Table 23). The most desirable inter- and intra allelic interactions were represented by seven, two, three, two, six, eight, eight, nine, seven, four twelve, one, four and twelve hybrids for silking date, tasseling date, ear height, plant height, leaf area, leaf angle, stem diameter, ear diameter, ear length, ear husk, number of rows/ ear, number of kernels/ row, 100-kernel weight and grain yield per plant, respectively. The cross 27 x 36 gave the highest S_{ij} effects followed by cross 101H x 70B and then by cross 105g x 36 for grain yield per plant and one or more of its components. Also, both crosses 101H x 36 and 70b x 105g expressed significant negative S_{ij} effects for ear and plant heights. In

Table (23): Estimates of specific combining ability effects in the F_2 generation.

Trait / Crosses	Tasseling date	Silking date	Ear height (cm)	Plant height (cm)	Leaf area (cm^2)	Leaf angle	Stem diameter (cm)
110B x 72	0.35	0.42	-1.21	12.07**	21.51	-0.39	-1.16**
x 27	2.39**	2.09**	-1.31	-6.72**	26.06	-1.62**	-0.42**
x 101	1.03	-0.58	22.13**	23.62**	74.92**	-1.42**	-0.80**
x 70B	0.63	0.60	11.41**	24.14**	2.24	-2.02**	1.46**
x 105g	-0.33	-0.61	10.77**	15.81**	19.30	0.51	-0.51
x 36	0.85	-0.56	21.39**	31.12**	18.26	-0.45	-0.75**
x 106i	-0.47	-0.75*	1.89*	2.88**	-97.63**	1.96**	1.71
72 x 27	0.12	-0.53	10.91**	20.49**	125.26**	-0.54	-0.41**
x 101	-0.40	0.13	12.33**	28.46**	11.67	-10.06**	-0.98**
x 70B	0.36	-0.68	21.68**	36.36**	-8.74	0.25	-0.60**
x 105g	-0.26	-1.90**	29.32**	42.56**	-40.08	-2.25**	-0.53**
x 36	-0.75	-1.68**	13.84**	22.16**	-215.90**	0.55	2.30**
x 106i	0.76	0.13	-3.17**	2.67*	-43.49	3.77**	-0.58**
27 x 101	1.31	0.80*	10.96**	3.99**	-70.01**	-0.55	-0.17*
x 70B	-1.43*	-1.18**	1.95*	9.83**	-43.37	-1.00**	0.06
x 105g	-1.97**	-2.06**	4.64**	31.99**	6.05	3.84**	0.27**
x 36	1.62*	3.99**	8.09**	24.37**	62.35*	0.16	0.23**
x 106i	-0.03	-0.70	26.07**	47.94**	52.26*	1.07**	0.17*
101 x 70B	0.05	-0.85*	41.24**	59.48**	68.98*	-5.12**	-0.45**
x 105g	-0.75	-1.06**	9.38**	38.54**	-13.01	1.17**	2.77**
x 36	-0.24	-0.51	-13.56**	-10.33**	-24.71	-0.42	-0.42**
x 106i	1.11	0.80*	2.16*	23.00**	-23.90	0.31	-0.21**
70B x 105g	0.19	-0.55	-4.24**	-12.30**	32.48	-0.01	-0.05
x 36	-0.14	1.00**	6.03**	17.31**	-7.42	-2.31**	-0.21*
x 106I	0.05	-0.68	25.68**	56.15**	-40.34	3.11**	0.08
105g x 36	0.74	-1.05**	18.40**	24.75**	-1.42	0.03	-0.18*
x 106I	-0.08	0.44	0.34	11.51**	-54.51*	-0.75	0.15*
36 x 106I	0.10	0.49	14.60**	23.91**	72.72**	0.38	-0.03
L.S.D 0.05 (S_{ij}- S_{ik})	2.38	1.22	2.98	3.14	88.82	1.52	0.28
L.S.D 0.01 (S_{ij}- S_{ik})	3.16	1.63	3.97	4.19	118.27	2.02	0.37
L.S.D 0.05 (S_{ij}- S_{kl})	2.24	1.15	2.81	2.96	83.74	1.43	0.26
L.S.D 0.01 (S_{ij}- S_{kl})	2.98	1.53	3.74	3.95	111.51	1.90	0.35

*** and ** significant at 0.05 and 0.01 levels of probability, respectively.**

Table (23): Cont.

Trait / Crosses	Husk of ear	Ear length (cm)	Ear diameter (cm)	No. of kernels/ row	No. of rows/ ear	Weight of 100-kernel	Shelling percentage	Grain yield/ plant(g)
110B x 72	0.02	0.03	0.44**	-4.05	-0.28	-5.27*	3.79**	-15.93**
x 27	-0.08	0.96	0.30	-1.64	-0.75	6.04**	-2.27**	4.81
x 101	0.13	0.89*	-1.14**	1.87	-0.99	-0.17	3.51**	-1.35
x 70B	0.00	0.61	-0.91**	0.92	0.49	1.41	0.57	8.98**
x 105g	-0.27	1.02**	-0.71**	0.19	0.50	-6.23**	-1.99*	-8.52**
x 36	0.08	0.56	1.12**	1.94	1.07*	4.39	-0.07	16.04**
x 106i	-0.29	-2.54**	-0.29	-5.50**	0.41	-1.90	1.03	-18.56**
72 x 27	-0.82**	1.12**	0.94**	2.31	1.88**	-2.74	0.78	5.38*
x 101	-0.29	0.73	0.65**	0.80	1.06	-1.98	1.70*	-0.06**
x 70B	-0.72**	-1.43**	-0.97**	-2.69	0.34	5.51*	0.35	18.42**
x 105g	0.33*	0.65	-0.72**	-2.07	1.10*	6.07**	3.60**	19.09**
x 36	-0.39*	-1.53**	-0.97**	-1.40	1.67**	-1.19	-0.17	2.27
x 106i	-0.45**	-2.05**	-0.84**	-0.33	0.47	-0.47	-4.16**	4.26**
27 x 101	-0.10	0.60	-1.24**	-0.37	-0.34	-1.66	-6.13**	-10.61**
x 70B	-0.39*	-1.55**	-1.04**	-0.28	1.01	0.38	1.60**	3.77
x 105g	-0.38*	-0.35	-0.66**	2.46	0.64	-0.50	-1.72*	8.94**
x 36	-0.15	1.09**	0.75**	0.17	1.89**	5.56*	-0.42	52.85**
x 106i	-0.49**	1.60**	-0.83**	1.24	0.51	-6.16**	0.90	-15.25**
101 x 70B	-0.13	-0.78	1.29**	0.46	0.75	3.38	-0.64	24.14**
x 105g	0.52**	-0.07	-0.42*	1.50	00.84	-3.94	0.47	-3.14
x 36	0.44**	-0.52	0.33*	-4.29*	-2.04	1.68	1.89*	-17.33**
x 106i	-0.22	0.08	-0.80**	-0.35	0.92	3.10	3.58**	16.17**
70B x 105g	-0.47**	-1.52**	-0.60**	-3.80	1.29*	-7.45**	0.26	-21.60**
x 36	-0.18	-0.63	-1.17**	-3.02	1.74**	-1.33	1.10*	3.90**
x 106I	-0.07	0.77*	1.61**	5.04*	1.10**	-5.11*	-0.29	1.34
105g x 36	-0.32*	-0.30	1.26**	-0.29	2.11**	2.69	-2.63**	21.32**
x 106I	0.33*	1.45**	-0.31	-6.14**	1.65**	4.17	-3.64**	0.94
36 x 106I	-0.09	-1.64**	-0.89**	-1.85	0.99	-5.32*	-6.70**	-7.82**
L.S.D 0.05 (S_{ij}- S_{ik})	0.55	1.30	0.55	6.95	1.83	7.72	2.85	8.65
L.S.D 0.01 (S_{ij}- S_{ik})	0.73	1.73	0.73	9.26	2.43	10.28	3.79	11.52
L.S.D 0.05 (S_{ij}- S_{kl})	0.52	1.23	0.52	6.56	1.72	7.28	2.69	8.16
L.S.D 0.01 (S_{ij}- S_{kl})	0.69	1.63	0.69	8.72	2.29	9.69	3.58	1087

* and ** significant at 0.05 and 0.01 levels of probability, respectively.

these traits, one or more of the previous crosses had significant desirable S_{ij} effects in the F_1 generation. The mentioned combinations might by of interest in breeding program aimed at producing inbred lines as most combination involved at least one good combiner.

SUMMARY

The aim of this investigation was to determine the extent of heterosis and combining ability and their interaction with seasons (environments) for growth and yield characteristics i.e. tasseling and silking dates, ear and plant heights, leaf area, leaf angle, ear husk, stem diameter, number of ears per plant, ear length, ear diameter, number of rows per ear, number of kernels per row, 100- kernel weight, shelling percentage and grain yield per plant.

To achieve this target F_1 and F_2 of the half dialle cross between eight inbred lines namely Moshtohor 101H, M 105g, M 110M, M 72, M 27, M 70B, M 106i and M 36 representing wide range of variability in most of the studied traits.

In 1994 season, crossing was made with all possible combinations among the eight parental inbred lines without the reciprocals and evaluated in 1995 season with three check varieties (including single cross 10, three way cross 310 and Giza 2) in a randomized complete block design with three replications. In 1996 season, two adjacent experiments were conducted the first involved the parental inbred lines and their twenty eight possible crosses and three check varieties, and the second included the parents and the F_2 crosses.

Data were recorded on F_1 using 10- plant per plot. However, on F_2 a 40- plant sample/ plot was used. The data obtained for each