
RESEARCH ARTICLE

Utilization of heterosis for improving yield and yield components in maize

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Abstract

An experiment was conducted at Agricultural Research Station, Madhira for utilization of heterosis for improving yield and to understand the magnitude of average heterosis, heterobeltiosis and standard heterosis in fourty five hybrids developed by crossing 15 lines with 3 testers in maize during *kharif* 2015. The analysis of variance revealed significant differences among the parents and hybrids for various characters studied. Most of the hybrids showed negative mid parent and better parent heterosis values for days to 50 % tasselling and days to 50 % silking values, indicating that the hybrids tend to flower earlier than their parents. Majority of the hybrids recorded positive significant values for plant height. For ear characters like ear length, ear girth, number of kernel rows per ear, number of kernels per row, test weight and seed yield, all the hybrids recorded positive significant heterosis and heterobeltiosis values indicating effectiveness of hybrid breeding to evolve better performing hybrids. The average heterosis for test weight ranged from 1.93 (MRC 1157 x BML 7) to 44.93 (MRC 1095 x BML 5). Seed yield also recorded positive heterotic values from 9.39 (MRC 1104 x BML 7) to 119.86 (MRC 1117 x BML 13) and heterobeltiosis values from 4.60 (MRC 1132 x BML 7) to 118.07 (MRC 1070 x BML 5) in the present study. Large number of hybrids showed superiority over their parents for various traits indicating existence of substantial heterosis in these hybrids and potential of these inbred lines for hybrid development.

Key words: Maize, heterosis, yield, hybrids

Introduction

Maize is known as Queen of cereals because of its highest yield potential and wider adaptability. Maize being a C4 plant, is physiologically more efficient, has higher grain yield and wider adaptation over a wide range of environmental conditions. It is widely grown in India suggesting its wide adaptability. The crop has assumed a place of prominence in Indian agriculture owing to its varied uses. Maize is a highly cross pollinated crop and the scope for the exploitation of hybrid vigour will depend on the magnitude of heterosis, biological feasibility and the type of gene action.

The use of heterosis in maize breeding has been emphasized since Shull (1908) suggested the inbred-hybrid concept. The development of superior hybrids depends on the combining ability of lines involved in the production of the hybrids. Maize breeders, therefore, know that the probability of obtaining a highly heterotic hybrid is greater when the crosses are between unrelated lines than crosses between related lines. Thus,

heterosis information serves as a measure of genetic diversity. Abundant heterosis manifestation by a cross leads to the conclusion that the parents are more genetically diverse than varieties whose crosses show little or no heterosis. Thus, the knowledge of the nature and magnitude of genotypic and phenotypic variability present in the crop species plays a vital role in formulating a successful breeding programme to evolve superior cultivars.

Material and methods

The present study was conducted at Agricultural Research Station farm, Madhira of PJTS Agricultural University, Hyderabad during *kharif* 2015 season. Fifteen selected inbred lines (MRC 1058, MRC 1070, MRC 1081, MRC 1091, MRC 1095, MRC 1104, MRC 1117, MRC 1119, MRC 1125, MRC 1132, MRC 1134, MRC 1144, MRC 1148, MRC 1150 and MRC 1157) were crossed to three testers (BML 5, BML 7 and BML 13) in line × tester mating design *kharif* 2014 to generate 45 F_1s for this study. All the eighteen parents (15 lines and 3 testers) together with 45 crosses and three standard checks (DHM 117, 30 V 92 and 900 M Gold) were evaluated during kharif 2015. Each genotype was grown in two rows of two meters length keeping row-to-row and plant to plant distance of 60 and 20 cm, respectively following randomized block design with three replications. The recommended packages of cultural practices, fertilizer levels and protection measures were followed to raise good crop. The data were recorded on days to 50% tasseling, days to 50% silking, days to maturity, plant height (cm), ear length (cm), ear girth (cm), number of kernel rows per ear, number of kernels per row, test weight (g) and seed yield per plant (g). Mean values of the ten quantitative characters recorded on the hybrids and parents were subjected to statistical analysis and variances were estimated following the method of Panse and Sukhatme (1961). Heterosis expressed as increase or decrease of F_1 hybrid value over mid-parent (relative heterosis), better parent (heterobeltiosis) and over the best commercial check (standard heterosis) were calculated for each character using the formulas suggested by Hayes *et al*., (1955).

Results and discussion

The analysis of variance revealed significant differences among the parents and hybrids for various characters studied (Table1). The average heterosis, heterobeltiosis and standard heterosis for 45 hybrids included in the present study for yield and component characters are presented in Table 2. In the present study, almost all the hybrids showed negative mid parent and better parent heterosis values for days to 50% tasselling and days to 50% silking values, indicating that the hybrids tend to flower earlier than their parents. However for days to maturity character, ten hybrids showed positive significant heterosis while seven hybrids recorded negative significant heterosis values, whereas the heterobeltiosis was negative for majority of hybrids indicating that hybrids tend to mature earlier than their better parent. Most of the hybrids recorded positive significant values for plant height with maximum plant height of 216.75 cm being recorded for MRC 1132 x BML 13. Similar results for these traits were also reported by earlier workers *viz*., Patil *et al*., (2012), Kumar Bupesh *et al*., (2013), Rajesh *et al*., (2014) and Rajitha *et al*., (2014).

For ear characters like ear length, ear girth, number of kernel rows per ear, number of kernels per row, test weight and seed yield, all the hybrids in the present study recorded positive significant heterosis and heterobeltiosis values indicating effectiveness of hybrid breeding to evolve better performing hybrids. Mid parent heterosis for ear length varied from 8.67 (MRC 1134 xBML 7) to 81.91 (MRC 1091 x BML 5) while heterobeltiosis ranged from 0.04 (MRC 1144 x BML 5) to 63.96 (MRC 1095 x BML 5). The highest value for ear length was recorded by MRC 1081 x BML 13 (20.53 cm) while the

lowest ear length was shown by MRC1125 x BML 5 (13.75 cm). The ear girth ranged from 12.24 cm to 15.58 cm with highest heterosis and heterobeltiosis values of 59.07 and 56.50, respectively for MRC 1150 x BML 5 hybrid. Positive significant heterosis for ear characters was also reported by earlier workers *viz*., Bhavana *et al*., (2011), Patil *et al*., (2012), Tajwar Izhar and Chakraborthy (2013) and Rajesh *et al*., (2014).

Number of kernel rows per ear also recorded positive heterosis values ranging from 0.71 (MRC 1132 x BML 7) to 30.03 (MRC 1070 x BML 13). The same hybrid MRC 1070 x BML 13 also had highest heterobeltiosis value of 30.03 for this trait. Singh *et al*., (2010), Bhavana *et al*., (2011), Sandeep Kumar and Mohan Reddy (2013) and Rajesh *et al*., (2014) also reported positive heterosis and heterobeltiosis for kernel characters in maize.

The average heterosis for test weight for the hybrids under present study ranged from 1.93 (MRC 1157 x BML 7) to 44.93 (MRC 1095 x BML 5). Highest significant heterobeltiosis value for this trait was also recorded by MRC 1095 x BML 5 (44.33). The parents of those hybrids can be used for getting superior lines for these traits. Sumalini and Shobha Rani (2011), Kumar Bupesh *et al*., (2013) and Rajitha *et al*., (2014) also reported similar results in there studies.

Similarly, for seed yield also positive heterotic values ranged from 9.39 (MRC 1104 x BML 7) to 119.86 (MRC 1117 x BML 13) whereas heterobeltiosis ranged from 4.60 (MRC 1132 x BML 7) to 118.07 (MRC 1070 x BML 5). These results are in accordance with the earlier findings of Premalatha and Kalamani (2010), Sandeep Kumar and Mohan Reddy (2013) and Rajesh et al (2014) who also reported positive heterosis for seed yield in maize.

The results showed that, heterosis estimates for most of the hybrids had positive heterosis and heterobeltiosis value for seed yield and its component characters. However, large number of hybrids showed superiority over their parents for various traits indicating the existence of substantial heterosis in the hybrids and the potential of these inbred lines for hybrid development. These hybrids may be further exploited in multilocation evaluation before releasing them for commercial cultivation.

References

1. Bhavana, P., Singh, R.P., and Gadag, R.N. 2011. Gene action and heterosis for yield and yield components in maize (*Zea mays* L.). Indian *J. Agril. Sci*., 81 (2): 163-166.
2. Hayes, H.K., Immer, F.R. and Smith, D.C. 1955. Methods of Plant Breeding. Mc. Graw Hill Book. Co. Inc. New York. P. 19.
3. Kumar, Bupesh, Razdan, A.K., Gupta, B.B. 2013. Heterosis and character association for grain yield and its component traits in single cross maize hybrids under mid hills of Jammu and Kashmir, India., *Agric. Sci. Digest*., 33(3):198-202.
4. Panse, V.G. and Sukhatme, P.V. 1961. Statistical methods for agricultural workers. 2 nd Ed., Indian Council. Agric. Res., New Delhi. pp. 22.
5. Patil, A.E., Charjan, S.U., Patil, S.R., Udasi, R.N., Puttawar, M.R. and Palkar, A.B. 2012. Studies on heterosis and combining ability analysis in maze (*Zea mays* L.). *J. Crops*., 22 (1): 129-138.
6. Premalatha, M., and Kalamani, A. 2010. Heterosis and combining ability studies for grain yield and growth characters in maize (*Zea mays* L.). *Indian J. Agril., Res*., 44 (1): 62-65.
7. Rajesh, V., Sudheer Kumar, S., Narsimha Reddy, V. and Siva Sankar, A. 2014. Heterosis studies for grain yield and its component traits in single cross hybrids of maize (*zea mays* L.). *Int. J. Plant, Animal Environ. Sci*., 4(1):304-306.
8. Rajitha, A., Ratna Babu, D., Lal Ahmed, M., and Srinivasa Rao, V. 2014. Heterosis and combining ability for grain yield and yield

component traits in maize (*Zea mays* L.). *Electronic J. Plant Breed*., 5(3): 378-384.

9. Sandeep Kumar, T. and Mohan Reddy, D. 2013. Heterosis and combining ability estimates for yield and yield components in maize (*Zea mays* L.). *Int.J. Biotech. Bioeng. Res*., 4(5): 509-510.
10. Singh, S.B., Gupta, B.B., and Anjani, K. 2010. Heterotic expression and combining ability for yield and its components in maize (*Zea mays* L.). *Progressive Agril*.,10 (2): 275-281.
11. Sumalini, K., and Shobha Rani, T. 2011. Heterosis and combining ability for polygenic traits in late maturity hybrids of maize (*Zea mays* L.). *Madras Agril. J*., 97 (10): 340-343.
12. Tajwar Izhar, and Chakraborty, M. 2013. Combining ability and heterosis for grain yield and its components in maize inbreds over environments (*Zea mays* L.). *African J. Agril. Res*., 8(25): 3276-3280.
13. Singh, K.N., Singh Santoshi V., and Singh H.G. 1986. Genetic analysis of yield components and protein content in pea. *Indian J. Agril Sci*., 56(11):757-764.

Table 1: Analysis of variance for grain yield and its component characters in maize

	df	Days to 50% tasseling	Days to 50% silking	Days to maturity	Plant height (cm)	Ear length (cm)	Ear girth (cm)	No. of kernel rows	Number of kernel/ row	Test weight (g)	Yield/ plant (g)
Replicates	2	2.16	13.40**	12.47*	985.17**	5.693	0.02	0.88	19.01*	3.07	104.12
Crosses	44	12.30**	10.07**	9.76**	1054.85**	8.57**	1.56**	2.83**	32.49**	10.67**	519.81**
Line effect	14	13.07	12.64*	15.42*	1541.16*	8.40	2.18	4.86**	71.51**	16.80**	546.25
Tester effect	2	46.49*	52.35**	6.45	4432.64**	61.57**	1.43	4.58	6.67	37.44**	1227.62
Line x Tester effect	28	9.47**	5.76**	7.16**	570.43**	4.87*	1.25**	1.69**	14.82**	5.69	456.04**
Error	88	1.52	1.70	2.74	195.33	2.56	0.53	0.56	4.90	1.37	101.85
Total	134	5.07	4.62	5.19	489.35	4.58	0.86	1.31	14.17	4.45	239.13

Table 2:Mean values and heterosis estimates for yield attributes in maize hybrids

	Days to 50% tasselling						Days to 50 % silking					
F_1 Cross	**Mean**	**Average heterosis**	**Heterobeltiosis**	**Standard heterosis**			**Mean**	**Average heterosis**	**Heterobeltiosis**	**Standard heterosis**		
				DHM 117	**30 V 92**	**900 M Gold**				**DHM 117**	**30 V 92**	**900 M Gold**
MRC 1058 x BML 7	55.33	0.61	-5.14**	-2.92	-6.74**	-5.68**	57.33	-1.99	-7.03**	-4.44**	-7.03**	-6.-01
MRC 1058 x BML 13	56.33	1.81	-4.52*	-1.17	-5.06**	-3.98*	58.00	-1.97	-7.94**	-3.33	-5.95**	-4.92**
MRC 1070 x BML 5	54.33	-5.23**	-10.93**	-4.68*	-8.43**	-7.39**	56.67	-5.29**	-10.99**	-5.56**	-8.11**	-7.10**
MRC 1070 x BML 7	54.67	-8.38**	-10.38**	-4.09*	-7.87**	-6.82**	57.33	-8.51**	-9.95**	-4.44**	-7.03**	-6.01**
MRC 1070 x BML 13	58.00	-3.33*	-4.92**	1.75	-2.25	-1.14	59.67	-5.79**	-6.28**	-0.56	-3.24	-2.19
MRC 1081 x BML 5	55.33	-6.44*	-8.79**	-2.92	-6.74**	-5.68**	57.33	-4.97**	-11.34**	-4.44**	-7.03**	-6.01**
MRC 1081 x BML 7	55.67	-3.21*	-8.24**	-2.34	-6.18**	-5.11**	57.00	-9.76**	-11.86**	-5.00**	-7.57**	-6.56**
MRC 1081 x BML 13	54.33	-9.19**	-10.44**	-4.68*	-8.43**	-7.39**	58.00	-9.14**	-10.31**	-3.33	-5.95**	-4.92**
MRC 1091 x BML 5	53.67	-5.01**	-9.55**	-5.85**	-9.55**	-8.52**	55.00	-6.78**	-11.29**	-8.33**	-10.81**	-9.84**
MRC 1091 x BML 7	53.00	-9.92**	-10.67**	-7.02**	-10.67**	-9.66**	55.00	-11.05**	-11.29**	-8.33**	-10.81**	-8.74**
MRC 1091 x BML 13	52.33	-11.55**	-11.80**	-8.19**	-11.80**	-10.80**	55.67	-10.93**	-11.64**	-7.22**	-9.73**	-8.74**
MRC 1095 x BML 5	54.00	-5.26**	-10.50**	-5.26**	-8.99	-7.95**	56.67	-4.76**	-10.05**	-5.56**	-8.11**	-7.10**
MRC 1095 x BML 7	53.00	-10.67**	-12.15**	-7.02**	-10.67**	-9.66**	56.33	-9.63**	-10.58**	-6.11**	-8.65**	-7.65**
MRC 1095 x BML 13	53.67	-10.06**	-11.05**	-5.85**	-9.55**	-8.52**	58.00	-7.94**	-7.94**	-3.33	-5.95**	-4.92**
MRC 1104 x BML 5	52.67	-4.53**	-7.06**	-7.60**	-11.24**	-10.23**	55.00	-4.35**	-6.78**	-8*33**	-10.81**	-9.84**
MRC 1104 x BML 7	53.67	-6.67**	*8.00**	-5.85**	-9.55**	-8.52**	56.00	-7.18**	-9.19**	-6.67**	-9.19**	-8.20**
MRC 1104 x BML 13	52.00	-10.09**	-11.86**	-8.77	-12.36**	-11.36**	55.33	-9.29**	-12.17**	-7.78**	-10.27**	-9.29**
MRC 1117 x BML 5	50.67	-12.39**	-18.28**	-11.11**	-14.61**	-13.64**	55.33	-12.33**	-18.78**	-11.11**	-13.51**	-12.57**
MRC 1117 x BML 7	59.33	-1.39	-4.30*	4.09*	0.00	1.14	59.67	-6.28**	-9.14**	-0.56	-3.24	-2.19
MRC 1117 x BML 13	52.67	-12.95**	-15.05**	-7.60**	-11.24**	-10.23**	56.00	-12.95**	-14.72**	-6.67**	-9.19**	-8.20**
MRC 1119 x BML 5	49.33	-10.03**	-11.90**	-13.45**	-16.85**	-15.91**	52.00	-9.57**	-11.86**	-13.33**	-15.68**	-14.75**
MRC 1119 x BML 7	53.00	-7.29**	-9.14**	-7.02**	-10.67**	-9.66**	55.33	-8.29**	-10.27**	-7.78**	-10.27**	-9.29**
MRC 1119 x BML 13	53.00	-7.83**	-10.17**	.7.02**	-10.67**	-9.66**	55.00	-9.84**	-12.70**	-8.33**	-10.81**	-9.84**
MRC 1125 x BML 5	51.67	-7.46**	-10.92**	-9.36**	-12.92**	-11.93**	54.00	-6.90**	-10.00**	-10.00**	-12.43**	-11.48**
MRC 1125 x BML 7	53.00	-8.88**	-9.14**	-7.02**	-10.67**	-9.66**	56.00	-7.95**	-9.19**	-6.67**	-9.19**	-8.20**
MRC 1125 x BML 13	52.67	-9.97**	-10.76**	-7.60**	-11.24**	-10.23**	55.67	-9.49**	-11.64**	-7.72**	-9.73**	-8.74**
MRC 1132 x BML 5	54.67	-2.96	-7.34**	-4.09*	-7.87**	-6.82**	56.67	-3.41*	-7.61**	-5.56**	-8.11**	-7.10**
MRC 1132 x BML 7	56.33	-3.98*	-4.52*	-1.17	-5.06**	-3.98*	58.67	-4.61**	-4.86**	-2.22	-4.86**	-3.83*
MRC 1132 x BML 13	53.67	-9.04**	-9.04**	-5.85**	-9.55**	-8.52**	56.00	-9.92**	-11.11**	-6.67**	-9.19**	-8.20**
MRC 1134 x BML 5	54.00	-2.41	-5.26**	-5.26**	-8.99**	-7.95**	57.67	-0.29	-3.35	-3.89*	-6.49**	-5.46**
MRC 1134 x BML 7	54.67	-5.20**	-6.29**	-4.09*	-7.87**	-6.82**	58.33	-3.85**	-5.41**	-2.78	-5.41**	-4.37**
MRC 1134 x BML 13	56.00	-3.45*	-5.08**	-1.75	-5.62**	-4.55*	57.00	-7.07**	-9.52**	-5.00**	-7.57**	-6.56**
MRC 1144 x BML 5	53.66	-4.19*	-7.51**	-6.43**	-10.11**	-9.09**	55.33	-5.41**	-9.29**	-7.78**	-10.27**	-9.29**
MRC 1144 x BML 7	54.00	-6.90	-7.43**	-5.26**	-8.99**	-7.95**	55.67	-9.24**	-9.73**	-7.22**	-9.73**	-8.74**
MRC 1144 x BML 13	55.00	-5.71**	-6.78**	-3.51	-7.30**	-6.25**	58.33	-5.91**	-7.41**	-2.78	-5.41**	-4.37**
MRC 1148 x BML 5	52.33	-6.82**	-10.80**	-8.19**	-11.80**	-10.80**	53.67	-8.26**	-12.02**	-10.56**	-12.97**	-12.02**
MRC 1148 x BML 7	56.67	-3.13*	-3.41	-0.58	-4.49*	-3.41	58.67	-4.35**	-4.86**	-2.22	-4.86**	-3.83*
MRC 1148 x BML 13	55.67	-5.38**	-5.65**	-2.34	-6.18**	-5.11**	58.67	-5.38**	-6.88**	-2.22	-4.86**	-3.83*
MRC 1150 x BML 5	52.33	-8.99**	-14.67**	-8.19**	-11.80**	-10.80**	55.67	-5.92**	-10.70**	-7.22**	-9.73**	-8.74**
MRC 1150 x BML 7	55.33	-7.52**	-9.78**	-2.92	-6.74**	-5.68**	58.00	-6.45**	-6.95**	-3.33	-5.95**	-4.92**
MRC 1150 x BML 13	59.00	-1.94	-3.80*	3.51	-0.56	0.57	61.33	-2.13	-2.65	2.22	-0.54	0.55
MRC 1157 x BML 5	53.00	-5.07**	-8.62**	-7.02**	-10.67**	-9.66**	55.00	-4.35**	-6.78**	-8.33**	-10.81**	-8.4**
MRC 1157 x BML 7	54.33	-6.59**	-6.86**	-4.68*	-8.43**	-7.39**	56.67	-6.08**	-8.11**	-5.56**	-8.11**	-7.10**
MRC 1157 x BML 13	51.33	-12.25**	-12.99**	-9.94**	-13.48**	-12.50**	54.67	-10.38**	-13.23**	-8.89**	-11.35**	-10.38**

Cont….

F_1 Cross	Days to maturity						Plant height (cm)					
	Mean	Average heterosis	Heterobeltiosis	Standard heterosis			Mean	Average heterosis	Heterobeltiosis	Standard heterosis		
				DHM 117	30 V 92	900 M Gold				DHM 117	30 V 92	900 M Gold
MRC 1058 x BML 7	92.67	4.71**	0.72	1.46	-2.46	0.72	151.92	19.82*	11.10	-26.46 **	-18.51**	-16.54**
MRC 1058 x BML 13	89.33	0.37	-3.94*	-2.19	-5.96**	-2.90	144.00	12.16	2.89	-30.29 **	-22.75**	-20.89**
MRC 1070 x BML 5	90.67	1.87	-2.86	-0.73	-4.56**	-1.45	139.67	43.69**	32.76**	-32.39**	-25.08**	-23.27**
MRC 1070 x BML 7	91.33	-1.44	-2.14	0.00	-3.86*	-0.72	170.67	41.09**	24.82**	-17.38**	-8.45	-6.24
MRC 1070 x BML 13	91.00	-2.33	-2.5	-0.36	-4.21**	-1.09	177.95	45.17**	27.15**	-13.86*	-4.54	-2.24
MRC 1081 x BML 5	87.33	-2.06	-6.76**	-4.38**	-8.07**	-5.07**	163.75	28.54**	-1.11	-20.73 **	-12.16*	-10.04
MRC 1081 x BML 7	89.33	-3.77**	-4.63**	-2.19	-5.96**	-2.90	212.98	40.9**	28.63**	3.11	14.25*	17.01**
MRC 1081 x BML 13	91.33	-2.14	-2.49	0.00	-3.86*	-0.72	207.93	36.11**	25.58**	0.66	11.54	14.23*
MRC 1091 x BML 5	91.67	3.19*	-1.43	0.36	-3.51*	-0.36	160.77	87.89**	80.24**	-22.17**	-13.76*	-11.67
MRC 1091 x BML 7	92.67	0.18	-0.36	1.46	-2.46	0.72	179.83	64.48**	31.52**	-12.94*	-3.53	-1.20
MRC 1091 x BML 13	90.00	-3.23*	-3.23*	-1.46	-5.26**	-2.17	153.25	38.14**	9.50	-25.81**	-17.79**	-15.81*
MRC 1095 x BML 5	88.33	3.72	3.11	-3.28*	-7.02**	-3.99*	155.25	19.46*	-9.06	-24.84 **	-16.72**	-14.71*
MRC 1095 x BML 7	90.00	1.31	-2.17	-1.46	-5.26**	-2.17	173.17	12.65*	1.44	-16.17**	-7.11	-4.87
MRC 1095 x BML 13	90.67	1.49	-2.51	-0.73	-4.56**	-1.45	153.42	-1.23	-10.13	-25.73**	-17.7**	-15.72*
MRC 1104 x BML 5	91.00	1.49	-3.87*	-0.36	-4.21**	-1.09	162.58	30.22**	1.30	-21.29 **	-12.78*	-10.68
MRC 1104 x BML 7	84.67	-9.29**	-10.56**	-7.30**	-10.88 **	-7.97**	176.92	19.04**	10.23	-14.35**	-5.10	-2.81
MRC 1104 x BML 13	92.00	-1.95	-2.82	0.73	-3.16*	0.00	178.75	18.99**	11.37	-13.47*	-4.11	-1.8
MRC 1117 x BML 5	87.33	-1.13	-5.07**	-4.38**	-8.07**	-5.07**	175.54	41.53**	10.50	-15.02**	-5.83	-3.56
MRC 1117 x BML 7	88.00	-4.35**	-4.35**	-3.65*	-7.37**	-4.35**	180.12	21.87**	13.38	-12.80*	-3.38	-1.05
MRC 1117 x BML 13	88.33	-4.50**	-5.02**	-3.28*	-7.02**	-3.99*	186.92	25.1**	17.66*	-9.51	0.27	2.69
MRC 1119 x BML 5	91.33	7.45**	7.03**	0.00	-3.86*	-0.72	135.58	22.28*	2.28	-34.36 **	-27.27**	-25.51**
MRC 1119 x BML 7	92.67	4.51**	0.72	1.46	-2.46	0.72	157.25	16.78*	15.00	-23.87 **	-15.65*	-13.61*
MRC 1119 x BML 13	93.67	5.05**	0.72	2.55	-1.40	1.81	166.45	22.16**	18.93*	-19.42**	-10.71	-8.56
MRC 1125 x BML 5	91.67	1.66	-4.18**	0.36	-3.51*	-0.36	180.2	51.57**	21.28**	-12.76*	-3.33	-1.00
MRC 1125 x BML 7	92.67	-1.24	-3.14*	1.46	-2.46	0.72	171.5	20.22**	15.42*	-16.98**	-8.00	-5.78
MRC 1125 x BML 13	91.33	-3.18*	-4.53**	0.00	-3.86*	-0.72	188	30.31**	26.53**	-8.99	0.85	3.28
MRC 1132 x BML 5	90.33	3.24*	0.00	-1.09	-4.91**	-1.81	152.77	30.28**	5.13	-26.04**	-18.05**	-16.07*
MRC 1132 x BML 7	91.33	0.18	-0.72	0.00	-3.86*	-0.72	183.75	30.3**	26.45**	-11.05*	-1.43	0.95
MRC 1132 x BML 13	93.00	1.45	0.00	1.82	-2.11	1.09	216.75	51.96**	49.16**	4.93	16.27**	19.08**
MRC 1134 x BML 5	91.33	2.24	-2.84	0.00	-3.86*	-0.72	147.61	35.1**	14.14	-28.54**	-20.82**	-18.91**
MRC 1134 x BML 7	92.00	-1.08	-2.13	0.73	-3.16*	0.00	203.19	52.75**	48.6**	-1.63	9.00	11.63
MRC 1134 x BML 13	91.00	-2.67	-3.19*	-0.36	-4.21**	-1.09	171.78	27.59**	22.74**	-16.84**	-7.85	-5.63
MRC 1144 x BML 5	89.67	3.07*	0.37	-1.82	-5.61**	-2.54	165.25	40.94**	13.73	-20**	-11.35	-9.21
MRC 1144 x BML 7	91.67	1.10	-0.36	0.36	-3.51*	-0.36	169.42	20.14**	16.6*	-17.98**	-9.12	-6.93
MRC 1144 x BML 13	91.67	0.55	-1.43	0.36	-3.51*	-0.36	162.17	13.7*	11.61	-21.49**	-13.01*	-10.91
MRC 1148 x BML 5	92.33	4.14**	-0.36	1.09	-2.81	0.36	141.92	46.71**	36.11**	-31.3**	-23.87**	-22.03**
MRC 1148 x BML 7	93.33	1.08	0.72	2.19	-1.75	1.45	157.75	30.91**	15.37	-23.63**	-15.38*	-13.34*
MRC 1148 x BML 13	91.67	-1.26	-1.43	0.36	-3.51*	-0.36	150	22.84**	7.18	-27.38**	-19.54**	-17.59**
MRC 1150 x BML 5	91.00	4.00**	0.74	-0.36	-4.21**	-1.09	166.83	35.25**	5.93	-19.24**	-10.51	-8.35
MRC 1150 x BML 7	91.33	0.18	-0.72	0.00	-3.86*	-0.72	169.25	15.04*	7.46	-18.07**	-9.21	-7.02
MRC 1150 x BML 13	88.33	-3.64*	-5.02**	-3.28*	-7.02**	-3.99*	186.53	25.42**	18.43*	-9.70	0.06	2.48
MRC 1157 x BML 5	91.67	3.38*	-1.08	0.36	-3.51*	-0.36	162.83	51.71**	29.78**	-21.17**	-12.65*	-10.54
MRC 1157 x BML 7	91.33	-1.08	-1.44	0.00	-3.86*	-0.72	153.17	16.83*	12.02	-25.85**	-17.84**	-15.85*
MRC 1157 x BML 13	92.00	-0.90	-1.08	0.73	-3.16*	0.00	183.75	38.46**	31.3**	-11.05*	-1.43	0.95

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F_1 Cross	Ear length (cm)						Ear girth (cm)					
	Mean	Average heterosis	Heterobeltiosis	Standard heterosis			Mean	Average heterosis	Heterobeltiosis	Standard heterosis		
				DHM 117	30 V 92	900 M Gold				DHM 117	30 V 92	900 M Gold
MRC 1058 x BML 7	16.3	22.84**	20.38*	-0.67	-12.66	18.92*	12.24	-13.31**	-22.6**	-21.98**	-15.32**	-14.85**
MRC 1058 x BML 13	18.46	36.12**	35.94**	12.47	-1.11	34.65**	14.25	2.96	-9.85 *	-9.12*	-1.36	-0.81
MRC 1070 x BML 5	18.42	70.66**	53.3**	12.21	-1.34	34.33**	14.17	16.55**	-2.54	-9.65*	-1.94	-1.39
MRC 1070 x BML 7	16.33	30.6**	25.64**	-0.49	-12.50	19.13*	14.79	9.74*	1.74	-5.67	2.38	2.95
MRC 1070 x BML 13	18.78	46.73**	38.27**	14.4	0.59	36.96**	15.74	19.19**	8.28	0.38	8.95*	9.56*
MRC 1081 x BML 5	14.50	17.42*	-4.14	-11.66	-22.32**	5.76	14.71	31.81**	17.27**	-6.21	1.80	2.37
MRC 1081 x BML 7	17.04	21.19**	12.67	3.84	-8.70	24.31**	14.46	15.85**	15.28**	-7.80	0.07	0.63
MRC 1081 x BML 13	20.53	43.03**	35.72**	25.08**	9.98	49.74**	14.52	18.89**	15.73**	-7.44	0.46	1.02
MRC 1091 x BML 5	17.2	81.91**	79.69**	4.77	-7.88	25.43**	14.48	37.96**	29.14**	-7.69	0.18	0.74
MRC 1091 x BML 7	15.25	36.55**	17.31	-7.09	-18.30**	11.23	15.33	29.72**	23.4**	-2.27	6.07	6.66
MRC 1091 x BML 13	17.79	55.29**	31.03**	8.41	-4.68	29.78**	15.23	31.91**	28.21**	-2.91	5.37	5.96
MRC 1095 x BML 5	18.36	76.83**	63.96**	11.88	-1.63	33.94**	13.46	15.88**	0.05	-14.18**	-6.85	-6.33
MRC 1095 x BML 7	16.84	39.2**	29.56**	2.62	-9.77	22.85*	15.13	16.93**	12.44**	-3.55	4.68	5.27
MRC 1095 x BML 13	15.92	28.46**	17.21	-3.03	-14.73*	16.10	13.46	6.28	0.05	-14.18**	-6.85	-6.33
MRC 1104 x BML 5	17.58	48.24**	24.23**	7.13	-5.8	28.25**	14.71	23.13**	4.20	-6.21	1.80	2.37
MRC 1104 x BML 7	14.88	9.58	5.11	-9.36	-20.3**	8.51	13.88	4.58	-1.70	-11.52**	-3.97	-3.43
MRC 1104 x BML 13	18.42	32.81**	30.12**	12.21	-1.34	34.33**	15.00	15.41**	6.26	-4.36	3.81	4.38
MRC 1117 x BML 5	16.65	50.6**	32.73**	1.46	-10.79	21.47*	13.88	19.57**	3.30	-11.52**	-3.97	-3.43
MRC 1117 x BML 7	15.79	23.59**	21.44*	-3.82	-15.43*	15.15	14.97	15.81**	11.44*	-4.55	3.6	4.18
MRC 1117 x BML 13	17.46	33.66**	28.57**	6.38	-6.46	27.35**	15.17	19.87**	12.93**	-3.27	4.98	5.57
MRC 1119 x BML 5	14.25	31.05**	17.03	-13.18	-23.66**	3.94	15.52	37.22**	20.84**	-1.04	7.40	8.00
MRC 1119 x BML 7	15.54	23.47**	19.56*	-5.30	-16.73*	13.37	15.38	21.78**	19.78**	-1.91	6.46	7.05
MRC 1119 x BML 13	19.13	48.52**	40.84**	16.53*	2.46	39.51**	15.25	23.38**	18.74**	-2.76	5.54	6.12
MRC 1125 x BML 5	13.75	26.26**	12.61	-16.23*	-26.34**	0.29	15.09	31.51**	14.58**	-3.8	4.41	4.99
MRC 1125 x BML 7	15.68	24.37**	20.59*	-4.49	-16.02*	14.34	14.03	9.69*	6.58	-10.52**	-2.88	-2.34
MRC 1125 x BML 13	19.45	50.86**	43.25**	18.52*	4.21	41.89**	15.40	22.99**	16.96**	-1.81	6.57	7.17
MRC 1132 x BML 5	15.79	50.76**	38.79**	-3.8	-15.41*	15.17	15.13	36.05**	21.4**	-3.55	4.68	5.27
MRC 1132 x BML 7	14.38	17.95*	10.59	-12.41	-22.98**	4.86	13.45	8.15	7.97	-14.22**	-6.90	-6.38
MRC 1132 x BML 13	18.17	45.59**	33.78**	10.68	-2.68	32.51**	15.32	25.9**	22.95**	-2.32	6.02	6.61
MRC 1134 x BML 5	14.63	32.31**	16.64	-10.89	-21.64**	6.69	13.79	24.15**	10.85*	-12.05**	-4.54	-4.01
MRC 1134 x BML 7	13.88	8.67	6.74	-15.45*	-25.66**	1.22	14.71	18.33**	18.22**	-6.21	1.80	2.37
MRC 1134 x BML 13	14.42	10.39	6.16	-12.16	-22.77**	5.15	14.08	15.82**	13.18*	-10.2*	-2.54	-1.99
MRC 1144 x BML 5	16.71	27.2**	0.04	1.81	-10.48	21.88*	14.50	29.5**	14.93**	-7.55	0.35	0.90
MRC 1144 x BML 7	18.42	24.00**	10.26	12.21	-1.34	34.33**	14.25	13.83**	12.95*	-9.14*	-1.38	-0.84
MRC 1144 x BML 13	18.25	20.53**	9.26	11.19	-2.23	33.11**	14.48	18.26**	14.8**	-7.65	0.23	0.79
MRC 1148 x BML 5	14.97	41.77**	29.66**	-8.81	-19.82**	9.17	14.64	33.77**	20.85**	-6.63	1.34	1.90
MRC 1148 x BML 7	14.58	18.84*	12.18	-11.15	-21.88**	6.37	14.36	17.05**	15.62**	-8.44*	-0.62	-0.07
MRC 1148 x BML 13	17.04	35.68**	25.5**	3.84	-8.70	24.31**	13.91	15.95**	14.80**	-11.31**	-3.74	-3.20
MRC 1150 x BML 5	17.14	65.28**	53.46**	4.41	-8.20	24.99**	15.3	59.07**	56.50**	-2.44	5.88	6.47
MRC 1150 x BML 7	17.29	43.12**	33.03**	5.36	-7.36	26.14**	14.71	34.46**	18.44**	-6.21	1.80	2.37
MRC 1150 x BML 13	18.36	48.41**	35.22**	11.88	-1.63	33.94**	14.61	36.95**	23.01**	-6.84	1.11	1.67
MRC 1157 x BML 5	14.78	33.17**	17.05	-9.95	-20.82**	7.80	14.20	25.18**	9.99*	-9.46*	-1.73	-1.18
MRC 1157 x BML 7	14.74	15.06	13.41	-10.17	-21.02**	7.54	15.58	22.99**	20.66**	-0.68	7.80	8.40
MRC 1157 x BML 13	16.93	29.18**	24.64**	3.13	-9.32	23.46*	15.43	24.48**	19.49**	-1.64	6.76	7.35

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F_1 Cross	No. of kernel rows						No. of kernels per row					
	Mean	Average heterosis	Heterobeltiosis	Standard heterosis			Mean	Average heterosis	Heterobeltiosis	Standard heterosis		
				DHM 117	30 V 92	900 M Gold					30 V 92	900 M Gold
MRC 1058 x BML 7	15.75	14.20**	13.17**	0.53	3.85	-3.30	33.92	23.15**	21.13**	2.01	-0.97	4.63
MRC 1058 x BML 13	14.17	8.63*	3.66	-9.57*	-6.59	-13.02**	38.42	47.05**	41.85**	15.54**	12.17*	18.51**
MRC 1070 x BML 5	16.50	28.91**	25.32**	5.32	8.79*	1.31	31.25	25.21**	25.00**	-6.02	-8.76	-3.60
MRC 1070 x BML 7	14.67	11.32**	5.39	-6.38	-3.30	-9.95*	35.17	32.7**	25.6**	5.76	2.68	8.48
MRC 1070 x BML 13	16.17	30.11**	30.03**	3.19	6.59	-0.74	36.33	44.85**	44.37**	9.27	6.08	12.08*
MRC 1081 x BML 5	13.33	8.84	1.27	-14.89**	-12.09**	-18.13**	33.75	40.38**	35.45**	1.50	-1.46	4.11
MRC 1081 x BML 7	14.50	14.85**	4.19	-7.45	-4.40	-10.97**	38.72	51.36**	38.3**	16.46**	13.06*	19.46**
MRC 1081 x BML 13	15.00	26.32**	20.81**	-4.26	-1.10	-7.90*	37.16	53.78**	47.67**	11.77*	8.51	14.64**
MRC 1091 x BML 5	15.00	13.21**	12.50*	-4.26	-1.10	-7.90*	32.25	39.71**	29.43**	-3.01	-5.84	-0.51
MRC 1091 x BML 7	15.67	14.98**	12.57**	0.00	3.30	-3.81	35.67	44.84**	27.38**	7.27	4.14	10.03
MRC 1091 x BML 13	15.83	22.98**	18.75**	1.06	4.40	-2.78	35.42	52.6**	40.73**	6.52	3.41	9.25
MRC 1095 x BML 5	13.83	8.44	5.06	-11.7**	-8.79*	-15.06**	32.75	33.36**	31.44**	-1.50	-4.38	1.03
MRC 1095 x BML 7	13.67	4.07	-1.80	-12.77**	-9.89*	-16.09**	35.5	36.02**	26.79**	6.77	3.65	9.51
MRC 1095 x BML 13	14.50	17.11**	16.78**	-7.45	-4.40	-10.97**	32.5	31.67**	29.14**	-2.26	-5.11	0.26
MRC 1104 x BML 5	14.50	6.10	2.35	-7.45	-4.40	-10.97**	32.75	15.59**	3.15	-1.50	-4.38	1.03
MRC 1104 x BML 7	14.33	2.08	1.18	-8.51*	-5.49	-11.99**	31.33	4.88	-1.31	-5.76	-8.52	-3.34
MRC 1104 x BML 13	14.50	9.09*	2.35	-7.45	-4.40	-10.97**	32.67	14.79**	2.89	-1.75	-4.62	0.77
MRC 1117 x BML 5	14.58	9.66*	8.59	-6.91	-3.85	-10.46**	32.00	27.36**	26.32**	-3.76	-6.57	-1.29
MRC 1117 x BML 7	14.92	9.09*	7.19	-4.79	-1.65	-8.41*	36.00	35.00**	28.57**	8.27	5.11	11.05*
MRC 1117 x BML 13	15.25	18.00**	13.55**	-2.66	0.55	-6.37	32.08	27.06**	26.64**	-3.51	-6.33	-1.03
MRC 1119 x BML 5	15.17	14.11**	13.04**	-3.19	0.00	-6.88	31.25	28.87**	25.42**	-6.02	-8.76	-3.60
MRC 1119 x BML 7	16.42	20.12**	17.96**	4.79	8.24	0.80	32.33	25.36**	15.48*	-2.76	-5.60	-0.26
MRC 1119 x BML 13	14.21	9.99*	5.89	-9.32*	-6.33	-12.77**	34.08	39.83**	35.43**	2.51	-0.49	5.14
MRC 1125 x BML 5	15.58	12.65**	7.47	-0.53	2.75	-4.32	35.25	40.77**	40.07**	6.02	2.92	8.74
MRC 1125 x BML 7	15.33	7.92*	5.75	-2.13	1.10	-5.85	35.5	33.54**	26.79**	6.77	3.65	9.51
MRC 1125 x BML 13	14.25	5.88	-1.72	-9.04*	-6.04	-12.51**	36.0	43.05**	43.05**	8.27	5.11	11.05*
MRC 1132 x BML 5	15.20	11.04**	6.94	-2.96	0.24	-6.65	38.25	45.48**	38.25**	15.04**	11.68*	17.99**
MRC 1132 x BML 7	14.17	0.71	-0.35	-9.57*	-6.59	-13.02**	32.0	14.97**	14.29*	-3.76	-6.57	-1.29
MRC 1132 x BML 13	14.17	6.38	-0.35	-9.57*	-6.59	-13.02**	33.50	26.81**	21.08**	0.75	-2.19	3.34
MRC 1134 x BML 5	14.42	16.50**	9.49	-7.98	-4.95	-11.48**	32.93	33.04**	32.15**	-0.97	-3.86	1.57
MRC 1134 x BML 7	14.50	13.73**	4.19	-7.45	-4.40	-10.97**	29.42	11.89*	5.06	-11.53*	-14.11**	-9.25
MRC 1134 x BML 13	13.09	9.11*	5.45	-16.43**	-13.67**	-19.61**	30.67	23.28**	21.85**	-7.77	-10.46*	-5.40
MRC 1144 x BML 5	14.50	19.18**	10.13*	-7.45	-4.40	-10.97**	32.08	33.91**	28.76**	-3.51	-6.33	-1.03
MRC 1144 x BML 7	14.83	18.27**	6.59	-5.32	-2.20	-8.92*	29.92	17.32**	6.85	-10.03	-12.65*	-7.71
MRC 1144 x BML 13	14.29	21.22**	15.11**	-8.77*	-5.76	-12.24**	34.83	44.64**	38.41**	4.76	1.70	7.46
MRC 1148 x BML 5	16.33	29.17**	24.05**	4.26	7.69	0.29	27.42	10.96	10.03	-17.54**	-19.95**	-15.42**
MRC 1148 x BML 7	16.00	22.89**	14.97**	2.13	5.49	-1.76	30.42	15.87**	8.63	-8.52	-11.19*	-6.17
MRC 1148 x BML 13	15.15	23.50**	22.04**	-3.28	-0.09	-6.96	29.67	19.46**	17.88*	-10.78*	-13.38*	-8.48
MRC 1150 x BML 5	14.83	26.24**	12.66*	-5.32	-2.20	-8.92*	41.30	85.63**	65.77**	24.22**	20.59**	27.41**
MRC 1150 x BML 7	13.21	8.95	-5.08	-15.68**	-12.9**	-18.89**	43.75	83.89**	56.25**	31.58**	27.74**	34.96**
MRC 1150 x BML 13	12.00	5.49	-3.36	-23.4**	-20.88**	-26.32**	36.75	64.25**	46.03**	10.53	7.30	13.37*
MRC 1157 x BML 5	16.25	23.81**	23.42**	3.72	7.14	-0.23	31.50	24.75**	23.13**	-5.26	-8.03	-2.83
MRC 1157 x BML 7	15.91	17.88**	14.35**	1.57	4.92	-2.29	28.25	5.44	0.89	-15.04**	-17.52**	-12.85*
MRC 1157 x BML 13	14.42	13.07**	10.19*	-7.98	-4.95	-11.48**	30.58	20.53**	19.54**	-8.02	-10.71*	-5.66

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F_1 Cross	Test weight (g)						Seed yield per plant (g)					
	Mean	Average heterosis	Heterobeltiosis	Standard heterosis			Mean	Average heterosis	Heterobeltiosis	Standard heterosis		
				DHM 117	30 V 92	900 M Gold				DHM 117	30 V 92	900 M Gold
MRC 1058 x BML 7	25.80	10.73**	5.52	-1.06	-2.00	9.87*	130.61	37.42**	35.59**	7.90	4.82	24.06**
MRC 1058 x BML 13	25.37	10.14**	3.78	-2.70	-3.62	8.05*	139.19	64.55**	44.49**	14.98*	11.70	32.21**
MRC 1070 x BML 5	27.16	32.77**	2.001**	4.15	3.17	15.66**	122.87	134.77**	118.07**	1.51	-1.39	16.71*
MRC 1070 x BML 7	28.28	26.83**	25.99**	8.45*	7.42*	20.43**	123.15	73.35**	31.35**	1.73	-1.17	16.97*
MRC 1070 x BML 13	30.35	37.74**	35.21**	16.39**	15.28**	29.24**	154.34	154.74**	111.87**	27.50**	23.86**	46.6**
MRC 1081 x BML 5	23.41	4.66	-10.88**	-10.24**	-11.09**	-0.33	103.08	64.93**	50.15**	-14.85*	-17.28*	-2.09
MRC 1081 x BML 7	27.86	15.11**	6.09	6.85	5.84	18.65**	131.47	61.91**	40.23**	8.61	5.51	24.88**
MRC 1081 x BML 13	28.98	21.02**	10.33**	11.12**	10.07**	23.39**	146.56	107.17**	101.20**	21.08**	17.62**	39.21**
MRC 1091 x BML 5	23.46	33.18**	27.06**	-10.02**	-10.88**	-0.09	95.54	63.88**	58.58**	-21.08**	-23.33**	-9.25
MRC 1091 x BML 7	24.36	25.2**	9.99*	-6.57	-7.46*	3.75	111.65	45.00**	19.08*	-7.77	-10.40	6.05
MRC 1091 x BML 13	26.20	36.48**	21.17**	0.47	-0.48	11.57**	125.72	88.93**	72.59**	3.86	0.89	19.42*
MRC 1095 x BML 5	26.65	44.93**	44.33**	2.21	1.24	13.50**	110.72	61.62**	37.26**	-8.53	-11.14	5.17
MRC 1095 x BML 7	24.32	20.21**	9.80*	-6.74	-7.62*	3.56	112.29	28.76**	19.77*	-7.23	-9.88	6.66
MRC 1095 x BML 13	26.91	34.76**	24.45**	3.20	2.22	14.59**	125.13	63.03**	55.12**	3.37	0.42	18.86*
MRC 1104 x BML 5	28.40	31.75**	15.25**	8.90*	7.86*	20.92**	106.84	35.03**	4.85	-11.74	-14.26*	1.48
MRC 1104 x BML 7	26.48	13.19**	7.47	1.55	0.58	12.76**	107.01	9.39	5.01	-11.60	-14.12*	1.64
MRC 1104 x BML 13	29.57	27.83**	20.01**	13.40**	12.32**	25.92**	127.74	46.21**	25.36**	5.53	2.51	21.34**
MRC 1117 x BML 5	24.92	21.81**	11.00*	-4.44	-5.34	6.12	116.89	117.04**	107.45**	-3.44	-6.20	11.03
MRC 1117 x BML 7	27.34	22.60**	21.78**	4.84	3.85	16.42**	116.30	60.28**	24.05**	-3.92	-6.67	10.47
MRC 1117 x BML 13	30.64	39.04**	36.48**	17.50**	16.38**	30.48**	136.54	119.86**	87.45**	12.80	9.58	29.70**
MRC 1119 x BML 5	25.67	29.14**	20.57**	-1.55	-2.48	9.33*	116.17	91.94**	79.56**	-4.03	-6.78	10.34
MRC 1119 x BML 7	26.54	22.18**	19.82**	1.78	0.81	13.02**	131.29	65.71**	40.03**	8.46	5.36	24.70**
MRC 1119 x BML 13	27.82	29.66**	28.67**	6.70	5.68	18.48**	122.57	78.23**	68.26**	1.25	-1.64	16.42*
MRC 1125 x BML 5	26.37	37.21**	32.02**	1.14	0.18	12.31**	112.82	68.46**	45.40**	-6.80	-9.46	7.16
MRC 1125 x BML 7	22.95	8.94*	3.60	-12.00**	-12.84**	-2.29	121.83	42.20**	29.94**	0.64	-2.23	15.72*
MRC 1125 x BML 13	24.33	16.97**	12.52**	-6.70	-7.58*	3.61	104.48	38.90**	34.65**	-13.69*	-16.16*	-0.76
MRC 1132 x BML 5	25.11	22.1**	10.81*	-3.72	-4.63	6.91	123.31	110.22**	102.25**	1.87	-1.04	17.13*
MRC 1132 x BML 7	25.18	12.39**	11.14**	-3.44	-4.36	7.22	98.07	26.77**	4.60	-18.98**	-21.30**	-6.85
MRC 1132 x BML 13	27.18	22.76**	19.96**	4.23	3.24	15.74**	116.56	74.22**	60.02**	-3.71	-6.46	10.72
MRC 1134 x BML 5	28.75	38.49**	24.73**	10.24**	9.19*	22.41**	110.39	85.20**	75.60**	-8.80	-11.41	4.86
MRC 1134 x BML 7	30.86	36.57**	33.92**	18.36**	17.23**	31.43**	109.56	39.91**	16.86	-9.49	-12.08	4.07
MRC 1134 x BML 13	27.97	25.24**	21.38**	7.27*	6.25	19.12**	100.98	48.82**	38.63**	-16.58*	-18.96**	-4.08
MRC 1144 x BML 5	26.91	43.54**	41.4**	3.21	2.23	14.61**	117.9	110.07**	109.25**	-2.60	-5.38	11.99
MRC 1144 x BML 7	25.67	24.66**	15.89**	-1.56	-2.49	9.31*	106.65	42.52**	13.76	-11.89	-14.41*	1.30
MRC 1144 x BML 13	28.76	41.46**	32.99**	10.28**	9.23*	22.46**	127.89	98.66**	75.57**	5.65	2.63	21.48**
MRC 1148 x BML 5	25.02	18.76**	5.70	-4.04	-4.95	6.56	109.16	76.46**	62.01**	-9.82	-12.40	3.69
MRC 1148 x BML 7	25.98	13.39**	9.74*	-0.37	-1.32	10.63**	119.56	48.39**	27.52**	-1.23	-4.06	13.56
MRC 1148 x BML 13	26.64	17.61**	12.52**	2.15	1.18	13.43**	114.41	63.19**	57.07**	-5.48	-8.18	8.68
MRC 1150 x BML 5	26.77	27.04**	13.07**	2.65	1.67	13.98**	142.48	149.76**	146.73**	17.70*	14.34*	35.33**
MRC 1150 x BML 7	27.54	20.2**	16.33**	5.61	4.61	17.27**	142.06	87.53**	51.52**	17.36*	14.00*	34.94**
MRC 1150 x BML 13	26.59	17.39**	12.31**	1.96	0.99	13.22**	106.99	63.85**	46.87**	-11.62	-14.14*	1.62
MRC 1157 x BML 5	25.81	13.25**	-4.81	-1.02	-1.96	9.91*	118.88	59.56**	28.30**	-1.79	-4.60	12.92
MRC 1157 x BML 7	25.11	1.93	-7.40*	-3.72	-4.63	6.91	109.14	17.09*	16.41	-9.84	-12.41	3.67
MRC 1157 x BML 13	27.53	12.96**	1.52	5.56	4.56	17.22**	122.41	47.92**	32.11**	1.12	-1.77	16.27*