

MANIFESTATION OF HETEROISIS AND HETEROBELTIOSIS FOR YIELD ATTRIBUTING TRAITS IN INBRED LINES OF MAIZE (*ZEA MAYS* L.)

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SUMMARY

The experiment was carried out during **rabi** 2012-13 involving 15 inbred lines in combination with four testers in line x tester design to obtain 60 cross combinations for evaluation along with three checks for heterosis in terms of yield and its attributes. The results indicated significant negative relative heterosis for days to 50 per cent tasseling in 26 hybrids indicating earliness for maturity. Relative heterosis for plant height varied from 10.99 to 102.98 per cent, heterobeltiosis from -1.45 to 61.89 and standard heterosis from -35.44 to 7.75 per cent, -28.55 to 19.26 per cent and -26.88 to 22.04 per cent over DHM 117, 30 V 92 and 900 M Gold, respectively. Relative heterosis and heterobeltiosis for ear height and ear length were found to be positively significant in most of the crosses. For 100-seed weight, majority of the hybrids showed significant and positive relative heterosis and heterobeltiosis with range of relative heterosis from 21.74 to 31.97 per cent and heterobeltiosis from -38.18 to 27.63 per cent and standard heterosis from -17.07 to 21.95 per cent over DHM-117, from -17.07 to 21.95 per cent over 30 V 92 and -8.11 to 35.14 over 900 M Gold, respectively. Significant positive relative heterosis and heterobeltiosis for grain yield per plant were also recorded by many hybrids indicating simultaneous manifestation of heterosis for yield component traits.

Key words : Maize, yield, yield attributes, heterosis

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. Though, the science of genetics and plant breeding has greatly contributed to improve the productivity through high yielding synthetics, composites and hybrids viz. single, double, multiple and varietal hybrids, of late, single cross hybrids have become the most popular because single crosses show higher uniformity and heterosis than the double and three-way crosses.

Besides, identification of favourable alleles in the inbreds, the information on combining ability is a pre-requisite for development of superior hybrids. The main goal of maize breeding is to obtain new hybrids with high genetic potential for yield and positive features that exceed the existing commercial hybrids. 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. Moreover, 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.

MATERIALS AND METHODS

The experiment was carried out at Agricultural Research Station, Madhira during **rabi** 2012-13. Selected 15 inbred lines were crossed with four testers in line x tester (L x T) mating design to obtain 60 cross combinations. During **kharif** 2013, set of 60 crosses along with 19 parents and three checks viz., DHM-117, 30 V 92 and 900 M Gold were sown in randomized block design replicated thrice. Each entry was sown in a row of five metres length with a spacing of 75 cm between rows and 20 cm between the plants. The recommended fertilizers of N, P and K were applied in the ratio of 120 : 80 : 60 kg/ha. Necessary plant protection measures were taken to protect the crop from pests and diseases. Observations on 11 different quantitative characteristics were recorded on five random plants except for days to 50 per cent tasseling, days to 50 per cent silking and

days to maturity. Estimates of heterosis were calculated according to Fonseca and Patterson (1968) and standard heterosis according to Yimani *et al.* (1982) for these characters and expressed as heterosis over mid-parent, superior parent and standard checks viz., DHM 117, 30 V 92 and 900 M Gold.

RESULTS AND DISCUSSION

The negative heterotic values for days to 50 per cent tasseling, days to 50 per cent silking and days to maturity indicated earliness, which is desirable. For other characters, positive estimates were considered as desirable. The character-wise heterotic estimates for hybrids are presented in Tables 1, 2, 3 and 4, the values being expressed in per cent.

Significant negative relative heterosis for days to 50 per cent tasseling was observed in 26 hybrids which ranged from -11.59 to 9.70 per cent and heterobeltiosis varied from -17.93 to 5.52 per cent. Fifty hybrids showed significant negative standard heterosis over DMH-117, 58 hybrids each over 30 V 92 and 900 M Gold. Standard heterosis over DHM-117 ranged from -16.67 to 4.02 per cent, whereas over 30 V 92 and 900 M Gold ranged from -19.89 to 0.00 and -20.77 to -1.09 per cent, respectively.

The relative heterosis for days to 50 per cent silking ranged from -10.40 to 7.55 per cent, while the heterobeltiosis ranged from -15.76 to 5.23 per cent. The standard heterosis over DHM-117, 30 V 92 and 900 M Gold ranged from -15.30 to 3.28%, -18.42 to -0.53 and -19.69 to -2.07 per cent, respectively. Relative heterosis for days to maturity ranged from -8.05 to 7.90 per cent, heterobeltiosis from -14.33 to -2.74 per cent and standard heterosis over DHM-117, 30 V 92 and 900 M Gold ranged from -7.22 to 2.53, -10.76 to -1.39 and -7.89 to 1.79 per cent, respectively. Days to 50 per cent tasseling, days to 50 per cent silking and days to maturity indicated the earliness of a genotype. Earliness is a desirable character as it is useful in multiple cropping and increases water and land use efficiency. Heterosis for earliness in maize was reported by Sadaiah *et al.* (2013) and Tajwar Izhar and Chakraborty (2013).

Relative heterosis for plant height varied from 10.99 to 102.98 per cent, heterobeltiosis from -1.45 to 61.89 per cent and standard heterosis from -35.44 to 7.75, -28.55 to 19.26 and -26.88 to 22.04 per cent over DHM 117, 30 V 92 and 900 M Gold, respectively. Relative

heterosis and heterobeltiosis for ear height and ear length were found to be positively significant in most of the crosses. The present results are comparable with the findings of Sadaiah *et al.* (2013), Tajwar Izhar and Chakraborty (2013), Rajesh *et al.* (2014) and Sharma *et al.* (2015).

Among 60 hybrids studied, 57 hybrids for relative heterosis, 21 for heterobeltiosis, none of the hybrids for standard heterosis over DHM-117, three hybrids each for standard heterosis over 30 V 92 and 900 M Gold recorded significant positive values for ear girth. Number of kernel rows per ear showed relative heterosis values from -9.52 (MRC 1176 x BML 14) to 48.57 per cent (MRC 1123 x BML 13) and heterobeltiosis from -27.45 (MRC 1604 x BML 13) to 30.00 per cent (MRC 1123 x BML 13). The standard heterosis over DHM-117 ranged from -22.92 (MRC 1604 x BML 13) to 8.33 per cent (MRC 1123 x BML 13), over 30 V 92 from -19.57 (MRC 1604 x BML 13) to 13.04 per cent (MRC 1123 x BML 13) and -19.57 (MRC 1604 x BML 13) to 13.04 (MRC 1123 x BML 13) over 900 M Gold.

Heterosis for number of kernels per row varied from 13.67 (MRC 1601 x BML 14) to 115.53 per cent (MRC 1209 x BML 7) and heterobeltiosis from -20.20 (MRC 1601 x BML 14) to 65.67 per cent (MRC 1209 x BML 7). Standard heterosis over DHM-117 ranged from -23.30 (MRC 1601 x BML 14) to 30.10 per cent (MRC 1604 x BML 7), over 30 V 92 from -25.47 (MRC 1601 x BML 14) to 26.42 per cent (MRC 1604 x BML 7) and over 900 M Gold from -21.00 (MRC 1601 x BML 14) to 34.00 (MRC 1604 x BML 7). Heterosis estimation for number of kernels per row had also been conducted by Netra Hiremath (2013), Rajesh *et al.* (2014) and Sharma *et al.* (2015) who reported significant positive heterosis for number of kernels per row.

For 100-seed weight, majority of the hybrids showed significant and positive relative heterosis and heterobeltiosis with range of relative heterosis from -21.74 to 31.97 per cent and heterobeltiosis from -38.18 to 27.63 per cent and standard heterosis from -17.07 to 21.95 per cent over DHM-117, from -17.07 to 21.95 per cent over 30 V 92 and -8.11 to 35.14 over 900 M Gold. The above results are in agreement with the findings of Rajitha *et al.* (2014) and Sharma *et al.* (2015) who reported significant positive heterosis for 100-seed weight.

Most of the hybrids exhibited significant

TABLE 1
Estimates of heterosis, heterobeltiosis and standard heterosis (over DHM-117, 30 V 92 and 900 M Gold) for days to 50 % tasseling, days 50 % silking and days to maturity in maize hybrids

| Cross | Days to 50% tasseling | | | | | Days to 50% silking | | | | | Days to maturity | | | | |
|------------------|-----------------------|------------------|--------------------|-----------|------------|---------------------|------------------|--------------------|-----------|------------|------------------|------------------|--------------------|-----------|------------|
| | Heterosis | Hetero beltiosis | Standard heterosis | | | Heterosis | Hetero beltiosis | Standard heterosis | | | Heterosis | Hetero beltiosis | Standard heterosis | | |
| | | | DHM-117 | 30 V 92 | 900 M Gold | | | DHM-117 | 30 V 92 | 900 M Gold | | | DHM-117 | 30 V 92 | 900 M Gold |
| MRC1112 X BML5 | -6.51 ** | -14.13 ** | -9.20 ** | -12.71 ** | -13.66 ** | -5.92 ** | -13.02 ** | -8.74 ** | -12.11 ** | -13.47 ** | -0.91 | -6.53 ** | -1.81 | -5.56 ** | -2.51 |
| MRC1112 X BML7 | 0.00 | -7.22 ** | -4.02 * | -7.73 ** | -8.74 ** | -1.42 | -8.42 ** | -4.92 * | -8.42 ** | -9.84 ** | 0.72 | -6.33 ** | 1.44 | -2.43 | 0.72 |
| MRC1112 X BML13 | 8.52 ** | 5.52 ** | -1.15 | -4.97 ** | -6.01 ** | 7.46 ** | 4.65 * | -1.64 | -5.26 ** | -6.74 ** | -1.45 | -7.19 ** | -2.17 | -5.9 ** | -2.87 |
| MRC1112 X BML14 | -7.60 ** | -13.14 ** | -12.64 ** | -16.02 ** | -16.94 ** | -7.2 ** | -12.5 ** | -12.02 ** | -15.26 ** | -16.58 ** | -2.74 | -7.96 ** | -3.97 * | -7.64 ** | -4.66 * |
| MRC 1123 X BML5 | -3.53 * | -10.87 ** | -5.75 ** | -9.39 ** | -10.38 ** | -3.64 * | -10.42 ** | -6.01 ** | -9.47 ** | -10.88 ** | -0.36 | -5.5 ** | -0.72 | -4.51 * | -1.43 |
| MRC 1123 X BML7 | -1.79 | -8.33 ** | -5.17 ** | -8.84 ** | -9.84 ** | -1.41 | -7.89 ** | -4.37 * | -7.89 ** | -9.33 ** | -1.25 | -7.67 ** | 0.00 | -3.82 * | -0.72 |
| MRC 1123 X BML13 | 7.84 ** | 5.52 ** | -1.15 | -4.97 ** | -6.01 ** | 7.42 ** | 5.23 * | -1.09 | -4.74 * | -6.22 ** | -1.99 | -7.19 ** | -2.17 | -5.90 ** | -2.87 |
| MRC 1123 X BML14 | -3.32 | -8.57 ** | -8.05 ** | -11.6 ** | -12.57 ** | -4.3 * | -9.24 ** | -8.74 ** | -12.11 ** | -13.47 ** | -2.18 | -6.92 ** | -2.89 | -6.60 ** | -3.58 * |
| MRC 1176 X BML5 | 4.32 * | -8.15 ** | -2.87 | -6.63 ** | -7.65 ** | 2.34 | -8.85 ** | -4.37 * | -7.89 ** | -9.33 ** | 2.91 | -8.93 ** | -4.33 * | -7.99 ** | -5.02 ** |
| MRC 1176 X BML7 | 5.00 ** | -6.67 ** | -3.45 | -7.18 ** | -8.20 ** | 4.12 * | -6.84 ** | -3.28 | -6.84 ** | -8.29 ** | 3.44 * | -9.67 ** | -2.17 | -5.90 ** | -2.87 |
| MRC 1176 X BML13 | 6.93 ** | -0.61 | -6.90 ** | -10.5 ** | -11.48 ** | 7.45 ** | 0.58 | -5.46 ** | -8.95 ** | -10.36 ** | 6.59 ** | -5.82 ** | -0.72 | -4.51 * | -1.43 |
| MRC 1176 X BML14 | 3.49 | -6.86 ** | -6.32 ** | -9.94 ** | -10.93 ** | 1.20 | -8.15 ** | -7.65 ** | -11.05 ** | -12.44 ** | 0.97 | -10.38 ** | -6.50 ** | -10.07 ** | -7.17 ** |
| MRC 1179 X BML5 | -3.53 * | -10.87 ** | -5.75 ** | -9.39 ** | -10.38 ** | -3.08 | -9.90 ** | -5.46 ** | -8.95 ** | -10.36 ** | 7.75 ** | -4.47 * | 0.36 | -3.47 * | -0.36 |
| MRC 1179 X BML7 | -3.57 * | -10.00 ** | -6.90 ** | -10.5 ** | -11.48 ** | -4.23 * | -10.53 ** | -7.10 ** | -10.53 ** | -11.92 ** | 7.05 ** | -6.33 ** | 1.44 | -2.43 | 0.72 |
| MRC 1179 X BML13 | 0.31 | -1.84 | -8.05 ** | -11.6 ** | -12.57 ** | 0.30 | -1.74 | -7.65 ** | -11.05 ** | -12.44 ** | 5.61 ** | -6.51 ** | -1.44 | -5.21 ** | -2.15 |
| MRC 1179 X BML14 | -4.53 * | -9.71 ** | -9.20 ** | -12.71 ** | -13.66 ** | -4.30 * | -9.24 ** | -8.74 ** | -12.11 ** | -13.47 ** | 5.84 ** | -5.88 ** | -1.81 | -5.56 ** | -2.51 |
| MRC 1209 X BML5 | -5.44 ** | -10.33 ** | -5.17 ** | -8.84 ** | -9.84 ** | -5.46 ** | -9.90 ** | -5.46 ** | -8.95 ** | -10.36 ** | -5.63 ** | -7.90 ** | -3.25 | -6.94 ** | -3.94 * |
| MRC 1209 X BML7 | -6.09 ** | -10.00 ** | -6.90 ** | -10.5 ** | -11.48 ** | -5.49 ** | -9.47 ** | -6.01 ** | -9.47 ** | -10.88 ** | -4.68 ** | -8.33 ** | -0.72 | -4.51 * | -1.43 |
| MRC 1209 X BML13 | -2.44 | -3.03 | -8.05 ** | -11.6 ** | -12.57 ** | -2.89 | -3.45 | -8.20 ** | -11.58 ** | -12.95 ** | -3.34 * | -5.82 ** | -0.72 | -4.51 * | -1.43 |
| MRC 1209 X BML14 | -6.47 ** | -9.14 ** | -8.62 ** | -12.15 ** | -13.11 ** | -6.70 ** | -9.24 ** | -8.74 ** | -12.11 ** | -13.47 ** | -6.71 ** | -8.65 ** | -4.69 * | -8.33 ** | -5.38 ** |
| MRC 1271 X BML5 | -4.45 * | -12.50 ** | -7.47 ** | -11.05 ** | -12.02 ** | -5.35 ** | -12.5 ** | -8.2 ** | -11.58 ** | -12.95 ** | 0.36 | -5.15 ** | -0.36 | -4.17 * | -1.08 |
| MRC 1271 X BML7 | -1.50 | -8.89 ** | -5.75 ** | -9.39 ** | -10.38 ** | -1.98 | -8.95 ** | -5.46 ** | -8.95 ** | -10.36 ** | -8.05 ** | -14.33 ** | -7.22 ** | -10.76 ** | -7.89 ** |
| MRC 1271 X BML13 | -0.63 | -3.68 | -9.77 ** | -13.26 ** | -14.21 ** | -0.30 | -2.91 | -8.74 ** | -12.11 ** | -13.47 ** | 1.27 | -4.45 * | 0.72 | -3.13 | 0.00 |
| MRC 1271 X BML14 | -5.49 ** | -11.43 ** | -10.92 ** | -14.36 ** | -15.30 ** | -6.63 ** | -11.96 ** | -11.48 ** | -14.74 ** | -16.06 ** | -1.46 | -6.57 ** | -2.53 | -6.25 ** | -3.23 |
| MRC 1358 X BML5 | -7.19 ** | -15.76 ** | -10.92 ** | -14.36 ** | -15.30 ** | -7.65 ** | -15.10 ** | -10.93 ** | -14.21 ** | -15.54 ** | 2.10 | -8.25 ** | -3.61 * | -7.29 ** | -4.30 * |
| MRC 1358 X BML7 | 9.70 ** | 0.56 | 4.02 * | 0.00 | -1.09 | 7.12 ** | -1.05 | 2.73 | -1.05 | -2.59 | 0.38 | -11.00 ** | -3.61 * | -7.29 ** | -4.30 * |
| MRC 1358 X BML13 | 2.88 | -1.23 | -7.47 ** | -11.05 ** | -12.02 ** | 2.10 | -1.16 | -7.10 ** | -10.53 ** | -11.92 ** | 2.29 | -8.22 ** | -3.25 | -6.94 ** | -3.94 * |
| MRC 1358 X BML14 | -8.31 ** | -14.86 ** | -14.37 ** | -17.68 ** | -18.58 ** | -8.41 ** | -14.13 ** | -13.66 ** | -16.84 ** | -18.13 ** | -0.58 | -10.38 ** | -6.50 ** | -10.07 ** | -7.17 ** |
| MRC 1544 X BML5 | -10.39 ** | -17.93 ** | -13.22 ** | -16.57 ** | -17.49 ** | -8.47 ** | -15.63 ** | -11.48 ** | -14.74 ** | -16.06 ** | 2.40 | -4.81 ** | 0.00 | -3.82 * | -0.72 |
| MRC 1544 X BML7 | -2.70 | -10.00 ** | -6.90 ** | -10.50 ** | -11.48 ** | -2.84 | -10.00 ** | -6.56 ** | -10.00 ** | -11.40 ** | 2.18 | -6.33 ** | 1.44 | -2.43 | 0.72 |
| MRC 1544 X BML13 | 1.27 | -1.84 | -8.05 ** | -11.60 ** | -12.57 ** | 1.20 | -1.74 | -7.65 ** | -11.05 ** | -12.44 ** | 4.8 ** | -2.74 | 2.53 | -1.39 | 1.79 |
| MRC 1544 X BML14 | -11.59 ** | -17.14 ** | -16.67 ** | -19.89 ** | -20.77 ** | -10.4 ** | -15.76 ** | -15.30 ** | -18.42 ** | -19.69 ** | 0.56 | -6.23 ** | -2.17 | -5.90 ** | -2.87 |
| MRC 1556 X BML5 | -6.23 ** | -14.13 ** | -9.20 ** | -12.71 ** | -13.66 ** | -5.65 ** | -13.02 ** | -8.74 ** | -12.11 ** | -13.47 ** | 4.12 * | -4.47 * | 0.36 | -3.47 * | -0.36 |
| MRC 1556 X BML7 | -2.70 | -10.00 ** | -6.90 ** | -10.50 ** | -11.48 ** | -2.27 | -9.47 ** | -6.01 ** | -9.47 ** | -10.88 ** | 3.50 * | -6.33 ** | 1.44 | -2.43 | 0.72 |
| MRC 1556 X BML13 | 1.90 | -1.23 | -7.47 ** | -11.05 ** | -12.02 ** | 1.80 | -1.16 | -7.10 ** | -10.53 ** | -11.92 ** | 3.55 * | -5.14 ** | 0.00 | -3.82 * | -0.72 |
| MRC 1556 X BML14 | -7.32 ** | -13.14 ** | -12.64 ** | -16.94 ** | -16.94 ** | -6.94 ** | -12.50 ** | -12.02 ** | -15.26 ** | -16.58 ** | 2.26 | -5.88 ** | -1.81 | -5.56 ** | -2.51 |
| MRC 1561 X BML5 | -8.94 ** | -11.41 ** | -6.32 ** | -9.94 ** | -10.93 ** | -8.80 ** | -10.94 ** | -6.56 ** | -10.00 ** | -11.40 ** | -4.86 ** | -5.84 ** | -1.08 | -4.86 ** | -1.79 |
| MRC 1561 X BML7 | -2.82 | -4.44 * | -1.15 | -4.97 ** | -6.01 ** | -4.02 * | -5.79 ** | -2.19 | -5.79 ** | -7.25 ** | -5.3 ** | -7.67 ** | 0.00 | -3.82 * | -0.72 |

contd.

HETEROISIS IN MAIZE

Table 1 contd.

| | | | | | | | | | | | | | | | |
|------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|---------|----------|---------|
| MRC 1561 X BML13 | -2.67 | -5.75 ** | -5.75 ** | -9.39 ** | -10.38 ** | -2.54 | -5.46 ** | -5.46 ** | -8.95 ** | -10.36 ** | -2.25 | -3.42 * | 1.81 | -2.08 | 1.08 |
| MRC 1561 X BML14 | -7.74 ** | -8.00 ** | -7.47 ** | -11.05 ** | -12.02 ** | -7.36 ** | -7.61 ** | -7.10 ** | -10.53 ** | -11.92 ** | -6.62 ** | -7.27 ** | -3.25 | -6.94 ** | -3.94 * |
| MRC 1564 X BML5 | -1.20 | -10.33 ** | -5.17 ** | -8.84 ** | -9.84 ** | 0.28 | -8.33 ** | -3.83 * | -7.37 ** | -8.81 ** | 2.97 | -4.81 ** | 0.00 | -3.82 * | -0.72 |
| MRC 1564 X BML7 | 1.21 | -7.22 ** | -4.02 * | -7.73 ** | -8.74 ** | 2.01 | -6.32 ** | -2.73 | -6.32 ** | -7.77 ** | 2.01 | -7.00 ** | 0.72 | -3.13 | 0.00 |
| MRC 1564 X BML13 | 9.27 ** | 4.91 * | -1.72 | -5.52 ** | -6.56 ** | 7.55 ** | 3.49 | -2.73 | -6.32 ** | -7.77 ** | 2.41 | -5.48 ** | -0.36 | -4.17 * | -1.08 |
| MRC 1564 X BML14 | -2.15 | -9.14 ** | -8.62 ** | -12.15 ** | -13.11 ** | -0.87 | -7.61 ** | -7.10 ** | -10.53 ** | -11.92 ** | 1.12 | -6.23 ** | -2.17 | -5.90 ** | -2.87 |
| MRC 1582 X BML5 | -3.26 | -11.41 ** | -6.32 ** | -9.94 ** | -10.93 ** | -4.52 ** | -11.98 ** | -7.65 ** | -11.05 ** | -12.44 ** | -1.27 | -6.53 ** | -1.81 | -5.56 ** | -2.51 |
| MRC 1582 X BML7 | -0.90 | -8.33 ** | -5.17 ** | -8.84 ** | -9.84 ** | -1.14 | -8.42 ** | -4.92 * | -8.42 ** | -9.84 ** | -0.71 | -7.33 ** | 0.36 | -3.47 * | -0.36 |
| MRC 1582 X BML13 | 5.06 ** | 1.84 | -4.60 * | -8.29 ** | -9.29 ** | 4.19 * | 1.16 | -4.92 * | -8.42 ** | -9.84 ** | 0.72 | -4.79 ** | 0.36 | -3.47 * | -0.36 |
| MRC 1582 X BML14 | -4.27 * | -10.29 ** | -9.77 ** | -13.26 ** | -14.21 ** | -5.78 ** | -11.41 ** | -10.93 ** | -14.21 ** | -15.54 ** | -3.10 | -7.96 ** | -3.97 * | -7.64 ** | -4.66 * |
| MRC 1601 X BML5 | -3.90 * | -13.04 ** | -8.05 ** | -11.60 ** | -12.57 ** | -5.38 ** | -13.02 ** | -8.74 ** | -12.11 ** | -13.47 ** | 7.90 ** | -3.78 * | 1.08 | -2.78 | 0.36 |
| MRC 1601 X BML7 | 5.17 ** | -3.89 * | -0.57 | -4.42 * | -5.46 ** | 3.13 | -4.74 * | -1.09 | -4.74 * | -6.22 ** | 7.20 ** | -5.67 ** | 2.17 | -1.74 | 1.43 |
| MRC 1601 X BML13 | 8.97 ** | 4.29 * | -2.30 | -6.08 ** | -7.10 ** | 7.51 ** | 4.07 * | -2.19 | -5.79 ** | -7.25 ** | 6.92 ** | -4.79 ** | 0.36 | -3.47 * | -0.36 |
| MRC 1601 X BML14 | -4.94 ** | -12.00 ** | -11.49 ** | -14.92 ** | -15.85 ** | -6.67 ** | -12.5 ** | -12.02 ** | -15.26 ** | -16.58 ** | 6.00 ** | -5.19 ** | -1.08 | -4.86 ** | -1.79 |
| MRC 1604 X BML5 | -10.99 ** | -14.13 ** | -9.20 ** | -12.71 ** | -13.66 ** | -10.22 ** | -13.02 ** | -8.74 ** | -12.11 ** | -13.47 ** | -1.79 | -5.84 ** | -1.08 | -4.86 ** | -1.79 |
| MRC 1604 X BML7 | -4.84 ** | -7.22 ** | -4.02 * | -7.73 ** | -8.74 ** | -5.41 ** | -7.89 ** | -4.37 * | -7.89 ** | -9.33 ** | -2.29 | -7.67 ** | 0.00 | -3.82 * | -0.72 |
| MRC 1604 X BML13 | 7.78 ** | 5.26 ** | 3.45 | -0.55 | -1.64 | 7.39 ** | 5.00 * | 3.28 | -0.53 | -2.07 | -4.11 ** | -8.22 ** | -3.25 | -6.94 ** | -3.94 * |
| MRC 1604 X BML14 | -10.98 ** | -12.00 ** | -11.49 ** | -14.92 ** | -15.85 ** | -9.89 ** | -10.87 ** | -10.38 ** | -13.68 ** | -15.03 ** | -2.88 | -6.57 ** | -2.53 | -6.25 ** | -3.23 |
| MRC 1661 X BML5 | -3.28 | -11.96 ** | -6.90 ** | -10.50 ** | -11.48 ** | -4.55 ** | -12.50 ** | -8.20 ** | -11.58 ** | -12.95 ** | 5.10 ** | -4.47 * | 0.36 | -3.47 * | -0.36 |
| MRC 1661 X BML7 | 0.30 | -7.78 ** | -4.60 * | -8.29 ** | -9.29 ** | -1.14 | -8.95 ** | -5.46 ** | -8.95 ** | -10.36 ** | 2.97 | -7.67 ** | 0.00 | -3.82 * | -0.72 |
| MRC 1661 X BML13 | 0.00 | -3.68 | -9.77 ** | -13.26 ** | -14.21 ** | 0.60 | -2.91 | -8.74 ** | -12.11 ** | -13.47 ** | 5.28 ** | -4.45 * | 0.72 | -3.13 | 0.00 |
| MRC 1661 X BML14 | -4.29 * | -10.86 ** | -10.34 ** | -13.81 ** | -14.75 ** | -5.23 ** | -11.41 ** | -10.93 ** | -14.21 ** | -15.54 ** | 3.23 | -5.88 ** | -1.81 | -5.56 ** | -2.51 |

*Significant at 5% level; ** Significant at 1% level.

TABLE 2

Estimates of heterosis, heterobeltiosis and standard heterosis (over DHM-117, 30 V 92 and 900 M Gold) for plant height, ear height and ear length in maize hybrids

| Cross | Plant height | | | | | Ear height | | | | | Ear length | | | | |
|------------------|--------------|------------------|--------------------|----------|------------|------------|------------------|--------------------|-----------|------------|------------|------------------|--------------------|-----------|------------|
| | Heterosis | Hetero beltiosis | Standard heterosis | | | Heterosis | Hetero beltiosis | Standard heterosis | | | Heterosis | Hetero beltiosis | Standard heterosis | | |
| | | | DHM-117 | 30 V 92 | 900 M Gold | | | DHM-117 | 30 V 92 | 900 M Gold | | | DHM-117 | 30 V 92 | 900 M Gold |
| MRC1112 X BML5 | 17.83** | 3.56 | -26.27** | -18.39** | -16.49** | 28.83 ** | 24.26 * | -27.84 ** | -10.64 | -6.67 | 22.5 ** | 13.95 | 0.00 | -14.04 * | 19.51 * |
| MRC1112 X BML7 | 42.25** | 4.00 | -25.95** | -18.04** | -16.13** | 86.21 ** | 43.79 ** | -16.49 ** | 3.40 | 8.00 | 36.11 ** | 13.95 | 0.00 | -14.04 * | 19.51 * |
| MRC1112 X BML13 | 14.77* | 5.33 | -25.00** | -16.99** | -15.05** | 39.58 ** | 36.69 ** | -20.62 ** | -1.70 | 2.67 | 57.75 ** | 30.23 ** | 14.29 * | -1.75 | 36.59 ** |
| MRC1112 X BML14 | 32.65** | 0.22 | -28.64** | -21.02** | -19.18** | 30.41 ** | 14.20 | -33.68 ** | -17.87 * | -14.22 | 33.33 ** | 6.98 | -6.12 | -19.30 ** | 12.20 |
| MRC 1123 X BML5 | 16.60* | 8.00 | -31.65** | -24.34** | -22.58** | 32.68 ** | 29.3 * | -30.24 ** | -13.62 | -9.78 | 49.37 ** | 40.48 ** | 20.41 ** | 3.51 | 43.90 ** |
| MRC 1123 X BML7 | 82.57** | 38.75** | -12.18** | -2.80 | -0.54 | 176.35 ** | 123.49 ** | 14.43 * | 41.7 ** | 48.00 ** | 38.03 ** | 16.67 * | 0.00 | -14.04 * | 19.51 * |
| MRC 1123 X BML13 | 51.03** | 46.50** | -7.28 | 2.63 | 5.02 | 74.92 ** | 67.90 ** | -6.53 | 15.74 * | 20.89 * | 68.57 ** | 40.48 ** | 20.41 ** | 3.51 | 43.9 ** |
| MRC 1123 X BML14 | 41.27** | 11.25 | -29.59** | -22.07** | -20.25** | 65.22 ** | 53.02 ** | -21.65 ** | -2.98 | 1.33 | 70.59 ** | 38.1 ** | 18.37 ** | 1.75 | 41.46 ** |
| MRC 1176 X BML5 | 25.12** | 8.64 | -20.41** | -11.91* | -9.86 | 70.94 ** | 54.64 ** | 3.09 | 27.66 ** | 33.33 ** | -5.38 | -21.43 ** | -10.20 | -22.81 ** | 7.32 |
| MRC 1176 X BML7 | 102.98** | 47.08** | 7.75 | 19.26** | 22.04** | 190.91 ** | 114.43 ** | 42.96 ** | 77.02 ** | 84.89 ** | 29.41 ** | -1.79 | 12.24 | -3.51 | 34.15 ** |
| MRC 1176 X BML13 | 61.14** | 46.00** | 6.96 | 18.39** | 21.15** | 111.8 ** | 94.33 ** | 29.55 ** | 60.43 ** | 67.56 ** | 45.24 ** | 8.93 | 24.49 ** | 7.02 | 48.78 ** |
| MRC 1176 X BML14 | 40.84** | 5.40 | -22.78** | -14.54** | -12.54** | 76.95 ** | 46.39 ** | -2.41 | 20.85 ** | 26.22 ** | 0.00 | -26.79 ** | -16.33 * | -28.07 ** | 0.00 |
| MRC 1179 X BML5 | 21.23** | 4.22 | -21.84** | -13.49** | -11.47* | 9.45 | -10.20 | -24.4 ** | -6.38 | -2.22 | 15.56 * | -1.89 | 6.12 | -8.77 | 26.83 ** |
| MRC 1179 X BML7 | 58.65** | 14.14* | -14.40** | -5.25 | -3.05 | 60.24 ** | 10.20 | -7.22 | 14.89 | 20.00 * | 12.20 | -13.21 * | -6.12 | -19.30 ** | 12.20 |
| MRC 1179 X BML13 | 11.06 | -0.42 | -25.32** | -17.34** | -15.41** | 12.04 | -6.94 | -21.65 ** | -2.98 | 1.33 | 33.33 ** | 1.89 | 10.2 | -5.26 | 31.71 ** |
| MRC 1179 X BML14 | 36.08** | 1.05 | -24.21** | -16.11** | -14.16** | 10.22 | -16.33 * | -29.55 ** | -12.77 | -8.89 | 24.05 ** | -7.55 | 0.00 | -14.04 * | 19.51 * |
| MRC 1209 X BML5 | 36.96** | 33.89** | -24.37** | -16.29** | -14.34** | 44.52 ** | 42.68 ** | -23.02 ** | -4.68 | -0.44 | 23.26 ** | 8.16 | 8.16 | -7.02 | 29.27 ** |
| MRC 1209 X BML7 | 84.78** | 46.22** | -17.41** | -8.58 | -6.45 | 86.12 ** | 49.02 ** | -21.65 ** | -2.98 | 1.33 | 28.21 ** | 2.04 | 2.04 | -12.28 * | 21.95 ** |
| MRC 1209 X BML13 | 29.06** | 25.80** | -25.16** | -17.16** | -15.23** | 24.44 * | 20.99 | -32.65 ** | -16.60 * | -12.89 | 29.87 ** | 2.04 | 2.04 | -12.28 * | 21.95 ** |
| MRC 1209 X BML14 | 57.75** | 29.69** | -26.74** | -18.91** | -17.03** | 48.57 ** | 35.95 ** | -28.52 ** | -11.49 | -7.56 | 41.33 ** | 8.16 | 8.16 | -7.02 | 29.27 ** |
| MRC 1271 X BML5 | 30.89** | 18.20** | -20.89** | -12.43* | -10.39* | 21.79 * | 21.02 | -34.71 ** | -19.15 * | -15.56 | 24.71 ** | 10.42 | 8.16 | -7.02 | 29.27 ** |
| MRC 1271 X BML7 | 68.94** | 26.00** | -15.66** | -6.65 | -4.48 | 111.34 ** | 68.39 ** | -10.31 | 11.06 | 16.00 * | 16.88 * | -6.25 | -8.16 | -21.05 ** | 9.76 |
| MRC 1271 X BML13 | 37.17** | 29.55** | -13.29** | -4.03 | -1.79 | 74.76 ** | 70.99 ** | -4.81 | 17.87 * | 23.11 ** | 47.37 ** | 16.67 * | 14.29 * | -1.75 | 36.59 ** |
| MRC 1271 X BML14 | 48.55** | 14.66* | -23.26** | -15.06** | -13.08* | 23.40 * | 12.26 | -40.21 ** | -25.96 ** | -22.67 ** | 35.14 ** | 4.17 | 2.04 | -12.28 * | 21.95 ** |
| MRC 1358 X BML5 | 46.99** | 37.60** | -14.87** | -5.78 | -3.58 | 40.32 ** | 39.87 ** | -24.05 ** | -5.96 | -1.78 | 29.87 ** | 25.00 ** | 2.04 | -12.28 * | 21.95 ** |
| MRC 1358 X BML7 | 81.30** | 38.87** | -14.08** | -4.90 | -2.69 | 97.6 ** | 56.33 ** | -15.12 * | 5.11 | 9.78 | 36.23 ** | 17.50 * | -4.08 | -17.54 ** | 14.63 |
| MRC 1358 X BML13 | 65.06** | 61.89** | 0.16 | 10.86* | 13.44** | 71.25 ** | 69.14 ** | -5.84 | 16.60 * | 21.78 ** | 73.53 ** | 47.50 ** | 20.41 ** | 3.51 | 43.90 ** |
| MRC 1358 X BML14 | 68.44** | 33.76** | -17.25** | -8.41 | -6.27 | 43.86 ** | 29.75 * | -29.55 ** | -12.77 | -8.89 | 42.42 ** | 17.50 * | -4.08 | -17.54 ** | 14.63 |
| MRC 1544 X BML5 | 10.99 | 1.21 | -33.70** | -26.62** | -24.91** | 12.97 | 3.16 | -32.65 ** | -16.60 * | -12.89 | -2.27 | -15.69 * | -12.24 | -24.56 ** | 4.88 |
| MRC 1544 X BML7 | 65.27** | 24.15** | -18.67** | -9.98** | -7.89 | 97.87 ** | 46.84 ** | -4.12 | 18.72 * | 24.00 ** | 22.50 ** | -3.92 | 0.00 | -14.04 * | 19.51 * |
| MRC 1544 X BML13 | 29.37** | 23.43** | -19.15** | -10.51* | -8.42 | 31.25 ** | 21.58 * | -20.62 ** | -1.70 | 2.67 | 46.84 ** | 13.73 * | 18.37 ** | 1.75 | 41.46 ** |
| MRC 1544 X BML14 | 26.71** | -1.45 | -35.44** | -28.55** | -26.88** | 14.20 | -4.74 | -37.8 ** | -22.98 ** | -19.56 * | 3.90 | -21.57 ** | -18.37 ** | -29.82 ** | -2.44 |
| MRC 1556 X BML5 | 39.27** | 25.77** | -15.82** | -6.83 | -4.66 | 28.65 ** | 18.92 | -24.4 ** | -6.38 | -2.22 | -2.33 | -14.29 * | -14.29 * | -26.32 ** | 2.44 |
| MRC 1556 X BML7 | 67.04** | 24.59** | -16.61** | -7.71 | -5.56 | 74.73 ** | 30.81 ** | -16.84 ** | 2.98 | 7.56 | 23.08 ** | -2.04 | -2.04 | -15.79 ** | 17.07 * |
| MRC 1556 X BML13 | 41.68** | 33.81** | -10.44* | -0.88 | 1.43 | 42.94 ** | 34.05 ** | -14.78 * | 5.53 | 10.22 | 50.65 ** | 18.37 ** | 18.37 ** | 1.75 | 41.46 ** |
| MRC 1556 X BML14 | 58.65** | 22.46** | -18.04** | -9.28 | -7.17 | 31.41 ** | 10.81 | -29.55 ** | -12.77 | -8.89 | 4.00 | -20.41 ** | -20.41 ** | -31.58 ** | -4.88 |
| MRC 1561 X BML5 | 26.34** | 16.63** | -25.63** | -17.69** | -15.77** | 45.88 ** | 22.51 ** | -2.75 | 20.43 ** | 25.78 ** | 17.65 * | 4.17 | 2.04 | -12.28 * | 21.95 ** |
| MRC 1561 X BML7 | 81.01** | 37.22** | -12.50** | -3.15 | -0.90 | 70.28 ** | 19.05 * | -5.50 | 17.02 * | 22.22 ** | 11.69 | -10.42 | -12.24 | -24.56 ** | 4.88 |

contd.

HETEROISIS IN MAIZE

Table 2 cond.

| | | | | | | | | | | | | | | | |
|------------------|---------|---------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|----------|----------|----------|-----------|----------|
| MRC 1561 X BML13 | 64.83** | 59.31** | 1.58 | 12.43* | 15.05** | 70.99 ** | 45.45 ** | 15.46 * | 42.98 ** | 49.33 ** | 34.21 ** | 6.25 | 4.08 | -10.53 | 24.39 ** |
| MRC 1561 X BML14 | 46.92** | 15.38* | -26.42** | -18.56** | 16.67** | 49.16 ** | 15.58 * | -8.25 | 13.62 | 18.67 * | 21.62 ** | -6.25 | -8.16 | -21.05 ** | 9.76 |
| MRC 1564 X BML5 | 20.37** | 9.64 | -28.01** | -20.32** | -18.46** | -5.24 | -19.56 * | -37.8 ** | -22.98 ** | -19.56 * | 7.32 | -2.22 | -10.2 | -22.81 ** | 7.32 |
| MRC 1564 X BML7 | 91.33** | 43.61** | -5.70 | 4.38 | 6.81 | 59.62 ** | 12.44 | -13.06 * | 7.66 | 12.44 | 13.51 | -6.67 | -14.29 * | -26.32 ** | 2.44 |
| MRC 1564 X BML13 | 33.25** | 26.99** | -16.61** | -7.71 | -5.56 | 24.55 ** | 7.11 | -17.18 ** | 2.55 | 7.11 | 17.81 * | -4.44 | -12.24 | -24.56 ** | 4.88 |
| MRC 1564 X BML14 | 36.43** | 6.02 | -30.38** | -22.94** | -21.15** | -6.25 | -26.67 ** | -43.3 ** | -29.79 ** | -26.67 ** | 15.49 | -8.89 | -16.33 * | -28.07 ** | 0.00 |
| MRC 1582 X BML5 | 22.66** | 5.73 | -21.20** | -12.78* | -10.75* | 13.24 | 1.52 | -30.93 ** | -14.47 | -10.67 | 10.11 | -5.77 | 0.00 | -14.04 * | 19.51 * |
| MRC 1582 X BML7 | 50.22** | 8.28 | -19.30** | -10.68* | -8.60 | 59.31 ** | 16.67 | -20.62 ** | -1.70 | 2.67 | 38.27 ** | 7.69 | 14.29 * | -1.75 | 36.59 ** |
| MRC 1582 X BML13 | 22.55** | 10.19 | -17.88** | -9.11 | -6.99 | 36.11 ** | 23.74 * | -15.81 * | 4.26 | 8.89 | 45.00 ** | 11.54 | 18.37 ** | 1.75 | 41.46 ** |
| MRC 1582 X BML14 | 40.66** | 4.67 | -21.99** | -13.66** | -11.65* | 13.85 | -6.57 | -36.43 ** | -21.28 ** | -17.78 * | 17.95 * | -11.54 | -6.12 | -19.3 ** | 12.20 |
| MRC 1601 X BML5 | 28.26** | 28.07** | -30.70** | -23.29** | -21.51** | 28.03 ** | 28.03 * | -30.93 ** | -14.47 | -10.67 | 8.43 | -2.17 | -8.16 | -21.05 ** | 9.76 |
| MRC 1601 X BML7 | 76.36** | 41.81** | -23.26** | -15.06** | -13.08* | 93.57 ** | 53.50 ** | -17.18 ** | 2.55 | 7.11 | 22.67 ** | 0.00 | -6.12 | -19.30 ** | 12.20 |
| MRC 1601 X BML13 | 28.69** | 22.87** | -26.90** | -19.09** | -17.20** | 53.61 ** | 51.23 ** | -15.81 * | 4.26 | 8.89 | 40.54 ** | 13.04 | 6.12 | -8.77 | 26.83 ** |
| MRC 1601 X BML14 | 44.41** | 20.76* | -34.65** | -27.67** | -25.99** | 29.58 ** | 17.20 | -36.77 ** | -21.70 ** | -18.22 * | 16.67 * | -8.70 | -14.29 * | -26.32 ** | 2.44 |
| MRC 1604 X BML5 | 58.29** | 49.61** | -9.34* | 0.35 | 2.69 | 47.12 ** | 24.89 ** | -3.44 | 19.57 * | 24.89 ** | 33.33 ** | 22.73 ** | 10.20 | -5.26 | 31.71 ** |
| MRC 1604 X BML7 | 96.28** | 51.44** | -8.23 | 1.58 | 3.94 | 75.39 ** | 23.56 ** | -4.47 | 18.30 * | 23.56 ** | 47.95 ** | 22.73 ** | 10.20 | -5.26 | 31.71 ** |
| MRC 1604 X BML13 | 48.09** | 46.74** | -11.08* | -1.58 | 0.72 | 46.77 ** | 26.22 ** | -2.41 | 20.85 ** | 26.22 ** | 52.78 ** | 25.00 ** | 12.24 | -3.51 | 34.15 ** |
| MRC 1604 X BML14 | 78.79** | 43.08** | -13.29** | -4.03 | -1.79 | 51.14 ** | 18.22 * | -8.59 | 13.19 | 18.22 * | 48.57 ** | 18.18 * | 6.12 | -8.77 | 26.83 ** |
| MRC 1661 X BML5 | 32.02** | 19.86** | -20.73** | -12.26* | -10.22* | 51.46 ** | 49.04 ** | -19.59 ** | -0.43 | 4.00 | 9.76 | 0.00 | -8.16 | -21.05 ** | 9.76 |
| MRC 1661 X BML7 | 50.80** | 12.92 | -25.32** | -17.34** | -15.41** | 90.16 ** | 52.63 ** | -20.27 ** | -1.28 | 3.11 | 18.92 * | -2.22 | -10.2 | -22.81 ** | 7.32 |
| MRC 1661 X BML13 | 41.81** | 34.69** | -10.92* | -1.40 | 0.90 | 89.17 ** | 83.33 ** | 2.06 | 26.38 ** | 32.00 ** | 39.73 ** | 13.33 | 4.08 | -10.53 | 24.39 ** |
| MRC 1661 X BML14 | 49.69** | 16.03* | -23.26** | -15.06** | -13.08* | 56.99 ** | 44.08 ** | -24.74 ** | -6.81 | -2.67 | 18.31 * | -6.67 | -14.29 * | -26.32 ** | 2.44 |

*Significant at 5% level; ** Significant at 1% level.

TABLE 3
Estimates of heterosis, heterobeltiosis and standard heterosis (over DHM-117, 30 V 92 and 900 M Gold) for ear girth, number of kernel rows per ear and number of kernels per row in maize hybrids

| Cross | Ear girth | | | No. of kernel rows per ear | | | No. of kernels per row | | | | | | | | |
|------------------|-----------|------------------|--------------------|----------------------------|------------|-----------|------------------------|--------------------|-----------|------------|-----------|------------------|--------------------|-----------|------------|
| | Heterosis | Hetero beltiosis | Standard heterosis | | | Heterosis | Hetero beltiosis | Standard heterosis | | | Heterosis | Hetero beltiosis | Standard heterosis | | |
| | | | DHM-117 | 30 V 92 | 900 M Gold | | | DHM-117 | 30 V 92 | 900 M Gold | | | DHM-117 | 30 V 92 | 900 M Gold |
| MRC1112 X BML5 | 20.59 ** | 0.00 | -14.58 ** | -6.82 | -6.82 | 37.14 ** | 14.29 ** | 0.00 | 4.35 | 4.35 | 28.95 ** | -10.91 * | -4.85 | -7.55 | -2.00 |
| MRC1112 X BML7 | 2.86 | -12.20 * | -25.00 ** | -18.18 ** | -18.18 ** | 33.33 ** | 14.29 ** | 0.00 | 4.35 | 4.35 | 43.84 ** | -4.55 | 1.94 | -0.94 | 5.00 |
| MRC1112 X BML13 | 27.03 ** | 14.63 ** | -2.08 | 6.82 | 6.82 | 36.11 ** | 16.67 ** | 2.08 | 6.52 | 6.52 | 66.43 ** | 8.18 | 15.53 ** | 12.26 * | 19.00 ** |
| MRC1112 X BML14 | 7.04 | -7.32 | -20.83 ** | -13.64 ** | -13.64 ** | 15.79 ** | 4.76 | -8.33 | -4.35 | -4.35 | 22.67 ** | -16.36 ** | -10.68 * | -13.21 ** | -8.00 |
| MRC 1123 X BML5 | 35.48 ** | 20.00 ** | -12.50 ** | -4.55 | -4.55 | 47.06 ** | 25.00 ** | 4.17 | 8.70 | 8.70 | 55.04 ** | 14.94 * | -2.91 | -5.66 | 0.00 |
| MRC 1123 X BML7 | 40.63 ** | 28.57 ** | -6.25 | 2.27 | 2.27 | 40.00 ** | 22.50 ** | 2.08 | 6.52 | 6.52 | 77.24 ** | 25.29 ** | 5.83 | 2.83 | 9.00 |
| MRC 1123 X BML13 | 41.18 ** | 37.14 ** | 0.00 | 9.09 * | 9.09 * | 48.57 ** | 30.00 ** | 8.33 | 13.04 ** | 13.04 ** | 86.67 ** | 28.74 ** | 8.74 | 5.66 | 12.00 * |
| MRC 1123 X BML14 | 38.46 ** | 28.57 ** | -6.25 | 2.27 | 2.27 | 37.84 ** | 27.50 ** | 6.25 | 10.87 * | 10.87 * | 44.88 ** | 5.75 | -10.68 * | -13.21 ** | -8.00 |
| MRC 1176 X BML5 | 22.22 ** | -2.22 | -8.33 * | 0.00 | 0.00 | 5.13 | -18.00 ** | -14.58 ** | -10.87 * | -10.87 * | 40.54 ** | -1.89 | 0.97 | -1.89 | 4.00 |
| MRC 1176 X BML7 | 27.03 ** | 4.44 | -2.08 | 6.82 | 6.82 | 25.00 ** | 0.00 | 4.17 | 8.70 | 8.70 | 67.61 ** | 12.26 * | 15.53 ** | 12.26 * | 19.00 ** |
| MRC 1176 X BML13 | 25.64 ** | 8.89 * | 2.08 | 11.36 * | 11.36 * | 22.5 ** | -2.00 | 2.08 | 6.52 | 6.52 | 66.91 ** | 9.43 * | 12.62 * | 9.43 * | 16.00 ** |
| MRC 1176 X BML14 | 9.33 * | -8.89 * | -14.58 ** | -6.82 | -6.82 | -9.52 * | -24.00 ** | -20.83 ** | -17.39 ** | -17.39 ** | 34.25 ** | -7.55 | -4.85 | -7.55 | -2.00 |
| MRC 1179 X BML5 | 22.86 ** | 0.00 | -10.42 * | -2.27 | -2.27 | 23.94 ** | 2.33 | -8.33 | -4.35 | -4.35 | 44.93 ** | 4.17 | -2.91 | -5.66 | 0.00 |
| MRC 1179 X BML7 | 22.22 ** | 2.33 | -8.33 * | 0.00 | 0.00 | 26.03 ** | 6.98 | -4.17 | 0.00 | 0.00 | 68.18 ** | 15.63 ** | 7.77 | 4.72 | 11.00 * |
| MRC 1179 X BML13 | 21.05 ** | 6.98 | -4.17 | 4.55 | 4.55 | 31.51 ** | 11.63 * | 0.00 | 4.35 | 4.35 | 76.74 ** | 18.75 ** | 10.68 * | 7.55 | 14.00 ** |
| MRC 1179 X BML14 | 9.59 * | -6.98 | -16.67 ** | -9.09 * | -9.09 * | 11.69 * | 0.00 | -10.42 * | -6.52 | -6.52 | 22.06 ** | -13.54 * | -19.42 ** | -21.70 ** | -17.00 ** |
| MRC 1209 X BML5 | 33.33 ** | 21.21 ** | -16.67 ** | -9.09 * | -9.09 * | 27.27 ** | 10.53 | -12.50 ** | -8.70 | -8.70 | 68.81 ** | 37.31 ** | -10.68 * | -13.21 ** | -8.00 |
| MRC 1209 X BML7 | 45.16 ** | 36.36 ** | -6.25 | 2.27 | 2.27 | 20.59 ** | 7.89 | -14.58 ** | -10.87 * | -10.87 * | 115.53 ** | 65.67 ** | 7.77 | 4.72 | 11.00 * |
| MRC 1209 X BML13 | 24.24 ** | 24.24 ** | -14.58 ** | -6.82 | -6.82 | 29.41 ** | 15.79 ** | -8.33 | -4.35 | -4.35 | 104 ** | 52.24 ** | -0.97 | -3.77 | 2.00 |
| MRC 1209 X BML14 | 17.46 ** | 12.12 * | -22.92 ** | -15.91 ** | -15.91 ** | 8.33 | 2.63 | -18.75 ** | -15.22 ** | -15.22 ** | 79.44 ** | 43.28 ** | -6.80 | -9.43 * | -4.00 |
| MRC 1271 X BML5 | 36.36 ** | 15.38 ** | -6.25 | 2.27 | 2.27 | 31.34 ** | 12.82 * | -8.33 | -4.35 | -4.35 | 64.52 ** | 24.39 ** | -0.97 | -3.77 | 2.00 |
| MRC 1271 X BML7 | 23.53 ** | 7.69 | -12.50 ** | -4.55 | -4.55 | 24.64 ** | 10.26 | -10.42 * | -6.52 | -6.52 | 66.1 ** | 19.51 ** | -4.85 | -7.55 | -2.00 |
| MRC 1271 X BML13 | 25.00 ** | 15.38 ** | -6.25 | 2.27 | 2.27 | 27.54 ** | 12.82 * | -8.33 | -4.35 | -4.35 | 75.65 ** | 23.17 ** | -1.94 | -4.72 | 1.00 |
| MRC 1271 X BML14 | 21.74 ** | 7.69 | -12.5 ** | -4.55 | -4.55 | 12.33 * | 5.13 | -14.58 ** | -10.87 * | -10.87 * | 54.1 ** | 14.63 * | -8.74 | -11.32 * | -6.00 |
| MRC 1358 X BML5 | 35.48 ** | 20.00 ** | -12.5 ** | -4.55 | -4.55 | 34.33 ** | 15.38 ** | -6.25 | -2.17 | -2.17 | 44.53 ** | 4.21 | -3.88 | -6.60 | -1.00 |
| MRC 1358 X BML7 | 40.63 ** | 28.57 ** | -6.25 | 2.27 | 2.27 | 30.43 ** | 15.38 ** | -6.25 | -2.17 | -2.17 | 69.47 ** | 16.84 ** | 7.77 | 4.72 | 11.00 * |
| MRC 1358 X BML13 | 35.29 ** | 31.43 ** | -4.17 | 4.55 | 4.55 | 44.93 ** | 28.21 ** | 4.17 | 8.70 | 8.70 | 57.81 ** | 6.32 | -1.94 | -4.72 | 1.00 |
| MRC 1358 X BML14 | 16.92 ** | 8.57 | -20.83 ** | -13.64 ** | -13.64 ** | 12.33 * | 5.13 | -14.58 ** | -10.87 * | -10.87 * | 37.78 ** | -2.11 | -9.71 * | -12.26 * | -7.00 |
| MRC 1544 X BML5 | 21.62 ** | -4.26 | -6.25 | 2.27 | 2.27 | 27.78 ** | 4.55 | -4.17 | 0.00 | 0.00 | 40.00 ** | 0.00 | -4.85 | -7.55 | -2.00 |
| MRC 1544 X BML7 | 21.05 ** | -2.13 | -4.17 | 4.55 | 4.55 | 35.14 ** | 13.64 ** | 4.17 | 8.70 | 8.70 | 49.25 ** | 2.04 | -2.91 | -5.66 | 0.00 |
| MRC 1544 X BML13 | 15.00 ** | -2.13 | -4.17 | 4.55 | 4.55 | 16.22 ** | -2.27 | -10.42 * | -6.52 | -6.52 | 61.83 ** | 8.16 | 2.91 | 0.00 | 6.00 |
| MRC 1544 X BML14 | 14.29 ** | -6.38 | -8.33 * | 0.00 | 0.00 | 10.26 * | -2.27 | -10.42 * | -6.52 | -6.52 | 33.33 ** | -6.12 | -10.68 * | -13.21 ** | -8.00 |
| MRC 1556 X BML5 | 32.35 ** | 9.76 * | -6.25 | 2.27 | 2.27 | 37.31 ** | 17.95 ** | -4.17 | 0.00 | 0.00 | 56.83 ** | 12.37 * | 5.83 | 2.83 | 9.00 |
| MRC 1556 X BML7 | 20.00 ** | 2.44 | -12.5 ** | -4.55 | -4.55 | 33.33 ** | 17.95 ** | -4.17 | 0.00 | 0.00 | 69.92 ** | 16.49 ** | 9.71 * | 6.60 | 13.00 * |

contd.

HETEROISIS IN MAIZE

Table 1 contd.

| | | | | | | | | | | | | | | | |
|------------------|----------|---------|-----------|----------|----------|----------|-----------|-----------|-----------|-----------|----------|-----------|-----------|-----------|-----------|
| MRC 1556 X BML13 | 18.92 ** | 7.32 | -8.33 * | 0.00 | 0.00 | 27.54 ** | 12.82 * | -8.33 | -4.35 | -4.35 | 55.38 ** | 4.12 | -1.94 | -4.72 | 1.00 |
| MRC 1556 X BML14 | 18.31 ** | 2.44 | -12.50 ** | -4.55 | -4.55 | 23.29 ** | 15.38 ** | -6.25 | -2.17 | -2.17 | 48.91 ** | 5.15 | -0.97 | -3.77 | 2.00 |
| MRC 1561 X BML5 | 32.35 ** | 9.76 * | -6.25 | 2.27 | 2.27 | 26.76 ** | 4.65 | -6.25 | -2.17 | -2.17 | 77.44 ** | 29.67 ** | 14.56 ** | 11.32 * | 18.00 ** |
| MRC 1561 X BML7 | 17.14 ** | 0.00 | -14.58 ** | -6.82 | -6.82 | 17.81 ** | 0.00 | -10.42 * | -6.52 | -6.52 | 55.91 ** | 8.79 | -3.88 | -6.60 | -1.00 |
| MRC 1561 X BML13 | 24.32 ** | 12.20 * | -4.17 | 4.55 | 4.55 | 17.81 ** | 0.00 | -10.42 * | -6.52 | -6.52 | 67.74 ** | 14.29 * | 0.97 | -1.89 | 4.00 |
| MRC 1561 X BML14 | 18.31 ** | 2.44 | -12.50 ** | -4.55 | -4.55 | 9.09 | -2.33 | -12.50 ** | -8.70 | -8.70 | 70.99 ** | 23.08 ** | 8.74 | 5.66 | 12.00 * |
| MRC 1564 X BML5 | 21.74 ** | 0.00 | -12.5 ** | -4.55 | -4.55 | 18.92 ** | -4.35 | -8.33 | -4.35 | -4.35 | 55.73 ** | 14.61 * | -0.97 | -3.77 | 2.00 |
| MRC 1564 X BML7 | 26.76 ** | 7.14 | -6.25 | 2.27 | 2.27 | 15.79 ** | -4.35 | -8.33 | -4.35 | -4.35 | 45.6 ** | 2.25 | -11.65 * | -14.15 ** | -9.00 |
| MRC 1564 X BML13 | 14.67 ** | 2.38 | -10.42 * | -2.27 | -2.27 | 5.26 | -13.04 ** | -16.67 ** | -13.04 ** | -13.04 ** | 57.38 ** | 7.87 | -6.80 | -9.43 * | -4.00 |
| MRC 1564 X BML14 | 8.33 | -7.14 | -18.75 ** | -11.36 * | -11.36 * | 2.50 | -10.87 * | -14.58 ** | -10.87 * | -10.87 * | 48.84 ** | 7.87 | -6.80 | -9.43 * | -4.00 |
| MRC 1582 X BML5 | 29.41 ** | 7.32 | -8.33 * | 0.00 | 0.00 | 23.94 ** | 2.33 | -8.33 | -4.35 | -4.35 | 53.49 ** | 13.79 * | -3.88 | -6.60 | -1.00 |
| MRC 1582 X BML7 | 22.86 ** | 4.88 | -10.42 * | -2.27 | -2.27 | 20.55 ** | 2.33 | -8.33 | -4.35 | -4.35 | 49.59 ** | 5.75 | -10.68 * | -13.21 ** | -8.00 |
| MRC 1582 X BML13 | 16.22 ** | 4.88 | -10.42 * | -2.27 | -2.27 | 20.55 ** | 2.33 | -8.33 | -4.35 | -4.35 | 80.00 ** | 24.14 ** | 4.85 | 1.89 | 8.00 |
| MRC 1582 X BML14 | 15.49 ** | 0.00 | -14.58 ** | -6.82 | -6.82 | 6.49 | -4.65 | -14.58 ** | -10.87 * | -10.87 * | 46.46 ** | 6.90 | -9.71 * | -12.26 * | -7.00 |
| MRC 1601 X BML5 | 34.33 ** | 12.50 * | -6.25 | 2.27 | 2.27 | 38.24 ** | 17.50 ** | -2.08 | 2.17 | 2.17 | 21.99 ** | -13.13 * | -16.5 ** | -18.87 ** | -14.00 ** |
| MRC 1601 X BML7 | 24.64 ** | 7.50 | -10.42 * | -2.27 | -2.27 | 37.14 ** | 20.00 ** | 0.00 | 4.35 | 4.35 | 40.74 ** | -4.04 | -7.77 | -10.38 * | -5.00 |
| MRC 1601 X BML13 | 12.33 ** | 2.50 | -14.58 ** | -6.82 | -6.82 | 28.57 ** | 12.50 * | -6.25 | -2.17 | -2.17 | 40.91 ** | -6.06 | -9.71 * | -12.26 * | -7.00 |
| MRC 1601 X BML14 | 20 ** | 5.00 | -12.50 ** | -4.55 | -4.55 | 24.32 ** | 15.00 ** | -4.17 | 0.00 | 0.00 | 13.67 * | -20.20 ** | -23.30 ** | -25.47 ** | -21.00 ** |
| MRC 1604 X BML5 | 29.58 ** | 4.55 | -4.17 | 4.55 | 4.55 | 13.92 ** | -11.76 ** | -6.25 | -2.17 | -2.17 | 92.42 ** | 41.11 ** | 23.3 ** | 19.81 ** | 27.00 ** |
| MRC 1604 X BML7 | 31.51 ** | 9.09 * | 0.00 | 9.09 * | 9.09 * | 11.11 * | -11.76 ** | -6.25 | -2.17 | -2.17 | 112.7 ** | 48.89 ** | 30.1 ** | 26.42 ** | 34.00 ** |
| MRC 1604 X BML13 | 14.29 ** | 0.00 | -8.33 * | 0.00 | 0.00 | -8.64 | -27.45 ** | -22.92 ** | -19.57 ** | -19.57 ** | 69.11 ** | 15.56 ** | 0.97 | -1.89 | 4.00 |
| MRC 1604 X BML14 | 24.32 ** | 4.55 | -4.17 | 4.55 | 4.55 | 12.94 ** | -5.88 | 0.00 | 4.35 | 4.35 | 89.23 ** | 36.67 ** | 19.42 ** | 16.04 ** | 23.00 ** |
| MRC 1661 X BML5 | 24.64 ** | 2.38 | -10.42 * | -2.27 | -2.27 | 46.27 ** | 25.64 ** | 2.08 | 6.52 | 6.52 | 47.37 ** | 7.69 | -4.85 | -7.55 | -2.00 |
| MRC 1661 X BML7 | 26.76 ** | 7.14 | -6.25 | 2.27 | 2.27 | 36.23 ** | 20.51 ** | -2.08 | 2.17 | 2.17 | 38.58 ** | -3.30 | -14.56 ** | -16.98 ** | -12.00 * |
| MRC 1661 X BML13 | 22.67 ** | 9.52 * | -4.17 | 4.55 | 4.55 | 27.54 ** | 12.82 * | -8.33 | -4.35 | -4.35 | 53.23 ** | 4.40 | -7.77 | -10.38 * | -5.00 |
| MRC 1661 X BML14 | 11.11 * | -4.76 | -16.67 ** | -9.09 * | -9.09 * | 26.03 ** | 17.95 ** | -4.17 | 0.00 | 0.00 | 40.46 ** | 1.10 | -10.68 * | -13.21 ** | -8.00 |

*Significant at 5% level; ** Significant at 1% level.

HETEROISIS IN MAIZE

TABLE 4
Estimates of heterosis, heterobeltiosis and standard heterosis (over DHM-117, 30 V 92 and 900 M Gold) for 100 seed weight and grain yield per plant in maize hybrids

| Cross | 100 seed weight | | | | | | | | | | Grain yield per plant | | | |
|------------------|-----------------|-----------|------------------|-----------|--------------------|-----------|-----------|-----------|------------------|------------|-----------------------|--|--|--|
| | Heterosis | | Hetero beltiosis | | Standard heterosis | | Heterosis | | Hetero beltiosis | | Standard heterosis | | | |
| | | | DHM-117 | 30 V 92 | 900 M Gold | | | DHM-117 | 30 V 92 | 900 M Gold | | | | |
| MRC1112 X BML5 | -2.53 | -18.95 ** | -6.10 | -6.10 | 4.05 | 42.06 ** | -3.50 | -7.97 | -3.76 | 4.07 | | | | |
| MRC1112 X BML7 | -6.36 | -14.74 ** | -1.22 | -1.22 | 9.46 * | 66.6 ** | 16.98 ** | 11.57 ** | 16.67 ** | 26.16 ** | | | | |
| MRC1112 X BML13 | -0.58 | -10.53 ** | 3.66 | 3.66 | 14.86 ** | 94.21 ** | 26.68 ** | 20.82 ** | 26.34 ** | 36.63 ** | | | | |
| MRC1112 X BML14 | -10.13 ** | -25.26 ** | -13.41 ** | -13.41 ** | -4.05 | 45.17 ** | -0.81 | -5.40 | -1.08 | 6.98 | | | | |
| MRC 1123 X BML5 | 9.09 * | -7.69 * | 2.44 | 2.44 | 13.51 ** | 82.07 ** | 31.13 ** | 1.80 | 6.45 | 15.12 ** | | | | |
| MRC 1123 X BML7 | 8.88 ** | 1.10 | 12.20 ** | 12.20 ** | 24.32 ** | 95.58 ** | 46.36 ** | 13.62 ** | 18.82 ** | 28.49 ** | | | | |
| MRC 1123 X BML13 | 19.76 ** | 9.89 ** | 21.95 ** | 21.95 ** | 35.14 ** | 143.37 ** | 67.22 ** | 29.82 ** | 35.75 ** | 46.80 ** | | | | |
| MRC 1123 X BML14 | 3.90 | -12.09 ** | -2.44 | -2.44 | 8.11 | 105.94 ** | 49.34 ** | 15.94 ** | 21.24 ** | 31.10 ** | | | | |
| MRC 1176 X BML5 | -14.45 ** | -32.73 ** | -9.76 * | -9.76 * | 0.00 | 29.73 ** | -12.73 ** | -13.62 ** | -9.68 * | -2.33 | | | | |
| MRC 1176 X BML7 | -3.19 | -17.27 ** | 10.98 ** | 10.98 ** | 22.97 ** | 67.10 ** | 16.10 ** | 14.91 ** | 20.16 ** | 29.94 ** | | | | |
| MRC 1176 X BML13 | 2.15 | -13.64 ** | 15.85 ** | 15.85 ** | 28.38 ** | 97.59 ** | 27.79 ** | 26.48 ** | 32.26 ** | 43.02 ** | | | | |
| MRC 1176 X BML14 | -21.39 ** | -38.18 ** | -17.07 ** | -17.07 ** | -8.11 | 29.75 ** | -12.21 ** | -13.11 ** | -9.14 * | -1.74 | | | | |
| MRC 1179 X BML5 | -12.05 ** | -29.13 ** | -10.98 ** | -10.98 ** | -1.35 | 24.11 ** | -15.82 ** | -19.28 ** | -15.59 ** | -8.72 | | | | |
| MRC 1179 X BML7 | -14.92 ** | -25.24 ** | -6.10 | -6.10 | 4.05 | 38.05 ** | -3.22 | -7.20 | -2.96 | 4.94 | | | | |
| MRC 1179 X BML13 | -9.50 ** | -21.36 ** | -1.22 | -1.22 | 9.46 * | 66.26 ** | 8.31 | 3.86 | 8.60 | 17.44 ** | | | | |
| MRC 1179 X BML14 | -18.07 ** | -33.98 ** | -17.07 ** | -17.07 ** | -8.11 | 22.59 ** | -16.35 ** | -19.79 ** | -16.13 ** | -9.30 | | | | |
| MRC 1209 X BML5 | 7.69 | -9.68 ** | 2.44 | 2.44 | 13.51 ** | 78.16 ** | 32.96 ** | -7.71 | -3.49 | 4.36 | | | | |
| MRC 1209 X BML7 | -12.28 ** | -19.35 ** | -8.54 * | -8.54 * | 1.35 | 35.19 ** | -6.17 | -1.88 | -1.88 | 6.10 | | | | |
| MRC 1209 X BML13 | -1.78 | -10.75 ** | 1.22 | 1.22 | 12.16 ** | 115.14 ** | 52.59 ** | 5.91 | 10.75 * | 19.77 ** | | | | |
| MRC 1209 X BML14 | 0.00 | -16.13 ** | -4.88 | -4.88 | 5.41 | 76.85 ** | 32.96 ** | -7.71 | -3.49 | 4.36 | | | | |
| MRC 1271 X BML5 | 19.73 ** | 4.76 | 7.32 | 7.32 | 18.92 ** | 71.01 ** | 27.01 ** | -10.54 * | -6.45 | 1.16 | | | | |
| MRC 1271 X BML7 | 2.47 | -1.19 | 1.22 | 1.22 | 12.16 ** | 74.06 ** | 34.67 ** | -5.14 | -0.81 | 1.27 | | | | |
| MRC 1271 X BML13 | 13.75 ** | 8.33 * | 10.98 ** | 10.98 ** | 22.97 ** | 111.89 ** | 49.64 ** | 5.40 | 10.22 * | 19.19 ** | | | | |
| MRC 1271 X BML14 | 11.56 ** | -2.38 | 0.00 | 0.00 | 10.81 | 69.76 ** | 27.01 ** | -10.54 * | -6.45 | 1.16 | | | | |
| MRC 1358 X BML5 | 16.42 ** | 9.86 * | -4.88 | -4.88 | 5.41 | 102.14 ** | 57.08 ** | -3.08 | 1.34 | 9.59 | | | | |
| MRC 1358 X BML7 | 14.09 ** | 8.97 * | 3.66 | 3.66 | 14.86 ** | 105.64 ** | 67.08 ** | 3.08 | 7.80 | 16.57 ** | | | | |
| MRC 1358 X BML13 | 31.97 ** | 27.63 ** | 18.29 ** | 18.29 ** | 31.08 ** | 178.75 ** | 105.00 ** | 26.48 ** | 32.26 ** | 43.02 ** | | | | |
| MRC 1358 X BML14 | 7.46 | 1.41 | -12.20 ** | -12.20 ** | -2.70 | 101.06 ** | 57.50 ** | -2.83 | 1.61 | 9.88 * | | | | |
| MRC 1544 X BML5 | -10.11 ** | -30.43 ** | -2.44 | -2.44 | 8.11 | 49.03 ** | 0.26 | -0.77 | 3.76 | 12.21 * | | | | |
| MRC 1544 X BML7 | -9.84 ** | -24.35 ** | 6.10 | 6.10 | 17.57 ** | 66.73 ** | 15.84 ** | 14.65 ** | 19.89 ** | 29.65 ** | | | | |
| MRC 1544 X BML13 | -8.9 ** | -24.33 ** | 6.10 | 6.10 | 17.57 ** | 62.65 ** | 5.19 | 4.11 | 8.87 | 17.73 ** | | | | |
| MRC 1544 X BML14 | -16.85 ** | -35.65 ** | -9.76 * | -9.76 * | 0.00 | 48.18 ** | 0.26 | -0.77 | 3.76 | 12.21 * | | | | |
| MRC 1556 X BML5 | -2.96 | -22.64 ** | 0.00 | 0.00 | 10.81 | 45.82 ** | -0.81 | -5.91 | -1.61 | 6.40 | | | | |
| MRC 1556 X BML7 | -21.74 ** | -32.08 ** | -12.20 ** | -12.20 ** | -2.70 | 51.45 ** | 6.50 | -12.6 ** | -8.60 | 14.24 ** | | | | |
| MRC 1556 X BML13 | -17.58 ** | -29.25 ** | -8.54 * | -8.54 * | 1.35 | 41.08 ** | -7.86 | -1.03 | -5.66 | 6.69 | | | | |
| MRC 1556 X BML14 | -11.24 ** | -29.25 ** | -8.54 * | -8.54 * | 1.35 | 45.35 ** | -0.54 | -5.66 | -1.34 | 6.69 | | | | |
| MRC 1561 X BML5 | -5.39 | -24.04 ** | -3.66 | -3.66 | 6.76 | 61.51 ** | 9.70 * | 4.63 | 9.41 * | 18.31 ** | | | | |
| MRC 1561 X BML7 | -13.19 ** | -24.04 ** | -3.66 | -3.66 | 6.76 | 23.22 ** | -13.48 ** | -17.48 ** | -13.71 ** | -6.69 | | | | |
| MRC 1561 X BML13 | -5.56 | -18.27 ** | 3.66 | 3.66 | 14.86 ** | 59.5 ** | 4.04 | -0.77 | 3.76 | 12.21 * | | | | |
| MRC 1561 X BML14 | -11.38 ** | -28.85 ** | -9.76 * | -9.76 * | 0.00 | 60.55 ** | 9.70 * | 4.63 | 9.41 * | 18.31 ** | | | | |
| MRC 1564 X BML5 | 4.76 | -16.19 ** | 7.32 | 7.32 | 18.92 ** | 42.46 ** | -3.23 | -7.71 | -3.49 | 4.36 | | | | |
| MRC 1564 X BML7 | 4.92 | -8.57 ** | 17.07 ** | 17.07 ** | 29.73 ** | 36.28 ** | -4.31 | -8.74 * | -4.57 | 3.20 | | | | |
| MRC 1564 X BML13 | -3.87 | -17.14 ** | 6.10 | 6.10 | 17.57 ** | 35.95 ** | -11.32 * | -15.42 ** | -11.56 * | -4.36 | | | | |
| MRC 1564 X BML14 | -2.38 | -21.9 ** | 0.00 | 0.00 | 10.81 | 41.62 ** | -3.23 | -7.71 | -3.49 | 4.36 | | | | |
| MRC 1582 X BML5 | -8.29 ** | -29.66 ** | 1.22 | 1.22 | 12.16 ** | 49.31 ** | 1.06 | -2.31 | 2.15 | 10.47 * | | | | |
| MRC 1582 X BML7 | -18.37 ** | -32.2 ** | -2.44 | -2.44 | 8.11 | 31.94 ** | -7.71 | -10.8 * | -6.72 | 0.87 | | | | |
| MRC 1582 X BML13 | -8.25 ** | -24.58 ** | 8.54 * | 8.54 * | 20.27 ** | 76.28 ** | 14.63 ** | 10.8 * | 15.86 ** | 25.29 ** | | | | |
| MRC 1582 X BML14 | -14.92 ** | -34.75 ** | -6.10 | -6.10 | 4.05 | 48.83 ** | 1.33 | -2.06 | 2.42 | 10.76 * | | | | |
| MRC 1601 X BML5 | 3.95 | -11.24 ** | -3.66 | -3.66 | 6.76 | 50.64 ** | 5.04 | -9.00 * | -4.84 | 2.91 | | | | |
| MRC 1601 X BML7 | 0.61 | -6.74 | 1.22 | 1.22 | 12.16 ** | 64.44 ** | 9.79 | -9.00 * | -4.84 | 2.91 | | | | |
| MRC 1601 X BML13 | -1.80 | -7.87 * | 0.00 | 0.00 | 10.81 | 63.04 ** | 17.80 ** | 2.06 | 6.72 | 15.41 ** | | | | |
| MRC 1601 X BML14 | -3.95 | -16.19 ** | 7.32 | 7.32 | 18.92 ** | 91.41 ** | 29.29 ** | 25.96 ** | 31.72 ** | 42.44 ** | | | | |
| MRC 1604 X BML5 | -3.95 | -17.98 ** | -10.98 ** | -10.98 ** | -1.35 | 49.68 ** | 5.04 | -9.00 * | -4.84 | 2.91 | | | | |
| MRC 1604 X BML7 | -1.64 | -14.29 ** | 9.76 * | 9.76 * | 21.62 ** | 77.32 ** | 23.75 ** | 20.57 ** | 26.08 ** | 36.34 ** | | | | |
| MRC 1604 X BML13 | -8.29 ** | -20.95 ** | 1.22 | 1.22 | 12.16 ** | 41.87 ** | -7.92 | -10.28 * | -6.18 | 1.45 | | | | |
| MRC 1604 X BML14 | -2.38 | -21.90 ** | 0.00 | 0.00 | 10.81 | 82.52 ** | 24.01 ** | 20.82 ** | 26.34 ** | 36.63 ** | | | | |
| MRC 1661 X BML5 | 3.85 | -12.90 ** | -1.22 | -1.22 | 9.46 * | 64.45 ** | 14.97 ** | -1.29 | 3.23 | 11.63 * | | | | |
| MRC 1661 X BML7 | -8.77 ** | -16.13 ** | -4.88 | -4.88 | 5.41 | 50.41 ** | 8.98 | -6.43 | -2.15 | 5.81 | | | | |
| MRC 1661 X BML13 | 0.59 | -8.60 * | 3.66 | 3.66 | 14.86 ** | 76.29 ** | 17.96 ** | 1.29 | 5.91 | 14.53 ** | | | | |
| MRC 1661 X BML14 | -5.13 | -20.43 ** | -9.76 * | -9.76 * | 0.00 | 62.98 ** | 14.67 ** | -1.54 | 2.96 | 11.34 * | | | | |

*Significant at 5% level; ** Significant at 1% level.

positive relative heterosis and heterobeltiosis for grain yield per plant. Relative heterosis varied from 22.59 (MRC 1179 x BML 14) to 178.75 per cent (MRC 1358 x BML 13), heterobeltiosis from -16.35 (MRC 1179 x BML 14) to 105 per cent (MRC 1358 x BML 13) and standard heterosis from -19.79 (MRC 1179 x BML 14) to 29.82 per cent (MRC 1123 x BML 13) over DHM-117, -16.13 (MRC 1179 x BML 14) to 35.75 per cent (MRC 1123 x BML 13) over 30 V 92 and from -9.30 (MRC 1179 x BML 14) to 46.80 per cent (MRC 1123 x BML 13) over 900 M Gold. Significant positive heterosis in grain yield per plant was also reported by Sandeep Kumar and Mohan Reddy (2013), Rajesh *et al.* (2014) and Sharma *et al.* (2015).

Estimates of relative heterosis, heterobeltiosis and standard heterosis were variable among crosses in desirable direction and some of them turned out to be the best specific crosses. Heterosis for grain yield per plant is mainly because of simultaneous manifestation of heterosis for yield component traits. The highest standard heterosis for grain yield per plant was recorded for hybrids, MRC 1123 x BML 13, MRC 1358 x BML 13, MRC 1123 x BML 14, MRC 1123 x BML 7 and MRC 1176 x BML 7 along with *per se*, average heterosis, heterobeltiosis and with high *sca* effects. These hybrids may be further exploited in multilocation evaluation before releasing them for commercial cultivation.

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