Electronic Journal of Plant Breeding, 8(1): 347-355 (March 2017)
ISSN 0975-928X
DOI: 10.5958/0975-928X.2017.00052.7

Research Note

Line x tester analysis for heterosis in groundnut (*Arachis hypogaea* L.)

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(Received: 01 Dec 2016; Revised: 11 March 2017; Accepted: 20 March 2017)

Abstract
A study was conducted in groundnut to estimate the magnitude of heterosis for eleven yield contributing characters. Fifteen F_1s were developed by utilizing eight diverse parents, 3 lines and 5 testers in Line x Testers mating design during *Kharif* 2015. Analysis of variance showed significant differences among the parents and hybrids for all the characters indicating presence of genetic variability. Large numbers of heterotic crosses were observed in most of the characters. The maximum positive standard heterosis for dry pod yield plant^{-1} over best check TKG Bold was observed in RTNG 53 X ICG 2630 (98.70 %) followed by RTNG 53 X KDG 171 (91.59%) and RTNG 53 X Konkan Gaurav (84.08 %). The range of heterosis for dry pod yield plant^{-1} was 9.72 to 131.80 per cent. Estimates of heterobeltiosis and standard heterosis for pod yield plant^{-1} were highly significant and positive in all hybrids over BP, SC-I and SC-II. The manifestation of heterosis for pod yield by best three crosses, also showed negative heterotic effects for days to 50% flowering, plant height, days to maturity, and positive heterotic effects for number of primary branches plant^{-1}, number of pods plant^{-1}, number of kernels pod^{-1}, dry haulm yield plant^{-1}, 100 kernel weight and sound mature kernels. From the present investigation, on the basis of economic heterosis it can be concluded that the heterosis breeding could be advantageous for the improvement of groundnut genotypes for dry pod yield and its contributing characters.

Key words
Groundnut, dry pod yield, heterobeltiosis, standard heterosis, hybrids

Groundnut (*Arachis hypogaea* L., 2n=40) is an important *oilseed* crop of India. It is also cultivated worldwide. It is a rich source of edible oil, high quality protein, fat and carbohydrates. In India groundnut crop is cultivated on area of 46.6 lakh hectares and production of 78.1 lakh tones with productivity of 1712 kg ha^{-1} during the year 2013-14, while in Maharashtra state it is cultivated on area of 1.96 lakh hectares with productivity of 1163 kg ha^{-1} and production of 2.28 lakh tones during *kharif* season and 0.71 lakh ha area and 0.97 lakh tonnes production with 1366 kg ha^{-1} productivity during *rabi* season 2013-14. In *Konkan* region groundnut crop is cultivated on more than 12700 ha area with productivity of 841 kg ha^{-1} and 2117 kg ha^{-1} during *Kharif* and *Rabi* respectively. In respect of varying environmental conditions and soil types, there are specific genotypes suited for specific regions. It is not possible to have one common cultivar to suit different regions. It is therefore, required to improve the region specific cultivars with high dry pod yields and adaptations. Exploitation of hybrid vigour in crop plants for quantum jump in yield and other quantitative characters is one of the approaches in crop improvement to cope up with the ever-increasing demand for food grains and oil production. In groundnut, heterosis cannot be exploited for higher production through commercial hybrids due to cleistogamous nature of flower and poor seed recovery during hybridization. For the development of an effective heterosis breeding programme in groundnut, one need to have information about genetic architecture and estimated prepotency of parents in hybrid combinations. The information is also essential to formulate efficient breeding programmes for the improvement of the crop. Though there are a number of reports on heterosis, information is limited in especially for the traits like pod yield and its contributing components. Therefore, the present investigation was carried out to estimate the magnitude of the heterosis in 15 crosses of groundnut.

The present investigation was carried out at Agricultural Research Station, Shirgaon (Ratnagiri) hybridization is done during *Rabi* 2014-15 and evolution of F_1s parent and checks were done during *Kharif* 2015. The experimental materials consisted of 15 hybrids of groundnut (*Arachis hypogaea* L.) obtained by crossing three lines *viz.*, RTNG-29, RTNG-53 and RHRG-6083, with high pod yield, Bold seeded and high selling percent respectively and five testers *viz.*, KDG 171, ICG 2630, ICGV 99017, TKG Bold and Konkan Gaurav. The hybrids and parents were evaluated in randomized block design with three replications. Each treatment was raised in two rows of 2 m length spaced at 30 cm apart with plant to plant distance of 10 cm. All the recommended agronomical practices and plant protection measures were followed as and when required to raise a good crop of groundnut. Observations were recorded for days to 50% flowering, plant height (cm), number of primary branches plant^{-1}, number of pods plant^{-1}, number of kernels pod^{-1}, dry pod yield plant^{-1} (g), dry haulm yield plant^{-1}, 100 kernel weight (g), shelling percentage, sound mature kernels (%) and days to maturity. Data were recorded on five random competitive plants from each entry from all replications and mean of five plants was taken for further analysis. Heterosis expressed as per cent increase or decrease in the performance of F1 hybrids over the mid-parent (average or relative heterosis), better parent (heterobeltiosis) and standard (economic) heterosis was computed for each character as suggested by Shull (1948) and Fonesca and Paterson (1968). The differences in the magnitudes of heterosis, heterobeltiosis and standard heterosis were tested as per the method proposed by Panse and Sukhatme (1969).

The analysis of variance revealed that significant variation due to parents for all eleven characters studied indicating that parents possesses good amount of genetic variability (Table 1). The variance due to hybrids was also significant for almost all the characters studied except days to 50% flowering and number of kernels pod^{-1}. Comparison of means of hybrids with mean of parents as a group was found to be significant for most of the characters which suggested that the hybrids differ considerably from the parents for most of the traits and also the existence of substantial heterosis for most of the characters studied. Moreover, the importance of non-additive genetic effects in determining these characters can also be revealed. Almost all the characters had shown considerable amount of heterosis over mid parent (relative heterosis), better parent (heterobeltiosis) or over the check variety (standard or economic heterosis). The degree of heterosis however differed for different characters of fifteen crosses studied. Considerable genetic variation for various traits including pod yield have been reported by many workers (Golakia *et al.* 2005; John *et al.* 2006; Kadam *et al.* 2007; Khote *et al.* 2009; Korat *et al.* 2009).

Three line, five testers and 15 F_1s were evaluated during *Kharif* 2015 and their mean values are given in table 2 and 3. Considering mean values, the line RTNG-29 recorded maximum mean values for others four traits, viz., number of pods plant^{-1} (23.6), dry haulm yield plant^{-1} (26.1 g), sound mature kernels (82.4 %) & days to maturity (116.3 days), RHRG-6083 recorded high mean valued for traits days to 50 % flowering (24.7 days), number of kernels pod^{-1} (2.0), dry pod yield (18.9 g) & hundred kernel weight (49.7 g) and RTNG-53 showed high values for other three traits in plant height (39.8 cm), Number of primary branches (3.8) and shelling percentage (78.5 %)

In tester considering mean values KDG-171 recorded maximum for five traits viz. days to 50 per cent flowering (25.7 days), number of primary branches plant^{-1} (4.5), number of pods plant^{-1} (21.4), dry pod yield plant^{-1} (21.5 g) and sound mature kernels (82.6 %) followed by TKG- bold observed maximum valued for four traits *viz.*, plant height (53.7 cm), dry haulm yield plant^{-1} (32.4 g), 100 kernel weight (55.7 g) and days to maturity (120.3 days) and maximum value recorded one each in tester ICGV-99017 (Number of kernels pods^{-1}) & ICG-2630(Shelling percentage 76.3 %).

Among the hybrids maximum mean values were recorded for four traits in cross RTNG 53 x ICG 2630 *viz*., dry pod yield per plant (33.5 g), number of pods plant^{-1} (35.3), dry haulm yield plant^{-1} (39.8 g) & shelling percentage (79.5 %), followed by RHRG 6083 x TKG-Bold observed maximum values for three traits plant height (59.0 cm), Number of kernels pods^{-1} (2.0) & 100 kernel weight (56.3 g), maximum value recorded one each in cross RTNG-53 x KDG-171 (number of primary branches plant^{-1}), RTNG-53 x TKG-Bold (SMK %), RTNG-29 x ICGV 99017 (days to 50 % flowering) and RHRG-6083 x Konkan Gaurav (days to maturity) The results are in agreement with the research findings of Khote *et al.* (2009) and Korat *et al.* (2009).

In present investigation, heterosis was recorded over better parent, and two standard checks TKG Bold and Konkan Gaurav (SC-I and SC-II). The range of standard heterosis and number of hybrids showing desirable significant heterosis over better parents and standard checks are presented in table 4. The important three best promising cross combinations, their heterobeltiosis and standard heterosis for various traits are presented in table 5. Positive heterosis was considered as desirable for the yield contributing characters while negative heterosis is considered as desirable for the characters days to 50 per cent flowering, plant height and days to maturity. The significant negative heterosis for days to 50 per cent flowering was observed in one each hybrid over better parent and TKG Bold respectively. The cross RTNG 53 X KDG 171 recorded maximum negative heterosis over better parent (-9.09 %) followed by standard check-I (TKG Bold, -6.67 %). The standard heterosis ranged from -9.09 to 8.22 per cent for character days to 50% flowering. Earliness is desirable character helps to develop early varieties. The early flowering in hybrids has also been reported by Khote *et al.* (2009) and Korat *et al.* (2009). Large numbers of heterotic crosses were observed in most of the characters.

The extent of heterosis for plant height ranged from -29.05 to 27.30 per cent over check. The cross RHRG 6083 x ICGV 99017 recorded maximum negative heterosis over SC-I (-29.05%) and SC-II (-19.45%). Dwarf and semi-spreading plant structure is desirable to develop high yielding varieties suitable for heavy rainfall zones. The significant negative heterosis for plant height was observed in 1, 10 and 2 hybrids over BP, SC-I and SC-II respectively. These finding are in conformity with Vyas *et al.* (2001) and Manivel *et al.* (2003). Among the hybrids under investigation the significant positive heterosis was observed for number of primary branches plant^{-1} in 5 hybrids over SC-II only. Among these hybrids, RTNG 53 x KDG 171 (2.44 %) over SC-I and RTNG 53 x KDG 171 (31.25 %), RTNG 53 x ICG 2630 (17.71 %) and RTNG 53 x Konkan Gaurav (15.63 %) over SC-II were recorded significant standard heterosis for the character number of primary branches plant^{-1}. Significant standard heterosis for number of primary branches per plant has been also reported by Yadav *et al.* (2006); Mothilal and Muralidharan (2007). Number of pods plant^{-1} is one of the most important yield components character. Thus, the hybrids with positive heterosis are desirable for higher yields. Total 12, 15 and 15 hybrids showed positive and significant heterosis for number of pods plant^{-1} over better parent, TKG Bold and Konkan Gaurav respectively. Heterosis for number of pods plant^{-1} contributing increased yield was also reported by Sharma and Gupta 2010.

The significant positive heterosis was observed for number of kernels pod^{-1} in 4, 1 and 11 hybrids over BP, SC-I and SC-II respectively. The maximum positive standard heterosis for dry pod yield plant^{-1} over SC-I (TKG Bold) was observed in RTNG 53 X ICG 2630 (98.70%) followed by RTNG 53 X KDG 171 (91.59%) and RTNG 53 X Konkan Gaurav (84.08%). The range of heterosis for dry pod yield plant^{-1} was 9.72 to 131.80 per cent. Estimates of heterobeltiosis and standard heterosis for pod yield plant^{-1} were highly significant and positive in all hybrids over BP, SC-I and SC-II. The cross RTNG 53 X ICG 2630 recorded highest standard heterosis for dry haulm yield plant^{-1} (g) of 22.76% over TKG Bold and 64.35% over Konkan Gaurav. Heterosis was varied from -18.00 to 70.21%. The significant positive heterosis was observed for dry haulm yield plant^{-1} (g) in 12, 2 and 15 hybrids over BP, SC-I and SC-II, respectively. High heterosis for pod yield and its contributing traits has been also reported by Venkateswarlu *et al.* 2007; Jivani *et al.* 2008; Sharma and Gupta 2010.

The range of heterosis for 100 kernel weight was -22.68 to 27.46%. The maximum positive standard heterosis for 100 kernel weight was recorded by the RHRG 6083 X TKG Bold over Konkan Gaurav was 14.13%. The significant positive heterosis for 100 kernel weight was observed in 6 and 5 hybrids over better parent and Konkan Gaurav respectively. The maximum positive standard heterosis was recorded for shelling percentages by the RTNG 53 X ICG 2630 over SC-I (TKG Bold) and SC-II (Konkan Gaurav) were 5.34% and 8.50%, respectively. Estimates of standard heterosis for shelling percentage were significant and positive in 1, 2 and 6 hybrids over BP, SC-I and SC-II, respectively. These results are comparable with the work done by Gor *et al.* (2012) and John *et al.* (2012).

The extent of heterosis for sound mature kernel (%) ranged from -7.76 to 9.58%. The cross RTNG 53 X TKG Bold recorded maximum positive heterosis over SC-I (9.58%). The significant negative heterosis for days to maturity was observed in 6, 8 and 5 hybrids over better parent, TKG Bold and Konkan Gaurav, respectively. The cross RTNG 29 X ICG 2630 recorded maximum negative heterosis over SC-I (-22.94%). The heterosis over the check was ranged from -22.94 to 15.67%. The early maturity in hybrids was also been reported by Sykes *et al.* (1986), John *et al.* (2014), Arunachalam *et al.* (1984), Jayalakshmi *et al.* (2000).

Improvement in a complex attribute like pod yield may be convenient if breeding programme will be made through attributing agro economical characters. The utility of hybrid breeding approach lies in the identification of most heterotic and useful cross combinations. Three hybrids were identified which were found superior than their respective better parents as well as standard checks in respect of dry pod weight plant^{-1}. The best three hybrids on the basis of heterobeltiosis and heterosis over high yielding standard checks TKG Bold and Konkan Gaurav were, RTNG 53 x ICG 2630 (SC-I=98.70%, SC-II=131.80%, BP=89.20%), RTNG 53 x KDG 171 (SC-I=91.59%, SC-II=123.50%, BP=50.39%) and RTNG 53 x Konkan Gaurav (SC-I=84.08%, SC-II=114.75%, BP=75.29%). The comparison of three crosses with high standard heterosis for dry pod yield with other yield attributing traits (Table 6) revealed that manifestation of heterosis for pod yield by RTNG 53 X ICG 2630, also showed heterotic effect for number of pods plant^{-1}, dry haulm yield plant^{-1} 100 kernel weight and sound mature kernels. Similarly, heterosis for dry pod yield by RTNG 53 X Konkan Gaurav, also showed heterotic effects for number of pods plant^{-1}, number of kernels pod^{-1} and dry haulm yield plant^{-1}. Also heterosis for dry pod yield by RTNG 53 X KDG 171 showed desirable negative heterotic effects for days to 50% flowering, plant height and days to maturity and positive heterotic effects for number of primary branches plant^{-1}, number of pods plant^{-1}, dry haulm yield plant^{-1}, 100 kernel weight. Such varying heterotic effects exhibited by different characters were reported by Gor *et al.* (2012), Boraih *et al.* (2012), Wyne *et al.* (1970), Sykes *et al.* (1986), John *et al.* (2014), Azad *et al.* (2014), Arunachalam *et al.* (1984), Jayalakshmi *et al.* (2000), John *et al.* (2012).

On the basis of economic heterosis, it can be concluded that the heterosis breeding could be advantageous for the improvement of groundnut genotypes for dry pod yield and its contributing characters. The crosses RTNG 53 x ICG 2630, RTNG 53 x KDG 171 and RTNG 53 x Konkan Gaurav could be utilize for development of high yielding groundnut varieties. The efforts can be made to develop multiple crosses among desirable F1s, following some sort of inter mating, which will considerably increase the frequency of potential and desirable transgressive segregants in the segregating generations. These segregating generations are to be subjected to intensive objective oriented selection for crop improvement.

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Electronic Journal of Plant Breeding, 8(1): 347-355 (March 2017)
ISSN 0975-928X
DOI: 10.5958/0975-928X.2017.00052.7

Table 1. General ANOVA in line x tester analysis for eleven characters of groundnut (*Arachis hypogaea* L.)

Source of Variation	DF	DFF	PH	NBP	NPPP	NKPP	DPY	DHY	HKW	SH	SMK	DM
Male	4	1.267	141.780**	1.371**	11.045	0.009	19.578*	53.927**	118.279**	7.067	43.294**	182.602**
Female	2	2.333	0.591	0.054	9.323	0.001	1.025	5.614	77.160**	36.778**	23.319	568.444**
Male vs Female	1	3.600	110.003*	0.006	71.556**	0.000	3.972	3.662	0.526	2.178	2.827	140.402**
Hybrids	14	1.784	81.143**	1.088**	41.172**	0.008	39.095**	35.931**	56.241**	21.132**	17.727*	198.376**
Parents vs. Hybrids	1	5.428	464.592**	6.093**	665.493**	-0.000	966.876**	580.954**	225.278**	5.656	101.124**	2.783
Error	44	4.852	19.384	0.086	5.072	0.008	6.669	10.625	11.178	4.284	7.331	18.343

*, ** Significant at 5 and 1 per cent level, respectively

Table 2. Mean Performance of Lines and testers for eleven characters in groundnut

Parents	DFF	PH	NBP	NPPP	NKPP	DPY	DHY	HKW	SH	SMK	DM
Lines											
RTNG-53	23.0	39.8	3.8	20.5	1.9	17.7	23.4	40.3	78.5**	77.2	91.3
RTNG-29	24.3	38.9	3.5	23.6**	1.9	18.5	26.1	48.3*	75.3	82.4*	116.6
RHRG-6083	24.7	39.2	3.6	23.5**	2.0	18.9*	24.6	49.7**	71.5	81.6	113.3
Testers											
KDG-171	25.7	41.1	4.5**	21.4	1.9	21.5**	26.5	44.3	72.5	82.6*	100.0
ICGV-99017	25.0	36.1	3.6	17.3	2.0	17.9	22.8	43.5	75.3	77.0	111.3
ICG2630	24.0	40.3	2.8	16.9	1.9	16.9	21.6	39.3	76.3**	75.6	111.4
TKG-Bold	25.0	53.7**	4.1**	19.0	2.0	16.9	32.4**	55.7**	75.3	78.6	120.3*
Konkan Gaurav	24.3	47.3*	3.2	20.3	1.9	14.5	24.2	49.3**	73.3	84.6**	117.3
Mean of parents	**24.50**	**42.05**	**3.64**	**20.31**	**1.94**	**17.85**	**25.20**	**46.30**	**74.75**	**79.95**	**110.19**
CD 5%	1.79	4.20	0.32	1.55	0.13	1.04	1.72	1.73	1.03	2.01	8.03
CD %	2.49	5.83	0.45	2.15	0.19	1.45	2.39	2.40	1.55	2.79	11.15

*, ** Significant at 5 and 1 per cent level, respectively

DFF = Days to fifty per cent flowering, PH = Plant Height (cm), NPB= Number of Primary Branches^{-1}, NPPP = Number of pods plant^{-1}, NKPP = number of kernel pod^{-1}, DPY = Dry pod yield plant^{-1} (g), DHY = Dry haulm yield plant^{-1}, HKW = Hundred kernel weight, SH = Shelling percentage, SMK= Sound mature kernel, DM= Days to maturity

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Table 3. Mean Performance of hybrids for eleven characters in Groundnut

Hybrids	DFF	PH	NBP	NPPP	NKPP	DPY	DHY	HKW	SH	SMK	DM
RTNG 53/ KDG 171	23.3	43.9	4.2**	31.3	2.0	32.3*	38.3*	48.0	75.2	80.7	115.6
RTNG 53/ICGV 99017	26.0	48.4	3.3	25.0	2.0	24.2	29.8	55.3	77.0	80.6	118.0*
RTNG 53/ ICG 2630	25.7	46.6	3.8*	35.3**	1.9	33.5**	39.8**	51.4	79.5	81.5	110.0
RTNG 53/ TKG-Bold	24.3	43.4	3.2	22.9	2.0	24.4	30.2	48.7	73.4	86.1	111.7
RTNG 53/Konkan Gaurav	25.3	43.3	3.7*	32.7*	2.0	31.1*	33.1	47.9	72.1	80.9	115.7
RTNG 29/KDG 171	25.3	42.8	3.1	24.7	2.0	23.6	30.0	49.1	77.6	81.2	98.0
RTNG 29/ ICGV 99017	26.3	44.7	2.2	25.0	2.0	23.6	29.6	45.9	79.0	82.7	105.4
RTNG 29/ ICG 2630	24.7	51.3	2.3	26.4	1.9	23.5	29.7	45.2	71.9	84.2	92.7
RTNG 29/ TKG-Bold	25.0	50.6	2.3	24.7	1.9	22.7	28.4	45.6	76.3	78.0	98.0
RTNG 29/ Konkan Gaurav	24.7	53.7	3.1	26.2	1.9	25.6	30.9	43.1	74.2	82.6	105.7
RHRG 6083 /KDG 171	25.0	49.0	3.1	26.7	1.9	25.0	31.3	54.8	72.9	85.1	111.7
RHRG 6083 / ICGV 99017	26.0	38.1	2.3	27.4	1.8	24.7	30.6	54.8	77.1	79.3	113.0
RHRG 6083 / ICG 2630	25.0	51.0	3.3	25.0	2.0	21.4	26.6	49.8	71.4	85.1	117.7*
RHRG 6083 / TKG-Bold	24.3	59.0*	2.7	27.7	2.0	24.7	30.2	56.3*	77.8	85.4	112.4
RHRG 6083 / Konkan Gaurav	25.3	46.7	2.6	21.4	2.0	25.1	31.0	55.4	76.1	84.1	119.7**
Mean of hybrids	**25.1**	**47.5**	**3.0**	**26.8**	**1.9**	**25.7**	**31.3**	**50.1**	**75.4**	**82.5**	**109.7**
CD 5%	4.41	8.77	0.57	4.55	0.12	5.01	5.77	5.84	4.25	5.46	6.92
CD %	5.95	11.83	0.83	6.61	0.16	6.76	8.39	7.88	5.74	7.36	9.33

DFF = Days to fifty per cent flowering, PH = Plant Height (cm), NPB= Number of Primary Branches^{-1}, NPPP = Number of pods plant^{-1}, NKPP = number of kernel pod^{-1}, DPY = Dry pod yield plant^{-1} (g), DHY = Dry haulm yield plant^{-1}, HKW = Hundred kernel weight, SH = Shelling percentage, SMK= Sound mature kernel, DM= Days to maturity

Table 4. Heterosis ranged for quantitative traits and number of hybrids exhibiting significant heterosis in groundnut

S. No.	Characters	Range (%)	SE$\pm$	No. of hybrids showed desirable significant heterosis over		
				BP	TKG-Bold (SC-I)	Konkan Gaurav (SC-II)
1	Days to 50 % flowering	-09.09 to 08.22	1.52	1	1	0
2	Plant height (cm)	-29.05 to 27.30	3.03	1	10	2
3	No. of primary branches plant^{-1}	-45.33 to 31.25	0.20	0	0	5
4	No. of pods plant^{-1}	-08.95 to 85.79	1.57	12	15	15
5	No. of kernels pod^{-1}	-09.84 to 06.14	0.04	4	1	11
6	Dry pod yield plant^{-1} (g)	09.72 to 131.80	1.73	15	15	15
7	Dry haulm yield plant^{-1} (g)	-18.00 to 70.21	1.99	12	2	15
8	100 Kernel weight (g)	-22.68 to 27.46	2.02	6	0	5
9	Shelling (%)	-08.31 to 08.50	1.47	1	2	6
10	Sound mature kernel (%)	-07.76 to 09.58	1.88	2	7	0
11	Days to maturity	-22.94 to 15.67	2.39	6	8	5

BP-Better parent

Electronic Journal of Plant Breeding, 8(1): 347-355 (March 2017)
ISSN 0975-928X
DOI: 10.5958/0975-928X.2017.00052.7

Table 5. Three best performing cross combination, their heterobeltiosis and standard heterosis for various traits

Characters	Best performing hybrids	Standard Heterosis over checks		Heterobeltiosis (%)
		TKG-Bold (SC-I)	Konkan Gaurav (SC-II)	
Days to 50 % flowering	RTNG 53/ KDG 171	-6.67**	-4.11	-9.09**
	RTNG 53/ TKG-Bold	-2.67	0.00	-2.67
	RHRG 6083 / TKG-Bold	-2.67	0.00	-2.67
Plant height (cm)	RHRG 6083 / ICGV 99017	-29.05**	-19.45**	-2.72
	RTNG 29/KDG 171	-20.36**	-9.58*	4.06
	RTNG 53/Konkan Gaurav	-19.37**	-8.46	-8.46
No. of primary branches plant^{-1}	RTNG 53/ KDG 171	2.44**	31.25**	-6.67**
	RTNG 53/ ICG 2630	-8.13**	17.71**	0.00
	RTNG 53/Konkan Gaurav	-9.76**	15.63**	-1.77**
No. of pods plant^{-1}	RTNG 53/ KDG 171	85.79**	73.89**	72.20**
	RTNG 29/ ICGV 99017	72.11**	61.08**	59.51**
	RHRG 6083 / Konkan Gaurav	64.74**	54.19**	46.49**
No. of kernels pod^{-1}	RTNG 53/ KDG 171	0.83**	6.14**	0.00
	RTNG 29/ ICGV 99017	0.00	5.26**	3.45**
	RHRG 6083 / Konkan Gaurav	-0.83**	4.39**	1.70**
Dry pod yield plant^{-1} (g)	RTNG 53/ ICG 2630	98.70**	131.80**	89.20**
	RTNG 53/ KDG 171	91.59**	123.50**	50.39**
	RTNG 53/Konkan Gaurav	84.08**	114.75**	75.29**
Dry haulm yield plant^{-1} (g)	RTNG 53/ ICG 2630	22.76**	64.35**	70.21**
	RTNG 53/ KDG 171	18.31**	58.40**	44.65**
	RTNG 53/Konkan Gaurav	2.06	36.64**	36.64**
100 Kernel weight (g)	RHRG 6083 / TKG-Bold	1.02	14.13**	1.08
	RHRG 6083 / Konkan Gaurav	-0.54	12.37**	11.47**
	RTNG 53/ICGV 99017	-0.66	12.24**	27.30**
Shelling (%)	RTNG 53/ ICG 2630	5.34*	8.50**	1.10
	RTNG 29/ ICGV 99017	4.68*	7.82**	4.91*
	RHRG 6083 / TKG-Bold	3.09	6.18	3.32
Sound mature kernel (%)	RTNG 53/ TKG-Bold	9.58**	1.81	9.54**
	RHRG 6083 / TKG-Bold	8.69**	0.99	4.66
	RHRG 6083 /KDG 171	8.31**	0.63	3.03
Days to maturity	RTNG 29/ ICG 2630	-22.94**	-20.97**	-20.52**
	RTNG 29/ TKG-Bold	-18.51**	-16.43**	-18.53**
	RTNG 29/KDG 171	-18.51**	-16.43**	-15.95**

*, ** Significant at 5 and 1 per cent level, respectively

Table 6. Promising hybrids for pod yield plant^{-1} with mid parent, heterobeltiosis and standard heterosis in groundnut

S. No.	Hybrids	Pod yield plant^{-1}	Heterobeltiosis (%)	Standard heterosis (%)		Useful and significant heterosis for component traits			
				SC-I	SC-II	MP	Heterobeltiosis	SC-I	SC-II
1	RTNG 53 x ICG 2630	33.53	89.20**	98.70**	131.80**	NPB, NPPP, DPY, DHY, HKY, SMK, DM	NPPP, DPY, DHY, HKY, SMK	PH, NPPP, DPY, DHY, SH	NPB, NPPP, DPY, DHY, SH
2	RTNG 53 x KDG 171	32.33	50.39**	91.59**	123.50**	NPPP, NKPP, DPY, DHY, HKY, DM	DFF, PH, NPB, NPPP, DPY, DHY, HKY, DM	DFF, PH, NPB, NPPP, DPY, DHY	PH, NPB, NPPP, DPY, DHY
3	RTNG 53 x Konkan Gaurav	31.07	75.29**	84.08**	114.75**	NPB, NPPP, NKPP, DPY, DHY, HKY	NPPP, NKPP, DPY, DHY	PH, NPPP, DPY	NPB, NPPP, NKPP, DPY, DHY

*, ** Significant at 5 and 1 per cent level, respectively, SC-I = TKG - Bold, SC-II = Konkan Gaurav.

DFF = Days to fifty per cent flowering, PH = Plant Height (cm), NPB= Number of Primary Branches^{-1}, NPPP = Number of pods plant^{-1}, NKPP = number of kernel pod^{-1}, DPY = Dry pod yield plant^{-1} (g), DHY = Dry haulm yield plant^{-1}, HKY = Hundred kernel weight, SH % = Shelling percentage, SMK= Sound mature kernel, DM= Days to maturity