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Estimation of Heterosis and inbreeding Depression for Yield, and its components Traits in rice (*Oryza sativa* L.)

Rohit Kumar[1*], S.S. Rao[2], Anjali Manhar[1], Deepak Gauraha[3] and Sanjay Sharma[2]
[1]Ph.D. Scholar, Department of Genetics and Plant Breeding,
College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh), India.
[2]Professor, Department of Genetics and Plant Breeding,
College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh), India.
[3]Scientist, Department of Genetics and Plant Breeding,
College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh), India.

(Corresponding author: Rohit Kumar)*
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ABSTRACT: The present study entitled was carried out at Research cum-Instructional Farm, Department of Genetics and Plant Breeding, College of Agriculture, IGKV, Raipur Chhattisgarh, India during *kharif* 2021-22. The experimental material comprised of five generations each cross of pair parents i.e. P_1, P_2, F_1, F_2 and F_3 of nine different crosses were conducted in Randomized Complete Block Design (RCBD) with three replications during *kharif* 2022, reprehensively, were used to estimation of heterosis and inbreeding depression for yield and its components traits in rice (*Oryza sativa* L.). Heterosis of hybrids over mid parent and better parent varied from cross to cross and character to character. IR64 × Vasumati showed the highest heterosis for yield per plant. Among the various hybrids exhibiting desirable value of heterosis, PKVHMT × Tarori Basmati, IR64 × Pusa1121 and MTU1010 x Pusa1121 were top performers for grain yield per plant and negative inbreeding depression for days to fifty per cent flowering showed that hybrid of this crosses flowered earlier than their parents. In case of plant height IR64 × Vasmati, MTU1010 × Pusa1121 and MTU1010 × Tarori Basmati showed significant negative heterosis which indicated the possibility of superior segregating lines for dwarf type.

Keyword: Heterosis, Inbreeding depression, Rice.

INTRODUCTION

Rice is one of the most important food crops of the world's population. It belongs to the family Poaceae and genus *Oryza* (Gross and Zhao 2014, Singh *et al*., 2018). The genus *Oryza* consist of 22 wild species (2n=24, 48) and two cultivated species i.e. *O. sativa* (2n=24=AA) and *O. glaberrima* Stued (2n=24=AA) (Singh *et al*., 2015). The primary center of origin of Asian rice is found in the river valleys of Yangtze and Mekon River area in China (Gross and Zhao 2014). African rice is originated in the upper valley of the niger river and it is cultivated in the western tropical Africa (Ansari *et al*., 2015). Cultivated rice (*O. sativa*) is predominantly selfpollinating and has lower out crossing ability. A crosspollination rate of *O. sativa* is less than one percent (Messeguer *et al*., 2001). However, the estimated out crossing rates among wild rice populations ranges from 4.3% to 55.9% (Oka, 1988). Rice is a highly diverse crop species with wide geographic dispersal from mean sea level up to 3000 M.S.L. in both temperate and tropical climates (Oka, 1988; Mickel *et al*., 1990). Globally rice is cultivated in 43.79 million hectares with production of 116.42 million tons and productivity of 2659 kg per hectare (Anon., 2019). India is the second largest producer of rice after China occupying 43.8 million hectare area with an average grain yield of 3.99 metric tonnes per hectare while the total production is 116.48 million metric tonnes in 2018-19 (USDA, 2020). In Chhattisgarh, rice is cultivated in 3791.00 thousand hectares with production of 7161.20 tones and productivity of 1889 kg per hectare (Ministry of Agriculture & Farmers Welfare, Govt. of India, 2021). Chhattisgarh famously called "Rice Bowl of India" has a lot of various rice germplasm. Forefront farming absolutely depends upon the generation of the fresh out of the box new improved high yielding assortments and for that feasible biodiversity is the base point. Over populace, urbanization, environmental change and serious agrarian exercise makes decent variety progressively helpless. The various crop species in which hybrid varieties are used commercially, rice ranks very high. Heterosis has been commercially exploited in rice with a yield advantage of 20-25% over the best pure lines (Rather *et al*., 2001). Hybrids offer opportunity to break through the yield ceilings of semi dwarf rice varieties. Significant heterosis, heterobiltiosis and standard heterosis have been reported in rice by a number of workers (Devarathinam, 1984; Peng and Virmani 1991; Lokaprakash *et al*., 1992; Watanesk, 1993; Zhang *et al*., 1994; Ali and Khan 1995; Rao *et al*., 1996; Mishra and Pandey 1998; Dwivedi *et al*., 1999; Li *et al*., 2002; Faiz *et al*., 2006. Saleem *et al*., 2008; Rashid *et al*., 2007; Rahimi *et al*., 2010). The phenomenon of heterosis has been observed in many self-pollinated crop species including several of the grain legumes. It is commonly found that the level of heterosis exhibited by a hybrid is a function of the genetic divergence between parents (Onyia *et al*., 2012). Heterosis may be positive or negative. Both positive and negative heterosis is useful in crop improvement, depending on the breeding objectives and nature of the traits. Heterosis is useful for deciding the direction of future breeding programme and to identify the superior cross combinations. Knowledge on heterosis together with inbreeding depression would be helpful for identification of potential crosses in early generations (Kumari and Senapati 2019).

MATERIALS AND METHODS

All genotypes were planted in randomized complete block design with 3replications, plot size 3.0 m × 2.0 m consisting of 15 lines, one line -P_1, one line-P_2, one line-F_1, six lines-F_2 and six lines-F_3 planted with 20 cm × 10 cm (R-R and P-P) spacing during *kharif* season of 2021-2022. All standardized agronomic practices adopted to maintain the good rice crop. Raised nursery seed bed was prepared for sowing of seeds. Nurseries were raised by taking seeds of all the 5 generation (P_1, P_2, F_1, F_2 and F_3) each cross. Twenty one days old seedlings were subsequently transplanted in to the field with randomized complete block design. The experimental material was planted in fifteen rows in three replications of each family. The NPK fertilizer was applied @ 120:60:60 kg/ha, respectively with full dose of P and K and 1/3rd of N as basal, 1/3rd of N at 30 DAT and remaining at 45 DAT. The standard agronomic practices were adopted for normal crop growth. Gap filling was done within a week in order to maintain uniform plant population.

RESULTS AND DISCUSSION

For days to fifty per cent flowering and days to maturity significant negative heterosis was desirable so that early flowering and early maturing hybrids could be obtained. As compared to better parent, significant early flowering and maturity was observed in four and one crosses showed significant negative desirable heterosis for days to fifty per cent flowering and days to maturity, respectively. Cross PKVHMT × Pusa 1121, PKVHMT × Tarori Basmati, IR-64 × Vasumati, IR-64 × Tarori Basmati and IR-64 × Pusa 1121 showed highest significant negative heterosis over better parent. A wide range of standard heterosis from negative to positive values have been reported by Rani *et al*. (2015); Peng and Virmani (1991); for the trait days to fifty per cent flowering and days to maturity. Significant desirable standard heterosis for earliness has been reported by Murthy and Kulkarni (1996); Rahimi *et al*. (2010). All the crosses showed significant inbreeding depression for days to fifty per cent flowering and maturity.

Semi dwarf plant phenotype is desirable for recording high yield in rice as partitioning of biomass is affected and it also reduces lodging. For plant height, all the F_1's were taller than their respective better parents. Three crosseswere negatively significant for plant heightnamely MTU1010 × Tarori Basmati, MTU1010 × PUSA 1121 and IR-64 × Vasumati, similar finding reports by Sarawgi *et al*. (2000), Vaithiyalingan and Nadarajan (2010); Tiwary *et al*. (2011); Sanghera and Hussain (2012). Negative heterosis has potential of giving promising F_1 hybrid vigor as parents in future breeding programe for plant height Most of the crosses are provide dwarf stature type plant height F_1 population in selection of hybrid varieties because of negative heterosis is desirable for plant height for the reason that this will make semi dwarf plant phenotype is desirable for recording high yield in rice as partitioning of biomass is affected and it also reduces lodging. For plant height, all the F_1's were taller than their respective better parents as compared to parents.

Panicle length with positive and significant heterosis may contribute to enhance the number of spikelets/panicle, subsequently increase the grain yield/plant. Most of the crosses observed significant positive heterosis for panicle length except, MTU1010 × Tarori Basmati and MTU1010 × Vasumati which showed significant negative heterosis. Similar finding reported by Roy *et al*. (2009); Sharma *et al*. (2013); Singh *et al*. (2013). While most of the crosses showed positive and negative inbreeding depression were found in crosses IR-64 × Tarori Basmati (-0.00 %) and MTU1010 × Tarori Basmati (-0.01%). Earlier worker reported Positive and significant inbreeding depression for this trait was reported by Sedeek *et al*. (2007); Kumar and Mani (2010, 2013); Singh *et al*. (2015).

For number of tillers per plant, positive heterosis was desirable as it which directly increase grain yield per plant. In the present study, most of the crosses showed significant positive heterosis over better parent and three crosses showed significant positive heterosis. Cross PKVHMT × Vasumati showed highest significant positive heterosis over better parent. For number of tillers significantly positive heterosis was earlier observed by Sunil *et al*. (2014); Rani *et al*. (2015); Zeng (1983); Pandya and Tripathi (2006). All the crosses recorded significant inbreeding depression except MTU1010 × Vasumati.

For effective tillers per plant, heterosis analysis reported most of the crosses are significant positive heterosis. Positive heterosis was desirable as it increases the more number of panicle bearing tillers and which directly increase grain yield per plantand six crosses showed significant positive heterosis. Cross PKVHMT × Vasumati showed highest significant positive heterosis over better parent. For number of effective tillers significantly positive heterosis was earlier observed by Ram *et al*. (2020). Most of the crosses showed positive inbreeding depression except MTU1010 × Vasumati. The results were in close association with that of reported Positive and significant inbreeding depression for this trait by Sedeek *et al*. (2007); Kumar and Mani (2010, 2013); Singh *et al*. (2015).

Number of grains per panicle is the major yield attributing character; hence significant positive heterosis is desirable. Five crosses showed significant positive heterosis over better parent. Cross IR-64 × Vasumati showed highest significant positive heterosis over better parent. In rest of the crosses found significant negative heterosis. Similar findings were also reported by Saravanan *et al*. (2008); Singh *et al*. (2013); Kumar *et al*. (2017); Devi *et al*. (2018); Makwana *et al*. (2018); Hijam and Singh (2019). Most of the crosses showed significant negative inbreeding depression except, MTU1010 × Pusa 1121, IR-64 × Tarori Basmati, and IR-64 × Pusa 1121 which showed significant positive inbreeding depression. On the contrary, positive and negative significant inbreeding depression for this character was reported by Vishwakarma *et al*. (1999); Sedeek *et al*. (2007); Kumar and Mani (2013).

The extent of spikelet fertility is an important character which directly influences the ultimate grain yield. Positive heterosis for spikelet fertility is desirable. Most of the crosses observed significant negative heterosis except, IR-64 × Tarori Basmati which showed significant positive heterosis. Similar findings were also reported by Shahid *et al*. (2012); Rani *et al*. (2015); Feng *et al*. (1995). Significant positive inbreeding depression was found in crosses PKVHMT × Pusa 1121, IR-64 × Tarori Basmati and MTU1010 × Vasumati. And rest of the crosses showed negative inbreeding depression these results were similar to the earlier reports of Vishwakarma *et al*. (1999); Sedeek *et al*., (2007).

Harvest Index which indirectly influences the grain yield through controlling the mechanism of distribution of photosynthesis to economic and non-economic part of plant as such is not a yield component. Therefore, it is an important consideration for genetic improvement. In the present investigation, three crosses showed positive and significant heterosis was recorded for the character harvest index and cross IR-64 × Tarori Basmati showed highest heterosis. Rest of others found significant negative heterosis. These results are in agreement with those obtained by Borah *et al*. (2017); Rumanti *et al*. (2017); Sravan and Jaiswal (2017); Thorat *et al*. (2017); Makwana *et al*. (2018); Balat *et al*. (2018).

The character 100-grain weight is one of the important common traits which influence the yield. In this study all the crosses showed positive heterosis. However, all the crosses showed significant positive heterosis over better parents. Cross IR-64 × Tarori Basmati showed highest significant positive heterosis over better parents and most of the crosses showed positive inbreeding depression except crosses MTU1010 × Tarori Basmati. Similar results were reported by Soni and Sharma (2011); Latha *et al*. (2013); Sravan and Jaiswal (2017); Ram *et al*. (2020).

Heterosis for yield per plant in positive direction is desirable as higher grain yield is the main objective for almost all the breeding programmes and six crosses showed positive significant heterosis over better parent. Cross IR-64 × Vasumati showed highest positive significant this character. Similar results reported by Reddy *et al*. (2012); Haque *et al*. (2014); Rukmini *et al*. (2014); Devi *et al*. (2014). Most of the crosses showed positive inbreeding depression except, MTU1010 × Tarori Basmati. Positive and significant inbreeding depression for yield plant per plant was earlier reported by Sedeek *et al*. (2007); Reddy *et al*. (2012); Kumar and Mani (2010); Singh *et al*. (2015).

Table 1: Estimation of heterosis and inbreeding depression in rice.

Crosses	Mean					Heterosis		Inbreeding Depression (%)
	P_1	P_2	F_1	F_2	F_3	MP	BP	
Days to 50 per cent flowering								
PKVHMT × PUSA 1121	101.34	91.17	91.17	96.56	90.08	-5.36*	-0.084*	-5.99*
PKVHMT × VASUMATI	100.33	91.20	93.01	94.22	92.41	-3.39*	1.97*	-1.30*
PKVHMT ×TARORI BASMATI	101.36	102.24	95.24	95.60	88.41	-6.43*	-6.01*	-0.37*
IR-64 × PUSA 1121	92.23	91.17	93.77	95.67	92.39	2.25*	1.67*	-2.02*
IR-64 × VASUMATI	92.23	91.20	92.01	94.59	90.96	0.32*	-0.23*	-2.80*
IR-64 × TARORI BASMATI	94.20	102.24	92.10	91.98	91.67	-5.27*	-0.13*	0.13*
MTU1010 × PUSA 1121	91.23	91.17	94.68	96.37	88.05	3.81*	3.77*	-1.78*
MTU1010 × VASUMATI	93.22	91.20	93.56	95.74	93.24	2.57*	2.55*	-2.33*
MTU1010 × TARORI BASMATI	91.23	102.24	96.55	96.36	94.38	-0.18*	5.83*	0.19*
Days to maturity								
PKVHMT × PUSA 1121	126.55	123.38	125.14	126.62	126.27	-0.25*	1.42*	-1.17*
PKVHMT × VASUMATI	125.69	124.75	125.69	125.55	122.46	0.02*	1.56*	0.10*
PKVHMT × TARORI BASMATI	127.55	129.36	128.68	130.61	129.37	0.16*	0.88*	-1.49*
IR-64 × PUSA 1121	124.47	123.38	122.53	122.34	123.93	-1.12*	-0.68*	0.16*
IR-64 × VASUMATI	123.46	123.75	124.06	124.87	122.26	-0.03*	0.25*	-0.64*
IR-64 × TARORI BASMATI	124.47	129.36	125.52	126.98	123.39	-1.11*	0.84*	-1.16*
MTU1010 × PUSA 1121	123.67	123.38	123.70	124.41	125.15	0.13*	0.02*	-0.57*
MTU1010 × VASUMATI	124.49	123.75	124.34	124.49	122.93	0.50*	0.47*	-0.12*
MTU1010 × TARORI BASMATI	126.25	127.35	126.93	126.40	126.25	0.32*	2.63*	0.42*

Table 1. counti…

Crosses	Mean					Heterosis		Inbreeding depression(%)
	P_1	P_2	F_1	F_2	F_3	MP	BP	
Plant height (cm)								
PKVHMT × PUSA 1121	106.66	120.71	138.05	112.90	130.92	21.43*	29.43*	0.18*
PKVHMT × VASUMATI	106.65	124.28	128.97	113.73	122.44	11.70*	20.91*	0.12*
PKVHMT × TARORI BASMATI	108.66	156.12	121.93	128.46	150.10	-7.20*	14.32*	-0.05*
IR-64 × PUSA 1121	117.65	121.72	130.99	124.15	130.21	9.91*	11.35*	0.05*
IR-64 × VASUMATI	115.64	124.26	116.01	122.05	107.14	-4.09*	-1.39*	-0.05*
IR-64 × TARORI BASMATI	119.65	157.11	131.72	124.67	123.93	-3.77*	11.96*	0.05*
MTU1010 × PUSA 1121	117.63	120.72	114.13	125.48	130.65	-4.22*	-2.95*	-0.10*
MTU1010 × VASUMATI	115.61	124.26	120.92	106.52	123.41	-0.01*	2.82*	0.12*
MTU1010 × TARORI BASMATI	117.65	156.12	110.31	126.65	128.40	-19.40*	-6.20*	-0.15*
Panicle length (cm)								
PKVHMT × PUSA 1121	22.81	28.81	29.23	25.40	26.63	15.49*	34.02*	0.13*
PKVHMT × VASUMATI	21.82	28.70	28.61	26.31	26.60	13.28*	31.17*	0.08*
PKVHMT × TARORI BASMATI	21.81	28.68	28.01	26.74	28.13	10.94*	28.42*	0.05*
IR-64 × PUSA 1121	25.85	28.70	28.33	26.32	24.96	7.23*	11.15*	10.69*
IR-64 × VASUMATI	26.85	28.70	28.33	26.32	24.96	1.99*	5.51*	7.09*
IR-64 × TARORI BASMATI	26.88	28.68	27.35	27.41	26.42	-1.50*	1.86*	-0.00*
MTU1010 × PUSA 1121	25.21	28.81	26.88	26.82	29.69	-2.30*	2.54*	0.00*
MTU1010 × VASUMATI	26.21	28.70	25.74	25.02	28.05	-6.26*	-1.81*	0.03*
MTU1010 × TARORI BASMATI	27.22	28.68	25.58	25.72	29.47	-6.79*	-2.39*	-0.01*

Table 1. counti…

Crosses	Mean					Heterosis		Inbreeding depression(%)
	P_1	P_2	F_1	F_2	F_3	MP	BP	
No. of tillers / plant								
PKVHMT × PUSA 1121	9.61	11.73	11.00	7.66	11.86	3.12*	14.58*	30.30*
PKVHMT × VASUMATI	10.60	9.00	11.73	7.34	9.92	26.16*	30.37*	37.41*
PKVHMT ×TARORI BASMATI	9.62	10.40	12.13	7.61	16.02	21.33*	26.39*	0.37*
IR-64 ×PUSA 1121	10.60	11.73	9.60	6.60	9.53	-14.03*	-9.43*	31.25*
IR-64 × VASUMATI	10.61	9.00	8.46	6.25	9.30	-13.60*	-5.93*	26.12*
IR-64 × TARORI BASMATI	11.62	10.40	7.93	6.74	9.36	-24.44*	-23.72*	0.14*
MTU1010 × PUSA 1121	10.00	11.73	9.93	9.38	10.26	-8.59*	-0.67*	0.05*
MTU1010 × VASUMATI	12.00	9.00	6.86	10.54	9.60	-27.72*	-23.70*	-0.54*
MTU1010 × TARORI BASMATI	10.12	10.40	7.93	6.52	9.36	-22.22*	-20.67*	0.18*
No. of Panicle / plant								
PKVHMT × PUSA 1121	9.40	8.20	9.86	6.34	10.61	18.88*	20.33*	0.36*
PKVHMT × VASUMATI	8.42	6.93	10.20	6.24	9.07	33.04*	47.12*	0.39*
PKVHMT × TARORI BASMATI	8.40	9.46	10.26	6.40	8.78	14.93*	22.22*	0.38*
IR-64 × PUSA 1121	9.53	8.20	8.20	5.90	8.58	-7.51*	0.00*	28.05*
IR-64 × VASUMATI	9.54	6.93	7.73	6.08	8.61	-6.07*	11.54*	0.21*
IR-64 × TARORI BASMATI	9.53	9.46	6.93	5.95	8.57	-27.01*	-26.76*	0.14*
MTU1010 × PUSA 1121	8.60	8.20	8.80	7.87	9.35	4.76*	7.32*	0.10*
MTU1010 × VASUMATI	10.62	6.93	5.80	8.62	9.03	-25.32*	-16.35*	-0.49*
MTU1010 × TARORI BASMATI	8.60	9.46	7.00	5.45	8.60	-22.51*	-18.61*	0.22*

Table 1. counti…

Crosses	Mean					Heterosis		Inbreeding depression(%)
	P_1	P_2	F_1	F_2	F_3	MP	BP	
No. of grains / panicle								
PKVHMT × PUSA 1121	226.46	118.13	106.00	153.90	147.36	-38.48*	-10.27*	-0.45*
PKVHMT × VASUMATI	228.47	126.46	118.06	153.76	138.08	-33.09*	-6.64*	-0.30*
PKVHMT × TARORI BASMATI	226.46	79.20	140.33	153.62	147.27	-8.18*	77.19*	-0.09*
IR-64 × PUSA 1121	73.86	118.13	136.60	100.95	103.27	42.29*	84.93*	0.26*
IR-64 × VASUMATI	72.85	126.46	145.93	164.43	106.78	45.69*	97.56*	-0.13*
IR-64 × TARORI BASMATI	73.86	79.20	143.66	139.10	137.71	87.72*	94.50*	0.03*
MTU1010 × PUSA 1121	134.00	118.13	117.13	117.38	120.82	-7.09*	-0.85*	0.00
MTU1010 × VASUMATI	138.21	126.46	101.53	121.27	118.04	-22.04*	-19.72*	-0.19*
MTU1010 × TARORI BASMATI	134.00	79.20	99.06	110.08	110.04	-7.07*	25.08*	-0.11*
Spikelet fertility (%)								
PKVHMT × PUSA 1121	92.90	88.64	57.98	67.04	71.59	-36.47*	-34.59*	-0.16*
PKVHMT × VASUMATI	93.92	82.88	66.79	63.45	68.92	-24.44*	-19.42*	0.05*
PKVHMT × TARORI BASMATI	93.90	79.68	55.39	63.71	71.44	-36.18*	-30.48*	-0.15*
IR-64 × PUSA 1121	66.73	88.64	62.98	66.60	65.94	-18.93*	-5.60*	-0.06*
IR-64 × VASUMATI	65.71	82.88	65.70	68.91	62.88	-12.16*	-1.52*	-0.05*
IR-64 × TARORI BASMATI	67.71	79.68	69.42	67.89	67.44	-5.15*	4.06*	0.02*
MTU1010 × PUSA 1121	87.70	88.64	66.71	68.18	66.42	-24.33*	-24.74*	-0.02*
MTU1010 × VASUMATI	88.69	82.88	68.89	68.34	67.05	-19.22*	-16.88*	0.01*
MTU1010 × TARORI BASMATI	87.68	79.68	66.12	70.68	68.67	-20.99*	-17.02*	-0.07*

Table 1. counti…

Crosses	P1	P2	Mean F1	F2	F3	Heterosis MP	Heterosis BP	Inbreeding depression(%)
Harvest Index (%)								
PKVHMT × PUSA 1121	43.87	47.52	40.84	37.28	52.50	-10.61*	-6.89*	0.09*
PKVHMT × VASUMATI	44.86	51.59	36.44	34.99	42.04	-23.64*	-16.92*	0.04*
PKVHMT × TARORI BASMATI	43.87	45.86	33.09	28.14	47.42	-26.25*	-24.57*	0.15*
IR-64 × PUSA 1121	36.04	47.52	34.46	39.42	33.95	-17.51*	-4.37*	-0.14*
IR-64 × VASUMATI	36.04	51.59	44.80	45.91	33.14	2.24*	24.30*	-0.02*
IR-64 × TARORI BASMATI	35.07	45.86	45.11	37.36	35.80	10.15*	25.16*	0.17*
MTU1010 × PUSA 1121	47.88	47.52	40.82	57.77	42.99	-14.42*	-14.09*	-0.41*
MTU1010 × VASUMATI	45.87	51.59	48.52	56.53	42.77	-2.44*	1.34*	-0.17*
MTU1010 × TARORI BASMATI	46.88	45.86	42.86	53.61	38.77	-8.56*	-6.55*	-0.25*
100 grain weight (g)								
PKVHMT × PUSA 1121	1.66	2.04	2.14	2.01	2.14	16.37*	30.56*	0.06*
PKVHMT × VASUMATI	1.64	2.13	2.53	1.91	2.18	34.23*	54.25*	0.24*
PKVHMT × TARORI BASMATI	1.63	2.12	2.64	1.75	1.77	40.80*	61.40*	0.34*
IR-64 × PUSA 1121	2.79	2.04	2.66	2.54	2.52	10.27*	30.71*	0.05*
IR-64 × VASUMATI	2.78	2.13	2.70	2.50	2.50	9.62*	26.79*	0.07*
IR-64 × TARORI BASMATI	2.78	2.12	4.71	2.58	4.52	91.54*	122.10*	0.45*
MTU1010 × PUSA 1121	2.06	2.04	2.94	2.65	2.59	43.32*	44.14*	0.10*
MTU1010 × VASUMATI	2.08	2.13	2.62	2.57	2.57	25.10*	27.10*	0.02*
MTU1010 × TARORI BASMATI	2.06	2.12	2.36	4.52	4.58	13.14*	14.70*	-0.91*

Table 1. counti…

Crosses	P1	P2	Mean F1	F2	F3	Heterosis MP	Heterosis BP	Inbreeding depression(%)
Yield / plant (g)								
PKVHMT × PUSA 1121	21.03	12.62	14.59	9.90	12.11	-10.66*	15.57*	0.32*
PKVHMT × VASUMATI	20.05	15.13	7.36	9.02	11.62	-58.15*	-51.38*	-0.23*
PKVHMT × TARORI BASMATI	19.03	7.19	17.10	6.87	8.57	25.62*	137.74*	0.60*
IR-64 X PUSA 1121	7.07	12.62	11.30	10.47	10.07	14.73*	59.72*	0.07*
IR-64 ×VASUMATI	8.07	15.13	18.73	11.31	8.86	68.68*	164.80*	0.40*
IR-64 × TARORI BASMATI	7.075	7.19	5.97	10.95	10.27	-16.22*	-15.51*	-0.83*
MTU1010 × PUSA 1121	17.47	12.62	18.53	17.56	16.28	43.32*	46.84*	0.10*
MTU1010 × VASUMATI	18.46	15.13	10.47	17.80	17.28	-35.75*	-30.81*	-0.70*
MTU1010 × TARORI BASMATI	17.45	7.19	10.16	10.53	9.92	-17.55*	41.32*	-0.04*

CONCLUSIONS

The findings of present study indicated that majority of the hybrids recorded high heterosis for grain yield per plant. Among the various hybrids exhibiting desirable value of heterosis, PKVHMT × Tarori Basmati, IR64 × Pusa1121 and MTU1010 × Pusa1121 were top performers for grain yield per plant. The hybrid, IR-64 × Vasumati recorded highest heterosis for yield per plant, and was among the best two performers for traits, 100 grain weight and number of grains per panicle. When yield and yield attributing traits were considered IR-64 × Vasumati was the best cross combination. Significant inbreeding depression was recorded for yield and yield attributing traits.

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