ISSN 0258-7122
Bangladesh J. Agril. Res. 34(3) : 465-472, September 2009

HETEROSIS IN BOTTLE GOURD

A.K.M. QUAMRUZZAMAN, M.A. RASHID
M.A.T. MASUD AND M. NAZIM UDDIN

Abstract

Heterosis in bottle gourd was studied in a set of 13 F_1 with 26 parents. Results indicated highly significant differences for all the characters among the materials studied. Heterosis was higher for yield per plant, number of fruits per plant and individual fruit weight, medium in fruit length and fruit diameter, and lower in days to 1st harvest. Hybrids (F_1) 10 x 17 and 19 x 26 manifested highest heterosis over midparent (73.1%) and better parent (61.8%), respectively, for yield per plant.

Key Words : Heterosis, bottle gourd, hybrid.

Introduction

Bottle gourd *[Lagenaria siceraria* (Mol.) Standl.] is one of the most important and widely cultivated popular winter vegetable in Bangladesh. It occupies about 12,100 ha with a total production of 101,325 tons. The average yield is only 8.37 tons per hectare (Anon., 2005), which is very low as compared to that in other tropical countries. This low yield may be either due to lack of high yielding varieties or poor fertility management. High yielding variety is an important factor for maximizing the yield of bottle gourd. Though a large number of bottle gourd varietiesl genotypes are available in this country for cultivation, most of them lost their potentiality due to cross pollination occurs during the pollination. There is a great scope for the improvement of this crop through hybridization. Therefore, the present study was undertaken to develop high yielding F_1 varieties suitable for winter as well as summer rainy season cultivation and to study the heterosis in bottle gourd.

Materials and Method

The experiment was conducted at the farm of Olericulture Division, Horticulture Research Centre, Bangladesh Agricultural Research Institute, Gazipur, Bangladesh during the winter season of 2004-05. The seeds of 13 F_1 with 26 parents of bottle gourd were sown on the polybag on 15 October 2004. The experiment was laid out in RCB design with three replications. The unit plot size was 8.0 x 2.0 m maintaining 2.0 x 2.5m spacing. The land was fertilized with cowdung, urea, TSP, MP, gypsum, and zinc @ 15000, 175, 175, 150, 100, and 12 kg/ha, respectively. The total amount of cowdung, TSP, gypsum, and zinc and

Olericulture Division, Horticulture Research Centre (HRC), BARI, Gazipur-1701, Bangladesh.

1/3rd of each of urea and MP were applied during fmal land preparation and in the pit. The rest of urea and MP were applied in four equal installments at 21, 35, 55, and 75 days after transplanting. The 25 days old seedlings were transplanted in the main field on 10 November 2004. The intercultural operations (weeding, irrigation, insecticide spray, etc.) were done as and when necessary. Data on days to first harvest, fruit length (cm), fruit diameter (cm), fruit number per plant, individual fruit wt (kg), fruit yield (kg/plant) were recorded from three randomly selected plants per entry per replication. The data on different characters was statistically analyzed. The significance of increase or decrease in F_1 hybrid over their corresponding mid parent and better parent was tested by comparing their means with the help of appropriate standard error values in percentage (Table 1).

Results and Discussion

The mean performance for 13 F_1 with 26 parents and per cent heterosis over mid parent and better parent for yield and yield contributing characters of heterotic crosses are presented in Table 1.

In case of days to first harvest six hybrids showed significant negative heterosis over mid parent indicating earliness. The estimates of mid parent heterosis ranged from -13.4 to 7.2%. The highest significant negative heterotic response for earliness was observed in the hybrid 22 x 29 followed by 6 x 13 (-5.8%). Nine hybrids performed significant negative better parent heterosis. The estimates of better parent heterosis ranged from -0.9 to -13.8 percent. The highest negative heterotic effect was also observed in the hybrid 22 x 29 followed by 6 x 13 (-7.9%). Singh *et al.* (1988) reported significant heterosis over the better parent was ARBGH-7 x LC2-1 for days to first female flowering and PSPL x ARBGH-7 for days to first fruit harvest. Sit and Sirohi (2002) also observed that the parental populations and hybrids were significantly different with regard to flowering in bottle gourd.

Among the 13 hybrids, seven hybrids showed significant positive heterotic response over mid parent for fruit length and range was 7.7-30.9%. Only one hybrid showed more than 20% heterosis. Highest percent mid parent heterosis was observed from the hybrid 10 x 17 followed by 23 x 30 (18.8%). For better parent, heterosis only four hybrids showed significant positive response in which three hybrids showed more than 20% heterosis. Significant positive heterosis for fruit length in bottle gourd was found by Singh *et al.* (1998) and Sit and Sirohi (2002). In case of fruit diameter, only one cross (22x29) exhibited more than 20% mid parent and better parent heterosis. Singh *et al.* (1998) and Sit and Sirohi (2002) also observed significant positive heterosis in fruit diameter of bottle gourd.

Table 1. Mean performance and percent heterosis over mid parent and better parent for yield and yield contributing characters in bottle gourd.

Crosses/ Parents	Mean performancee (days)	Days to first harvest		Mean performance (cm)	Fruit length		Mean performance (cm)	Fruit diameter	
		Mid parent	Better parent		Mid parent	Better parent		Mid parent	Better parent
06X13	105	-5.8**	-7.9**	37.5	-0.7	-3.8	9	-7.7	-14.3**
07X14	107	-0.5	-0.9	44	9.3*	27.5**	10	2.6	0.0
08X15	108	-2.3	-2.7	32.5	4.0	8.3	11	7.3*	4.8
09X16	116	1.8	-1.7	28	1 1.8**	21.1**	10.5	-2.3	-4.5
10X17	111	0.9	-1.8	26.5	30.9**	-14.1**	11	-4.3	-15.4**
I1X12	103	7.2**	-7.2**	38	-3.2	-8.4	9.5	-7.3*	-13.6**
18X25	107	0.5	-6.1**	39.5	12.9**	3.9	9.5	0.0	-5.0
19X26	107	-0.5	-2.7*	46	5.1	-3.2	9.5	18.8**	18.8**
20X27	103	-5.1**	-7.2**	32	-11.7**	-12.3*	11.5	7.0*	4.5
21X28	106	-3.6**	-3.6**	42	7.7*	23.5**	10.5	10.5**	5.0
22X29	94	-13.4**	-13.8**	38	4.1	5.6	10.5	23.5**	23.5**
23X30	110	-4.3**	-6.8**	30	18.8**	-10.4*	11	5.3	-31.3**
24X31	103	-5.1**	-5.5**	40	8.8*	14.3**	10	5.3	-4.8
BGN06	109			36.5			10.5		
BGN07	107			46			9.5		
BGN08	111			32.5			10		
BGN09	110			28			11		
BGN10	113			25			10		
BGN11	111			37			11		
BGN12	111			41.5			9.5		

Table 1. Cont'd.

Crosses/ Parents	Mean performancee (days)	Days to first harvest		Mean performance (cm)	Fruit length		Mean performance (cm)	Fruit diameter	
		Mid parent	Better parent		Mid parent	Better parent		Mid parent	Better parent
BGN13	114			39			9		
BGN14	108			34.5			10		
BGN15	110			30			10.5		
BGN16	118			35.5			10.5		
BGN17	107			15.5			13		
BGN18	114			32			10		
BGNI9	110			35			10.5		
BGN20	111			36			11		
BGN2I	110			44			9		
BGN22	109			37			8.5		
BGN23	118			17			16		
BGN24	109			38.5			8.5		
BGN25	99			38			9		
BGN26	105			47.5			8		
BGN27	106			36.5			10.5		
BGN28	110			34			10		
BGN29	108			36			8.5		
BGN3O	112			33.5			11		
BGN3I	108			35			10.5		
SE		1.1	1.0		3.2	4.1		3.1	4.1
LSD (0.05)		2.4	2.2		7.0	8.9		6.8	8.9
LSD (0.01)		3.4	3.1		9.8	12.5		9.5	12.5

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

Table 1. Cont'd.

Crosses/ Parents	Mean performance (number)	No. of fruits/plant		Mean performance (kg)	Individual fruit weight		Mean performance (kg)	Yield/plant	
		Mid parent	Better parent		Mid parent	Better parent		Mid parent	Better parent
06X13	10	25.I1	11.1	1.7	0.0	0.0	17.0	25.0	11.1
07X14	11	29.4**	22.2*	2.1	20.1**	5.0	23.1	69.5**	44.4**
08X15	7	16.7	16.7**	1.8	5.9	5.9	12.6	23.5	23.5*
09X16	6	9.1	0.0	1.5	-14.3	-16.7**	9.0	-6.7	-16.7
10X17	10	53.8*	42.9	1.8	12.5**	12.5**	18.0	73.1**	60.7**
IlXl2	7	-6.7	-22.2	1.8	-2.7	-l0.0	12.6	-7.7	-l7.6
18X25	9	12.5	12.4	1.7	9.7	-5.6	15.3	23.4**	6.2
19X26	11	15.8	0.0	2.0	12,0**	11.1	22.0	67.9**	61.8**
20X27	6	-18.9	-23.1**	2.0	5.3	0.0	12.0	-14.9	-23.1*
21X28	11	22.2**	22.2**	2.0	17.6**	17.6**	22.0	52.2**	43.8**
22X29	9	28.6**	28.6**	1.6	3.2	0.0	14.4	32.7**	28.6**
23X30	9	20.0**	12.6*	1.8	5.9	0.0	16.2	26.6**	12.5
24X31	9	9.1	0.0	2.1	40.0**	40.0**	18.9	52.7**	40.1**
BGN06	7			1.7			11.9		
BGN07	8			2.0			16.0		
BGN08	6			1.7			10.2		
BGN09	5			1.7			8.5		
BGN10	6			1.6			9.6		
BGN11	6			2.0			12.0		
BGN12	9			1.7			15.3		

Table 1. Cont'd.

Crosses/ Parents	Mean performance (number)	No. of fruits/plant		Mean performance (kg)	Individual fruit weight		Mean performance (kg)	Yield/plant	
		Mid parent	Better parent		Mid parent	Better parent		Mid parent	Better parent
BGN13	9			1.7			15.3		
BGN14	7.5			1.5			11.3		
BGN15	6			1.7			10.2		
BGN16	6			1.8			10.8		
BGN17	7			1.6			11.2		
B0N18	8			1.8			14.4		
BGN19	7			1.8			12.6		
BGN20	7.8			2.0			15.6		
BGN21	9			1.7			15.3		
BGN22	7			1.6			11.2		
B0N23	7			1.6			11.2		
BGN24	9			1.5			13.5		
BGN25	8			1.3			10.4		
BGN26	8			1.7			13.6		
BGN27	7			1.8			12.6		
BGN28	8			1.7			13.6		
B0N29	7			1.5			10.5		
BGN30	8			1.8			14.4		
BGN31	7.5			*1.5*			11.3		
SE		4.9	5.2		3.6	3.9		8.3	8.0
LSD (0.05)		10.7	11.3		7.8	8.5		18.1	17.4
LSD(0.0l)		15.0	15.9		11.0	11.9		25.4	24.4

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

Eight crosses showed significant positive mid parent heterosis for number of fruits per plant and range was 12.5-53.8 percent. The highest significant positive heterosis was obtained by the cross 10 x 17 followed by 7 x 14 (29.4%). Seven crosses exhibited significant positive better parent heterosis for this trait. The significant positive better parent heterosis range from 12.4-42.9%. The highest significant positive better parent heterosis was also attained by the cross 10 x 17 followed by 22 x 29 (28.6%) and Singh *et al.* (1998) observed higher percentage of heterosis of number of fruits in bottle gourd. Similar results were also reported by Sit and Sirohi (2002).

In case of individual fruit weight, two crosses showed more than 20% mid parent heterosis and highest significant positive heterosis was obtained by the cross 24 x 31(40.0%), whereas only one cross 24 x 31 (40.0%) exhibited more than 20% better parent heterosis. Significant positive heterosis for fruit weight in bottle gourd was also reported by Singh *et al.* (1998) and Sit and Sirohi (2002).

Ten crosses for yield per plant showed significant positive mid parent heterosis. Percent of mid parent positive heterosis range from 23.4 to 73.1%. The highest significant positive heterosis was obtained from the cross 10 x 17. More than 50% heterosis was observed from four crosses. The highest were 10 x 17 (73.1%), 7 x 14 (69.5%), 24.31 (52.7 %), and 21 x 28 (52.2%). Kumar *et al.* (1999) reported 117.26 % yield increase over mid parent in bottle gourd. In the case of better parent heterosis for this trait, seven crosses showed significant positive better parent heterosis. Percent of significant positive heterosis ranged from *23.5* to 61.8%. The highest significant positive better parent heterosis was exhibited from the hybrid 19 x 26 followed by 10 x 17 (60.7%). Janakiram and Sirohi (1992) reported the best performing hybrids for yield.

Janakiram and Sirohi (1989) concluded that the increase in yields of hybrids was mainly due to fruits number per plant, single fruit weight and fruit size, while Singh *et el.* (1998) reported that heterosis in yield was attributed to earliness of fruit harvest. In case of yield per plant, the cross combination 10 x 17 and 19 x 26 manifested the highest heterosis over mid parent and better parent, respectively, but not in all characters. So it could be concluded that heterosis was not responsible to only fruit length or fruit diameter, but also responsible to individual fruit weight, number of fruits per plant and earliness.

References

Anonymous. 2004. Year Book of Agricultural Statistics of Bangladesh 2002. Bangladesh Bureau of Statistics, Ministry of Planning, Government of People's Republic of Bangladesh, Dhaka, Bangladesh. pp 94-102

Janakiram. T and P.S. Sirohi. 1992. Studies on heterosis on quantitive characters in bottle gourd. *J. Maharashtra Agril. Univ*. **17**(2): 204-206.

Janakiram, T and P.S. Sirohi. 1989. Hetrosis studies in round-fruited bottle gourd. *J. Maharashtra Agril.* **76** (6): 339-342.

Kumar Sarvesh, S.P., R. C. Singh, Jaiswal and S. Kumar. 1999. Heterosis over mid and top parent under the line x tester fashion in bottle gourd. *Veg. Sc.* **26**(1): 30-32.

Singh. P.K., J.C. Kumar and J.R. Sharma. 1998. Heterosis studies in long fruited bottle gourd. *Vegetable Science* **25**(1): 55-57.

Sit. A.K and P.S. Sirohi. 2002. Exploitation of heterosis in bottle gourd. *Hort. J.* **15**(2): 55-60.