Indian J. Hort. 70(2), June 2013: 290-292

Short communication

Heterosis for yield and yield components in okra

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ABSTRACT

Magnitude of hecterosis for yield and contributing traits were studied in okra. Seven genotypes were crossed in all possible combinations resulting in 33 hybrids. Six hetrotic hybrid combinations observed were MF-3 × OHD-1, MF-3 × Varsha Uphar, MF3 × Arka Anamika, OHD-1 × Varsha Uphar, OHD-1 × Arka Anamika, Vasha Uphar × Arka Anamika, which were better over mid-parental values. Hybrid Varsha Uphar × Arka Anamika had the highest heterosis (52.22%) for yield per plant.

Key words: Heterosis, okra, yield parameters.

In India, major problem in okra cultivation is lack of high yielding varieties along with location specific and disease tolerant hybrids. Of the various approaches being used to overcome this problem, hybrid technology for exploitation of heterosis is considered as one of the desirable, sustainable and eco-friendly approach. Hybrid vigour is a special genetic mechanism wherein the genotypes when brought together in a specific pattern express their ability to exhibit a dramatic shift in particular characters. Exploitation of hybrid vigour provides an efficient approach for the improvement of quantitative traits in crops like okra. The crop okra which categorized under often cross-pollinated group showed easy emasculation and high number of seed production in one pollination (Weerasekara *et al*., 9). Keeping in above facts, the present investigation was undertaken to estimate the magnitude of heterosis for yield and its contributing characters in okra.

The experimental material comprised of 7 okra genotypes of diverse origin crossed in all possible combinations resulted in 33 hybrids with failure of seed set in few combinations. Parents along with hybrids were sown at a spacing of 45 cm × 30 cm in a randomized block design with two replications at College Orchard, Horticultural College and Research Institute, TNAU, Coimbatore. Observations were recorded on ten randomly selected plants in each replication. Observations were recorded on first flowering height, number of fruits per plant, individual fruit weight, fruit length, fruit girth, plant height at final harvest, number of branches per plant, yield per plant and crude fibre content in fruits. Statistical analysis was done on the mean values and the heterosis was determined as the increase or decrease in F_1 hybrids over the mid and best parents.

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The analysis of variance indicated highly significant differences for all most all the characters suggesting presence of genetic variability (Table 1). Variance due to crosses showed significant differences for all the characters indicating the presence of wide range of variability among crosses. The per cent of heterosis estimated over mid and best parent for yield and other characters of the best crosses are shown in Table 2.

In the present investigation among the 33 hybrids, six heterotic hybrid combinations, *viz*., MF-3 x OHD-1, MF-3 x Varsha Uphar, MF-3 x Arka Anamika, OHD-1 x Varsha Uphar , OHD-1 x Arka Anamika and Varsha Uphar x Arka Anamika expressed high mean performance as well as heterosis (over best parent) for yield and its components.

Flowering at a shorter height is an indication of earliness, which is a desirable character in okra for getting early and consequently high yields. MF-3 × Varsha Uphar recorded the highest heterosis over the mid parent with an estimate of -26.63 per cent. The highest over the best parent was recorded in Varsha Uphar × MF-1 with an estimate of -38.94 per cent. The over all mean of the hybrids was lower than that of parents, thereby indicating the tendency of earliness.

The relative heterosis for number of fruits/plant ranged from -16.57 per cent in Varsha Uphar × OHD-1 to 75.78 per cent in MF-2 × MF-1. The hybrids MF-3 × MF-2 and MF-3 × OHD-1 recorded the highest heterosis (21.59%) over the best parent . Such a high heterosis for this important yield contributing trait was reported in okra by Sreeparvathy *et al*. (8). This may be due to the multiplicative interaction of the parents. Further, the parents were from diverse origin leading to the high heterozygosity in the hybrids (More and Patil, 3). As yield is a complex trait and the ultimate objective of any breeding program is increase in heterosis of such identifiable contributing trait can strengthen the

Table 1. Analysis of variance for yield components in okra.

Source of variation	df	Plant height at first flower bud appearance (cm)	No. of fruits/ plant	Fruit weight (g)	Fruit length (cm)	Fruit girth (cm)	Plant height at final harvest (cm)	No. of branches/ plant	Yield/ plant (g)
Replication	1	4.26	8.64	11.33	0.01	0.21	0.32	0.01	2433.66
Treatment	39	10.90**	31.23**	8.85**	3.20**	0.58**	136.74**	8.29**	10992.12**
Error	39	1.25	1.94	1.33	0.37	0.07	2.46	1.81	324.86

** Significant at 1% level.

Table 2. Crosses showing high heterosis for yield and its components in okra.

Hybrid	First flowering height		No. of fruits/ plant		Fruit weight		Fruit length	
	MP	BP	MP	BP	MP	BP	MP	BP
MF-3 × OHD-1	-21.14**	-27.67**	40.30**	21.59**	-21.82**	-38.70**	-11.24**	-12.11**
MF-3 × Arka Anamika	3.10	-5.31	10.94	-6.87	-14.99**	-30.40**	-5.73	-10.86**
MF-3 × Varsha Uphar	-26.63**	-34.08**	51.10**	3.09	-24.66**	-30.18**	-7.11	-9.42
OHD-1 × Arka Anamika	16.60**	-2.56	0.06	-2.66	3.18	-22.68**	-8.83*	-12.91**
OHD-1 × Varsha Uphar	-9.96*	-26.56**	-9.36	-9.87	-2.23	-16.17**	-7.02	-8.48*
Varsha Uphar × Arka Anamika	25.31**	19.85**	20.27	0.42	25.56**	12.00**	9.09*	2.56

* and ** indicate significance at 5 and 1%, respectively, MP = Heterosis over mid parent; BP = Heterosis over best parent

Hybrid	Fruit girth		Plant height at final harvest		No. of branches/ plant		Yield/ plant	
	MP	BP	MP	BP	MP	BP	MP	BP
MF-3 × OHD-1	-20.65**	-26.49**	3.63	1.04	6.74	-5.47	34.49**	24.15**
MF-3 × Arka Anamika	-14.24**	-16.83**	5.47*	4.73	8.92	-2.99	20.05	18.32**
MF-3 × Varsha Uphar	-15.36**	-23.70**	-0.43	-1.50	12.96	10.45*	37.22**	11.13**
OHD-1 × Arka Anamika	-18.66**	-22.19**	-2.63	-5.74*	-26.48**	-31.59**	26.52**	1.64
OHD-1 × Varsha Uphar	-8.75*	-18.94**	7.90**	4.04	-19.90**	-22.89**	29.75**	24.51**
Varsha Uphar × Arka Anamika	9.36*	-15.55**	6.16*	4.27	19.98**	12.71**	52.22**	39.97**

* and ** indicate significance at 5 and 1%, respectively, MP = Heterosis over mid parent; BP = Heterosis over best parent

exploitation of hybrid vigour in this crop. The hybrid Varsha Uphar × Arka Anamika (25.56 per cent) showed the highest significant heterosis over mid parent and best parent (12.00%) for fruit weight. Individual fruit weight is yet another character contributing directly to the yield. Both the parents and hybrids exhibited wider variation for this trait in the present study. In this cross Varsha Uphar x Arka Anamika, both parents were the high yielder. Such an increase in fruit weight can be attributed to the conglomeration of favourable genes in the hybrids. This is in acocordance with Saha and Kabir (6), and Murugan (4).

There was not much variation between the parents and hybrids for fruit length and girth. Most of the hybrids exhibited negative heterosis for fruit length and fruit girth. Varsha Uphar x Arka Anamika recorded positive and significant values for both fruit length and girth which further exemplifies the potentiality of hybrid vigour for these characters in okra (Sreeparvathy *et al*., 8).

Plant height at final harvest was highest in OHD-1 × Varsha Uphar (7.90%). Varsha Uphar x Arka Anamika showed the highest significant standard heterosis (4.27%). The higher heterosis for this character indicated the presence of non-additive gene action. Similar findings were reported by Chavadhal and Malkhandale (1). Number of branches per plant was of diverse nature in both the parents as well as the hybrids. Except the hybrids Varsha Uphar x Arka Anamika and MF-3 x Varsha Uphar, all the hybrids showed negative and significant heterosis. Similar results on hybrid vigour for this trait in okra have been reported earlier by Rewale *et al*. (5).

Yield per plant is one of the most important traits, which deserve highest consideration in any breeding programme. In the present study, 22 hybrids showed significant positive heterosis for yield per plant. The magnitude of heterosis ranged from 34.49 per cent (MF-3 x MF-1) to 52.22 per cent (Varsha Uphar x Arka Anamika). Nine hybrids recorded higher yields than the best parent. The six hybrid combinations, MF-3 x OHD-1, MF-3 x Varsha Uphar, MF-3 x Arka Anamika, OHD-1 x Arka Anamika, OHD-1 x Varsha Uphar and Varsha Uphar x Arka Anamika recorded higher yields than the best parent. It can be seen that in the hybrids, one or both of the parents were high yielders. Even among these high heterotic hybrids the high x high parental combination of Varsha Uphar x Arka Anamika and OHD-1 x Varsha Uphar topped the others. This is in line with the findings of Metwally and Etsamy (2), and Shobha (7).

Manifestation of heterosis over the mid parent was observed in almost all the characters. The magnitude of heterosis found in the present study stressed the importance of using genetically divergent parents in hybridization programme. This study resulted in 6 heterotic hybrid combinations, *viz.*, MF-3 × OHD-1, MF-3 × Varsha Uphar, MF-3 × Arka Anamika, OHD-1 × Varsha Uphar, OHD-1 × Arka Anamika and Varsha Uphar × Arka Anamika. These crosses could be selected for exploitation of hybrid vigour and commercial utilization.

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Received: June, 2007; Revised: December, 2010; Accepted: November, 2012