



Research Note

Heterosis for yield and yield components in sesame (*Sesamum indicum* L.)

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Abstract

Heterosis for days to flowering, days to maturity, plant height, number of primary branches per plant, number of capsules per plant, number of seeds per capsule, chlorophyll content, oil per cent, protein per cent and single plant yield were evaluated in 36 crosses derived from a 9 x 9 diallel mating design in sesame. Heterosis was worked out over midparent and better parent. Combinations Priya X Vianyak, PBTil-1 X TMV-6 and TC-25 X Vinayak showed a highly significant relative heterosis and heterobeltiosis for single plant yield and some of its yield components and hence could be exploited for developing superior varieties.

Key words

Sesame, heterosis, economic traits

Sesame (*Sesamum indicum* L.) is one of the most ancient and important oilseed crops and its seed contains 50 % oil and 25 % protein. It is sixth most important oil seed crop in India and has 19.01 lakh ha area with 8.10 lakh tones production and productivity of 426 kg/ha. The yield improvement achieved through conventional hybridization followed by selection has been only marginal. Although sesame is largely a self-pollinated crop, high level of heterosis for yield and its components has been reported by Fatteh *et al.* (1995), Padmavathi, (1998), Jadhav and Mohrir, (2013). But, the commercial exploitation of this phenomenon is feasible only if the means of producing hybrid seeds economically could be made available. Further, with convincing reports on availability of heterosis and possibility of commercial hybrids, generation of cytoplasmic male sterility system in sesame using the possible wild donors can enable the production of hybrids. The sesame plant has distinct features favourable for hybrid seed production. Heterosis of small amount for individual yield contributing characters may have an additive or synergistic effect on the end product (Sasikumar and Sardana, 1990). Therefore, the present study was undertaken to study the extent of heterosis for quantitative traits in sesame.

Nine morphological diverse sesame genotypes, representing different sesame growing regions of India, namely GT-2 and GT-10 from Gujarat, T-78 from U.P., TKG-22 from M.P., PB Til -1 from Panjab, Priya from W B, Vinayak from Orissa and TMV-6 from T.N., were crosses in a half diallel mating system in 9 x 9 diallel mating design during *kharif* -2011. The resulting 36 F₁ hybrids along with their parents were grown in three environments in three consecutive seasons viz, *kharif*-12, *semi rabi*-12 and *summer*-13 at Regional Oilseeds Research Station, S. D. Agricultural

University, Talod, Dist: Sabarkantha (Gujarat) following a randomised block design with three replications. The parents were raised in rows of 5 m in length following a spacing of 60 cm between row and 15 cm between plants. Observations on randomly selected five plants from each replication in each season were recorded for days to flowering, days to maturity, plant height, number of primary branches per plant, number of capsules per plant, number of seeds per capsule, chlorophyll content, oil per cent, protein per cent and single plant yield. For all the characters, relative heterosis, heterobeltiosis and standard heterosis were estimated following Fonesca and Patterson (1968).

Heterosis was calculated as per cent increase or decrease over midparent, corresponding better parent and standard checks GT-10 and TKG-22. The present study furnishes information on variability of genotypes for chlorophyll content and seed yield. Chlorophyll content index indicates total chlorophyll content in plants. The rate of photosynthesis is directly proportional to the chlorophyll content. The cross T-78 x TC-25 exhibited high significant positive heterosis in chlorophyll content, even though not registered for high seed yield. This indicates chlorophyll content is not directly effects on seed yield. The relation of the photosynthetic capacity and crop yield is complex. The range of heterosis and number of crosses showing a desirable heterotic response for the characters studied are presented in Table 1. Table 2 shows the top three crosses with the highest relative heterosis and heterobeltiosis for all the characters studied.

In the present study one cross viz., TKG-22 X GT-10 exhibited a significant negative heterosis for plant height. One cross viz, Vinayak X TMV-6 exhibited a significant positive heterosis for

number of branches per plant. Similar results were reported by Alam *et al.* (1999). Twenty and fifteen crosses exhibited significant standard negative heterosis over check GT-10 for days to flowering and plant height respectively. Priya X Vinayak, PBTil-1 X TMV-6 and Vinayak X TMV-6 exhibited significant positive heterosis and heterobeltosis for number of capsules per plant. Similar results were reported by Govindrasu *et al.* (2001). For the number of seeds per capsule, one cross viz, GT-2 X TKG-22 recorded significant positive heterosis and heterobeltosis. Two and four crosses exhibited positive significant standard heterosis over check GT-10 and TKG-22 respectively. For harvest index, one cross viz, GT-2 x T-78 recorded significant positive heterosis and heterobeltosis. Seven and five crosses exhibited positive significant standard heterosis over check GT-10 and TKG-22 respectively. One cross viz, T-78 x TC-25 exhibited a significant positive heterosis for chlorophyll content. For oil per cent, two crosses viz, Priya x TMV-6 and T-78 x TC-25 reported significant and positive low heterotic values on all the three bases. Low heterosis for oil content was reported by Navadiya *et al.* (1995). Two and twenty two crosses exhibited significant positive standard heterosis over check GT-10 and TKG-22 respectively for oil percent. For protein percent, twenty two and two crosses exhibited significant positive standard heterosis over check GT-10 and TKG-22 respectively. Significant and positive heterotic values for single plant yield on all the three bases were found in ten crosses viz., Priya x Vinayak, PBTil-1 x TMV-6, Priya x GT-10, TC-25 x Vinayak, Vinayak x TMV-6, PBTil-1 x GT-10, GT-2 x Priya, TC-25 x GT-10, TMV-6 x GT-10 and GT-2 x TC-25. A total eighteen crosses exhibited significant positive standard heterosis over check GT-10 for seed yield per plant. Similar results were reported by Padmavathi (1998).

The crosses Priya x Vinayak and PBTil-1 x TMV-6 had a high heterotic vigour for two traits viz, number of capsules per plant and single plant yield. The crosses T-78 x PBTil-1 had high heterotic vigour for two traits viz, test weight and protein content. The high heterotic crosses can be utilized for developing superior hybrids.

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Table 1. Number of crosses showing desirable heterotic performance and range of heterosis for yield and yield components

Characters	Mean value	Range of heterosis (%)		Number of crosses with desirable heterosis	
		Relative heterosis (%)	Heterobeltiosis (%)	Relative heterosis (%)	Heterobeltiosis (%)
Days to flowering	41.95	-8.17 to 11.75	-5.21 to 30.37	0	0
Days to maturity	100.10	1.30 to 15.31	4.19 to 23.10	0	0
Plant height	109.63	-7.88 to 11.22	-0.77 to 19.25	1	0
Number of primary branches per plant	4.23	-28.26 to 24.32	-34.00 to 16.67	1	0
Number of capsule per plant	61.56	-25.27 to 37.25	-33.29 to 33.80	8	4
Number of seeds per capsule	65.48	-15.32 to 17.25	-20.06 to 15.51	4	1
1000 seed weight(g)	3.62	-20.05 to 29.95	-22.55 to 25.53	5	2
Harvest index (%)	32.03	-41.75 to 38.83	-42.85 to 14.59	7	3
Chlorophyll content(cci)	23.13	-42.94 to 22.65	-53.33 to 14.23	1	1
Oil content (%)	43.55	-8.97 to 14.76	-11.21 to 12.14	4	2
Protein content (%)	24.29	-15.57 to 31.13	-27.95 to 28.83	9	3
Seed yield per plant (g)	11.96	-41.70 to 80.31	-53.77 to 68.89	16	10



Table 2. Best three crosses showing high heterotic vigour for yield and yield components

Character	Relative heterosis	Heterobeltiosis
Days to flowering	-	-
Days to maturity	-	-
Plant height(cm)	TKG-22 x GT-10	-
Number of primary branches per plant	VINAYAK X TMV-6	-
Number of capsules per plant	PRIYA X VINAYAK PBTil-1 X TMV-6 VINAYAK X TMV-6	PRIYA X VINAYAK PBTil-1 X TMV-6 VINAYAK X TMV-6
Number of seeds per capsule	GT-2 X TKG-22 PBTil-1 X PRIYA T-78 X GT-10	GT-2 X TKG-22 - -
Harvest index(%)	TKG-22 X VINAYAK T-78 X TKG-22 GT-2 X T-78	GT-2 X T-78 GT-2 X TC-25 GT-2 X TKG-22
1000 seed weight(g)	T-78 X PBTil-1 GT-2 X PBTil-1 T-78 X GT-10	T-78 X PBTil-1 GT-2 X PBTil-1 -
Chlorophyll content(cci)	T-78 X TC-25 TKG-22 X PBTil-1 -	T-78 X TC-25 - -
Oil content(%)	PRIYA X TMV-6 T-78 X TC-25 PBTil-1 X TMV-6	PRIYA X TMV-6 T-78 X TC-25 -
Protein content(%)	T-78 X PBTil-1 PBTil-1 X VINAYAK T-78 X PRIYA	PBTil-1 X VINAYAK T-78 X PRIYA T-78 X PBTil-1
Seed yield per plant(g)	PRIYA x VINAYAK PBTil-1 x TMV-6 PRIYA x GT-10	PRIYA x VINAYAK PBTil-1 x TMV-6 TKG-22 x TC-25