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# Heterobeltiosis for Seed Yield in Seasame (*Sesamum indicum* L.)

Dr. Sukla Das

Chief Volunteer (West Bengal), BLESS India
E-mail: drshukladas055@gmail.com

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## ABSTRACT

Heterobeltiosis for 1000 seed weight and seed yield/plant were evaluated in 45 double cross combinations in sesame derived from a selective mating of 15 $F_1$'s of an 8 x 8 diallel cross (excluding reciprocals) for purpose of selection of high yielding hybrids which would give desirable recombinants in segregating generations. Heterobeltiosis was computed on the basis of superiority of hybrid for 1000 seed weight and seed yield/plant. Most of the double cross combinations had highly significant positive heterobeltiosis for 1000 seed weight and seed yield/plant. It was observed that 21 double cross combinations have shown highly significant positive heterobeltiosis for both characters, though estimated economic heterosis was negative for 1000 seed weight. High values of heterobeltiosis in (B 14 x T 12) x (R 9 x MT 67-52) and (B 14 x T 12) x (B 9 x R 9) indicate feasibility of exploitation of hybrid vigour for seed yield.

**Key words:** Heterobeltiosis, 1000 seed weight, seed yield/plant, double cross combinations, sesame.

## INTRODUCTION

Sesame (*Sesamum indicum* L.) is one of the most important ancient oilseed crops (Bedigian and Harlan, 1986). Despite high nutritional value and oil quality, research on sesame has been scarce (Bedigian, 2003). Average productivity of this important oilseed crop in India is only 453 kg $ha^{-1}$, which is far below the average productivity in China (1127 kg $ha^{-1}$) and Egypt (1211 kg $ha^{-1}$). The exploitation of hybrid vigour appears to be one of the alternatives for making further breakthrough in seed yield. The degree of economic heterosis should be measured as superiority, if any, of $F_1$ hybrid over the best commercial variety released so far for cultivation. This estimate, in real sense, decides whether the hybrid is worth exploiting or not. Hybrid vigour which has been exploited commercially in cross-pollinated crops like maize, sunflower and pearl millet, could also play an important role in the improvement of yield of several self-pollinated crops in which heterotic effects are pronounced. For the feasibility of developing commercially exploitable hybrids, more information on the desirable parental combination exhibiting high degree of heterotic response is inevitable. The present investigation was, therefore, conducted to know the extent of heterosis for 1000 seed weight and seed yield/plant in the hybrids which can be directly used for cultivation or further selection to get desirable recombinant/s in segregating generations so that high-yielding genotypes of good promise could be evolved.

## MATERIALS AND METHODS

The varieties B 67, B 14, B 9, R 9, MT 67-52, T 12, RT 54 and TC 25 which were chosen on the basis of their diversity in seed yield were crossed in a 8 x 8 diallel design (excluding reciprocals) during

kharif season in first year at Bidhan Chandra Krishi Viswavidyalaya Farm, Kalyani. The 28 hybrids along with their 8 parents were grown in a randomized block design with 3 replications during pre-kharif seasons of second and third year. One row of 3 metres length was allotted for each hybrid and parent with a spacing of 50 cm x 8 cm between the rows and the plants in a row. Observations of ten competitive plants of each row from each replication were recorded for yield and yield contributing characters. A selective mating with 15 $F_1$'s : (1) – B 67 x B 14, (2) – B 67 x B 9, (3) – B 67 x R 9, (4) – B 67 x MT 67-52, (5) – B 67 x T 12, (6) – B 14 x B 9, (7) – B 14 x R 9, (8) – B 14 x MT 67-52, (9) – B 14 x T 12, (10) – B 9 x R 9, (11) – B 9 x MT 67-52, (12) – B 9 x T 12, (13) – R 9 x MT 67-52, (14) – R 9 x T 12 and (15) – MT 67-52 x T 12 was conducted during pre-kharif season of third year based on the combining ability of the first season's set of $F_1$s. The double hybrid generation comprising of 45 cross-combinations was raised during kharif season of the same year in a randomized block design with 3 replications. One row of 3 metres length was allotted for each double hybrid with 50 cm spacing between the rows and 8 cm between plants in a row. Observations of ten competitive plants of each row were recorded for 1000 seed weight and seed yield/plant. Heterobeltiosis for 1000 seed weight and seed yield/plant was calculated from the mean difference of $F_1$ and best parent. Percent heterobeltiosis was estimated as

$$\frac{\overline{\cdot_1} - \overline{BP}}{\overline{BP}} \times 100$$

where BP was the hybrid which was comparatively superior for 1000 seed weight and seed yield/plant.

## RESULTS AND DISCUSSION

Earlier study heterobeltiosis for oil content of the 15 $F_1$ hybrids by Das and Samanta (1989) showed negative values concluding that heterosis breeding for increasing oil content is not desirable. Estimates of combining ability, however, indicated the influence of both additive and non-additive gene actions for 1000 seed weight and seed yield/plant (Das and Sen, 1989). In this context, it would be worthwhile to mention that Shrivas and Singh (1981) also found more negative than positive heterosis for seed yield with high estimates of specific combining ability than the corresponding estimates for general combining ability indicating the preponderance of non-additive gene expression. Godawat and Gupta (1985) also reported that dominance was important for seed yield. However, heterosis in seed yield observed by him was attributed to heterosis for plant height and number of capsules/plant. The strategy for improvement of these two characters for increasing seed yield will be further selections for desirable recombinants from the progenies raised by crossing the comparatively superior hybrids. With this in view, the 15 hybrids referred above were therefore used in this experiment to develop the double hybrid generation of 45 cross-combinations for the study of heterobeltiosis for 1000 seed weight and seed yield/plant.

Table-1shows highly significant positive heterobeltiosis in 23 cross combinations and significant positive heterobeltiosis in 3 cross combinations for 1000 seed weight. On the contrary, 40 cross combinations show highly significant positive heterobeltiosis for seed yield/plant. It is evident from the table that most of the cross combinations showing highly significant positive heterobeltiosis for 1000 seed weight also exhibit highly significant positive heterobeltiosis for seed yield/plant. In this connection, it would be worthwhile to mention the work of Chavan *et al.* (1982) who obtained significant positive heterosis for capsules/plant, number of days to maturity and seed yield/plant. Likewise, analysis of data from a 4 x 4 complete diallel revealed that positive heterosis over the midparental value was most pronounced for branches/plant, capsules/plant, seeds/capsule and seed yield/plant.

## CONCLUSION

In view of the present finding, it is worthwhile to mention that since appreciable economic heterosis is noted, at least for seed yield/plant in the double cross combination i.e., (B 14 x T 12) x (R 9 x MT 67-52) and (B 14 x T 12) x (B 9 x R 9), these could be the source of hybrid seed of economic value for seed yield. The high heterotic response for both characters in 22 double cross combinations may principally be due to accumulation of favourable additive genes and complementary and duplicate epistasis which may be fixable. Such cross combinations are also expected to throw more superior segregants owing to their balanced homeostatic system than their respective superior parents and may be improved further by mass selection followed by recurrent method of breeding.

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**Table 1- Heterobeltiosis for 1000 seed weight and seed yield/plant in double hybrid cross combinations**

| Sl. No. | Double cross combinations | 1000 Seed weight | Seed yield/plant |
|---|---|---|---|
| 1. | (B 67 x B 14) x (B 9 x R 9) | -3.062 | 21.099** |
| 2. | (B 67 x B 14) x (B 9 x MT 67-52) | 7.612** | 2.155** |
| 3. | (B 67 x B 14) x (B 9 x T 12) | 10.303** | 17.856** |
| 4. | (B 67 x B 14) x (R 9 x MT 67-52) | -0.151 | 19.199** |
| 5. | (B 67 x B 14) x (R 9 x T 12) | 1.570 | 21.538** |
| 6. | (B 67 x B 14) x (MT 67-52 x T 12) | 5.716** | -15.844 |
| 7. | (B 67 x B 9) x (B 14 x R 9) | 11.425** | 32.533** |
| 8. | (B 67 x B 9) x (B 14 x MT 67-52) | 11.445** | 29.765** |
| 9. | (B 67 x B 9) x (B 14 x T 12) | 4.853** | 34.655** |
| 10. | (B 67 x B 9) x (R 9 x MT 67-52) | 5.777** | 35.345** |
| 11. | (B 67 x B 9) x (R 9 x T 12) | 4.460** | 26.821** |
| 12. | (B 67 x B 9) x (MT 67-52 x T 12) | 5.367** | -25.842 |
| 13. | (B 67 x R 9) x (B 14 x B 9) | -0.522 | 30.171** |
| 14. | (B 67 x R 9) x (B 14 x MT 67-52) | 12.166** | 34.889** |
| 15. | (B 67 x R 9) x (B 14 x T 12) | 1.972* | 35.945** |
| 16. | (B 67 x R 9) x (B 9 x MT 67-52) | 7.520** | 5.594** |
| 17. | (B 67 x R 9) x (B 9 x T 12) | 4.568** | 19.403** |
| 18. | (B 67 x R 9) x (MT 67-52 x T 12) | -0.508 | 6.364** |
| 19. | (B 67 x MT 67-52) x (B 14 x B 9) | -1.658 | 6.364** |
| 20. | (B 67 x MT 67-52) x (B 14 x R 9) | 6.113** | 23.148** |
| 21. | (B 67 x MT 67-52) x (B 14 x T 12) | 4.352** | 48.001** |
| 22. | (B 67 x MT 67-52) x (B 9 x R 9) | -13.717 | 46.448** |
| 23. | (B 67 x MT 67-52) x (B 9 x T 12) | 7.846** | 42.472** |
| 24. | (B 67 x MT 67-52) x (R 9 x T 12) | 4.931** | 33.675** |
| 25. | (B 67 x T 12) x (B 14 x B 9) | 6.572** | 38.210** |
| 26. | (B 67 x T 12) x (B 14 x R 9) | 11.929** | 41.047** |
| 27. | (B 67 x T 12) x (B 14 x MT 67-52) | 7.900** | 40.429** |
| 28. | (B 67 x T 12) x (B 9 x R 9) | -16.718 | 40.503** |
| 29. | (B 67 x T 12) x (B 9 x MT 67-52) | -14.499 | 24.267** |
| 30. | (B 67 x T 12) x (R 9 x MT 67-52) | 2.874** | 38.697** |
| 31. | (B 14 x B 9) x (R 9 x MT 67-52) | -0.393 | 36.600** |
| 32. | (B 14 x B 9) x (R 9 x T 12) | -1.505 | 33.382** |
| 33. | (B 14 x B 9) x (MT 67-52 x T 12) | 4.177** | -26.362 |
| 34. | (B 14 x R 9) x (B 9 x MT 67-52) | -8.303 | 21.356** |
| 35. | (B 14 x R 9) x (B 9 x T 12) | -10.030 | 39.335** |
| 36. | (B 14 x R 9) x (MT 67-52 x T 12) | 7.367** | -27.228 |
| 37. | (B 14 x MT 67-52) x (B 9 x R 9) | -18.187 | 43.491** |
| 38. | (B 14 x MT 67-52) x (B 9 x T 12) | -7.469 | 43.669** |
| 39. | (B 14 x MT 67-52) x (R 9 x T 12) | 7.789** | 35.865** |
| 40. | (B 14 x T 12) x (B 9 x R 9) | -12.982 | 61.424** |
| 41. | (B 14 x T 12) x (B 9 x MT 67-52) | 1.722* | 26.166** |
| 42. | (B 14 x T 12) x (R 9 x MT 67-52) | -2.571 | 62.183** |
| 43. | (B 9 x R 9) x (MT 67-52 x T 12) | -1.408 | -25.275 |
| 44. | (B 9 x MT 67-52) x (R 9 x T 12) | 2.104* | 18.233** |
| 45. | (B 9 x T 12) x (R 9 x MT 67-52) | 1.059 | 39.591 |

* Significant at 5 % level of probability
** Significant at 1 % level of probability