https://doi.org/10.29321/MAJ.10.A02834

Madras agric J. 67. (5) : 295–299 May 1980

A Study on Heterosis in Sesamum (*Sesamum indicum L*)

TILAK RAJ GUPTA[1]

Heterosis for yield and three yield components, viz. capsules per plant, branches per plant and plant height was studied in 30 crosses involving six varieties of sesamum (*Sesamum indicum L.*) Significant heterosis for yield was observed in 13 and 6 crosses over mid- and better parent respectively. The hybrid TS 15-72×Til black gave the highest heterosis over mid-(69.86%) and better parent (59.96%) followed by TS 15-72×Kalanag with respective values of 57.14% and 30.69%. The heterosis in yield was due to simultaneous heterosis for a number of yield components. The cross TS 15-72×Til black recorded significant heterosis over both mid-and better parent for grain yield, capsules per plant, branches per plant and plant height. Heterosis over better parent could be used as criterion in future breeding programme.

Sesamum is an important oilseed crop of India but the yield levels are low. Srivastava and Singh (1968) reported heterosis in yield and other plant characters in sesamum. Sarathe and Dabral (1969) studied 13 characters in seven F_1 hybrids Heterotic effects were greatest for leaf area, capsules per plant and grain yield. Murty (1975) reported heterosis was the highest for seed yield (33%) followed by number of capsules per plant. (16%). Heterosis was small for earliness, plant height and number of primary branches while it was not significant for number of secondary branches. The present study was taken up to evaluate the extent of heterosis for yield and yield components in 30 crosses of sesamum involving six parents in complete diallel.

MATERIAL AND METHODS

Six sesamum varieties, Pb *til* No. 1, Shahabad, Kalanag, Bahadurpur II, *Til* black, and TS 15-72, were crossed in all possible combinations including reciprocals. Pb *til* No. 1 is a popular variety in Punjab. Shahabad, Kalanag, Bahadurpur II and *Til* black are local collection from different regions of Himachal Pradesh and Punjab. TS 15-72 is a selection from local material Thirty six entries, including six parents, 15 F_1 S and 15 reciprocals, were grown in randomised block design with four replications. Each plot consisted of one row of 3m length. Observations were recorded on five plants in a row for plant height, number of branches, capsules per plant and grain yield. To test the performance of F_1 hybrids, heterosis was calculated over both the mid-parent and better parent. The mid-parent heterosis (MP) was computed as the F_1 mean minus mid-parent mean divided by mid-parent mean and multiplied by 100. Similarly the better parent heterosis (BP) was computed as

1. Regional Research station, Punjab Agricultural University, Gurdaspur.

the F_1 mean minus better parent mean and multiplied by 100.

RESULTS AND DISCUSSION

The analyses of variance for yield and its components exhibited significant differences. This showed that parents and hybrids differ from each other. Heterosis in percentage in F_1 hybrid over mid-parent and better parent is given in (Table I).

Grain yield:

In thirteen combinations, F_1 hybrids produced significantly higher yield than mid-parent. The extent of heterosis varied from - 53.66% (*Til* black × Shahabad) to 69.86% (TS 15-72 × *Til* black). In six crosses F_1 hybrids significantly exceeded the better parent, the maximum increase being 56.96% for the cross TS 15-72 × *Til* black.

Capsules per plant:

Two cross combinations, Kalanag × *Til* black and TS 15-72 × *Til* black, exhibited significant heterosis over mid-parent and one over better parent, the maximum increase over mid-and better parent being 32.54 and 31.73% respectively both in TS 15-72 × *Til* black.

Branches per plant:

Significant heterosis was revealed by fourteen cross combinations over mid-parent; out of this eleven out performed the better parent. The range was from-27.84 to 22.33% over mid-parent and from-23.73 to 21.15% over better parent.

Plant height :

Thirteen cross combinations showed significant increase over mid-parent. The highest value (10.79%) was in cross *Til* black × Shahabad. In four crosses significant increase over better parent was observed. The highest increase of 6.94% was in cross *Til* black × Shahabad followed by Pb *til* No. 1 × Shahabad with 5.64% increase. Six hybrids, Kalanag × Pb *Til* No. 1, Kalanag × Shahabad. Kalanag × *Til* black, *Til* black × TS 15-72 TS 15-72 × Kalanag and TS 15-72 × *Til* black, showed significant yield heterosis over better parent. However, only four (Kalanag × Pb *Til* No. 1, Kalanag × Shahabad, Kalanag × *Til* black TS 15-72 × Kalanag) showed significantly higher number of branches per plant. One hybrid, TS 15-72 × *Til* black, exhibited higher number of branches, capsules per plant and plant height. Thus yield heterosis in most of the hybrids may be attributed to favourable expression of branches/plant, while hybrid TS 15-72 × *Til* black revealed the maximum heterosis for yield and yield components, branches per plant capsules per plant and plant height. The reciprocal cross of this had shown heterosis for yield only. This indicated that there were reciprocal differences in the expression of heterosis.

The extent of heterosis was measured in two ways i.e. over mid-parent and better parent values in the present investigation for yield and yield components. The overall yield heterosis was 56.96% over better parent in the

present study while 33.2% and 66.2% were observed by Murty (1975) and Riccelli and Mazzani (1964). The differences in heterosis might be due to several reasons such as, (i) Genetic diversity of the parents used, (ii) agronomic conditions in the experiment particularly soil type and plant spacing and (iii) non-allelic interaction on which can either increase or decrease the expression of heterosis.

The heterosis for yield in most cases was due to simultaneous heterosis for number of branches and plant height either over mid-parent or over both mid-and better parent. The hybrid, TS 15-72 × *Til* black, recorded significant heterosis over both mid- and better parent in all the characters under study. It showed maximum heterosis for grain yield (69.89, 56.96%) and capsules per plant (32 54, 31.73%). The next best hybrid was Kalanag × *Til* black. Delgado(1972) reported that out of 16 F_1 hybrids between shattering and non shattering cultivars and selections, six hybrids outyielded their best parents by 200 to 275%. In another study by Kotecha and Yermanos (1978) in 8 × 8 diallel set, F_1 hybrids exceeded their better parent in seed yield upto 238%. Fonseca and Patterson (1968) emphasised that in the utilization of heterosis in commercial crops, only the vigour in excess of that of the better parent is of significance. In sesamum, this holds true and in future breeding programme, heterosis over better parent should be used as the criterion. Heterosis for number of capsules per plant number of branches and plant height was reported by Srivastava and Singh (1938). High heterosis over better parent for seed yield per plant, Capsules per plant and capsule length has been found by Srivastava and Prakash (1977) in 6 F_1s from 4 parents. The present study also revealed that significant heterosis for yield and yield components in a number of crosses was due to favourable action and interaction of genes for branches/plant and plant height.

Considerable range of exploitable heterosis is available in the material under study. Sesamum is predominantly a self-pollinated crop. The built in floral structure and breeding behaviour with respect to free and unrestricted movement of pollen from one plant to another make commercial seed production very complicated and costly. Very little information on genetic and chemical control like gametocides is available on sesamum crop. However, Brar and Yermanos (1974) (quoted by Gurdip and Ahuja, 1979) reported that the functional male sterility was exhibited under field conditions by several lines and controlled by a single recessive gene pair. The anthers in these lines due to short filements of their stemens always remained below the stigma and they either failed to produce functional pollen or did not dehisce at maturity to shed pollen. The same lines grown under different environmental conditions in green houses produces normal stamens and regular capsules/set. In this system the seed of the male sterile lines could be produced in the green

house and that of hybrid seed in the field under environmental conditions suitable for the expression of male sterility. This shows that more research is needed for the commercial production of F_1 hybrids in sesamum.

REFERENCES

DELGADO, M. A. 1972, Yield components of sesame under different plant population densities, M. Sc. Thesis, University of California, Riverside, U.S.A.

FONSECA, S. and F L. PATTERSON. 1968 Hybrid vigour in seven-parent diallel cross in common winter wheat. *Crop Sci.* 6: 382-83.

GURDIP. S. and K. L. AHUJA. 1979. Sesame, its culture, genetics, Breeding & biochemistry Annual Res. Plant Science, New Delhi, India.

KOTECHA, A. D. and D. M. YERMANOS. 1978. *Agronomy Abstracts* pp. 55.

MURTY, D. S. 1975. Heterosis, combining ability and reciprocal effects for agronomic and chemical characters in sesame. *Theoretical and Applied Genetics*. 45: 294-99.

RICCELLI, M. and B. MAZZANI, 1964. Manifestationes de heterosisen desarrollow precocidady randimiento delos cruces dialelos de 32 cultivares de ajonjoli. *Agron. Trop. Venezuela* 14: 101-25.

SARATHE, M. L. and K. C. DABRAL, 1969. Heterosis studies in *sesamum orientale* L. *Sci. Culture* 35: 572-73.

SRIVASTAVA, D. P. and S. N. Singh 1968. Heterosis in sesamum. *J. Indian. Bot. Soc*, 4: 79-88.

SRIVASTAVA S. C. and R. PRAKASH 1977 Heterosis in sesame *Curr. Res.* 6(3): 49-51.

TABLE I. Heterosis % in F_1 hybrids of sesamum over mid-parent and better parent value

Seeds	Grain	Yield	No. of capsules per plant		No. of branches/plant		Plant height	
	MP	MP	MP	BP	MP	BP	MP	BP
Pb. Til No. 1 x Shahabad	−18.82	−39.68	−1.23	−17.23	−3.85	−5.25	7.13*	5.64*
„ „ x Kalanag	−19.78	−1.98	1.23	−14.80	14.58*	7.84	7.00	0.31
„ x Bahadurpur II	−38.40	−58.52	−30.43	−47.86	5.15*	−1.92	0.43	−5.35
„ x Til black	1.43*	−10.12	−16.28	−20.69	0.52*	−4.00	−2.35	−2.43
„ x TS 15-72	−37.50	40.30	−70.15	−36.77	−27.84	−32.69	−14.44	−15.77
Shahabad x Pb. Til No. 1	−39.57	−55.55	−20.83	−33.66	−3 85	−15.25	−3.30	−4.73
„ x Kalanag	−10.13	−19 05	−4 40	−491	−1.82	−8 47	5.06*	1.95
„ x Bahadurpur II	−21.19	32.39	−9.06	−20.96	−0.90	−5.08	7·92	2.30
„ x Til black	−18 05	−33.33	−10.38	−21.34	−10.09	−16.95	2.79	2.24
„ x TS 15-72	−21.24	−39.68	−2.53	−14 11	−13.51	−18.64	3.11	3.07
Kalanag x Pb. Til 1	35.80*	8 91*	2.41	−13.81	14.58*	78.4*	2,63*	−1 01
„ x Shahabad	−11.89	20.63*	−6 46	−6.96	14.55*	−1.69	7.80	4.60*
Bahadurpur x Bahadrpur I	−6.14	−26.14	−12 00	−23.86	−10.68	−9.62	32.27	0.82
„ x Til black	20.00*	6 93*	16.58*	2.80	12.87*	11.76*	4.16*	0.55
„ x TS 15-72	17.86*	−1.98	0.61	−10.92	−10.68	−11.54	−1.81	−4.76
Bahadurpur II x Pb. Til. 1	6.33*	−28.40	−9.50	−32.17	13.40*	5.77*	8.47*	2.23
„ x Shahabad	−13.25	−25.57	−8.68	−20.63	9.91*	3.39*	−6.89	8.32
„ x Kalanag	−16.97	−34.66	−11.47	−23·40	8.74*	7.69	−0.68	1.56
„ x Til black	16.86*	−15.34	−3.87	−28.48	17.65*	15 38*	−1.46	−7.06
„ x TS 15-72	17.70*	−1.70	0.13	−21.75	17.31*	17.31*	7.33*	1.71
Til black x Pb. Til No. 1	−10 00	−2.53	−0.44	−5.67	−5.26	−10 00	−3.78	−3.86
„ x Shahabad	−53.66	−61.11	−25·13	−43.21	−17.43	23,73	−9.71	−10.20
„ x Kalanag	4.44*	−6.93	0.82	−11.10	−8·91	−9.80	10.79*	6.94*
„ x Bahadarpur II	−6.66	−49 43	−32.63	−47.53	−8.80	−11.54	−1.22	−6.84
„ x TS 15-72	16.44*	6.59*	−0.64	−1.99	−11.76	−31.46	1.58	1.08
TS 15-72 x Pb. Til No. 1	−25.00	−28 35	−17.27	−22.95	−15.46	−21.15	−0 33	−0.91
„ x Shahabad	−44.04	−57.14	−15.23	−36.25	−13.51	−18 64	−7.26	−7 30
„ x Kalanag	57.14*	30.69*	−33.94	−18.59	22.33*	21.15*	4.87*	1.72
„ x Bahadurpur II	11 93*	−22.73	3 58	−19.05	7.69*	7.69*	9.37	0.74
„ x Til black	69.86*	56.96*	32.54*	31.73*	11.76*	9.62*	5.75*	5.23*
SED	0.46	0.54	2.95	3.40	0.14	0.14	1.99	2.29
CD (P=0.05)	0.91	1.07	5.84	6.73	0 28	0.28	3.94	4.53