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HETEROSIS AND INBREEDING DEPRESSION IN SESAME

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The performance of F_1 hybrids involving 10 varieties of sesame was studied to investigate heterosis for seed yield and eight other component characters. The mid-parent and better-parent heterosis for seed yield ranged from -16.76 to 105 70 and 34 99 to 60 27% respectively. The hybrid JT 66-173 x SH 50 and T 12 x SH 62 exhibited the maximum heterosis for seed yield, the values for which were 105.76 and 60.27% respectively.

The heterosis for seed yield appeared to be due to high manifestation of heterosis for number of capsules/plant which in turn was due to additive action of number of primary branches and secondary branches. Since majority of hyrbids showed inbreeding depression in F_2 it suggested that the heterosis should be exploited in the F_1 itself.

Oil seeds play an important role in agricultural economy of India particularly at this crucial stage when the oils are in short supply Among the different oil seed crops grown in the country sesame (*Sesamum indicum L.*) is the third crop after groundnut and mustard being grown extensively. Though it has high protein (19.3%) and high proportion of methionine (3.4%), the genetic studies made so far to improve yield potential of this crop are very limited Sarathe and Dabral, 1969). In view of high yields obtained by heterosis breeding in many crops like maize, sorghum and pearl millet a study was undertaken to determine the magnitude of heterosis in F_1 and inbreeding depression in F_2 in sesame.

MATERIAL AND METHODS

The materials comprised of 10 varieties *viz*. 'N 128', 'JT 7', 'Patan 64', 'T 13', 'B. local', 'JT 66-173', 'T 12', 'SH 50', 'N 32' and 'Sh 62', and their hybrids crossed in diallel model were raised in randomized block design with four replications during *kharif* season of 1979. In each replication each entry was represented by 14 plants raised in a row of 3.5 m long, spaced 50 cm apart with a plant distance of 25 cm Ten plants from each entry were selected at random in each replication to record observations on days to flower number of primary branches, number of secondary branches, plant height (cm), number of capsules/plant, days to maturity, 1000-seed weight(g), seed yield (g) and oil percentage. The performance of F_1 in terms of percentage increase and decrease over the mid and better parents was calculated to express the extent of heterosis. The F_2 population was raised in *kharif* 1981 and the inbreeding depression was measured as the deviation of mean performance of F_2

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ɜr the mean value of F_1 and was ‹pressed in percentage.

RESULTS AND DISCUSSION

Differences among the parents and F_1 hybrids were substantial for the different characters studied. Table 1* The performance of some of the hybrids in Table 2.

Significant heterosis was observed in both directions in hybrids for all the characters. Negative heterosis over mid-parent for days to flowers, a desirable character was observed upto the maximum of (-19.63% in the cross N 128xSH 62). Tyagi and Singh (1981) also observed similar negative heterosis for this trait upto-12.69%. Dixit (1976) has however, noted a considerable delay in flowering in hybrids of this crop. It was interesting to note that the magnitude of heterosis for days to maturity in desired direction was generally very low. In general, all the hybrids except a few were either late or more or less equal in muturity duration.

In case of number of primary branches value of 84.76% over the better parent was recorded for the cross Patan 64xB. local. The cross T 12 x SH 50 was found to have the highest of 240.00 and 254.62% over the better and mid-parents respectively for number of secondary branches.

The highest value of heterosis over superior parent for plant height recorded was 26.81%. The negative heterosis also indicates the possibility of reducing the height in hybrids. Tyagi and Singh (198) also observed maximum positive heterosis for plant height of 55.08%.

In addition to the above number of capsules / plant and 1,000 - seed weight are the most important yield contributing characters. Since yield is a complex entity depending upon the multiplicative interaction of its various components, it would be interesting to compare the hybrids with respect to these components of yields also. In the present study the manifestation of heterosis in F_1 over the superior parent was maximum of 146. 32% for number of capsules / plant in the hybrid JT 66-173xT 12. For 1,000 seed weight positive and significant heterotic effect over the superior parent was observed in 9 hybrids, the highest value of 25.51% being recorded for the cross T 21xSH 50. The values for seed yield/plant ranged from 7.52 to 25.52 gm in the hybrids. The highest heterotic effect of 60.27 and 105.70% over the superior and mid-parent was recorded for the cross T 12 x SH 62 and JT 66-173 x SH 50 respectively.

In respect of oil percentage, the extent of heterosis was very low ranging from 18 13 to 44.22 over superior parent and -14.88 to 14.08% over midparental value

The above results indicate that maximum heterosis was recorded for

* Values of inbreeding depression in F_2 are not published for want of space and are available with the author

number of secondary branches followed by number of capsules/plant, number of primary branches and seed yield. The detailed examination of these crosses further revealed that the mechanism for the expression of heterosis was more or less similar. Hybrid Patan 64 x B. local which has significant heterosis for seed yield also showed significant heterosis for the component characters like number of primary branches, and number capsules/plant. Obviously, the heterosis for seed yield in this cross seemed to be due to heterotic effects of the above components of yield. Murty (1975) Dixit (1976), have also observed heterosis in seed yield because of simultaneous heterosis in a number of yield components Grafius (1959) has suggested that there may not be any gene for yield *per se* but for the components and as such the yield is an end product of multiplicative interaction between yield components, Generally, hybrids having parents of diverse origin or having different genetic back ground showed high heterotic effects. Murty (1975) has also emphasized the role of genetic diversity for high heterotic respose in this crop. Thus, in this population, heterosis for yield appeared to be mainly due to the number of primary branches, and number of capsules/plant. When inbreeding depression in F_2 was taken into consideration, majority of the crosses which showed significant heterosis in F_1 also showed proportionately highly significant inbreeding depression in F_2 for all the characters, The maximnm depression of 70.86, 56.99, 49 42, 42.01, 34.34, 22.59. 15.21, -18.69 and -12.59 precent we recorded for seed yield, number of secondary branches' number of capsules/plant, number of primary branches, plant height, 1,000 seed weight oil percentage, days to maturity and days to flower respectively. This increased depression may be due to the presence of non-allelic interaction of higher magnitude in the inheritance of these characters. In some of the crosses though there was significant heterosis, no marked depression in F_2 was seen, which indicated that there might be a high proportion of fixable genes in them. Since the vigour was not of retentive nature as indicated by high percentage of inbreeding depression in F_2 for most of the characters, it should be exploited in the F_1 itself.

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Table 1 The mean performance of parents and hybrids and inbreeding despression in a 10 x 10 complete diallel cross in Sesame

Parents and hybids	Days to flower	No of primary branches	Plant height	'No. of capsule/plant	'Days to maturity	'1000 seed weight (gms)	'Seed Yield' (gms)	Oil percentage
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
1	2	3	4	5	6	7	8	9
P_1	69.33	5.23	163.88	65.68	111.53	2.46	6.63	47.31
P_2	54.68	4.20	147.25	55.43	108.78	2.78	14.28	46.14
P_3	58.58	2.60	152.75	70.85	106.18	2.85	8.54	31.07
P_4	48.25	4.05	130.18	65.23	100.70	2.83	12.91	48.26
P_5	52.60	4.10	153.25	81.90	102.98	2.73	15.19	48.85
P_6	59.63	4.13	136.98	64.70	111.88	2.64	6.41	47.17
P_7	46.48	4.48	145.20	64.65	103.53	2.69	14.34	44.75
P_8	51.13	5.38	145.33	81.38	103.08	2.73	17.62	45.35
P_9	64.65	4.18	175.25	66.20	113.18	2.79	11.44	48.63
P_{10}	53.73	4.33	126.88	76.95	101.45	2.85	14.35	31.55
P_1xP_2	54.45	5.60	195.58	105.50	111.00	2.54	14.96	49.05
P_1xP_3	56.73	3.80	193.03	119.33	110.78	2.94	9.35	51.56
P_1xP_4	57.10	6.15	193.38	100.65	102.65	2.55	11.76	49.88
P_1xP_5	55.00	6.28	156.28	117.35	101.08	2.53	21.68	51.09
P_1xP_6	58.75	7.05	183.30	133.23	113.73	2.63	8.85	49.81
P_1xP_7	52.40	6.10	155.93	112.73	109.45	2.53	9.32	41.48
P_1xP_8	53.53	5.73	153.30	103.18	99.03	2.90	13.81	50.17
P_1xP_9	60.58	5.65	190.33	94.83	113.85	2.36	7.52	43.81
P_1xP_{10}	49.45	7.40	150.60	115.98	96.13	2.40	16.96	48.07
P_2xP_3	52.48	4.90	172.95	109.58	99.00	2.79	13.04	50.69
P_2xP_4	51.58	4.60	160.08	154.30	97.68	2.68	18.42	50.89
P_2xP_5	46.38	5.53	163.35	129.23	101.08	2.94	17.14	45.72
P_2xP_6	52.60	6.85	175.15	105.00	107.25	1.58	15.11	49.98
P_2xP_7	54.55	6.38	161.33	140.40	100.88	2.93	19.20	51.84

Table 1 Continued

1	2	3	4	5	6	7	8	9
PxP_8	51.40	5.13	153.95	134.05	86.75	2.88	18.77	48.18
P_2xP_9	53.71	6.30	186.08	129.23	107.38	2.31	11.64	51.27
P_2xP_{10}	50.50	5.85	155.28	142.05	100.30	3.09	16.48	50.73
P_3xP_4	52.54	4.68	188.75	101.35	102.50	3.09	15.86	51.44
P_3xP_5	51.25	7.58	160.01	155.98	98.98	3.12	22.75	50.45
P_3xP_6	59.15	5.88	187.08	119.18	109.00	2.59	8.07	41.80
P_3xP_7	49.00	6.03	162.18	93.98	100.50	2.38	18.85	50.10
P_3xP_8	50.60	6.05	156.98	171.80	101.30	2.79	22.44	51.94
P_3xP_9	56.90	5.90	172.45	118.23	111.38	2.90	12.26	44.56
P_3xP_{10}	50.03	6.40	163.35	143.03	99.20	3.10	22.84	46.80
P_4xP_5	51.15	5.70	158.93	120. 0	99.75	2.99	16.28	50.84
P_4xP_6	58.58	5.40	158.10	80.50	103.20	3.49	9.32	47.38
P_4xP_7	45.98	4.88	158.78	123.13	98.00	3.27	16.28	51.34
P_4xP_8	50.73	6.38	150.90	153.23	99.30	3.34	23.22	51.96
P_4xP_9	55.20	6.18	163.43	90.65	107.75	2.87	11.39	46.40
P_4xP_{10}	52.58	4.98	156.55	97.83	98.35	2.95	17.88	41.85
P_5xP_6	56.60	4.10	172.90	138.60	104.53	2.50	10.16	48.04
P_5xP_7	50.18	2.81	153.60	13 88	99.00	2.65	16.51	41.26
P_5xP_8	47.23	7.20	156.43	149.65	100.50	3.44	25.52	44.22
P_5xP_9	43.90	5.23	160.80	118.45	102.95	3.31	15.34	51.38
P_5xP_{10}	53.27	5.40	153.58	126.80	98.18	2.90	23.70	57.69
P_6xP_7	54.55	6.70	161.88	159.38	100.08	3.14	19.71	51.63
P_6xP_8	54.88	7.53	173.58	149.33	101.00	2.90	24.72	49.96
P_6xP_9	57.35	6.95	192.98	76.90	113.50	3.14	14.33	42.91
P_6xP_{10}	52.88	6.23	173.30	133.15	99.78	2.90	16.49	48.71
P_7xP_8	44.28	4.80	143.38	110.63	99.25	3.23	16.64	50.52
P_7xP_9	51.15	6.10	175.43	121.60	100.48	3.63	22.81	50.62
P_7xP_{10}	48.90	5.75	152.85	102.25	97.00	3.06	23.01	50.42
P_8xP_9	54.02	5.18	177.83	131.95	108.00	3.05	13.71	45.24
P_8xP_{10}	49.30	4.60	142.78	161.85	98.80	2.83	14.84	49.14
P_9xP_{10}	50.23	6.55	126.80	139.90	100.65	2.73	20.01	48.46

(P_1) N 128, (P_2) JT 7, (P_3) Patan 64, (P_5) B local, (P_6) JT 66-173, (P_7) T 12, (P_8) SH 50, (P_9) N 32, (P_{10}) SH 62;
* and * Significant at 1% and 5% level respectively.

Table 2 Per cent heterosis of a few best hybrids over mid-parent (MP) and the better parent (BP)

Characters	Crosses			per cent heterosis MP	BP
Days to flower	N 128	x	SH 62	-19.63**	-7.96**
	N 32	x	SH 62	-15.14**	-6.51
No. of primary branches	Patan 64	x	B local	126.12**	84.76**
	B. local	x	T 12	90 67**	82 68**
No. of secondary branches	T 12	x	SH 50	254.62**	240 00**
	T 12	x	SH 62	177.09**	155.67*
Plant height	J 66-173	x	SH 62	3 .36**	26 81**
	patan 64	x	T 13	33 07**	23 24**
No. of capsules/plant	JR 66-173	z	T 2	149.80**	146.32**
	JT 7	x	T 13	153 70	136.56**
Days to maturity	JT 7	x	Patan 64	-7.88**	-6.76*
	N 128	x	SH 62	-9.73**	-5.24
1000 Seed Weight	T 12	x	SH 50	26. 1**	25.51**
	T 13	x	JT 66-173	27 54**	23 56**
Seed yield	T.12	x	SH 62	60.36**	60. 7**
	JT 66-173	x	SH 50	10 70**	40 28**
Oil percentage	B local	x	T 12	-9.47**	44.22
	JT 7	x	T 12	14.01**	12.36**

* and ** Significant at 1% and 5% levels respectively.