Frontiers in Crop Improvement 1(2) : 165-168 (2013)

COMBINING ABILITY STUDIES FOR YIELD AND YIELD COMPONENTS IN SESAME [*Sesamum indicum* (L.)]

V.M. Sarvaliya, J.J. Savaliya, L.K. Sharma, A.G. Pansuriya and D.S. Kelaiya
Department of Agricultural Botany, College of Agriculture, Junagadh Agricultural University, Junagadh-362001

ABSTRACT

Four lines and eleven testers of sesame were evaluated for general and specific combining ability through line x tester cross analysis. Both additive and non-additive types of gene effects were involved in the control of all the characters under study. The magnitude of additive variance was relatively higher than non-additive variance for all the characters except number of seeds per capsule, oil content and seed yield per plant. Parents viz. ABT 19, AT 92, AT 123, AT 102, AT 119, ABT 25 and AT 124 were found to be good general combiners for seed yield per plant and yield components. The sca effects the cross viz., AT 92 x AT 123, ABT 19 x AT 79, AT 92 x AT 114, ABT 19 x AT 103, G. til 2 x AT 102, AT 90 x AT 127 and ABT 19 x ABT 25 were found promising for seed per plant and yield components.

Key words : *Combining ability, line x tester analysis, sesame.*

The oilseed crops play an important role in agricultural and industrial economy of our country. India occupies a very prominent place in the oilseed map of the world as it produces a large variety of oilseed crops and ranks first in respect of total hectare and production. Sesame (*Sesamum indicum* (L.)) is one of the most important oilseeds crops grown next to groundnut and mustard in India. The information about combining ability is immense help to the plant breeder in the choice of suitable parents for hybridization programme. The nature of gene action has bearing on development of efficient breeding programme. The general combining ability is attributed to additive x additive gene effects, which are fixable, while specific combining ability is attributed to non-additive gene actions, which may be due to dominance or / and epistasis. Therefore, proper understanding of combining ability of parents and gene effects for yield and its components characters could be of greater help in selecting appropriate parents for hybridization and breeding programme.

MATERIALS AND METHODS

A set of 44 hybrids involving four female (AT 90, AT 92, ABT 19 and G. til -2) and eleven males (AT 79, AT 84, AT 102, AT 103, AT 114, AT 119, AT 120, AT 123, AT 124, AT 127 and ABT 125) lines of sesame was made using line x tester mating during kharif-2005. The experimental material, consisting 59 entries including 15 parents and their 44 crosses, was raised in a randomized block design with three replications during kharif-2010 at three locations viz., Instructional Farm, Junagadh, Rajkot and Amreli. Each entry was grown in a single-row plot of 5.00 m length, spaced 20 cm. apart between plants and row spacing being 45 cm. recommended cultural practices were followed uniformly in all the three environments, to raise a healthy crop. Five competitive plants were selected randomly from each plot and observations were recorded for the ten characters, and their averages were used in the statistical analysis. The data were analyzed for combining ability following (1).

RESULTS AND DISCUSSION

The analysis of variance for combining ability pooled over environments (Table-1) revealed that mean square due to environments were highly significant for all the characters except oil content, indicating sufficient diversity among environments. The mean squares due to females were significant for all the traits, whereas mean squares due to males were significant for the most of characters except number of seeds per capsule, number of capsule per plant and oil content. The mean squares due to females x males were significant for all the traits, which indicated the importance of both additive and non-additive gene effects. The interaction mean squares due to females x environments and males x environments were significant for all the traits except number of branches

Table-1: Analysis of variance for combining ability over environments for 10 traits in sesame.

Source of variation	d.f.	Mean squares									
		Days to 50 % flowering	Days to maturity	Plant height	No.r of branches / plant	Capsule length	No. of seeds /capsule	No. of capsule / plant	1000-seed weight	Oil content	Seed yield / plant
Females (Gi.)	3	3064.818**++	1187.194**++	21762.258**++	200.537**++	1.654**++	502.0.70*	32901.724**	1.966**++	5.579*	582.606**
Males (G.j)	10	199.552**++	121.085**++	3006.217**	4.279*	0.231**++	139.236	1838.063	0.277**	2.893	101.122*+
Females x males (Sij)	30	22.516**++	12.920*	436.312**	1.616**++	0.049**	142.813**	1408.819**++	0.070**	1.597**	45.211**++
Environment (E)	2	4057.684**	8336.495**	14902.434**	1.302**	1.488**	1383.719**	43005.09**	20.778**	0.316	2167.585**
Females x Environment (Gi. x E)	6	22.775**++	9.687*	499.733**	5.832**++	0.164**	389.272**	11649.933**++	0.221**	2.843**	351.287**++
Males x environment (G.j x E)	20	10.832*+	4.001*	118.185	0.528	0.040**	35.894	697.462**++	0.017	0.854	34.676**+
(Femalesxmales) x environment (Sij x E)	60	4.471**	1.971	72.972	0.376**	0.010	38.197	141.900**	0.018	0.716	8.590**
Error	258	2.246	7.390	92.717	0.135	0.024	31.221	63.589	0.024	0.619	1.774
$\hat{\sigma}^2$ sca		2.01	1.22	40.37	0.14	0.04	11.62	140.77	0.06	0.098	4.07
$\hat{\sigma}^2$ gca		23.67	9.43	173.51	1.45	0.012	0.05	147.10	0.014	0.022	1.67
$\hat{\sigma}^2$ sca/$\hat{\sigma}^2$ gca		0.08	0.13	0.23	0.10	0.333	232.4	0.96	0.43	4.45	2.44

*, ** Significant at 5 and 1 % levels, respectively, +, ++ Significant at 5 and 1 % levels, respectively when tested against interaction m.s.

per plant, number of seeds per capsule , 1000-seed weight and oil content for males x environments which indicated that estimates of gca and sca variances were highly influence by the environments. The magnitude of gca variance component was higher resulting in lower/which indicated the predominance additive gene action in the expression of all the traits except number of seeds per capsule, oil content and seed yield per plant. Greater importance additive type of gene action for all the attributes suggested that directional selection could be effective and better homozygous lines could be isolated from segregating populations. The predominance of additive gene action has also been reported by (2) for days to 50 % flowering and plant height, (3) for yield components and (4) for oil content.

General combing ability effects of parents (Table-2) revealed that none of the parent proved to be good combiner for all the traits. (5) reported same type of results in sesame. However, the estimates of gca effects showed that female parent AT 92 was good combiner for days to 50 % flowering, days to maturity, capsule length, number of seeds per capsule and test weight, ABT 19 for plant height, number of branches per plant, number of capsule per plant and oil content. Among the male parents AT 102 for days to 50 % flowering, days to maturity and number of capsule per plant, AT 119 for plant height and capsule length, AT 123 for number of branches per plant, number of seeds per capsule and number of capsule per plant and ABT 25 for plant height, number of branches per plant and number of capsule per plant.

For earliness female parents AT 90 and G. til 2 and male parents viz., AT 79, AT 84, AT 103, and AT 114 expressed significant and desirable (negative) gca effect. Thus, female parents AT 92 and ABT 19 and male parents AT 102, AT 119, AT 123 and AT 25 were good general combiner for seed yield and yield attributing characters and parents viz., AT 90, G.til 2, AT 79, AT 84, AT 103, and AT 114 for earliness, which may utilized in crossing programme to generate the genetic variability for effective selection to develop high yielding and early maturing varieties of sesame.

The sca effect depicted that no parent had consistently high sca for all the characters (Table 3) as out of forty four crosses only ten crosses manifested

Table-2 : Estimate of gca effect of parents pooled over environments for seed yield and yield attributing traits in sesame.

Parents	Days to 50% flowering	Days to maturity	Plant height (cm)	No. branche s/plant	Capsule length (cm)	No. of seeds/ capsule	No. of capsule s/plant	1000-seed weight (g)	Oil content (%)	Seed yield plant (g)
Female (lines)										
AT 90	-2.45**	-1.23**	-10.34**	-0.67**	0.07**	0.21	-11.94**	0.06**	0.06	-1.29**
AT 92	-2.89**	-2.59**	-5.51**	-0.72**	0.15**	3.04**	-5.04**	0.15**	0.04	0.40*
ABT 19	8.34**	5.11**	22.05**	2.31**	-0.10**	-2.19**	27.00**	-0.18**	0.23*	3.22**
G. til 2	-3.00**	-1.30**	-6.50**	-0.75**	-0.12**	-1.06	-10.02**	-0.03	-0.33**	-2.32**
SE gi. ±	0.21	0.39	1.37	0.05	0.02	0.79	1.13	0.02	0.11	0.19
Males (testers)										
AT 79	-0.36**	-0.02	0.32	1.04	-0.01	0.32	1.04	-0.01	0.25	-0.71*
AT 84	-0.33**	-0.10*	-1.24	-11.61**	-0.03	-1.24	-11.61**	-0.03	0.24	-1.87**
AT 102	-0.05	0.00	1.49	10.61**	0.01	1.49	10.61**	0.01	-0.31	1.22**
AT 103	-0.19*	0.04	1.21	-2.75	-0.00	1.21	-2.75	-0.00	-0.15	-1.44**
AT 114	-0.40*	-0.04	0.11	-7.43**	0.09*	0.11	-7.43**	0.09*	0.05	-1.76**
AT 119	0.03	0.13**	2.16	3.04	-0.01	2.16	3.04	-0.01	0.29	1.31**
AT 120	0.02	-0.16**	-2.40*	-6.22**	-0.13**	-2.40*	-6.22**	-0.13**	-0.61**	-2.16**
AT 123	0.19*	0.01	3.53*	8.53**	-0.16**	3.53*	8.53**	-0.16**	0.12	2.40**
AT 124	0.48**	0.01	-2.30	-1.89	0.07*	-2.30	-1.89	0.07*	0.25	0.52
AT 127	-0.04	0.07*	-2.16	-1.21	0.14**	-2.16	-1.21	0.14**	0.03	0.26
ABT 25	0.70**	0.05	-0.72	8.28**	0.03	-0.72	8.28**	0.03	-0.16	2.22**
SE g.j ±	0.09	0.04	1.32	1.88	0.04	1.32	1.88	0.04	0.19	0.31

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

Table-3 : Promising hybrids showing high specific combining ability effects for seed yield and yield attributing traits across the environments.

Crosses	Days to 50 % flowering	Day to maturity	Plant height (cm)	No. of branches per plant	Capsule length (cm)	No. of seeds per capsule	No. of capsules per plant	1000-see d weight (g)	Oil content (%)	Seed yield per plant (g)
AT 92 x AT 123	0.84	0.01	4.99	0.52**	0.03	0.42	21.58**	-0.06	0.19	5.76**
ABT 19 x AT 79	1.19	0.31	7.69	-0.18	0.09	-1.58	17.82**	0.04	0.08	3.01**
AT 92 x AT 114	-0.77	-0.02	-1.71	0.07	0.08	7.77**	11.45**	-0.07	0.17	2.66**
ABT 19 x AT 103	2.41**	1.86	12.75*	0.73**	0.08	-0.30	24.89**	-0.01	0.46	2.56**
G. til 2 x AT 102	0.02	-0.54	6.58	0.39*	0.15*	5.70*	8.97*	0.01	-0.01	2.55**
AT 90 x AT 124	-0.36	-0.03	1.60	-0.12	-0.04	-2.51	9.26*	-0.06	0.07	2.30**
AT 90 x AT 127	1.23	2.56*	10.61*	0.49*	0.03	2.55	10.07*	0.02	-0.06	2.12**
ABT 19 x ABT 25	-5.98**	-3.14*	-8.80*	0.12	0.04	5.02*	4.68	0.01	-0.08	2.05**
AT 90 x AT 119	-0.61	0.23	-1.35	0.04	0.06	-3.17	9.37*	0.00	0.21	1.95**
ABT 19 x AT 84	1.38*	0.67	13.48**	0.05	0.67	-0.28	4.24	-0.17*	-0.14	1.67*
G. til 2 x AT 127	-0.78	-0.71	0.73	0.68**	0.03	-3.36	2.16	-0.14*	0.63	1.33*
G. til 2 x AT 127	-0.78	-0.71	0.73	0.68**	0.03	-3.36	2.16	-0.14*	2.16	-0.14*
S.E. Sij ±	0.50	0.91	3.21	0.12	0.05	1.86	2.66	0.05	2.66	0.05

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

significant and positive sca effect for seed yield per plant. The hybrid AT 92 x AT 123 showed the highest significant for seed yield per plant and yield related traits and other hybrids exhibiting higher and significant positive sca effects were viz., AT 90 x AT 127 and ABT 19 x AT 103. These crosses involved parents with good x good, poor x good and good x poor gca effects. The cross ABT 19 x ABT 25 recorded good sca effect for early flowering and early maturity and number of seeds per capsule, which included poor x poor gca effect for earliness, poor x average gca effects for seeds per capsule. The cross, G. til 2 x AT 102 recorded high sca effect for number of branches per plant, capsule length, number of seeds per capsule, number of capsules per plant and seed yield per plant, which included poor or average female parent and good or average male parent for all these yield components. While the cross G til-2 x AT 127 (poor x poor) was found to be good specific combiner for number of branches per plant. The high sca effect for seed yield per plant was due to desirable sca effect of component characters viz., number of branches per plant, number of capsules per plant and number of seeds per capsule. Since additive and non-additive components genetic variance were important for all these traits, exploitation of both types of gene action would be imperative and recurrent selection for hybrid varieties would prove most effective.

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Received : May-2013; Revised : May-2013; Accepted : June-2013