STABILITY ANALYSIS IN SESAME [*Sesamum indicum* L.]

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ABSTRACT

Stability for seed yield performance and genotype x environment (G x E) interaction was studied in 45 genotypes (Nine diverse parents and their 36 hybrids made by using half diallel mating design) of sesame by evaluating them in four different environments [(two locations, Junagadh and Nana Kandhasar and two dates of sowing, February 20 and March 10, 2016 at Junagadh and February 22 and March 12, 2016 at Nana Kandhasar)] following randomized block design with three replications during summer 2016. Single parent (AT 345) and eleven hybrids (AT 238 x AT 345, AT 282 × GT 10, AT 164 × AT 238, AT 345 × China, AT 255 × Nesadi Selection, AT 345 × GT 10, China × GT 10, Nesadi Selection x GT 1, AT 255 x GT 10, AT 255 x GT 1 and AT 282 × AT 345) expressed their stability across the environments for seed yield per plant across the environments due to their high seed yield per plant, non-significant regression coefficient (b_i) and deviation from linear regression (S^2d_i). The hybrids, AT 238 × GT 1, AT 238 x GT 10, AT 255 x China, AT 255 x AT 345 and China × GT 1 were having more seed yield per plant and had the least deviation from linear regression, but significant regression coefficient (bi >1) and thus, found to be highly responsive to better environments. The highest yielding stable parent, AT 345 (7.07 g), which was found to be stable for seed yield per plant was also found stable for plant height, number of branches per plant and harvest index. Stable hybrids with respect to seed yield per plant also showed stability for one or more component traits like days to flowering, days to maturity, plant height, number of branches per plant, number of capsules per plant, number of seeds per capsule, 1000 seed weight, biological yield per plant, harvest index and oil content. This indicated that stability of various component traits might be responsible for the observed stability of various hybrids for seed yield per plant. Hence, chances of selection of stable hybrids for yield could be enhanced by selecting for stability for yield components.

KEY WORDS: Environment, Genotype x environment interaction, Sesame, Stability

INTRODUCTION

Sesame (*Sesamum indicum* L., 2n = 26) is a very ancient oilseed crop grown next to groundnut, rapeseed and mustard in India. It belongs to the order *Tubiflorae*, family *Pedaliaceae*. It is basically considered a crop of tropical and sub-tropical regions, but it also spread to the temperate parts of the world. Africa has been considered to be the primary centre of origin of sesame and it spread early through West Asia to India, China and Japan, which themselves became secondary distribution centres (Weiss, 1983). Out of 36 species have been identified in sesame, of which 22 species have been found in Africa, five in Asia, seven in both Africa and Asia and one species each in Crete and Brazil (Kobayashi *et al* 1990). Sesame is called as the "***Queen of Oilseeds***" because of its excellent qualities of the seed, oil and meal. Generally, the oil content in sesame ranges from 34 to 63 per cent (Were *et al.,* 2006).

At present, Myanmar is the largest producer of sesame seed in the world followed by India, China, Turkey and Pakistan in Asia; Egypt and Sudan in Africa; Greece in Europe; Venezuela, Argentina and Columbia in South America; Nicaragua and El-Salvador in Central America; and Mexico and the U.S.A. in North America. India is still the world leader with maximum (25.80 %) production from the largest (29.30 %) area and the highest (40.00 %) export of sesame in the world. In India, during 2015-16, sesame is cultivated in an area of 17.46 lakh ha with a production of 9.11 lakh tones annually and productivity of 474 kg/ha (Anon., 2016). Being the fourth most important oilseeds crop in Indian agriculture, it is widely cultivated in the states of Uttar Pradesh, Rajasthan, Orissa, Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka, West Bengal, Bihar and Assam. In Gujarat, during 2015-16, sesame is cultivated in an area of 2.56 lakh ha with a production of 1.52 lakh tones and productivity of 530 kg/ha (Anon., 2016).

Genotype and its interaction with prevailing environment is the basic factor determining the final yield. The genotype x environment interaction is particularly important in the expression of quantitative characters, which are controlled by polygenic systems and are greatly modified by the environmental influences. Thus, in order to have unbiased estimates of various genetic components, it is imperative that the experiment should be repeated over different environments. Crop yield in which the plant breeder is most interested is dependent on the genotype, the environment and the interaction between genotype and environment. The result of the genotype x environment interaction is expressed as adaptability and stability of the genotype. When interaction between genotype and environment exists, ranking of genotype will be different under different environments. The stability of productivity is, therefore, very important. Hence, it is always desirable to study the stability of hybrids in respect of economically important characters. The estimates of genotype x environment interactions give an idea of stability or buffering ability of populations under study. The present investigation was, therefore, planned to measure the genotype x environment interaction and to estimate stability parameters for grain yield and its components in sesame.

MATERIALS AND METHODS

The experimental material comprised of 36 crosses developed from 9 diverse parents using half diallel mating design. The materials was evaluated in a Randomized Block Design with three replications in four different environments [two locations, Junagadh and Nana Kandhasar and two dates of sowing, February 20 and March 10, 2016 at Junagadh and February 22 and March 12, 2016 at Nana Kandhasar] during *summer* 2016. Each entry was sown in single row of 3.0 m length with a spacing of 45 cm between row and 15 cm between plants within the row. Five competitive plants per genotype in each replication in each environment were selected randomly for recording observations on different characters *viz*., days to flowering, days to maturity, plant height (cm), number of branches per plant, number of capsules per plant, height to first capsule (cm), length of capsule (cm), width of capsule (cm), number of capsule per leaf axil, number of seeds per capsule, 1000 seed weight (g), seed yield per plant (g), biological yield per plant (g), harvest index (%) and oil content (%). The data were analyzed for G x E interactions and stability parameters following the model of Eberhart and Russell (1966).

RESULTS AND DISCUSSION

The pooled analysis of variance (Table 1) revealed that the mean squares due to genotypes were found significant for all the characters studied. The mean squares due to environments were found significant for all the characters studied except number of capsules per leaf axil when tested against pooled deviation. G x E interactions were found highly significant for number of capsules per plant and height to first capsule when tested against pooled deviation. This suggested that genotypes interacted significantly in different environments for these traits. The mean squares due to environments (linear) were also noted highly significant difference for all the characters studied except number of capsules per leaf axil when tested against pooled error, suggesting that differences between environments were considerable for all these traits and these traits were influenced greatly by environment indicating thereby that large differences between environments along with the greater part of genotypic response was a linear function of environment. This also indicated that environments created by sowing dates and location was justified and had linear effects. The coincidence of genotypic performance with environmental values was observed for days to flowering, plant height, number of branches per plant, number of capsules per plant, height to first capsule, length of capsule, width of capsule, number of capsules per leaf axil, number of seeds per capsule, seed yield per plant, biological yield per plant and harvest index (%), as evident by significant G x E (linear) mean squares when tested against pooled deviation, indicating that performance of genotypes over environments could be predicted reasonably for these traits. Mean squares due to pooled deviation were significant for number of branches per plant, number of capsules per plant, height to first capsule and harvest index, which suggested that prediction of performance of genotypes over environments based on regression analysis for these traits, might not be very reliable. The results, in general, are in agreement with those of Kumar *et al.* (2013), Chemeda *et al.* (2014), Sedeck *et al.* (2014), Abd El-Rhman *et al.* (2015), Khan *et al.* (2015), Misganaw *et al.* (2015), Raikwar (2016) and Misganaw *et al.* (2017) reported in sesame for stability analysis.

The stability of performance is one of the most desired characters of a genotype for wider adaptation. The stability parameters *viz*., mean performance (Xi), regression coefficient (bi) and deviation from linear regression (S^2di) for parents as well as hybrids were estimated for fifteen characters to assess the relative phenotypic stability of performance over environments.

Recently, interest has been focused on regression analysis. The regression approach was first proposed by Yates and Cochran (1938), which was later modified by Finlay and Wilkinson (1963) was used to interpret the varietal adaption to varying environments. Regression technique was slightly improved by adding one more parameters i.e. deviation from regression by Eberhart and Russell (1966). According to them, both linear (b_i) and non-linear (S^2d_i) function should be considered while judging the phenotypic stability of genotype. Eberhart and Russell (1966) defined a stable genotype as one which produces high mean yield, depicts regression coefficient (b_i) around unity and deviation from regression (S^2d_i) near zero. Later on Breese (1969) and Paroda and Hayes (1971) suggested that linear regression (b_i) should simply be regarded as a measure of response of a particular genotype, whereas the deviation from regression (S^2d_i) as a measure of stability. Mehra and Ramanujan (1979) and Singh and Singh (1980) suggested the methodology to classify different genotypes in to different groups.

It is always justified to breed for genotypes with only high yield potential because of the times the yield potential cannot be expressed. Therefore, a much higher priority should be given to improve yield stability (Ceccarelli, 1989). Stability is genetically controlled characters (Bradshaw, 1965 and Scott, 1967), therefore, one can breed also for stability. Stability for yield may be dependent upon stability of different yield components. Hence, information on the relative stability for different yield components is essential to understand diverse mechanism contributing to yield stability.

Stability in performance is one of the most desirable properties of a genotype for its wide adaptability. The stability parameters *viz*., mean performance (X_i) across the environments, regression coefficient (b_i) and deviation from linear regression (S^2d_i) for parents and hybrids were estimated as per Eberhart and Russell (1966) for 15 characters to assess the relative stability of genotypes over environments and are presented in Table 2 to 4. The perusal of stability parameters for seed yield per plant and other 14 characters revealed that none of genotypes was stable for all the characters which indicated that any generalization pertaining to stability of genotypes for all the traits was not possible. For seed yield per plant, single parent AT 345 and as many as 11 hybrids (AT 238 x AT 345, AT 282 × GT 10, AT 164 × AT 238, AT 345 × China, AT 255 × Nesadi Selection, AT 345 × GT 10, China × GT 10, Nesadi Selection x GT 1, AT 255 x GT 10, AT 255 x GT 1 and AT 282 × AT 345) expressed their stability across the environments due to their high seed yield per plant, non-significant regression coefficient (b_i) and deviation from linear regression (S^2d_i). The hybrids, AT 238 × GT 1, AT 238 x GT 10, AT 255 x China, AT 255 x AT 345 and China × GT 1 were having more seed yield per plant and had the least deviation from linear regression, but significant regression coefficient (bi >1) and thus, found to be highly responsive to better environments. The hybrid China x Nesadi Selection having more seed yield per plant and had the least deviation from linear regression, but significant regression coefficient (bi < 1) and thus, was found to be highly responsive to poor environments.

In general, parents found stable for seed yield per plant also depicted their stability of performance across the environments for one or more yield attributing traits. The highest yielding stable parent, AT 345 (7.07 g), which was found to be stable for seed yield per plant was also found stable for plant height, number of branches per plant and harvest index. AT 345 was one of the parents of the four stable hybrids (AT 238 x AT 345, AT 345 × China, AT 345 × GT 10 and AT 282 × AT 345) for seed yield per plant. Its utilization in hybrid breeding would be useful in boosting the yield of sesame.

The eleven stable hybrids for seed yield per plant are listed in Table 5 along with their seed yield per plant and various component traits for which they showed stability. The perusal of the data revealed that the best three stable hybrids for seed yield per plant were AT 238 x AT 345 (9.35 g), AT 282 × GT 10 (9.03 g) and AT 164 × AT 238 (8.41 g). Among these, first ranked stable hybrid, AT 238 x AT 345 was also found to be stable for days to flowering, days to maturity, number of capsules per plant, length of capsule, number of seeds per capsule and teat weight. It also showed stability under favourable condition for width of capsule and under unfavourable condition for height to first capsule and oil content. The second best stable hybrid AT 282 × GT 10 was found to be stable for plant height, number of branches per plant, biological yield and harvest index. It also showed stability under favourable environment for length of capsule. The third ranked stable hybrid, AT 164 × AT 238 was found to be stable for days to flowering, days to maturity and number of seeds per capsule. It was also highly responsive to favourable environments for length of capsule, 1000 seed weight and biological yield per plant and to unfavourable environments for oil content.

In general, hybrids identified as stable for seed yield per plant also showed stability for one or more component traits like days to flowering, days to maturity, plant height, number of branches per plant, number of capsules per plant, length of capsule, number of seeds per capsule, 1000 seed weight, biological yield per plant, harvest index and oil content. This indicated that stability of various component traits might be responsible for the observed stability of various hybrids for seed yield per plant. Hence, chances of selection of stable hybrids for yield could be enhanced by selecting for stability for yield components. Grafius (1959) also observed that stability of grain yield might be due to the stability of various yield components.

The stability parameters for component traits revealed that none of the parent and hybrid (genotype) was stable for all the traits. The stability parameters for component traits revealed that 13, 20 and 5 genotypes turned out to be stable each for days to flowering, days to maturity and height to first capsule, respectively with low mean values (negative values were considered desirable for these traits), non-significant regression coefficient and deviation from linear regression. Out of 45 genotypes (9 parents + 36 hybrids), 17, 11, 4, 9, 4, 4, 13, 18, 10, 16 and 12 genotypes were found to be stable for plant height, number of branches per plant, number of capsules per plant, length of capsule, width of capsule, number of capsules per leaf axil, number of seeds per capsule, 1000 seed weight, biological yield per plant, harvest index and oil content, respectively with high mean, non-significant regression coefficient and deviation from linear regression.

Traits wise result of genotypes showing specific adaptation to favourable (better management condition) and unfavourable (poor management condition) environments revealed that 4 and 6 genotypes for days to flowering, 2 and 2 genotypes for days to maturity, 0 and 6 genotypes for plant height, 3 and 1 genotypes for number of branches per plant, 3 and 0 genotypes for number of capsules per plant, 2 and 10 genotypes for height to first capsule, 5 and 3 genotypes for length of capsule, 6 and 4 genotypes for width of capsule, 2 and 1 genotypes for number of capsules per leaf axil, 8 and 3 genotypes for number of seeds per capsule, 3 and 2 genotypes for 1000 seed weight, 8 and 2 genotypes for biological yield per plant, 5 and 3 genotypes for harvest index and 1 and 3 genotypes for oil content were found to be highly responsive to favourable and unfavourable environments, respectively. The potential yield of each genotype can be realized under a particular set of agronomical practices. Hence, it is suggested that in order to identify stable genotypes, actual testing under variable environments including favourable and unfavourable would be advantageous. During selection, the attention should be paid to the phenotypic stability of characters directly related to seed yield per plant *viz*., plant height, number of branches per plant, number of capsules per plant, height to first capsule, length of capsule, width of capsule, number of seeds per capsule and 1000 seed weight for seed yield per plant in sesame.

CONCLUSION

From the foregoing discussion, it is clear that parent, AT 345 (7.07 g) was found to be stable for seed yield per plant, plant height, number of branches per plant and harvest index, should be given due importance while formulating breeding programme aiming to develop high yielding and stable hybrids in sesame. The best three stable cross combinations for seed yield per plant and important yield components *viz*., AT 238 x AT 345, AT 282 × GT 10 and AT 164 × AT 238 could be exploited for rational improvement in yield of sesame.

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Table 1: Analysis of variance for phenotypic stability for different characters in sesame

Sources of variation	d.f.	Characters							
		Days to Flowering	Days to maturity	Plant height (cm)	Number of branches per plant	Number of capsules per plant	Height to first capsule (cm)	Length of capsule (cm)	Width of capsule (cm)
Genotypes	44	15.88**	130.85**	83.22**	2.20**	238.14**	29.53**	0.28**	0.016**
Genotype x Environment	132	1.50	3.57	7.76	0.08	38.16**	2.44**	0.04	0.002
Environments	3	40.08**	95.24**	339.47**	0.58**	813.16**	381.38**	1.14**	0.142**
Environments (linear)	1	120.25**	285.71**	1018.39**	1.74**	2439.49**	1144.15**	3.40**	0.425**
Genotype x Environment (linear)	44	3.29**	2.74	9.43*	0.15**	39.34**	5.27**	0.07**	0.005**
Pooled deviation	90	0.59	3.89	6.77	0.05**	36.73**	1.00**	0.02	0.001
Pooled error	352	1.67	9.49	6.23	0.03	5.93	0.31	0.02	0.001

Table 1: Contd...

Sources of variation	d.f.	Characters						
		Number of capsules per leaf axil	1000 seed weight	Number of seeds per capsule	Seed yield per plant (g)	Biological yield per plant (g)	Harvest index (%)	Oil content (%)
Genotypes	44	1.11**	0.27**	82.01**	8.28**	36.27**	138.02**	1.23**
Genotype x Environment	132	0.01	0.003	4.78	0.19	1.20	5.39	0.05
Environments	3	0.01	0.18**	401.34**	30.16**	101.15**	185.22**	1.36**
Environments (linear)	1	0.03	0.54**	1204.03**	90.48**	303.43**	555.66**	4.09**
Genotype x Environment (linear)	44	0.01**	0.003	8.20*	0.36**	2.33**	10.43**	0.04
Pooled deviation	90	0.005	0.002	3.01	0.10	0.62	2.80**	0.05
Pooled error	352	0.005	0.003	5.13	0.18	0.57	1.74	0.52

**** and ** significant at 5 and 1 per cent level probability, respectively***

Table 2: Stability parameters of different genotypes for days to flowering, days to maturity, plant height (cm), number of branches per plant and number of capsules per plant in sesame

Sr. No.	Genotypes	Days to flowering			Days to maturity			Plant height (cm)			Number of branches per plant			Number of capsules per plant		
		Mean	b_i	S^2d_i	Mean	b_i	S^2d_i	Mean	b_i	S^2d_i	Mean	b_i	S^2d_i	Mean	b_i	S^2d_i
Parents																
1	AT 164	36.35	-0.18**	-1.66	84.55	0.74	-3.34	55.42	2.35**	-2.15	3.64	4.21	0.20**	41.77	1.27**	-5.75
2	AT 238	36.60	-0.50**	-1.36	86.48	1.84	-2.32	50.61	1.82**	-4.42	1.93	-1.28**	-0.02	37.47	1.67	59.43**
3	AT 255	37.85	-0.31**	-1.66	86.75	1.14	-7.71	58.98	2.27**	-4.70	1.89	-0.50*	-0.01	34.77	1.42	39.52**
4	AT 282	34.60	0.34**	-1.55	80.20	-0.03	-4.05	57.17	1.19	-4.17	1.74	0.23*	-0.02	37.63	0.80	-2.92
5	AT 345	34.35	-0.45**	-1.65	89.20	2.04*	-8.17	64.82	1.46	-3.27	3.60	0.34	-0.01	54.75	2.59	46.15**
6	China	32.00	-0.47**	-1.25	83.75	0.48	-7.29	63.82	1.72	-0.90	1.01	0.07**	-0.03	33.20	1.20	15.91**
7	Nesadi Selection	27.40	-0.10**	-1.56	71.35	0.001*	-8.00	53.16	1.52**	-5.79	2.47	1.41	0.01	28.88	0.83	-0.62
8	GT 1	34.30	1.12	-1.22	79.88	1.77*	-8.81	57.17	1.18	-3.59	2.25	-0.28**	-0.02	35.83	-0.03	71.11**
9	GT 10	39.55	-1.88**	-1.15	106.20	0.39*	-9.09	69.26	1.59	-1.70	4.91	1.74	0.02	51.08	3.35*	65.86**
Hybrids																
10	AT 164 x AT 238	35.15	1.03	-1.52	78.25	1.51	-8.40	67.08	1.00	-5.19	4.10	11.70**	0.42**	43.10	3.19	139.45**
11	AT 164 x AT 255	36.40	1.53	2.24*	79.48	1.12	-9.33	66.80	0.39**	-6.00	2.10	1.80	-0.02	38.37	0.79	-3.02
12	AT 164 x AT 282	34.50	2.15*	-1.10	79.75	1.65	-7.58	66.81	0.43*	-4.75	2.37	0.41*	-0.02	34.43	0.27	8.83*
13	AT 164 x AT 345	34.25	0.65	-1.54	82.30	1.71	5.46	63.67	0.91	-5.66	2.94	3.08**	-0.02	34.95	0.94	18.88**
14	AT 164 x China	34.95	-0.16**	-1.41	84.25	0.31	-8.41	66.90	0.66	-5.18	2.07	0.14*	-0.02	34.83	0.52	5.41
15	AT 164 xNesadi Selection	33.55	1.75	-0.45	82.00	0.93	-4.10	59.20	0.96	-5.30	2.30	1.25	0.03*	35.10	-0.25	94.07**
16	AT 164 x GT 1	34.40	2.54**	-1.39	81.70	0.26	6.03	63.11	0.33*	-3.62	2.23	2.32	0.01	27.27	0.87	0.58
17	AT 164 x GT 10	35.05	1.06	-1.35	87.60	1.73	-5.84	62.87	1.68	-2.94	3.02	-0.13	0.37**	46.24	1.82**	-5.12
18	AT 238 x AT 255	34.45	1.53*	-1.51	81.55	1.07	-7.30	61.79	0.82	19.58**	2.76	2.88**	-0.02	31.87	0.53	3.18
19	AT 238 x AT 282	35.25	2.98**	-1.47	77.80	1.20	-5.75	59.23	1.48	-3.11	2.48	0.12	-0.01	28.40	0.46**	-5.87
20	AT 238 x AT 345	34.55	0.51	-1.44	77.70	1.50	-8.02	64.23	0.28	6.65*	3.24	0.71	0.14**	41.00	1.17	-2.46
21	AT 238 x China	35.75	-0.48**	-1.48	81.05	0.23	-7.25	65.12	0.69	-4.12	1.83	-0.07*	-0.02	38.28	1.32	15.09**
22	AT 238 xNesadi Selection	33.85	0.48	-1.37	74.60	0.65	-8.32	59.40	0.68	-2.27	2.38	0.40	0.04*	32.37	0.21	49.47**
23	AT 238 x GT 1	34.60	1.33	-0.56	77.38	0.92	-7.39	64.14	-0.36*	3.34	2.48	-0.12**	-0.02	36.59	1.28	9.47*

Table 2: Contd...

Sr. No.	Genotypes	Days to flowering			Days to maturity			Plant height (cm)			Number of branches per plant			Number of capsules per plant		
		Mean	b_i	S^2d_i	Mean	b_i	Mean	b_i	Mean	b_i	Mean	b_i	S^2d_i	Mean	b_i	S^2d_i
24	AT 238 x GT 10	35.15	0.55*	-1.53	90.70	2.24*	-7.18	71.69	-0.23	33.70**	3.25	0.96	-0.02	49.83	2.51	262.97**
25	AT 255 x AT 282	35.00	0.87	-1.61	84.75	0.28	-8.48	64.13	1.27	-3.02	2.24	0.18*	-0.02	28.88	0.77	6.60*
26	AT 255 x AT 345	35.83	2.04**	-1.52	81.65	2.05**	-8.92	67.09	0.77	-1.77	2.98	0.17	0.26**	46.65	0.29	48.46**
27	AT 255 x China	36.60	1.09	0.06	83.20	0.83**	-9.49	66.14	0.41	-4.10	2.68	-0.04	0.01	37.05	0.23	25.24**
28	AT 255 x Nesadi Selection	33.55	0.31**	-1.66	75.95	0.45	-0.56	61.10	1.08	12.54*	2.03	-0.10*	-0.02	28.42	-0.06**	-4.02
29	AT 255 x GT 1	34.20	1.38	-1.52	80.50	1.06	-7.06	60.97	0.19	10.37*	2.07	0.38	-0.02	32.85	0.63	3.69
30	AT 255 x GT 10	36.15	2.22**	-1.39	90.00	-0.28	-4.10	64.57	1.19	-4.03	3.05	1.62	-0.00	50.93	1.32*	-4.63
31	AT 282 x AT 345	34.70	-0.31**	-1.22	83.50	1.89	-5.31	61.29	0.79	7.70*	2.49	0.10**	-0.03	38.62	1.63	24.09**
32	AT 282 x China	34.55	1.24	-0.40	82.90	1.20	-8.59	64.71	1.04	17.19**	2.33	1.70	-0.01	31.28	0.33*	-1.75
33	AT 282 x Nesadi Selection	35.15	1.58	-0.63	75.10	0.79	-8.07	57.02	1.31	-0.08	2.25	0.60	-0.03	26.92	-0.38	22.74**
34	AT 282 x GT 1	35.05	1.39	-1.31	84.30	0.98	-8.34	53.48	1.81	4.80	2.72	0.32	-0.02	25.68	-0.13**	0.96
35	AT 282 x GT 10	36.95	2.26	-0.53	90.45	1.11	-8.05	63.35	0.69	-3.71	3.60	0.81	0.02	56.23	1.57	18.83**
36	AT 345 x China	36.90	2.97**	-1.64	83.75	0.84	-4.98	67.55	0.32*	-3.51	1.73	1.79	0.04*	38.56	0.42	0.24
37	AT 345 x Nesadi Selection	36.70	3.13	2.10*	81.65	1.11	-6.76	64.08	0.74	-0.82	2.03	0.26**	-0.03	30.57	0.11**	-1.28
38	AT 345 x GT 1	36.25	2.67**	-0.72	84.70	0.93	-9.09	63.58	0.42**	-5.78	2.90	-0.22**	-0.02	38.00	1.36	100.74**
39	AT 345 x GT 10	35.45	1.80	0.48	87.50	2.03	-3.13	67.34	0.53	-3.30	3.54	0.24	-0.01	49.61	2.22	112.55**
40	China x Nesadi Selection	38.85	1.53**	-1.56	78.75	-0.50	9.48*	60.14	1.46	1.18	1.19	1.52	0.06**	29.55	1.02	3.39
41	China x GT 1	38.95	0.18**	-1.62	82.50	0.94	-8.12	62.56	2.31	28.90**	1.92	0.234	-0.02	32.52	1.02	-2.26
42	China x GT 10	39.10	0.76	-1.38	91.40	0.77	-5.51	70.78	1.71*	-3.90	3.00	0.19	-0.02	34.07	0.89	42.61**
43	Nesadi Selection x GT 1	36.60	0.24**	-1.67	84.25	0.71	-5.94	61.14	1.41	-4.93	2.15	0.68	-0.01	32.60	1.67	15.50**
44	Nesadi Selection x GT 10	36.90	0.73	-1.32	87.20	0.72	2.69	64.44	0.68	-4.10	2.91	1.09	-0.01	44.98	0.33	55.91**
45	GT 1 x GT 10	35.90	1.87	-0.62	88.10	1.71	-1.51	66.17	0.08	0.33	3.11	2.06*	-0.02	34.42	1.08	39.12**
Mean		35.43	-	-	83.26	-	-	62.76	-	-	2.58	-	-	37.25	-	-
S. Em±		0.65	0.47	-	1.54	0.78	-	1.25	0.55	-	0.14	1.15	-	3.09	0.82	-
C.D. at 5 %		1.81	-	-	4.31	-	-	3.49	-	-	0.40	-	-	8.65	-	-

**** and ** significant at 5 and 1 per cent level probability, respectively***

Table 3: Stability parameters of different genotypes for height to first capsule (cm), length of capsule (cm), width of capsule (cm), number of capsules per leaf axil and number of seeds per capsule in sesame

Sr. No.	Genotypes	Height to first capsule (cm)			Length of capsule (cm)			Width of capsule (cm)			Number of capsules per leaf axil			Number of seeds per capsule		
		Mean	b_i	S^2d_i	Mean	b_i	S^2d_i	Mean	b_i	S^2d_i	Mean	b_i	S^2d_i	Mean	b_i	S^2d_i
Parents																
1	AT 164	13.25	1.00	2.781**	2.67	0.33**	-0.01	0.71	0.03**	-0.001	1.97	20.65	0.13**	51.55	-0.12**	-4.23
2	AT 238	11.18	0.84**	-0.267	2.62	-0.32**	-0.02	0.76	-0.04**	-0.001	2.05	5.33	0.00	62.08	0.64**	-4.82
3	AT 255	14.82	1.56**	0.193	3.03	0.09**	-0.02	0.88	0.49**	-0.001	2.21	4.95	0.03**	64.41	1.26	-4.09
4	AT 282	12.04	0.88	-0.17	2.93	-0.25**	-0.01	0.86	0.28**	-0.001	1.00	0.00	-0.01	52.22	0.44**	-4.97
5	AT 345	12.65	0.89	-0.158	2.65	0.04**	-0.02	0.77	0.02**	-0.001	2.00	3.53**	-0.01	54.87	0.67**	-5.00
6	China	14.03	1.09	0.251	3.53	1.35	0.01	0.74	0.09**	-0.001	2.62	3.83	0.00	61.23	0.93	-4.56
7	Nesadi Selection	9.35	0.60**	0.289*	2.60	0.46**	-0.02	0.72	-0.71**	-0.001	2.48	7.71	0.02**	55.55	0.63**	-4.85
8	GT 1	10.43	0.50*	0.713*	2.67	0.20**	-0.02	0.69	0.09**	-0.001	1.98	0.27	-0.00	54.04	0.84**	-5.06
9	GT 10	19.21	1.20	-0.055	2.50	-0.27**	-0.02	0.67	1.01	-0.001	1.00	0.00	-0.01	52.34	0.43**	-3.92
Hybrids																
10	AT 164 x AT 238	12.40	1.10	0.41*	3.27	2.19**	-0.01	0.94	1.32*	-0.001	1.00	0.00	-0.01	66.37	1.00	-4.85
11	AT 164 x AT 255	8.54	-0.01**	-0.15	3.19	1.65	0.13**	0.82	1.38	0.008**	1.00	0.00	-0.01	65.42	1.42	-1.02
12	AT 164 x AT 282	9.78	-0.08	10.22**	3.23	0.55	-0.00	0.85	0.80	0.002**	1.00	0.00	-0.01	59.88	0.80	-3.86
13	AT 164 x AT 345	11.25	0.60**	-0.29	3.35	1.37	-0.01	0.83	0.19*	0.000	1.00	0.00	-0.01	63.33	1.24**	-5.09
14	AT 164xChina	15.13	1.41*	0.40*	3.37	0.38	0.00	0.83	0.67	-0.001	1.00	0.00	-0.01	63.55	1.85	3.61
15	AT 164 x NesadiSelection	11.96	1.03	0.05	3.15	0.71	0.00	0.76	1.28	0.000	1.00	0.00	-0.01	60.66	1.88*	-2.08
16	AT 164 x GT 1	11.43	0.86**	-0.26	3.19	1.73	0.01	0.76	0.70	0.000	1.00	0.00	-0.01	56.94	0.69	-2.67
17	AT 164 x GT10	18.11	1.63**	0.87**	2.78	1.16	-0.01	0.72	0.79**	-0.001	1.00	0.00	-0.01	58.46	1.05	28.26**
18	AT 238 x AT 255	13.60	0.54**	0.08	3.41	2.38**	-0.00	0.78	2.45**	0.000	1.82	2.28	-0.00	65.18	1.19	-4.65
19	AT 238 x AT 282	9.56	0.32**	-0.23	2.83	1.19	-0.01	0.87	0.78	0.001	1.00	0.00	-0.01	62.18	0.36**	-5.05
20	AT 238 x AT 345	8.27	0.25**	-0.27	3.39	0.76	-0.01	0.88	1.18**	-0.001	1.00	0.00	-0.01	64.43	0.95	-2.29
21	AT 238 x China	13.85	0.53**	-0.07	3.38	0.63**	-0.02	0.91	1.17**	-0.001	1.65	-1.29	0.00	67.94	0.81	-4.58
22	AT 238 x NesadiSelection	11.68	0.83*	-0.17	2.88	1.90**	-0.01	0.76	0.86*	-0.001	1.00	0.00	-0.01	59.67	1.53	-1.38
23	AT 238 x GT 1	14.40	1.41**	0.03	3.06	1.44	-0.01	0.75	0.54**	-0.001	1.83	-2.01**	-0.00	60.25	1.37**	-4.87

Table 3: Contd...

Sr. No.	Genotypes	Height to first capsule (cm)			Length of capsule (cm)			Width of capsule (cm)			Number of capsules per leaf axil			Number of seeds per capsule		
		Mean	b_i	S^2d_i	Mean	b_i	Mean	b_i	Mean	b_i	Mean	b_i	S^2d_i	Mean	b_i	S^2d_i
24	AT 238 x GT 10	17.17	1.25**	-0.24	2.88	0.37*	-0.01	0.76	1.28*	-0.001	1.00	0.00	-0.01	52.75	0.36**	-3.56
25	AT 255 x AT 282	12.09	0.97	-0.24	3.04	2.45**	-0.01	0.75	3.30**	0.000	1.00	0.00	-0.01	61.02	1.73**	-4.01
26	AT 255 x AT 345	14.23	1.49*	0.60*	3.11	-0.28**	-0.01	0.85	1.54**	-0.001	2.10	3.50	-0.00	65.11	1.05	-4.43
27	AT 255 x China	15.17	1.59**	-0.21	3.48	1.38	-0.01	0.90	1.46**	-0.001	2.50	7.25*	0.00	66.86	1.74**	-3.65
28	AT 255 x Nesadi Selection	12.68	1.12	0.69*	3.03	2.87**	-0.01	0.70	1.12	0.000	2.00	2.01	-0.00	58.84	0.97	-4.87
29	AT 255 x GT 1	11.58	0.55**	0.07	3.17	3.19**	-0.01	0.78	0.87	-0.001	1.10	-7.52**	-0.00	63.89	2.03*	1.53
30	AT 255 x GT 10	16.94	1.47**	-0.25	2.79	0.02**	-0.01	0.71	1.10	-0.001	1.00	0.00	-0.01	59.58	2.04	3.80
31	AT 282 x AT 345	16.36	1.09	0.16	2.92	2.05**	-0.02	0.85	0.45**	-0.001	1.00	0.00	-0.01	58.85	0.97	-2.70
32	AT 282 x China	8.37	0.39**	0.07	3.33	1.18	-0.01	0.79	2.67**	-0.001	1.00	0.00	-0.01	63.31	1.69	-1.07
33	AT 282 x Nesadi Selection	12.14	1.05	-0.28	2.98	-0.63**	-0.00	0.72	0.58**	-0.001	1.00	0.00	-0.01	51.58	0.11**	-3.35
34	AT 282 x GT 1	13.21	1.21*	-0.04	3.04	0.88	0.08**	0.82	1.57**	-0.001	1.00	0.00	-0.01	58.01	0.90	-4.57
35	AT 282 x GT 10	17.44	1.78**	0.17	3.08	3.38**	-0.01	0.73	1.04	-0.001	1.00	0.00	-0.01	52.40	0.13	1.79
36	AT 345 x China	13.23	1.67	7.04**	3.27	0.54	0.07**	0.86	0.80	0.004**	1.00	0.00	-0.01	63.09	0.71	1.57
37	AT 345 x Nesadi Selection	13.23	1.37**	-0.29	2.93	1.45**	-0.01	0.77	1.48**	-0.001	1.00	0.00	-0.01	63.99	1.76*	-2.58
38	AT 345 x GT 1	14.08	1.13	2.26**	2.87	1.23	0.01	0.78	1.47**	-0.001	1.00	0.00	-0.01	61.23	0.50	-1.40
39	AT 345 x GT 10	16.21	1.27*	0.10	2.81	2.00	0.03*	0.71	1.33**	-0.001	1.00	0.00	-0.01	54.13	0.98	-2.46
40	China x Nesadi Selection	13.07	0.69**	-0.27	3.25	-0.14**	-0.01	0.84	0.89	-0.001	1.00	0.00	-0.01	63.51	0.30**	-4.84
41	China x GT 1	14.35	1.15**	-0.29	3.23	0.73	0.01	0.82	1.05	-0.001	1.90	-5.51**	-0.00	56.90	0.14	2.90
42	China x GT 10	17.74	1.45	3.95**	3.13	0.75	-0.01	0.78	1.26	0.001*	1.00	0.00	-0.01	62.95	1.35	-1.96
43	Nesadi Selection x GT 1	17.78	1.71	2.55**	2.81	1.77*	-0.01	0.76	1.30	0.000	1.00	0.00	-0.01	59.79	1.22	-4.23
44	Nesadi Selection x GT 10	11.98	0.70	1.61**	2.77	0.22	-0.00	0.74	1.25	0.000	1.00	0.00	-0.01	58.33	0.87	-2.14
45	GT 1 x GT 10	13.68	0.95	-0.15	2.77	-0.08*	-0.00	0.82	1.82**	0.000	1.00	0.00	-0.01	61.03	1.61*	-3.24
	Mean	13.32	-	-	3.03	-	-	0.79	-	-	1.34	-	-	59.99	-	-
	S. Em±	0.78	0.20	-	0.09	0.45	-	0.02	0.28	-	0.04	2.72	-	0.03	0.45	-
	C.D. at 5 %	2.19	-	-	0.26	-	-	0.06	-	-	0.12	-	-	0.08	-	-

*** and ** significant at 5 and 1 per cent level probability, respectively***

Table 4: Stability parameters of different genotypes for 1000 seed weight (g), seed yield per plant (g), biological yield per plant (g), harvest index (%) and oil content (%) in sesame

Sr. No.	Genotypes	1000 seed weight (g)			Seed yield per plant (g)			Biological yield per plant (g)			Harvest index (%)			Oil content (%)		
		Mean	b_i	S^2d_i	Mean	b_i	S^2d_i	Mean	b_i	S^2d_i	Mean	b_i	S^2d_i	Mean	b_i	S^2d_i
Parents																
1	AT 164	3.44	1.58	-0.002	4.49	0.80	-0.14	10.70	0.43*	-0.22	41.77	2.13*	1.62	47.33	0.88	-0.52
2	AT 238	3.46	1.36	0.009**	4.59	0.50*	-0.10	10.99	0.28*	0.10	41.65	1.40	0.54	46.96	2.83	-0.27
3	AT 255	3.40	1.03	0.001	3.95	0.63*	-0.11	10.20	0.35*	-0.05	38.53	1.79	2.83*	48.02	1.05	-0.38
4	AT 282	3.61	0.66	0.007*	5.03	0.67	-0.05	11.97	0.65	-0.35	41.75	0.66	5.01**	47.21	2.65	-0.44
5	AT 345	3.59	1.71	0.006*	7.07	0.35	-0.16	15.18	0.38**	-0.56	46.57	0.06**	-1.71	45.61	0.99	-0.49
6	China	2.49	0.96	0.006*	3.99	0.70*	-0.15	11.74	0.48**	-0.42	33.78	1.81**	-1.73	46.05	1.43	-0.50
7	Nesadi Selection	3.46	1.05	-0.003	3.79	0.77	-0.14	10.56	0.46**	-0.30	35.71	2.24**	-1.18	46.65	0.90	-0.48
8	GT 1	3.54	1.03	-0.002	4.12	0.69*	-0.14	10.99	0.24**	-0.56	37.35	1.85	4.82**	48.17	1.43**	-0.52
9	GT 10	3.09	0.31	-0.002	5.86	0.99	-0.16	17.78	1.03	-0.35	32.84	1.09	-1.63	47.67	0.93	-0.49
Hybrids																
10	AT 164 x AT 238	3.75	1.74*	-0.002	8.41	1.52	-0.01	18.83	2.57**	-0.40	45.07	-0.30	18.86**	47.71	0.32*	-0.52
11	AT 164 x AT 255	3.36	1.04	-0.003	5.98	0.72	-0.11	13.11	1.14	1.07*	45.82	-1.13**	-0.96	47.04	1.03	-0.49
12	AT 164 x AT 282	3.39	1.37	-0.001	5.83	0.73**	-0.17	13.06	1.18	-0.10	44.83	-0.27	4.50**	47.48	0.91	-0.21
13	AT 164 x AT 345	3.45	1.17	0.002	5.67	0.71	-0.13	14.95	0.93	0.06	37.91	0.69	-1.07	46.73	2.25**	-0.51
14	AT 164 x China	2.98	1.19	0.007*	5.83	0.83	-0.05	13.05	0.73	-0.08	44.55	1.20	-1.00	46.89	1.37	-0.51
15	AT 164 x Nesadi Selection	3.60	1.10	-0.003	5.20	0.31**	-0.17	11.59	0.16**	-0.22	44.73	1.29	-0.91	46.68	1.50	-0.48
16	AT 164 x GT 1	3.63	1.02	0.001	3.68	0.55*	-0.10	11.39	0.38**	-0.25	32.18	1.59**	-1.19	47.20	0.81	-0.50
17	AT 164 x GT 10	3.15	0.01**	-0.003	4.88	1.31**	-0.18	17.37	1.61**	-0.57	27.61	1.36	-1.01	47.20	1.00	-0.52
18	AT 238 x AT 255	3.46	-0.19**	-0.002	3.86	0.99	-0.17	16.05	1.16	-0.49	23.79	1.22	0.40	47.57	0.73*	-0.52
19	AT 238 x AT 282	3.33	1.01	-0.003	5.40	1.55**	-0.18	12.52	1.16	-0.32	42.52	2.49*	4.25**	47.65	0.70	-0.52
20	AT 238 x AT 345	3.67	1.13	-0.002	9.35	2.18	0.18	20.08	2.12	9.71**	46.49	0.40	2.74*	48.08	0.61*	-0.52
21	AT 238 x China	3.33	1.19	-0.002	5.56	0.86	-0.13	12.05	0.59	-0.14	45.94	1.76	-1.72	47.66	1.16	-0.52
22	AT 238 x Nesadi Selection	3.44	1.15	-0.002	5.11	1.00	-0.15	11.64	0.55*	-0.33	43.56	2.44	-0.93	47.71	0.80	-0.52
23	AT 238 x GT 1	3.42	1.53**	-0.003	8.92	1.65**	-0.06	19.33	1.90**	-0.09	46.16	0.70	0.44	48.03	1.39	-0.52

Table 4: Contd...

Sr. No.	Genotypes	1000 seed weight (g)			Seed yield per plant (g)			Biological yield per plant (g)			Harvest index (%)			Oil content (%)		
		Mean	b_i	S^2d_i	Mean	b_i	Mean	b_i	Mean	b_i	Mean	b_i	S^2d_i	Mean	b_i	S^2d_i
24	AT 238 x GT 10	3.20	0.37	-0.002	7.88	1.62**	-0.11	17.00	2.28**	-0.31	46.55	-0.53**	0.32	46.87	0.91	-0.43
25	AT 255 x AT 282	3.07	0.56	-0.003	5.43	0.73	0.02	12.19	0.64	0.85*	44.52	0.29	0.54	48.03	0.53	-0.51
26	AT 255 x AT 345	3.57	1.42	-0.002	6.82	1.44**	-0.18	14.99	1.71**	-0.43	45.40	0.26**	-1.43	47.59	-0.03	-0.32
27	AT 255 x China	3.11	0.15**	-0.003	6.95	1.38**	-0.18	15.65	1.00	-0.39	44.12	1.70	-0.14	47.16	0.69	-0.52
28	AT 255 x Nesadi Selection	3.55	1.29	-0.003	7.67	0.98	0.01	16.47	1.54**	-0.52	46.72	-0.35	7.58	47.89	1.06	-0.52
29	AT 255 x GT 1	3.19	0.87	-0.002	6.67	1.15	-0.11	14.09	0.98	0.10	47.14	0.88	-1.27	48.05	0.56	-0.46
30	AT 255 x GT 10	3.57	0.43	-0.002	6.68	0.98	-0.12	14.82	0.99	0.32	45.06	0.33**	-1.61	47.42	0.54	-0.51
31	AT 282 x AT 345	3.67	0.82	-0.003	6.05	1.00	-0.13	13.21	1.19**	-0.55	45.65	0.39	1.57	46.67	1.44	-0.52
32	AT 282 x China	3.35	0.53**	-0.003	5.28	1.02	-0.10	12.52	0.91	-0.55	41.80	1.84	3.01	47.59	0.33	-0.50
33	AT 282 x Nesadi Selection	3.11	0.33**	-0.003	5.77	0.62	-0.03	13.14	0.55**	-0.56	43.82	1.08	7.71	46.73	1.98	-0.51
34	AT 282 x GT 1	3.03	0.87	-0.002	5.96	1.22**	-0.18	12.86	1.46*	-0.35	46.33	0.73	4.23	47.28	1.58	-0.51
35	AT 282 x GT 10	3.05	1.25	-0.001	9.03	1.63	0.03	20.25	1.35	-0.11	44.37	1.26	-0.737	46.97	1.43	-0.46
36	AT 345 x China	3.03	1.37	-0.001	7.81	1.33	-0.07	17.30	0.96	-0.43	44.90	1.54*	-0.89	46.88	0.50	-0.51
37	AT 345 x Nesadi Selection	3.38	1.45*	-0.003	4.73	1.42**	-0.17	12.29	1.02	-0.47	37.89	2.61**	2.74*	46.83	0.74	-0.51
38	AT 345 x GT 1	3.52	1.34	-0.003	5.20	1.00	-0.10	12.43	0.60**	-0.41	41.49	2.25**	-1.55	46.90	0.55	-0.49
39	AT 345 x GT 10	3.23	1.61*	-0.003	7.38	1.44	0.03	17.60	1.18	-0.07	41.69	1.40	-0.06	46.85	0.06	-0.49
40	China x Nesadi Selection	2.98	1.70	0.002	6.05	0.06**	0.08	15.43	-0.08**	0.20	39.11	0.81	0.15	46.73	-0.02	-0.49
41	China x GT 1	2.97	0.14*	-0.001	6.59	1.42**	-0.15	21.87	1.74**	-0.24	29.91	1.01	-1.61	46.79	1.83	-0.47
42	China x GT 10	2.99	1.82	0.000	6.99	0.72	0.18	19.13	1.33**	-0.57	36.49	-0.73*	-0.24	47.15	0.23	-0.50
43	Nesadi SelectionxGT1	3.67	1.22	-0.002	6.98	1.23	0.02	14.70	1.67	1.79**	47.69	-0.50**	1.75*	46.51	0.87	-0.15
44	NesadiSelectionxGT10	3.19	0.68	-0.003	5.29	0.87	-0.06	16.78	0.90	0.12	31.38	1.15	-1.53	47.20	0.65	-0.51
45	GT 1 x GT 10	3.42	0.66	-0.003	5.80	0.76	-0.06	16.89	0.64	-0.20	34.16	1.12	-1.60	47.18	0.92	-0.51
	Mean	3.33	-	-	5.99	-	-	14.59	-	-	41.05	-	-	47.21	-	-
	S. Em±	1.13	0.34	-	0.21	0.23	-	0.55	0.30	-	1.16	0.48	-	0.36	0.74	-
	C.D. at 5 %	3.17	-	-	0.60	-	-	1.54	-	-	3.25	-	-	1.01	-	-

**** and ** significant at 5 and 1 per cent level probability, respectively***

Table 5: Stable hybrids for seed yield per plant along with their *per se* performance and showing stability for other component traits in sesame

Sr. No.	Hybrids	Stable for Seed Yield per Plant (g)	Stable for Component Traits
1	AT 238 x AT 345	9.35	DF, DM, NC, HFC^{++}, LC, WC^{+}, NS, TW,OC^{++}
2	AT 282 x GT 10	9.03	PH, NB, LC^{+}, BY, HI
3	AT 164 x AT 238	8.41	DF, DM, LC^{+}, NS, TW^{+}, BY^{+}, OC^{++}
4	AT 345 x China	7.81	PH^{++}, NC, NS, BY, HI^{+}
5	AT 255 x Nesadi Selection	7.67	DM, TW, BY^{+}
6	AT 345 x GT 10	7.38	PH, NB, BY, HI
7	China x GT 10	6.99	PH^{+}, NB, LC, BY^{+}
8	Nesadi Selection x GT 1	6.98	PH, TW
9	AT 255 x GT 10	6.68	PH, NB, TW, BY, HI^{++}, OC
10	AT 255 x GT 1	6.67	DF, DM, HFC^{++}, LC^{+}, OC
11	AT 282 x AT 345	6.05	DF^{++}, TW, HI

+, ++, indicates better for favourable and unfavourable environments, respectively
DF = Days to flowering, ***DM = Days to maturity,***
PH = Plant height (cm), ***NB = Number of branches per plant,***
NC = Number of capsules per plant, ***HFC = Height to first capsule (cm),***
LC = Length of capsule (cm), ***WC = Width of capsule (cm),***
NS = Number of seeds per capsule, ***TW=1000 seed weight,***
BY = Biological yield per plant, ***HI = Harvest index***

[MS received : June 14 , 2018] *[MS accepted : June 17, 2018]*