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Estimation of Genotype × Environment interaction for Yield and Yield Contributing Characters in Sesame (*Sesamum indicum* L.)

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ABSTRACT: An investigation was undertaken to study the "Estimation of Stability Parameter for Yield and Yield Contributing Characters in Sesame (*Sesamum indicum* L.)" to gather information on different variability parameters, genotype × environment interactions and stability parameters. The experimental material comprised of 60 different Varieties of sesamum. The experiment was conducted in Randomized Complete Block Design with three replications at Project Coordinating Unit (Sesame and Niger) Research Farm, JNKVV, Jabalpur during *Kharif* 2016 (E1), Summer 2017 (E2), *Kharif* 2017 (E3) and Summer 2018 (E4). Observations on five randomly selected plants per genotype per replication in each environment were recorded for days to flower initiation, days to 50% flowering, days to maturity, flower petal colour, flower petal hairiness, plant branching pattern, plant branching habit, stem hairiness, leaf lobes, leaf size, leaf serration of margin, capsule shape, capsule arrangement, capsule hairiness, number of locules per capsule, number of capsules per leaf axil and seed coat colour. Pooled analysis of variance revealed significant mean square estimates due to genotypes for all the characters included for stability analysis. The significance of genotype × environment interaction for number of capsules per plant, number of seeds per capsule and oil content revealed differential response of the genotype to varying dates of sowing. Overall results of stability analysis indicates that genotype YLM-11 was found as stable genotype which exhibited stable performances for more than two characters, while genotypes such as N-32, SAVITRI, RAMA, RAJESHWARI, RT-351 and GT-1 exhibited above average stability for yield and yield components and therefore, these genotypes were specifically adapted to unfavorable environmental conditions. The genotypes YLM-11, N-32, SAVITRI, SWETHA TIL-1, RAMA, VINAYAK, RAJESHWARI, RT-351 and GT-1 which were found to be adaptable for all environments for most of the characters can also be utilized in breeding programmes in order to transfer the responsiveness and stability of yield attributes in high yielding genetic background.

Keywords: Sesame, stability, yield components, Genotype × Environment interaction.

INTRODUCTION

Sesamum indicum L. (Syn. *Sesamum orientale* L.), which is known variously as sesamum, til, gingelly, simsim, gergelim etc. Sesame is a one of the World's oldest cultivated oilseed crop. Sesame is a self pollinated crop, which belongs to family pedaliaceae with having (2n = 26) chromosome number. It is cultivated in warm regions of the tropics and sub tropics.Sesame is better known as "Queen of oilseeds" by virtue of its quality edible oil and protein content. As it contains (44-63%) oil and (18-20%) protein. Sesame oil has long shelf life and rich in linoleic acid. Its protein is rich in sulphur containing amino acid (Methionine).Sesame is grown in India on an area of 17.06 Lakh hectare with a productivity of 332 kg/ha, which is far below than the world average of 389 kg/ha. It is widely cultivated in the states of Uttar Pradesh, Rajasthan, Orissa, Andhra Pradesh, Tamil Nadu, Karnataka, West Bengal, Bihar and Assam It is necessary to screen and identify phenotypically stable genotypes for yield which could perform more or less uniformly under different environmental conditions. It is an established fact that yield is complex character and largely depend on its component character with an interaction with environment resulting into the ultimate product i.e. yield. So far breeding a stable variety it is necessary to get the information on the extent of Genotype × Environment interaction for yield and its component character, stability variance, coefficient of determination, regression approach (Eberhart and Russell, 1966) etc. with suitable parameters are available to provide necessary criteria to rank varieties for stability. Eberhart and Russell's Model (1966) is the most popular.

MATERIALS AND METHODS

The present investigation consist estimation the stability parameter for yield and yield components in Sesame (*Sesamum indicum* L.) over 60 varieties. The

experimental material was evaluated in Randomized Block Design (R.B.D.) with 3 replications under different seasons during during *Kharif* 2016 (E1), Summer 2017 (E2), *Kharif* 2017 (E3) and Summer 2018 (E4) at Project Coordinating Unit (Sesame and Niger) Research Farm, JNKVV, Jabalpur, The sowing was carried out at the spacing of 30 cm and 10 cm between the rows and plants, respectively. The method of sowing followed was dibbling. One plant per hill was maintained by thinning 15 days after sowing. The recommended dose of fertilizer 30 kg N + 60 kg $P2O_5$ + 30 kg K_2O per hectare was applied at time of sowing. All other cultural practices were undertaken to maintain healthy crop. Five plants were selected from each treatment randomly for recording observations were recorded on the characters vis. days to flower initiation, days to 50% flowering, days to maturity, flower petal colour, flower petal hairiness, plant branching pattern, plant branching habit, stem hairiness, leaf lobes, leaf size, leaf serration of margin, capsule shape, capsule arrangement, capsule hairiness, number of locules per capsule, number of capsules per leaf axil and seed coat colour. Stability was carried out as per model of Eberhart and Russell (1966) for understanding stability Genotype × Environment. The analysis was carried out in computer using software WINDOSTAT.

RESULTS AND DISCUSSION

Genotype × environment (G × E) interaction is extremely important in the development and evaluation of plant varieties because they reduce the genotypic-stability values under diverse environments. Hence, a study of genotype × environment interaction can lead to successful evaluation of sesame genotypes for stability in yield performance across environments, when genotypes are compared over a series of environments to relative ranking usually differs. This causes difficulties in determining the significant superiority of any genotypes, breeder should select stable genotype that interact less with the environments in which they are to be grown, and the genotype should be evaluated by growing in more number of environments with only few stable genotypes remaining for final stable of testing, the breeder would be greatly aided in his selection of superior genotypes.

The results of the present investigation conducted with a view to identify genotypes of sesame suitable for all the season, based on the stability parameters for yield and yield attributing traits are discussed below:

Eberhart and Russell's Model 1966

Analysis of variance for stability

The analysis of variance revealed that the differences among the genotypes were highly significant for days to flower initiation, oil content and harvest index. The genotype x environment interaction showed significant differences for traits like number of capsules per plant, number of seeds per capsule and oil content. Traits reporting high significant genotypes × environment interactions under study suggested that these characters are highly influenced by the change in the environmental conditions.

The variation due to environment (linear) was found significant for all the traits except days to flower initiation indicating the genetic control of response of genotypes to environmental fluctuations prevailed during four environments at the same location thus, satisfying the requirement of stability analysis. Similar results were reported for seed yield by Suvarna *et al.*, (2011); Anuradha and Reddy (2005); Kumaresan and Nadarajan (2005); Raghuwanshi *et al.* (2005).

The G × E linear was found to be highly significant for traits such as number of capsules per plant and number of seeds per capsule. However, it was significant at 5% level of significant for oil content. The G × E linear interaction was found to be non significant for majority of the characters such as days to flower initiation, days to 50% flowering, days to maturity, capsule length, plant height, number of primary branches per plant, number of secondary branches per plant, 1000 seed weight, harvest index and seed yield per plant, indicating that genotype do not differ for their regression on their environmental index. Similar results were reported by Suvarna *et al*. (2011). However, the higher magnitude of linear components for seed yield as compared to non-linear was exported by Raghuwanshi *et al.* (2005); Anuradha and Reddy (2005); Kumaresan and Nadarajan (2005).

A good method to measure stability was previously proposed by Finlay and Wilkinson, 1963 and was later improved by Eberhart and Russell in 1966. The stability of varieties was defined by high mean value than population mean and regression coefficient (Bi=1) with deviations from regression near to zero ($S^2di = 0$). In the present study, mean performance, regression coefficient and deviation from regression have been considered together for judging the stability of genotypes in sesame.

Stability parameters for individual traits. Genotypes viz., RT-103 and DS-5 for days to flower initiation, JLT-408, TMV-7, MT-75, PKVNT-11, Brijeshwari and Vinayak for capsule length, RT-127, N-32, Smarak, PKDS-11, GT-10 and Prachi for plant height, RT-46, YLM-11, Thilarani and Kanak for number of primary branches per plant, TKG-21 for number of secondary branches per plant, VRI-1, Chandana, Savitri, Tarun and YLM-11 for number of seeds per capsule, Krishna and YLM-11 for oil content, PT-1, Smarak, Brijeshwari and JLT-7 for harvest index are stable which exhibited unity or near to unity regression coefficient (Bi~1) with minimum deviation from regression (S^2di~0).

Genotypes viz., RT-127, RT-54, RT-46, GT-1, TKG-306, JTS-8, TKG-55, JLT-408, MT-75, VRI-1, VRI-2, PT-1, T-4, AKT-101, Nirmala, Chandana, Swetha Til-1, Kalika, Krishna, Hima, DS-1, TMV-4 and TKG-21 for days to flower initiation, JLT-408, VRI-2, Nirmala, Usha, Chandana and PKVNT-11 for days to 50% flowering, RT-346, JTS-8, DS-5, Rama, Usha, PKDS-11 and Swetha Til-1 for days to maturity, RT-127, RT-346, GT-2, TKG-55, DS-5, TKG-22, AKT-101, PKDS-11, YLM-17, Thilarani, RT-125, Rajeshwari, DSS-9, Tarun, Kalika, Hima, N-8, YLM-11, Sekhar, Prachi, TMV-4, Kanak and SSD-5 for capsule length, Nirmala, Usha, PKDS-11, Swetha til-1, TMV-7, Thilak, CO-1, YLM-11, and PRACHI for number of primary branches per plant, RT-54, RT-346 and PKVNT-11for number of secondary branches per plant, VRI-1for number of

capsules per plant, RT-103, VRI-2, Swetha Til-1 and PKVNT-11 for number of seeds per capsule, RT-46, JLT-408, MT-75, VRI-1, VRI-2, DS-5, PT-1, N-32, AKT-101, Nirmala, Usha, Chandana, Smarak, Savitri, PKDS-8, Swetha til-1, PKVNT-11, YLM-11, YLM-66, CO-1, Kalika, Krishna, Hima, DS-1, Sekhar, Prachi, JT-12 and TKG-21for 1000 seed weight, TKG-22, PT-1, TMV-7, PKVNT-11, YLM-17, Tarun and TMV-4 for oil content, RT-346, RT-54, GT-1, VRI-1, Rama, RT-125, GT-10, DSS-9, Tarun and Kanak for harvest index were these genotypes show below average stability because they exhibited higher than unity regression coefficient (Bi>1) value with minimum deviation from regression value (S^2di~0). These results are in conformity with the findings of Narayan and Muragan (2013) for days to 50% flowering, plant height, number of capsules per plant, capsule length, number of seeds per capsule and number of branches per plant,.

Genotypes viz., RT-346, GT-2, TKG-22, N-32, Rama, GT-4, Usha, Smarak, Savitri, PKDS-8, PKDS-11, TMV-7, Thilak, PKVNT-11, YLM-66, RT-351, Rajeshwari, Tarun and YLM-11 for days to flower initiation were, RT-103, RT-46, GT-4, RT-351 and Kalika for days to 50% flowering, N-32 for capsule length, RT-103, RT-54, RT-46, GT-1, TKG-306, JTS-8, VRI-1, VRI-2, PT-1, N-32 Rama, GT-4, Niramala, Smarak, Savitri, PKDS-8, Swetha tiL-1, Thilak, YLM-66, CO-1, GT-10, RT-351, Krishna and JLT-7 for days to maturity, GT-2, TKG-55, Usha, Chandana, Swetha Til-1, Vinayak for plant height, RT-127, GT-1, TKG-306, TKG-22, PT-1, Rama, T-4, Savitri, RT-351, Brijeshwari, Rajeshwari, Tarun, N-32, JT-12 and TKG-21 for number of primary branches per plant, GT-1, GT-2, Rama and RT-351 for number of secondary branches per plant, TKG-55, Rama, Savitri, N-8 and DS-1 for number of capsules per plant, MT-75, T-4, Nirmala, TMV-7, Thilak, YLM-11, YLM-66, CO-1, RT-351, Brijeshwari, Vinayak, Krishna, Hima, N-32, Sekhar and TKG-21 for number of seeds per capsule, RT-103, RT-54, Rama, GT-4, T-4, PKDS-11, Thilak, Thilarani, RT-125, RT-351, GT-10, Brijeshwari, Rajeshwari, DSS-9, Vinayak, Tarun, N-32, N-8, YLM-11 and JLT-7 for 1000 seed weight, RT-346, TKG-55, JLT-408, PKDS-8, RT-351, GT-10, Rajeshwari and JLT-7 for oil content genotypes, RT-103, RT-46, JTS-8, JLT-408, MT-75, VRI-2, DS-5, N-32, AKT-101, Chandana, PKDS-8, PKDS-11, Swetha Til-1, TMV-7, YLM-66, RT-351, Rajeshwari, Vinayak, Hima, YLM-11 and TMV-4 for harvest index, Savitri, Brijeshwari, TMV-4 and SSD-5 for seed yield per plant were these genotypes show above average stability because they exhibited regression coefficient lower than unity (Bi<1) coupled with least deviation from regression (S^2di~0). These results are in conformity with the finding of Narayan and Muragan (2013) for number of capsule per plant, number of seeds per capsule and 1000 seed weight, Raikwar et al (2016) for seed yield.

Rest all the genotypes exhibited deviating S^2di values (deviating from zero) with varying Bi values are considered unstable.

Table 1: List of genotypes used in study.

Sr. No.	Genotypes	Sr. No.	Genotypes	Sr. No.	Genotypes	Sr. No.	Genotypes
1.	RT-127	16.	DS-5	31.	TMV-7	46.	KALIKA
2.	RT-346	17.	PT-1	32.	THILAK	47.	KRISHNA
3.	RT-103	18.	N-32	33.	PKV-NT-11	48.	HIMA
4.	RT-54	19.	RAMA	34.	YLM-17	49.	THILATHARA
5.	RT-46	20.	GT-4	35.	YLM-66	50.	N-8
6.	GT-1	21.	T-4	36.	THILARANI	51.	DS-1
7.	GT-2	22.	AKT-101	37.	CO-1	52.	YLM-11
8.	TKG-306	23.	NIRMALA	38.	RT-125	53.	SEKHAR
9.	JTS-8	24.	USHA	39.	RT-351	54.	JLT-7
10.	TKG-55	25.	CHANDANA	40.	GT-10	55.	PRACHI
11.	TKG-22	26.	SMARAK	41.	BRIJESHWARI	56.	TMV-4
12.	JLT-408	27.	SAVITRI	42.	RAJESHWARI	57.	KANAK
13.	MT-75	28.	PKDS-8	43.	DSS-9	58.	SSD-5
14.	VRI-1	29.	PKDS-11	44.	VINAYAK	59.	JT-12(PKDS-12)
15.	VRI-2	30.	SWETHA TIL-1	45.	TARUN	60.	TKG-21

Table 2: Stability Analysis of variance for seed yield and its component characters in sesame.

Source of variation	DF	Days to flower initiation	Days to 50% flowering	Days to maturity	Capsule length (cm)	Plant height (cm)	Primary branches per plant	Secondary branches per plant	Capsules/ plant	Seeds per capsule	1000 Seed Weight (g)	Oil Content (%)	Harvest Index	Seed yield per plant
Genotypes	59	26.03***	24.05	24.80	0.05	131.32	0.66	0.78	241.95	18.07	0.07	8.94***	5.59***	10.93
Env.+ (Gen. × Env.)	180	4.12	17.95	29.30**	0.08**	772.06***	0.98*	0.98	273.34*	47.47***	0.07	11.97***	1.68	16.47
Environments (Lin.)	1	2.32	188.55**	2257.22***	5.55***	109351.08***	42.24***	28.49***	3514.55***	4511.24***	0.81**	1280.8***1	43.59***	510.77***
Gen. × Env.(Lin.)	59	5.14	10.99	15.26	0.06	72.17	0.84	0.76	369.83**	32.41**	0.05	6.30*	0.98	9.53
Pooled Deviation	120	3.64**	19.95***	17.63***	0.05***	211.35***	0.70***	0.86***	198.89***	17.68***	0.08***	4.18***	1.67*	15.77***
Pooled Error	472	2.49	3.02	3.52	0.02	41.23	0.21	0.09	25.84	6.71	0.02	1.02	1.27	1.09
Total	239	9.53	19.46	28.19	0.08	613.89	0.90	0.93	265.59	40.21	0.07	11.22	2.64	15.10

Table 3: Stability parameters (ER 1966).

	Days to Flower Initiation			Days to 50% Flowering			Days to Maturity		
Genotypes	**μ Mean**	**βi**	**σ²di**	**μ Mean**	**βi**	**σ²di**	**μ Mean**	**βi**	**σ²di**
1 RT-127	36.667	5.272	-2.068	39.000	1.946	1.601	86.758	-0.056	12.231
2 RT-346	37.000	0.671	-2.206	38.817	2.130	5.001	87.958	1.116	-1.258
3 RT-103	36.417	0.911	-2.505	40.017	0.580	-2.395	86.108	0.001	63.471
4 RT-54	35.667	1.629	-1.138	39.958	-0.282	8.217	86.300	-0.426	53.894
5 RT-46	36.417	1.869	-2.335	39.517	0.670	-2.172	86.783	0.468	11.399
6 GT-1	34.250	2.732	-0.522	38.983	0.269	0.753	87.375	0.459	30.641
7 GT-2	37.333	0.671	-2.429	38.992	2.839	18.565	86.392	0.992	27.476
8 TKG-306	38.333	2.588	-1.883	38.933	2.916	22.621	86.308	0.650	5.362
9 JTS-8	35.417	3.882	-1.558	37.342	2.486	8.003	89.667	1.201	-3.216
10 TKG-55	37.667	2.971	-1.035	39.033	2.803	17.722	85.358	0.284	8.622
11 TKG-22	38.833	-0.192	-2.032	40.050	2.789	17.390	86.042	0.824	22.788
12 JLT-408	36.833	1.438	-1.627	38.825	1.264	-2.629	85.825	0.856	26.126
13 MT-75	35.833	3.450	-1.817	36.000	3.691	43.589	89.100	0.771	18.837
14 VRI-1	35.083	1.581	-2.315	37.875	2.080	4.292	88.958	0.758	40.681
15 VRI-2	35.667	2.971	-2.368	38.967	1.142	-2.912	89.750	0.697	12.932
16 DS-5	31.750	0.911	-2.394	34.533	1.801	0.941	88.350	1.483	-3.248
17 PT-1	44.500	1.150	-1.834	42.892	4.930	96.946	87.683	1.182	31.095
18 N-32	37.167	-1.150	-2.501	38.300	2.733	29.331	88.108	0.651	5.476
19 RAMA	37.917	-2.252	-0.254	39.533	1.387	2.014	88.075	1.171	-0.207
20 GT-4	29.417	0.240	-0.268	33.317	0.555	-1.551	87.517	1.221	3.155
21 T-4	37.000	1.629	-1.805	41.908	0.333	0.141	89.850	1.498	11.890
22 AKT-101	33.750	1.581	-2.093	39.375	-0.640	15.198	90.150	2.235	8.146
23 Nirmala	34.167	1.821	-2.317	37.608	1.164	-2.876	88.958	1.783	1.322
24 Usha	37.583	-3.211	-0.689	41.025	1.092	-2.973	88.767	2.040	-1.376
25 Chandana	31.583	2.061	-2.460	34.633	1.429	-1.936	89.275	1.831	1.123
26 SMARAK	32.500	0.767	-1.598	34.192	1.808	1.014	86.892	1.157	32.513
27 Savitri	35.000	-3.259	-2.292	37.617	2.016	3.428	89.133	1.856	23.698
28 PKDS-8	36.333	0.671	-2.429	38.417	2.761	16.733	87.433	1.773	2.912
29 PKDS-11	42.667	-4.601	-2.496	43.983	3.706	44.090	87.683	1.935	-3.256
30 Swetha TIL-1	34.750	2.540	-2.503	35.900	2.918	20.479	87.692	1.772	-2.823
31 TMV-7	35.833	-1.150	-2.279	36.333	2.912	27.344	89.900	0.570	18.930
32 THILAK	34.750	-7.236	-0.723	37.950	1.316	2.226	92.450	2.015	15.788
33 PKV-NT-11	36.250	0.335	-0.492	38.092	1.115	-1.970	90.742	1.337	4.944
34 YLM-17	36.833	-11.022	1.955	37.333	1.925	17.508	90.367	1.951	10.405
35 YLM-66	36.167	-8.051	-0.172	35.817	3.228	57.158	88.875	1.387	8.177
36 Thilarani	36.667	-14.760	1.482	41.775	-1.732	17.522	88.433	0.909	9.599
37 CO-1	39.583	16.534	1.340	44.808	2.000	5.124	86.700	0.936	4.944
38 RT-125	34.583	-5.224	0.872	39.975	-2.089	37.532	89.967	1.385	7.358
39 RT-351	36.417	-0.431	-2.271	39.992	0.288	-0.187	86.808	1.074	5.659
40 GT-10	36.333	-26.262	8.921	39.775	-1.493	14.432	91.425	1.715	16.610
41 Brijeshwari	37.167	-13.994	0.852	40.317	-0.845	5.678	92.908	1.209	14.384
42 Rajeshwari	35.167	-3.450	-1.150	39.892	-0.692	9.850	91.267	0.697	16.294
43 DSS-9	28.667	-42.077	57.596	34.717	-6.121	128.945	93.317	0.547	4.584
44 Vinayak	35.917	-9.441	2.233	40.217	-1.072	9.141	91.000	1.531	17.230
45 Tarun	36.167	0.479	-0.702	40.842	-0.416	7.688	91.975	0.697	2.256
46 Kalika	37.583	3.019	-2.443	40.558	0.894	-2.665	91.583	1.171	44.154
47 Krishna	35.417	1.581	-0.982	41.117	-0.705	16.633	93.133	0.524	24.146
48 Hima	35.833	11.981	-1.471	40.367	0.820	7.149	91.625	0.447	5.174
49 N-32	36.250	8.291	0.294	40.883	-0.038	10.944	92.383	-0.407	-3.070
50 N-8	36.833	19.553	4.360	43.350	1.455	16.386	91.758	0.896	20.106
51 DS-1	35.750	6.853	-0.730	41.933	0.126	13.067	92.967	1.006	5.692
52 YLM-11	37.750	-0.431	-2.271	42.942	-0.528	11.158	95.042	0.659	26.270
53 Sekhar	35.500	-21.853	12.964	40.000	-2.365	26.651	93.508	1.585	39.938
54 JLT-7	38.250	29.952	13.844	40.308	5.055	37.835	93.800	1.103	8.240
55 PRACHI	35.750	10.112	1.757	41.592	0.340	15.328	92.917	1.231	22.225
56 TMV-4	36.167	11.310	-1.836	42.100	-0.409	37.350	90.933	-0.317	0.907
57 Kanak	34.667	4.601	0.282	39.542	-0.237	8.948	91.367	0.466	16.860
58 SSD-5	33.000	28.275	14.134	40.567	1.629	36.287	94.567	0.960	8.536
59 JT-12(PKDS-12)	30.250	32.636	19.154	37.725	0.661	59.666	89.667	-0.391	13.596
60 TKG-21	35.667	8.530	-2.270	42.475	-0.339	25.627	91.317	0.922	16.450
Population Mean	**35.911**			**39.314**			**89.616**		

Table 4: Stability parameters (ER 1966).

	Capsule Length (cm)			Plant Height (cm)			Number of Primary Branches per plant		
Genotyps	**μ Mean**	**βi**	**σ^2di**	**μ Mean**	**βi**	**σ^2di**	**μ Mean**	**βi**	**σ^2di**
1 RT-127	2.383	1.259	0.029	103.692	0.942	-22.880	3.667	0.797	-0.102
2 RT-346	2.350	1.191	-0.016	109.308	0.622	88.282	3.667	1.694	0.222
3 RT-103	2.600	0.389	-0.013	99.133	0.922	176.301	4.167	0.454	0.882
4 RT-54	2.383	-0.181	-0.017	103.717	0.979	65.732	3.833	-0.025	0.954
5 RT-46	2.433	-0.319	-0.011	104.908	0.630	195.748	3.250	0.965	0.058
6 GT-1	2.567	0.889	0.019	102.608	0.663	40.574	3.167	-0.633	-0.075
7 GT-2	2.500	1.134	-0.014	103.267	0.751	-2.294	3.667	0.597	1.107
8 TKG-306	2.392	-0.232	-0.016	107.608	0.809	6.464	3.333	-0.608	-0.009
9 JTS-8	2.250	-0.133	0.048	108.850	0.724	11.051	3.750	0.661	0.676
10 TKG-55	2.392	1.197	0.026	109.117	0.747	-21.653	3.583	-0.611	0.143
11 TKG-22	2.442	1.197	-0.013	107.875	1.192	159.566	3.583	-0.222	-0.188
12 JLT-408	2.558	1.046	0.024	102.250	1.180	250.200	4.167	0.822	0.161
13 MT-75	2.500	0.964	0.001	106.808	1.327	225.619	3.667	1.086	0.484
14 VRI-1	2.475	0.852	0.043	107.142	1.146	172.949	4.750	0.800	2.493
15 VRI-2	2.475	0.564	0.003	110.650	1.047	63.863	4.333	-0.129	0.338
16 DS-5	2.367	1.122	-0.008	119.617	0.931	827.861	4.083	0.711	0.430
17 PT-1	2.308	-0.370	-0.013	106.983	1.165	334.324	3.750	-0.207	-0.074
18 N-32	2.458	0.351	-0.011	99.475	0.996	-26.686	3.417	1.419	1.899
19 RAMA	2.383	-0.294	-0.017	107.475	1.201	181.775	4.167	0.314	0.031
20 GT-4	2.475	1.497	-0.005	111.550	1.075	734.182	3.917	2.001	1.198
21 T-4	2.667	1.246	0.254	102.033	1.097	62.288	3.333	0.668	-0.036
22 AKT-101	2.225	2.231	0.041	96.342	1.068	22.317	4.083	1.697	0.260
23 Nirmala	2.458	0.677	-0.018	107.633	0.904	333.797	3.583	1.333	-0.129
24 Usha	2.308	-0.271	0.189	93.525	0.657	-12.840	4.500	3.045	-0.198
25 Chandana	2.558	0.782	0.106	107.667	0.725	-8.155	3.500	2.416	1.566
26 SMARAK	2.542	-0.151	-0.008	105.483	1.048	-25.249	4.083	2.045	2.025
27 Savitri	2.367	0.032	0.030	102.850	0.778	121.135	3.667	0.368	0.074
28 PKDS-8	2.500	0.150	0.003	110.433	0.886	2.732	4.333	1.765	2.469
29 PKDS-11	2.458	1.109	0.013	108.183	0.990	-36.140	3.917	2.369	0.076
30 Swetha TIL-1	2.308	0.451	-0.015	109.333	0.798	-29.365	4.417	1.358	-0.153
31 TMV-7	2.250	1.047	0.025	106.033	0.976	67.967	4.000	4.675	-0.126
32 THILAK	2.200	0.633	0.018	97.858	0.983	588.964	4.167	2.377	0.077
33 PKV-NT-11	2.475	1.083	0.016	102.908	1.023	150.017	4.167	3.034	0.603
34 YLM-17	2.175	1.818	0.008	105.158	0.993	45.639	3.083	0.979	-0.063
35 YLM-66	2.433	0.809	-0.003	104.117	0.826	7.161	4.083	1.537	0.109
36 Thilarani	2.175	1.410	0.011	107.417	1.194	121.836	3.833	0.961	-0.037
37 CO-1	2.392	0.175	-0.017	105.250	1.111	391.922	3.333	1.136	-0.111
38 RT-125	2.300	1.278	0.075	101.892	1.280	65.327	2.917	0.397	0.108
39 RT-351	2.292	0.764	0.035	100.033	1.261	137.627	3.250	-0.650	-0.208
40 GT-10	2.225	0.238	0.001	112.000	0.997	-27.293	3.583	0.775	0.285
41 Brijeshwari	2.392	0.920	0.075	111.608	1.039	102.739	3.917	-0.550	0.056
42 Rajeshwari	2.325	1.447	0.054	110.583	0.790	108.452	3.917	0.207	-0.074
43 DSS-9	2.283	1.115	-0.001	107.875	0.785	278.820	3.833	1.290	0.369
44 Vinayak	2.317	0.984	-0.002	115.967	0.802	-25.635	4.167	2.369	2.757
45 Tarun	2.275	3.221	0.050	113.858	1.074	61.334	3.750	0.650	-0.208
46 Kalika	2.333	2.657	0.030	105.792	1.109	143.522	4.167	1.998	0.216
47 Krishna	2.300	0.840	0.015	103.767	1.281	131.727	4.417	0.929	1.859
48 Hima	2.242	2.369	0.012	117.292	0.997	50.654	4.333	2.144	2.392
49 N-32	2.167	2.187	0.031	107.850	1.194	226.160	3.333	-0.150	0.002
50 N-8	2.250	2.018	-0.015	118.908	0.867	-40.838	3.500	1.998	0.216
51 DS-1	2.575	1.328	0.320	111.283	0.833	152.351	4.083	-0.625	1.025
52 YLM-11	2.267	1.736	0.026	102.325	1.053	280.480	3.417	1.447	-0.130
53 Sekhar	2.292	2.456	0.048	113.142	1.239	417.633	3.500	0.762	0.973
54 JLT-7	2.458	-0.169	-0.020	102.925	1.211	417.490	3.167	0.672	0.685
55 PRACHI	2.400	1.360	0.002	116.325	0.970	-0.952	3.417	1.447	-0.130
56 TMV-4	2.408	1.855	-0.004	119.200	1.017	11.637	3.917	1.333	1.537
57 Kanak	2.367	2.244	0.059	107.350	1.175	303.918	3.333	0.947	-0.194
58 SSD-5	2.508	1.422	0.049	112.642	1.005	-30.084	4.000	2.183	0.888
59 JT-12(PKDS-12)	2.317	1.246	0.122	98.317	1.456	1356.189	3.250	0.057	-0.172
60 TKG-21	2.367	1.127	0.115	97.267	1.461	761.771	3.417	-1.283	-0.083
Population Mean	**2.381**			**106.874**			**3.776**		

Table 5: Stability parameters (ER 1966).

	Number of Secondary Branches per plant			Number of Capsules per Plant			Number of Seeds Per Capsule		
Genotypes	**μ Mean**	**βi**	**σ^2di**	**μ Mean**	**βi**	**σ^2di**	**μ Mean**	**βi**	**σ^2di**
1 RT-127	2.167	0.825	0.911	59.833	-2.373	10.186	66.567	2.791	7.830
2 RT-346	2.583	3.484	0.066	69.500	2.522	322.639	65.108	2.723	199.411
3 RT-103	3.333	1.599	0.521	55.925	0.025	40.009	70.900	2.407	-4.708
4 RT-54	2.417	1.481	-0.018	69.375	2.132	317.528	65.417	0.830	9.348
5 RT-46	2.083	1.664	0.401	61.525	1.074	39.837	69.300	2.366	21.689
6 GT-1	2.000	-1.455	-0.041	59.950	0.966	62.867	64.617	0.843	15.437
7 GT-2	1.917	0.843	0.001	67.183	1.028	116.309	64.375	0.602	0.137
8 TKG-306	2.083	0.561	0.873	62.833	1.320	240.158	64.558	0.657	2.371
9 JTS-8	2.333	1.778	0.155	63.067	2.170	192.623	65.025	0.520	1.373
10 TKG-55	2.333	2.785	0.843	66.475	-1.278	-23.626	65.392	1.174	16.903
11 TKG-22	1.917	-0.611	0.192	51.217	-0.865	17.669	64.708	0.595	6.650
12 JLT-408	2.750	0.338	1.143	58.367	-0.523	1.471	65.158	0.689	26.828
13 MT-75	2.500	0.361	0.375	66.883	1.964	254.318	66.642	0.012	-6.058
14 VRI-1	2.667	-0.499	0.180	75.592	4.367	-22.365	64.375	0.916	-3.378
15 VRI-2	2.083	0.104	1.167	69.542	-1.239	99.777	60.092	1.191	-5.403
16 DS-5	2.500	-0.825	0.911	64.067	0.305	197.466	63.092	1.232	40.653
17 PT-1	1.917	0.110	0.611	55.775	-4.090	53.391	63.367	1.050	10.906
18 N-32	2.250	-0.350	1.030	61.675	0.025	7.361	63.108	0.845	5.048
19 RAMA	2.167	-0.454	-0.087	68.642	0.851	-19.546	64.250	1.137	5.504
20 GT-4	2.167	1.812	0.960	67.958	5.539	164.286	63.400	0.012	15.168
21 T-4	1.000	0.815	0.415	53.925	0.494	6.126	62.817	0.505	-2.598
22 AKT-101	2.000	2.488	2.547	79.175	5.075	214.822	63.525	0.408	29.651
23 Nirmala	2.583	1.889	0.101	67.733	3.480	346.095	66.275	0.654	-3.098
24 Usha	2.750	1.933	0.838	66.817	5.774	22.682	65.450	1.131	1.125
25 Chandana	2.333	0.870	0.282	72.550	3.449	1068.350	65.142	1.038	-0.372
26 SMARAK	2.417	0.810	2.236	56.883	-0.859	232.989	63.483	1.203	28.057
27 Savitri	1.583	0.980	0.164	57.467	0.647	-18.750	66.125	0.994	-2.972
28 PKDS-8	2.417	1.516	1.291	76.542	3.483	312.734	65.342	1.218	1.158
29 PKDS-11	2.000	1.178	0.354	75.633	1.949	78.423	64.900	0.832	4.565
30 Swetha TIL-1	3.000	1.049	0.867	80.458	2.491	381.463	63.375	1.263	0.068
31 TMV-7	3.417	2.885	0.416	92.242	3.944	9.628	65.842	0.668	-2.616
32 THILAK	2.833	3.812	1.178	74.383	3.917	626.467	64.600	0.550	-5.924
33 PKV-NT-11	2.750	3.938	0.044	65.842	0.684	100.539	62.192	1.252	-4.706
34 YLM-17	2.417	3.216	2.380	72.158	0.767	543.395	66.983	0.718	-6.095
35 YLM-66	2.500	1.055	1.142	68.850	-1.427	154.283	67.933	0.794	-4.003
36 Thilarani	2.667	-0.452	0.635	64.575	-2.611	320.570	63.792	1.259	13.064
37 CO-1	1.917	0.933	0.519	75.417	-0.885	42.254	67.067	0.323	-6.178
38 RT-125	1.667	0.133	0.235	55.508	-3.327	7.408	62.208	0.027	46.243
39 RT-351	2.000	-0.230	0.005	66.600	-0.156	643.639	64.867	0.437	-3.757
40 GT-10	2.833	0.322	0.159	64.408	-0.011	426.780	62.733	0.775	20.187
41 Brijeshwari	2.750	-0.933	0.519	70.342	2.128	172.608	66.200	0.445	-3.534
42 Rajeshwari	1.917	0.243	0.711	70.000	2.397	29.264	66.542	0.978	0.582
43 DSS-9	2.250	0.336	0.254	59.892	1.073	237.954	62.583	0.939	21.181
44 Vinayak	2.417	0.506	3.665	78.217	7.691	259.615	66.000	0.639	-6.116
45 Tarun	2.167	0.903	0.657	68.250	2.913	193.610	66.508	0.918	-3.708
46 Kalika	3.083	1.317	4.869	64.033	1.340	234.759	65.158	1.010	10.046
47 Krishna	2.250	1.116	1.430	66.075	1.581	567.099	65.150	0.485	-6.186
48 Hima	2.750	2.710	1.649	69.933	5.554	223.584	67.467	0.741	-6.442
49 N-32	1.833	1.324	0.212	64.875	-2.561	8.063	65.683	0.304	-2.660
50 N-8	2.500	0.415	0.365	77.625	-3.139	-23.982	68.067	0.522	17.802
51 DS-1	2.250	-0.428	0.126	72.625	-2.035	-8.229	64.083	0.615	20.484
52 YLM-11	2.000	-1.954	0.444	60.042	0.768	7.457	68.750	0.923	-5.493
53 Sekhar	1.667	1.225	0.106	61.183	-1.612	92.587	66.100	0.863	-0.427
54 JLT-7	2.083	1.988	0.787	57.017	-4.064	45.381	61.783	1.548	100.740
55 PRACHI	2.833	1.238	1.042	67.508	1.514	144.159	68.467	2.486	14.041
56 TMV-4	2.167	2.127	1.554	71.917	2.633	133.342	70.592	2.424	14.291
57 Kanak	2.667	-0.090	1.015	53.983	0.693	277.223	68.708	2.231	18.243
58 SSD-5	3.167	0.915	0.207	76.400	2.642	97.206	64.542	1.401	5.494
59 JT-12(PKDS-12)	2.417	3.259	0.314	63.867	0.349	58.697	67.358	1.754	6.022
60 TKG-21	2.000	1.092	0.067	60.692	-0.661	46.464	66.767	0.133	-1.234
Population Mean	**2.340**			**66.617**			**65.343**		

Table 6: Stability parameters (ER 1966).

	1000 Seed Weight (g)			Oil Content (%)			Harvest Index (%)		
Genotypes	**μ Mean**	**βi**	**σ^2di**	**μ Mean**	**βi**	**σ^2di**	**μ Mean**	**βi**	**σ^2di**
1 RT-127	3.592	-2.001	0.171	44.100	1.092	2.993	25.275	2.817	1.957
2 RT-346	3.467	-2.375	0.165	45.567	0.645	-0.881	25.425	1.179	-0.753
3 RT-103	3.358	-3.140	0.073	41.825	1.550	2.692	22.858	0.103	-0.646
4 RT-54	3.367	-0.139	0.027	42.008	0.113	3.924	24.217	1.520	-0.780
5 RT-46	3.258	1.610	-0.017	43.592	0.847	4.794	23.150	0.761	-0.574
6 GT-1	3.467	0.633	0.111	42.625	1.342	2.987	23.908	1.807	-0.795
7 GT-2	3.525	-0.286	0.287	43.717	0.936	6.050	23.200	-0.689	0.852
8 TKG-306	3.333	-0.488	0.132	43.175	1.592	6.866	24.308	2.657	1.115
9 JTS-8	3.442	-1.477	0.334	44.000	0.753	0.830	22.842	-0.077	-0.244
10 TKG-55	3.450	-0.469	0.172	45.958	0.382	-0.680	25.175	3.122	3.142
11 TKG-22	3.400	-4.904	0.198	44.917	1.800	0.097	22.167	-0.663	0.864
12 JLT-408	3.358	1.521	0.029	44.192	0.853	-1.004	22.858	0.871	-0.876
13 MT-75	3.417	1.923	0.040	45.533	0.821	2.479	24.300	0.226	-1.106
14 VRI-1	3.358	1.458	0.000	41.533	1.261	3.246	24.350	2.368	0.085
15 VRI-2	3.492	2.559	0.039	41.642	0.049	5.751	23.450	0.789	-1.216
16 DS-5	3.433	2.106	0.029	44.725	0.548	2.928	23.617	0.113	-0.661
17 PT-1	3.400	2.750	0.018	43.675	1.603	-0.090	22.717	0.921	-0.982
18 N-32	3.317	1.580	0.008	41.500	1.850	28.148	23.292	0.711	-0.406
19 RAMA	3.375	-0.264	0.064	40.658	2.278	2.630	24.167	2.017	-0.453
20 GT-4	3.258	0.295	0.059	42.583	0.981	6.712	21.975	-0.419	0.514
21 T-4	3.275	-2.916	-0.018	42.092	1.945	5.324	24.975	2.617	0.935
22 AKT-101	3.233	1.627	0.046	40.908	1.681	0.613	22.875	0.083	-0.614
23 Nirmala	3.150	3.132	0.076	41.900	1.328	8.888	25.425	2.623	0.656
24 Usha	3.167	3.476	0.080	45.033	0.951	5.419	21.658	-0.853	1.649
25 Chandana	3.317	3.940	0.064	44.400	-0.235	1.177	23.642	0.851	-0.828
26 SMARAK	3.275	3.567	0.035	42.375	1.176	11.612	23.942	0.973	-0.748
27 Savitri	3.175	3.301	0.025	46.792	0.698	10.417	24.258	2.717	1.408
28 PKDS-8	3.033	3.736	-0.002	44.100	0.689	-0.455	23.525	0.380	-0.456
29 PKDS-11	2.933	-0.129	0.036	44.325	0.304	0.366	23.458	0.503	-0.656
30 Swetha TIL-1	3.275	2.321	0.000	44.608	0.930	6.760	23.758	0.831	-0.776
31 TMV-7	3.367	3.002	0.133	43.100	1.252	-0.064	22.758	0.553	-0.910
32 THILAK	3.467	0.816	0.025	45.125	0.853	6.045	25.042	2.326	0.664
33 PKV-NT-11	3.333	2.132	-0.017	41.842	1.373	-0.940	22.425	-0.958	1.744
34 YLM-17	3.383	2.202	0.016	44.900	1.629	-0.272	25.017	2.567	0.727
35 YLM-66	3.442	2.189	-0.018	42.883	1.055	1.475	23.042	-0.117	-0.122
36 Thilarani	3.383	0.777	-0.020	42.150	1.444	1.076	25.025	3.102	3.006
37 CO-1	3.333	1.506	-0.013	43.800	1.688	2.927	21.767	-0.983	2.344
38 RT-125	3.317	0.072	0.011	41.650	0.968	0.247	23.200	1.380	-1.072
39 RT-351	3.225	-0.019	0.004	43.175	0.667	-0.996	24.025	0.874	-0.953
40 GT-10	3.208	-1.208	0.019	45.108	0.035	-0.420	24.567	2.348	0.037
41 Brijeshwari	3.283	-0.595	0.002	43.492	0.902	0.544	22.942	1.079	-0.982
42 Rajeshwari	3.417	-0.521	0.049	43.608	0.377	-0.958	23.850	0.033	-0.519
43 DSS-9	3.425	-0.643	0.065	45.000	0.033	0.116	23.442	1.210	-1.227
44 Vinayak	3.225	0.208	-0.018	42.275	1.052	3.454	22.858	0.871	-0.876
45 Tarun	3.225	-0.343	0.066	43.967	1.499	-0.965	25.275	2.047	-0.377
46 Kalika	3.158	4.600	0.068	43.492	0.577	1.780	24.342	-0.299	0.542
47 Krishna	3.117	2.449	0.010	42.992	1.008	-0.156	24.600	2.388	0.135
48 Hima	3.300	2.207	0.004	39.900	1.935	5.031	23.383	0.393	-0.775
49 N-32	3.425	0.103	0.084	42.842	1.690	14.957	25.183	2.115	0.247
50 N-8	3.342	0.588	-0.007	43.908	1.096	0.352	21.658	-0.733	1.121
51 DS-1	3.175	1.396	0.021	41.467	0.700	2.555	24.900	-0.138	5.355
52 YLM-11	3.258	0.384	-0.010	40.942	1.033	-0.562	23.450	0.364	-0.816
53 Sekhar	3.050	4.131	-0.004	40.383	1.251	0.128	25.133	2.428	0.246
54 JLT-7	3.225	0.390	0.005	43.767	0.239	-0.950	23.142	1.039	-1.052
55 PRACHI	3.300	1.327	0.005	45.233	0.720	2.236	22.233	1.771	7.381
56 TMV-4	3.092	-0.112	0.132	42.108	1.347	-0.498	23.217	0.681	-0.296
57 Kanak	3.242	2.109	0.163	43.433	0.339	17.248	23.567	1.300	-1.172
58 SSD-5	3.133	2.650	0.165	43.258	0.987	4.496	25.542	2.246	0.306
59 JT-12(PKDS-12)	3.108	3.799	0.068	44.250	0.732	0.304	22.508	-1.138	2.647
60 TKG-21	3.242	1.456	0.009	44.075	0.755	0.779	19.400	0.391	10.151
Population Mean	**3.302**			**43.303**			**23.638**		

Table 7: Stability parameters (ER 1966).

	Seed yield per plant (g)		
Genotypes	**μ Mean**	**βi**	**σ^2di**
1 RT-127	10.133	0.335	4.113
2 RT-346	11.875	1.472	13.314
3 RT-103	9.483	0.925	2.782
4 RT-54	12.117	2.373	7.351
5 RT-46	11.950	2.668	4.389
6 GT-1	10.250	1.514	5.620
7 GT-2	10.367	0.625	1.684
8 TKG-306	11.467	2.425	9.106
9 JTS-8	9.725	0.760	6.846
10 TKG-55	12.258	1.865	17.992
11 TKG-22	9.358	0.762	13.118
12 JLT-408	11.208	1.976	13.953
13 MT-75	11.317	0.666	25.926
14 VRI-1	12.558	1.332	8.690
15 VRI-2	13.875	1.706	9.317
16 DS-5	11.558	0.741	13.481
17 PT-1	10.175	-0.374	33.650
18 N-32	11.158	0.848	16.070
19 RAMA	12.658	0.722	21.409
20 GT-4	11.308	0.460	16.163
21 T-4	8.408	0.544	2.249
22 AKT-101	11.842	-0.813	17.075
23 Nirmala	10.467	1.386	56.069
24 Usha	9.900	0.488	54.595
25 Chandana	11.542	2.599	59.009
26 SMARAK	10.000	2.096	5.176
27 Savitri	8.683	0.746	-0.713
28 PKDS-8	10.767	-1.690	0.275
29 PKDS-11	12.608	1.303	6.475
30 Swetha TIL-1	13.117	-0.814	5.461
31 TMV-7	17.308	1.274	7.537
32 THILAK	12.617	-1.034	16.370
33 PKV-NT-11	11.525	2.840	5.073
34 YLM-17	11.550	2.918	32.058
35 YLM-66	12.867	1.345	10.026
36 Thilarani	11.092	-0.562	28.005
37 CO-1	11.833	0.694	15.794
38 RT-125	9.067	0.000	8.805
39 RT-351	11.058	1.693	34.490
40 GT-10	9.125	-0.240	9.824
41 Brijeshwari	9.792	-0.371	-0.411
42 Rajeshwari	10.142	1.033	0.862
43 DSS-9	7.492	0.928	0.702
44 Vinayak	13.175	-1.480	60.432
45 Tarun	9.608	0.239	5.268
46 Kalika	9.150	1.204	21.844
47 Krishna	11.742	3.152	12.840
48 Hima	11.525	1.294	31.687
49 N-32	10.225	1.394	17.655
50 N-8	13.942	1.556	35.543
51 DS-1	12.692	0.852	18.148
52 YLM-11	8.675	1.644	0.922
53 Sekhar	10.425	1.795	17.423
54 JLT-7	9.417	1.278	10.401
55 PRACHI	9.692	1.797	2.403
56 TMV-4	9.867	-0.011	-0.868
57 Kanak	9.050	1.691	8.179
58 SSD-5	12.050	0.432	0.006
59 JT-12(PKDS-12)	9.650	1.759	17.063
60 TKG-21	10.067	1.242	1.719
Population Mean	**10.976**		

Overall results of stability analysis revealed that genotype YLM-11 was found as stable genotype which exhibited stable performances for more than two characters, while genotypes such as N-32, Savitri, Rama, Rajeshwari, RT-351, and GT-1 exhibited above average stability for yield and yield components and therefore, these genotypes were specifically adapted to unfavourable environmental conditions.

CONCLUSIONS

Overall results of stability analysis indicates that genotype YLM-11 was found as stable genotypes which exhibited stable performances for more than two characters, while genotypes N-32, SAVITRI, RAMA, RAJESHWARI, RT-351 and GT-1 exhibited above average stability for yield and yield components and therefore, these genotypes were specifically adapted to unfavorable environmental conditions.

FUTURE SCOPE

(i). Due weight should be given on yield factors viz., number of branches per plant and number of capsules per plant in selection breeding programmes aimed at the improvement of seed yield.
(ii). Attempts should be made to know the mode of inheritance governing the inheritance of seed yield, its attributes, quality parameters and to establish the QTLs for phenotyping of these traits in *Sesamum indicum.*

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Conflict of Interest. None.

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