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Research Article

Stability parameters in *rabi* sorghum

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Abstract

Stability analysis indicated that the linear component was high for leaf area per plant and dry stover yield per plant indicating that linear component contributed more towards the genotype x environment interactions, while high value of non-linear components was observed in days to maturity and plant height. In case of days to 50 per cent flowering and leaves per plant both linear and non-linear components was almost equal indicating importance of both linear and non-linear components in determining genotype x environment interactions for these attributes. For days to 50% flowering, eight male parents, 31 hybrids and check CSH 15R showed average stability over environments, whereas the female parent 104A showed above average stability and suitability to poor environments. Five male parents, 17 hybrids and check CSH 15R recorded low mean, non-significant regression coefficient and non-significant S^2di values that showed average stability over environments for days to maturity. As regards to plant height 6 males and 25 hybrids were found stable and four hybrids were found above average stable and suitable for poor environments whereas, one hybrid 9168A x RSV 1006 was found below average stable for this trait. For number of leaves per plant 8 male parents and 33 hybrids showed average stability over environments and two hybrids 9168A x RSV 1006 and 9168A x SPV 1546 exhibited below average stability and suitability to favourable environments. Male SPV 1546, check BP 53 and 10 hybrids showed average stability over environments whereas the hybrid 1543A x SPV 1359 showed below average stability and suitability to favourable environments and the hybrid 1343A x RSSGV 43 exhibited above average stability and suitability for unfavourable environments for leaf area per plant. For dry stover yield per plant, ten male parents and 22 hybrids were considered stable for this trait. The hybrid 9168A x RSV 1006 showed below average stability which was suitable for rich environments. From the stability analysis, it can be concluded that none of genotype was found to be ideal with wider adaptability for all the characters, hence the parents and hybrids showing average stability for different characters could be considered for future breeding programme for genetic improvement of *rabi* sorghum.

Key words

Genotype x environment interaction, stability, linear, non-linear

Introduction

Breeders and geneticists continually strive to broaden the genetic base of crop species to prevent problems associated with genetic vulnerability. With emphasis on broadening the genetic base and unpredictable climatic factors encountered at different sites and/or years, differential responses are expected of improved cultivars/hybrids in different environments. These differential genotypic responses to differential environments are collectively called genotype x environment (G x E) interactions

Genotype x environment interaction is an important subject in quantitative genetics as related to plant breeding. Variation among genotypes in phenotypic sensitivity to the environment (G x E) presents a real problem for breeders, as it may necessitate thedevelopment of locally adapted varieties (Falconer, 1952). If none of the genotype has superiority in all situations, G x E interaction indicates the potential for genetic differentiation of populations under prolonged selection in different environments. (Via, 1984).Thus far, agricultural production has kept pace with the world's population growth mainly because of innovative ideas and efforts of agricultural researchers. The world's population is expected to double in the next 40 to 50 years (Lee, 1995). The key to doubling agricultural production is increased efficiency in utilization of resources and that includes a better understanding of G x E interaction and way to exploit it.Eberhart and Russell (1966) defined a stable genotype as one, which produced high mean yield and depicted regression coefficient (b_i) around unity and deviations from regression (S^2d_i) near zero. Present investigation aimed to study the interaction of 91 genotypes (five female sterile lines, fourteen testers, resultant seventy hybrids and two checks) of *rabi* sorghum with environments.

Materials and method

The experimental materials comprised of five male sterile lines, fourteen testers, and their seventy hybrids along with two checks of *rabi* sorghum. The experiment consisted of 91 genotypes was conducted in randomized block design with three replications during *rabi* 2012-13 at three different locations *viz.*, E_1: College farm, Navsari Agricultural University, Navsari, E_2: Main Sorghum Research Station, Athwa farm, NAU, Surat and E_3: Agricultural Research Station, NAU, Achhalia, during *rabi*, 2012-13. In individual experiment, each net plot had single row of 3 m each and the inter row spacing of 45 cm. The border row was planted around each replication. Recommended package of practices was followed to raise a good crop. Observations were recorded on the randomly selected five plants from each treatment in each replication for days to 50% flowering, days to maturity, plant height, number of leaves per plant, leaf area per plant and dry stover yield per plant. Data were analyzed following model proposed by Eberhart and Russel (1966)

Result and discussion

The analysis of variance for phenotypic stability (Table 1) revealed that mean squares due to genotypes as well as environments were highly significant for all the characters when tested against pooled deviation. The genotypes interacted significantly with environments for all the characters when tested against pooled error specifying that the genotypes interacted significantly to diverse environments.

The mean squares due to environments (linear) were highly significant for all the characters when tested against pooled deviation. However, the same was significant for all the characters when tested against pooled error. This indicated that variation among environments was linear and it signifies unit change in environmental index for each unit change in the environmental conditions.

The variances due to G x E were further partitioned in to components (i) G x E (linear) and (ii) G x E (non-linear) *i.e.* pooled deviation. The coincidence of genotypic performance with environmental values was observed for grain yield, panicle length, primaries per panicle and harvest index an evident from significant genotypes x environments (linear) mean squares when tested against pooled deviations. Although, G x E (linear) was found to be significant for all the characters when tested against pooled error indicating differential performance of genotypes under diverse environments but with considerably varying norms, *i.e*., the linear sensitivity of different genotypes is variable. The mean squares due to pooled deviations were significant for all the characters except harvest index, which suggested that performance of different genotypes fluctuated significantly from their respective linear path of response to environments.

On comparing relative magnitude of genotype x environment (linear) and pooled deviation from linearity (non-linear), it was found that the linear component was high for leaf area per plant and dry stover yield per plant indicating that linear component contributed more towards the genotype x environment interactions, while high value of non linear components was observed in days to maturity and plant height. In case of days to 50 per cent flowering and leaves per plant both linear and non-linear components was almost equal indicating importance of both linear and non linear components in determining genotype x environment interactions for these attributes. These results were in general, concurring with those of Muppidathi *et al.* (1995[a&b]), Narkhede *et al.* (1998[a&b]), Muppidathi *et al.* (1999[a&b]), Patil *et al.* (1991), Shivanna *et al.* (1992), Das and Prabhakar (2003), Khandelwal *et al.* (2005) and Kale (2012).

The stability parameters *viz.*, mean performance (X), regression coefficient (bi) and individual squared deviation from linear regression (S^2di) for parents as well as hybrids were estimated for seven characters to assess the stability over the environments and are presented in Table 2.1-2.2. Total 91 genotypes were divided in to two groups; first comprising all hybrids with hybrid check CSH 15R and second comprising all parents with varietal check BP 53. Population means of these two groups were estimated separately and used for assessment of stability parameters.

For days to 50% flowering, among parents, 8 male parents recorded low mean, non significant regression coefficient and non significant S^2di values showed average stability over environments. The top three most stable observed males are RSV 458, RSV 1006 and RSV 1427. The female parent 104A showed above average stability and suitability to poor environments. Out of 70 hybrids, 31 hybrids and check CSH 15R had low mean, non-significant regression coefficient and non-significant S^2di values which indicated their ideal stability over environments. The performance of 10 hybrids could not be predicted under variable environments in view of significant S^2di values. The best five hybrids among the stable hybrids for this trait were 9168A x RSV 458, 1409A x RSV 458, 1409A x SPV 1546, 1409A x RSV 1006 and 9168A x RSV 1006.

As regards to days to maturity, 5 male parents recorded low mean, non significant regression coefficient and non significant S^2di values showed average stability over environments. The top three most stable observed males are RSV 458, RSV 1006 and RSV 1297. Among the hybrids, 17 hybrids and check CSH 15R had low mean, non-significant regression coefficient and non-significant S^2di values which indicated their ideal stability over environments. The best five hybrids among the stable hybrids for this trait were 9168A x RSV 1460, 9168A x RSV 1188, 9168A x RSSGV 43, 9168A x RSV 1427 and 9168A x RSV 1006. Cross 104A x RSSGV 43 showed above average stability and suitability to rich environments due to their low mean, regression coefficient more than unity and non significant S^2di values.

For plant height, 6 males were found stable as evident from its high mean with regression coefficient near to unity and non-significant non-linear components. The male parent RSV 1297 exhibited high mean with bi value significantly less than unity and non significant S^2di values, showed above average stability which was suitable for poor environments. Among hybrids, 25 hybrids exhibited high mean along with regression coefficient near unity and non-significant deviation from regression and therefore they were classified as stable hybrids. The superlative five stable hybrids were 1543A x RSV 1297, 9168A x SPV 1359, 1343A x RSV 1200, 9168A x RSV 1188 and 1343A x SPV 1359. Four hybrids were found above average stable and suitable for poor environments whereas, one hybrid 9168A x RSV 1006 was found below average stable for this trait.

Among the parents, 8 male parents recorded higher leaves per plant than the parental mean, non-significant regression coefficient and non significant S^2di values, indicating average stability over environments. The top three most stable males observed were SPV 1546, RPOSV 3 and RSV 1130. The male parent RSV 1093 showed above average stability and suitability for unfavourable environments. Out of 70 hybrids, 33 hybrids were considered to be stable over environments due to their higher leaves per plant than mean, non significant bi value and non-significant non-linear components. The performance of cross 1343A x RSSGV 43 and 1543A x RSV 1200 hybrids could not be predicted under variable environments in view of significant deviation mean square. The best five stable hybrids were 1343A x RSV 1200, 1543A x RSV 1297, 1343A x SPV 1359, 1543A x SPV 1704 and 1343A x SPV 1704. The two hybrids 9168A x RSV 1006 and 9168A x SPV 1546 exhibited below average stability and suitability to favourable environments.

Among the parents, only one male SPV 1546 and check BP 53 recorded higher leaf area per plant than the parental mean, non-significant regression coefficient and non-significant S^2di values, indicating average stability over environments. Out of 70 hybrids, 10 hybrids were considered to be stable over environments due to their higher leaves per plant than the hybrid mean, non significant bi value and non-significant non-linear components. The performance of 16 hybrids could not be predicted under variable environments in view of significant deviation mean square. The hybrid 1543A x SPV 1359 showed below average stability and suitability to favourable environments due to high mean and significant bi value (bi>1) whereas, the hybrid 1343A x RSSGV 43 exhibited above average stability and suitability for unfavourable environments. The best five stable hybrids were 1343A x RSV 1200, 1343A x RSV 1359, 1343A x SPV 1704, 1543A x SPV 1704 and 1343A x SPV 1460.

For dry stover yield per plant, ten male parents had higher mean than parental mean with bi magnitude not significantly deviating from unity and non-significant deviation from regression, hence were considered stable for this trait. Out of 70 hybrids and check (CSH 15R) tested, 22 hybrids exhibited high mean, along with regression coefficient near unity and non-significant deviation from regression and therefore they were classified as stable hybrids. The superlative five stable hybrids were 104A x RSV 1188, 104A x RSV 1093, 9168A x RSSGV 43, 9168A x SPV 1359, 104A x RSV 1006. The hybrid 9168A x RSV 1006 exhibited high mean, bi value significantly greater than one and non-significant deviation from regression showed below average stability which was suitable for rich environments.

The heterozygous entries (hybrids) were in general, slightly more stable than the homozygous ones (parents), but the wide ranges found within both the parents and hybrids for stability parameters indicated that it should be possible to select stable entries at both levels of genetic structure. These results corroborated with the findings of Reich and Atkins (1970), Majisu and Dogget (1972), Patanothai and Atkins (1974), Rao *et al.* (1981), Patel *et al.* (1984), Haussmann *et al.* (2000) and Kale (2012).

From the stability analysis, it can be concluded that none of genotype was found to be ideal with wider adaptability for all the characters, hence the parents and hybrids showing average stability for different characters could be considered for future breeding programme for genetic improvement in *rabi* sorghum.

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Table 1. Analysis of variance (mean square) for phenotypic stability for six different characters in *rabi* sorghum

Source of variation	d.f.	DF	DM	PH	LPP	LA	DSY
Genotypes	90	20.24 ++**	43.67 ++**	2252.34 ++**	1.59 ++**	47.18 ++**	3630.06 ++**
Environments	2	581.46 ++**	757.01 ++**	20869.66 ++**	4.47 ++**	926.39 ++**	4670.19 ++**
G x E	180	3.50 **	8.72 **	119.54 **	0.19 **	23.88 +**	603.77 +**
Environments (Lin)	1	1162.92 ++**	1514.03 ++**	41739.33 ++**	8.95 ++**	1852.78 ++**	9340.38 ++**
G x E (Lin)	90	3.75 **	5.68 **	109.07 **	0.19 **	30.23 ++**	817.41 ++**
Pooled Deviation	91	3.23 **	11.63 **	128.58 **	0.18 **	17.34 **	385.84 **
Pooled Error	540	0.67	1.37	47.66	0.13	0.81	161.60

+, ++ : Significant against pooled deviation M.S. at 5% and 1% levels, respectively.
*, ** : Significant against pooled error M.S. at 5% and 1% levels, respectively.

DF : Days to 50 per cent flowering
DM : Days to maturity
PH : Plant height (cm)
LPP : Leaves per plant
LA: Leaf area (dm^2)
DSY : Dry stover yield(g)

Table 2.1. Stability parameters for days to 50 per cent flowering, days to maturity and plant height in *rabi* sorghum

Sr. No.	Genotypes	Days to 50 per cent flowering			Days to maturity			Plant height (cm)		
		Mean	b_i	S^2di	Mean	b_i	S^2di	Mean	b_i	S^2di
1	104A x RSV 458	66.22	0.73	9.39**	124.00	1.51	-0.50	184.04	0.95	-45.80
2	104A x RSV 1006	67.89	-0.02	1.17	120.22	0.90	3.40	250.36	0.23*	-47.20
3	104A x RSV 1093	68.67	0.79	-0.63	120.33	1.17	0.10	243.20	0.47	-19.60
4	104A x RSV 1130	69.67	1.39	-0.65	124.11	1.43	48.90**	244.43	0.17*	-48.30
5	104A x RSV 1188	69.22	0.99	-0.53	123.89	0.78	-0.60	237.73	0.45	210.90*
6	104A x RSV 1200	70.67	1.45	-0.55	124.33	2.03	20.80 **	213.07	1.25	601.40**
7	104A x RSV 1297	69.33	1.30	0.59	120.00	1.62	3.10	226.63	1.11	-37.20
8	104A x SPV 1359	70.56	2.40	1.17	124.44	1.51	37.10 **	223.01	1.42	16.00
9	104A x RSV 1427	68.33	0.70	1.27	117.56	0.38	34.10**	230.97	1.13	214.10*
10	104A x RSV 1460	69.89	1.90	-0.32	119.44	0.81	-1.30	217.34	1.19	6.40
11	104A x SPV 1546	68.33	1.62	1.91	119.67	1.25	-1.30	223.37	0.96	-48.40
12	104A x SPV 1704	69.00	1.08	4.62 **	122.22	1.65	5.60*	223.15	1.08	-45.50
13	104A x RPOSV 3	69.78	1.15	4.07 **	119.78	1.12	5.50 *	198.30	1.78	-13.30
14	104A x RSSGV 43	68.78	1.30	1.28	119.67	1.59*	-1.40	212.95	1.09	-25.20
15	1343A x RSV 458	68.44	0.62	3.55 *	116.89	0.76	27.80 **	196.54	1.86	-36.00
16	1343A x RSV 1006	68.78	0.51	0.79	121.33	1.12	27.70 **	244.44	0.29	-37.40
17	1343A x RSV 1093	71.56	0.38	-0.26	125.22	1.58*	-1.30	230.90	1.87	515.70**
18	1343A x RSV 1130	74.22	0.96	2.18 *	125.33	1.32	-0.90	224.81	1.78	552.30**
19	1343A x RSV 1188	72.55	1.07	0.05	122.56	1.20	-0.80	232.60	1.23	215.30*
20	1343A x RSV 1200	75.37	1.22	8.57**	127.22	1.20	-0.80	249.07	0.23	-21.90
21	1343A x RSV 1297	73.89	1.77	9.16**	129.22	0.38	18.60**	249.40	0.37	-39.70
22	1343A x SPV 1359	72.56	0.75	1.09	120.90	1.61	5.00*	241.36	1.37	59.50
23	1343A x RSV 1427	72.89	1.745	1.60	126.74	1.47	-1.20	221.40	0.72	-42.90
24	1343A x RSV 1460	72.44	1.39	-0.26	123.01	1.29	57.20 **	212.35	0.85	477.50**
25	1343A x SPV 1546	71.67	1.20	-0.37	123.22	1.69	-1.30	218.39	0.95	165.10*
26	1343A x SPV 1704	70.33	0.31	1.02	119.99	1.07	12.50 **	237.93	0.60	-43.00
27	1343A x RPOSV 3	71.33	0.92	-0.62	124.22	1.23	5.10 *	189.01	1.64	-14.90
28	1343A x RSSGV43	69.78	0.43	1.89	118.56	0.94	13.70**	217.00	1.39	446.40**
29	1409A x RSV 458	67.00	1.77	0.01	122.67	1.73	19.10**	176.63	1.05	-47.30
30	1409A x RSV 1006	67.67	1.50	-0.08	120.67	1.34	58.10**	221.53	1.39	130.50
31	1409A x RSV 1093	68.89	1.14	5.33 **	121.56	1.84	2.90	226.55	0.82	-5.80
32	1409A x RSV 1130	69.33	0.82	4.33 **	122.22	1.87	0.10	210.93	1.64	56.10
33	1409A x RSV 1188	68.22	0.72	-0.57	123.22	2.56	1.70	219.55	0.93	-16.90
34	1409A x RSV 1200	70.56	0.87	-0.43	122.11	1.56	-1.20	231.23	0.65	101.00
35	1409A x RSV 1297	68.56	1.70	0.23	122.56	1.39	-0.80	219.03	1.15	-27.30
36	1409A x SPV 1359	69.67	1.49	1.82	121.78	1.33	3.40	220.99	1.22	11.60
37	1409A x RSV 1427	70.44	1.12	-0.65	122.44	0.84	-1.10	215.57	0.64	493.30**
38	1409A x RSV 1460	70.00	1.42	3.20 *	123.67	1.90	21.10**	185.90	1.07	-47.20
39	1409A x SPV 1546	67.33	0.83	1.35	120.56	1.28	27.60**	198.69	1.37	-16.00
40	1409A x SPV 1704	68.56	1.73	-0.18	121.33	0.98	-1.30	218.67	1.11	-45.50
41	1409A x RPOSV 3	70.89	1.85*	-0.63	119.67	1.36	0.80	193.13	1.47	-35.40
42	1409A x RSSGV43	69.67	1.17	0.53	121.00	1.36	6.00 *	219.44	0.89	-5.50
43	1543A x RSV 458	69.00	0.89	2.73 *	122.11	1.08	3.40	193.33	1.09	117.80
44	1543A x RSV 1006	69.56	1.19	-0.66	120.78	0.84	7.50 *	204.98	1.30	14.00
45	1543A x RSV 1093	71.89	1.06	-0.66	124.11	1.13	65.10**	227.95	1.17	5.70
46	1543A x RSV 1130	73.33	1.34	1.09	124.78	1.36	16.60**	232.80	1.14	6.60
47	1543A x RSV 1188	72.56	1.16	3.54 *	122.33	1.55	-0.80	242.94	0.70	2.60
48	1543A x RSV 1200	72.33	0.48	0.57	122.67	1.32	-0.90	238.08	1.22	183.80*

*, ** Significant at 5% and 1% level of probability, respectively.

Table 2.1. Contd.,

Sr. No.	Genotypes	Days to 50 per cent flowering			Days to maturity			Plant height (cm)		
		Mean	**b_i**	**S^2di**	**Mean**	**b_i**	**S^2di**	**Mean**	**b_i**	**S^2di**
49	1543A x RSV 1297	76.70	0.49	58.68 **	125.89	0.66	16.40**	256.39	0.75	120.10
50	1543A x SPV 1359	72.67	0.95	1.34	125.33	0.86	10.90 **	245.01	0.77	700.30**
51	1543A x RSV 1427	71.55	0.75	4.89 **	127.78	1.11	-1.40	227.37	1.40	124.20
52	1543A x RSV 1460	70.55	1.52	-0.55	122.33	1.58	24.10 **	204.43	1.62	-35.40
53	1543A x SPV 1546	70.55	1.00	-0.46	122.78	1.22	11.00 **	218.68	1.38*	-48.10
54	1543A x SPV 1704	72.22	0.93	-0.66	121.44	0.50	9.00 **	240.10	0.62*	-48.10
55	1543A x RPOSV 3	71.11	0.86	-0.66	122.44	1.74	11.20 **	203.39	1.73	-5.60
56	1543A x RSSGV43	70.55	0.59	-0.59	118.11	0.39	1.40	212.34	1.39*	-48.30
57	9168A x RSV 458	65.11	0.84	0.11	115.67	0.84	3.80	207.73	1.09	-27.80
58	9168A x RSV 1006	67.89	0.71	0.59	115.22	0.25	-0.60	236.55	1.53*	-48.10
59	9168A x RSV 1093	68.55	0.50	1.52	115.78	0.06	5.80 *	240.16	1.82	127.40
60	9168A x RSV 1130	69.89	0.33	-0.62	116.33	0.46	1.10	237.07	0.70	19.40
61	9168A x RSV 1188	68.89	0.56	2.95*	114.67	0.38	-0.90	246.27	1.47	-40.40
62	9168A x RSV 1200	69.67	0.72	-0.34	116.00	-0.33	3.70	242.24	1.23	35.00
63	9168A x RSV 1297	68.11	0.04	1.61	115.33	-0.45	-0.50	241.35	0.93	-18.70
64	9168A x SPV 1359	69.44	0.52	-0.51	116.44	0.28	6.70 *	252.47	0.86	129.90
65	9168A x RSV 1427	67.89	0.05	0.26	115.00	0.19	3.60	248.37	1.24	-30.10
66	9168A x RSV 1460	68.00	-0.07	-0.52	114.22	0.29	0.40	234.80	1.78	32.60
67	9168A x SPV 1546	69.11	0.17	1.70	115.56	0.33	7.70 *	231.47	1.29	-41.10
68	9168A x SPV 1704	69.00	0.19	-0.46	116.33	0.01	12.60 **	233.77	1.32	7.10
69	9168A x RPOSV 3	70.11	0.58	0.00	116.78	-3.50	2.90	229.13	1.11	-48.00
70	9168A x RSSGV 43	68.78	0.96	2.30 *	114.89	8.60	-1.30	241.39	0.34*	-48.10
71	CSH 15 R (c)	69.11	0.65	-0.48	118.89	0.25	-0.60	207.56	0.55	43.00
	Mean (Hybrids)	**70.04**			**120.98**			**224.36**		
72	104A	71.67	0.39*	-0.66	125.33	1.17	0.10	144.28	0.24	52.00
73	1343A	70.39	1.72	3.85 **	125.30	1.41	59.30 **	135.19	0.93	-30.70
74	1409A	73.00	1.84	-0.47	128.89	1.38	9.30 **	113.77	-0.28*	-47.50
75	1543A	76.01	0.61	21.79 **	129.00	0.18	6.30 *	130.14	0.12	-37.80
76	9168A	73.33	0.93	-0.30	119.89	0.68	31.90 **	163.75	0.64	203.70*
77	RSV 458	66.89	1.86	-0.22	114.11	0.21	2.40	163.05	1.33	374.70**
78	RSV 1006	69.00	2.59	-0.26	118.22	1.12	-1.40	175.70	0.52	61.40
79	RSV 1093	72.33	0.28	-0.10	126.56	0.07	4.40*	218.83	1.74	139.60*
80	RSV 1130	77.55	1.54	22.61**	127.67	0.57	7.10 *	217.24	0.63	24.20
81	RSV 1188	75.89	1.44	7.19 **	128.33	0.83	-0.30	204.79	1.72	755.40**
82	RSV 1200	75.11	1.15	1.60	122.61	0.12	40.20 **	218.29	0.50	-34.50
83	RSV 1297	72.00	0.68	-0.23	122.44	0.80	-0.50	228.57	0.22*	-48.30
84	SPV 1359	73.33	1.05	11.15 **	124.00	0.95	-0.10	229.39	0.56	-40.70
85	RSV 1427	70.11	0.73	-0.66	120.56	1.00	6.00 *	205.83	0.40	9.20
86	RSV 1460	72.44	1.35	2.63 *	120.42	1.39	48.10 **	214.93	0.18	174.90*
87	SPV 1546	72.33	0.47	-0.58	121.22	0.63	1.10	211.16	1.57	204.70
88	SPV 1704	72.33	1.21	24.70 **	122.22	0.63	-1.30	215.35	0.57	-44.60
89	RPOSV 3	72.78	0.14	-0.41	126.00	0.60	6.90 *	205.95	0.34	710.40**
90	RSSGV 43	71.33	1.72	-0.48	118.11	1.78	29.90 **	199.99	0.63	227.70*
91	BP 53 (c)	80.67	1.11	-0.21	128.89	1.30	15.8**	175.98	0.83	-6.80
	Mean(Parents)	**72.92**			**123.49**			**188.61**		

*, ** Significant at 5% and 1% level of probability, respectively.

Table 2.2. Stability parameters for leaves per plant, plant, leaf area per plant and dry stover yield per plant in *rabi* sorghum

Sr. No.	Genotypes	Leaves per plant			Leaf area per plant(dm^2)			Dry stover yield per plant(g)		
		Mean	b_i	S^2di	Mean	b_i	S^2di	Mean	b_i	S^2di
1	104A x RSV 458	9.44	0.44	-0.13	30.65	-0.99	7.53 **	145.30	-0.21	38.30
2	104A x RSV 1006	10.22	2.64	0.24	31.65	-0.22	65.82**	204.90	2.73	-66.80
3	104A x RSV 1093	9.81	1.60	-0.13	32.30	1.46	21.64**	215.30	2.73	-52.50
4	104A x RSV 1130	10.37	2.90	-0.12	32.79	1.74	-0.47	161.10	2.39	-34.50
5	104A x RSV 1188	10.44	0.46	0.01	31.91	2.42	17.95**	159.80	1.17	-159.80
6	104A x RSV 1200	9.92	3.29	0.19	28.24	0.78	3.06 *	114.30	-0.56	-137.70
7	104A x RSV 1297	10.00	2.18	-0.09	31.64	0.43*	-0.79	119.20	1.96*	-160.70
8	104A x SPV 1359	10.07	1.00	-0.08	33.49	-1.08	9.14**	143.00	1.31	275.10
9	104A x RSV 1427	9.78	2.17	-0.13	30.72	0.49	-0.19	145.80	-0.84	-66.60
10	104A x RSV 1460	9.59	2.02*	-0.14	33.26	0.42	17.00 **	122.80	2.10	-159.60
11	104A x SPV 1546	9.70	1.16	-0.14	33.38	-0.95	12.66 **	90.30	-1.76	-42.40
12	104A x SPV 1704	10.15	-0.53	0.49 *	32.41	2.24	21.19 **	144.00	3.70	-137.90
13	104A x RPOSV 3	9.44	2.99	0.39	33.84	-0.24	17.45 **	66.50	-1.74*	-159.00
14	104A x RSSGV 43	9.59	0.75	0.01	29.43	0.29	29.44**	136.10	5.77	272.20
15	1343A x RSV 458	10.07	0.15	-0.13	33.91	1.91	83.63**	139.00	-4.25	682.80*
16	1343A x RSV 1006	10.55	0.90	0.08	35.42	2.22	11.96**	202.90	-1.27	-79.20
17	1343A x RSV 1093	10.96	1.90	0.01	36.41	2.48	7.09**	168.10	-2.50	136.00
18	1343A x RSV 1130	10.81	2.93	0.24	35.82	1.73	4.58*	141.80	0.74	310.60
19	1343A x RSV 1188	11.11	1.32	-0.08	36.71	1.16	22.15**	161.40	-6.69	1437.5**
20	1343A x RSV 1200	11.95	-0.39	-0.05	44.04	1.22	0.53	123.80	0.35	-120.10
21	1343A x RSV 1297	10.70	1.17	-0.11	34.67	2.70	-0.50	204.80	-1.63	666.90*
22	1343A x SPV 1359	11.59	-0.71	0.01	42.26	1.00	-0.74	122.60	1.79	-159.90
23	1343A x RSV 1427	10.96	0.25	-0.13	38.82	0.99	10.47**	111.20	2.38	-136.60
24	1343A x RSV 1460	11.49	-0.44	-0.12	39.89	1.6	0.43	106.50	1.44	433.40
25	1343A x SPV 1546	10.74	1.88	-0.13	37.42	1.71	17.62**	131.50	-5.44	-46.80
26	1343A x SPV 1704	11.43	0.52	0.33	40.55	1.00	0.17	119.10	1.75	-44.90
27	1343A x RPOSV 3	9.96	2.29	-0.03	35.31	-2.42	25.40 **	146.20	1.92	17.10
28	1343A x RSSGV43	10.41	0.63	0.47*	35.67	0.70*	-0.81	145.40	3.63	154.80
29	1409A x RSV 458	8.63	2.29	-0.03	27.60	-1.40	9.44 **	75.70	-1.48*	-157.50
30	1409A x RSV 1006	9.41	0.58*	-0.14	32.81	0.96	20.02**	137.50	-1.64	218.10
31	1409A x RSV 1093	9.93	-0.12	0.02	38.15	1.80	2.98*	115.00	3.70	87.90
32	1409A x RSV 1130	9.48	2.45	-0.13	36.07	0.45	-0.59	175.10	1.58	-160.40
33	1409A x RSV 1188	9.22	0.83	0.26	32.62	1.25	11.30**	133.00	4.06	1598.20**
34	1409A x RSV 1200	11.38	-0.48	-0.04	41.25	2.02	1.04	91.30	-0.12	-24.80
35	1409A x RSV 1297	9.26	1.59	-0.13	34.09	-0.33	7.42 **	128.30	1.14	800.40*
36	1409A x SPV 1359	9.41	0.59	-0.11	35.46	0.74	5.59**	113.30	2.38	-145.80
37	1409A x RSV 1427	9.37	1.19	0.08	33.27	-0.05	9.72**	101.50	0.31	111.00
38	1409A x RSV 1460	8.70	-0.13	-0.08	30.03	1.65	-0.42	126.20	-2.83	-132.30
39	1409A x SPV 1546	8.85	0.99	0.02	34.71	1.38	45.53**	103.00	-2.06	-0.40
40	1409A x SPV 1704	9.22	2.14	0.18	33.86	-0.64	6.96**	111.80	-4.09	340.30
41	1409A x RPOSV 3	8.81	2.42	0.38	30.44	-1.17	4.21*	156.90	1.62	1597.40**
42	1409A x RSSGV43	9.15	-0.60	-0.04	32.29	0.93	3.03*	108.30	1.52	832.30*
43	1543A x RSV 458	9.59	1.59	-0.13	28.43	1.42	4.66**	107.50	0.16	470.30*
44	1543A x RSV 1006	10.26	0.71	-0.08	32.85	1.60	19.12**	98.40	-2.20	-149.80
45	1543A x RSV 1093	10.48	2.90	-0.12	32.56	1.26	-0.77	133.90	-2.45	-101.10
46	1543A x RSV 1130	10.67	3.02	-0.07	36.50	1.90	-0.64	160.50	0.31	100.10
47	1543A x RSV 1188	11.40	1.54	-0.12	40.78	1.72	8.47**	120.90	1.58	-39.50
48	1543A x RSV 1200	10.92	2.07	0.46 *	36.014	1.65	-0.46	127.80	0.82	102.10

* and ** Significant at 5% and 1% level of probability, respectively.

Table 2.2. Contd.,

Sr. No.	Genotypes	Leaves per plant			Leaf area per plant(dm^2)			Dry stover yield per plant(g)		
		Mean	b_i	S^2di	Mean	b_i	S^2di	Mean	b_i	S^2di
49	1543A x RSV 1297	11.77	-2.54	0.20	41.93	1.57	34.36 **	130.80	1.16	-11.20
50	1543A x SPV 1359	10.63	1.05	0.16	36.38	1.58*	-0.80	129.90	-2.49	264.80
51	1543A x RSV 1427	10.48	-0.10	0.36	38.35	1.78	6.00 **	121.80	2.85	-102.30
52	1543A x RSV 1460	9.70	1.13	0.09	33.92	1.78	5.64 **	112.40	-2.63*	-158.20
53	1543A x SPV 1546	10.04	2.04	-0.04	34.12	0.97	19.93**	127.60	-0.33	-143.30
54	1543A x SPV 1704	11.51	-0.68	-0.01	39.78	2.10	1.11	122.90	2.66	20.00
55	1543A x RPOSV 3	9.81	2.88	-0.11	34.09	-0.74*	-0.63	164.60	2.50	1583.40**
56	1543A x RSSGV43	10.37	2.02	-0.11	30.21	0.94	3.15 *	132.40	5.49	625.0*
57	9168A x RSV 458	10.00	1.31	-0.13	30.33	1.05	60.38 **	192.60	9.80	95.50
58	9168A x RSV 1006	10.55	4.78*	-0.13	33.41	1.64	-0.69	181.70	5.15*	-156.20
59	9168A x RSV 1093	10.33	2.16	-0.13	28.47	-1.06	0.61	161.80	3.89	943.60**
60	9168A x RSV 1130	11.55	-0.00	-0.08	35.00	-3.22	5.44 **	110.60	4.02	375.00
61	9168A x RSV 1188	10.70	2.45	-0.13	30.90	1.24*	-0.81	237.10	6.59	-114.50
62	9168A x RSV 1200	10.55	2.20	0.15	32.02	2.07	-0.11	123.90	-0.74*	-160.80
63	9168A x RSV 1297	10.52	0.61	0.08	35.30	1.86	65.91**	201.90	0.75	427.80
64	9168A x SPV 1359	10.67	2.16	-0.13	32.16	-1.96	26.91**	209.80	-1.31	-55.70
65	9168A x RSV 1427	10.59	-0.13	-0.08	31.17	1.46	3.56*	164.70	6.05	446.20
66	9168A x RSV 1460	10.22	3.06	0.00	33.69	-0.22	26.48**	196.40	1.79	21.10
67	9168A x SPV 1546	10.48	2.02*	-0.14	32.76	1.26	65.85**	162.70	2.04	496.20*
68	9168A x SPV 1704	10.89	0.88	-0.11	34.71	1.64	40.25 **	155.60	1.82	564.60*
69	9168A x RPOSV 3	10.26	0.69	0.17	32.33	0.69	20.48**	101.30	3.82	395.60
70	9168A x RSSGV 43	10.36	1.91	0.77	33.07	1.03	36.25**	212.90	8.23	-104.10
71	CSH 15 R (c)	9.62	-0.30	-0.11	31.10	1.50	0.79	138.60	0.21	-160.40
	Mean (Hybrids)	**10.24**			**34.19**			**141.02**		
72	104A	9.22	0.43	-0.13	30.08	1.07	3.76*	121.70	0.10	-0.40
73	1343A	9.93	0.28	-0.029	36.64	1.45	5.56 **	120.30	2.25	-15.70
74	1409A	8.41	2.74	-0.13	26.42	-1.52	8.56 **	76.80	-1.56	1018.40**
75	1543A	9.92	-0.18	0.16	31.48	2.17	33.49**	108.70	0.22	372.40
76	9168A	10.05	0.15	1.16	34.22	0.56	143.66**	103.80	1.43	-130.30
77	RSV 458	9.85	0.11	0.17	20.74	-0.52	0.59	106.40	0.84	-127.60
78	RSV 1006	9.96	1.41	0.27	23.48	1.22	13.43 **	134.70	1.62	-160.30
79	RSV 1093	10.95	-1.27*	-0.17	36.18	1.19	34.45 **	170.30	2.27	-143.90
80	RSV 1130	10.44	0.73	-0.07	37.59	2.05	21.16 **	149.40	-2.48	-32.80
81	RSV 1188	10.23	0.64	-0.11	36.13	1.76	27.73 **	167.60	1.71	177.40
82	RSV 1200	10.21	-0.23	0.29	30.86	2.33	79.43 **	168.30	-2.68	-65.30
83	RSV 1297	10.01	-2.65	-0.06	30.46	1.83	0.76	149.00	-0.75	-52.70
84	SPV 1359	10.26	-0.99	0.03	33.72	2.98	10.92 **	190.90	2.37	-5.50
85	RSV 1427	10.09	-2.44	0.43	28.99	1.65	1.12	128.80	2.30	-123.70
86	RSV 1460	10.23	-0.48	0.15	30.52	2.17	43.61 **	182.70	-2.92	425.70
87	SPV 1546	10.93	-0.62	-0.11	37.02	3.18	0.05	171.90	-0.04	-160.00
88	SPV 1704	10.03	0.02	0.02	28.84	1.94	61.38 **	174.50	2.37	-97.50
89	RPOSV 3	10.63	2.32	-0.12	33.86	0.81	19.14*	169.50	4.16	19.90
90	RSSGV 43	10.62	2.33	-0.09	32.29	1.14	14.6**	97.00	4.60	596.80*
91	BP 53 (c)	10.26	-1.93	0.59*	41.69	3.13	0.50	135.60	0.59	-121.90
	Mean (Parents)	**10.11**			**32.06**			**141.40**		

*, ** Significant at 5% and 1% level of probability, respectively.