https://doi.org/10.29321/MAJ.10.A02614

Madras agric. J. 70. (5): 284—288 May 1983

STABILITY ANALYSIS OF CERTAIN YIELD COMPONENTS IN MULTICUT TYPES OF FORAGE SORGHUM

HIRACHAND PATHAK[1] and A. K. SANGHI[2]

Ten promising varieties of forage sorghum were evaluated for stability of performance for plant height, stem girth, tillers/plant, leaves/plant, leaf length in 5 environments in two cuts at Anand (Gujarat) during 1980-'81. Genotypes and evironments were highly significant in both cuts for all the characters studied. Characters like plant height tillers/plant, leaves/plant and leaf breadth were unstable in all the varieties studied. However, varieties like M. P. Chari in First cut for stem girth and leaf length and IS 3211 in second cut for stem girth showed average stability. Genotype IS 3201 showed the maximum plant height, stem girth and leaf length and was generally stable. SSG 59-3 possessed higher tillers and the highest leaves/plant. Stability parameters showed association between $\overline{X}$ and b for plant height, $\overline{X}$ and S^2d for leaves/plant and $\overline{X}$ and b for leaf breadth. All three parameters were significantly associated for tillers/plant.

Forage crops in general are low seed producers probably because of their more vegetative growth and application of low selection pressure for high seed production ability. Consequently the cost of seed production increases. Therefore, some compensatory mechanism in these crop varieties is needed to increase their fodder productivity when low seed rates are used. Genotypes differ in their stability of performance. Forage yield being a complex character depends upon many components. The present study was, therefore, undertaken to select genotypes having stability for various yield components for forage which may impart this ability to their performance.

MATERIAL AND METHODS

The experimental material consisted of ten promising varieties of forage sorghum *viz.*, M.P. Chari, SSG 59-3, IS 3201, IS 3211, IS 720, IS 3301, IS 3279, Piper Sudan and IS 3318. The varieties were evaluated in five separate experiments in randomized block design with three replications at the Forage Research Farm, Gujarat Agriculture University, Anand. The environments were created by sowing at 5 different spacings i.e., solid sowing (20Kg/ha seed rate), 5cm, 10cm, 15cm, and 20cm within rows and 30cm between rows. Individual plot consisted of 5 rows of 5m length. Observations on five randomly selected plants were recorded on plant height (cm) stem girth length and leaf (mm), tillers/plant, leaves /plant, leaf breadth (cm). Harvesting was done at 50% flowering. Forty Kg N+40Kg P_2O_5 was applied as basal dose followed by 40Kg N after one month. Twenty Kg nitrogen/ha was applied after first cut Normal agronomic practices were followed to maintain the crop.

The stability parameters were worked cut according to the method given by Eberhart and Russel (1966).

Department of Agricultural Botany, Gujarat Agricultural University, Anand Campus, Anand.

RESULTS AND DISCUSSION

The mean squares due to varieties and environments were highly significant indicating that the varieties and the environments differ significantly in their response. The genotype x environment interactions were also highly significant when tested against pooled error revealing differential response of genotypes to varying environments for various characters studied. The varieties differ significantly for linear response to environmental effects and also for the deviations from linearity for all the characters under both the cuts. The mean squares due to pooled deviations were also significant for all the characters in both the cuts indicating that both the linear regressions and the deviations from linearity were the major components for differences in stability for various characters.

All the three parameters of stability for various genotypes for the characters studied are presented in Table 1. Both b and S^2d values were significant for 8 varieties in I cut and 2 varieties in II cut indicating that both linear and non-linear components accounted for genotype-environment interactions for these varieties. Genotypic-environment interactions were absent for 2 varieties in II cut. Genotype IS 3201 showed the maximum plant heigh, above average response in II cut and was unstable. Six varieties in I cut and 5 varieties in II cut showed better response to favourable environment whereas the reverse was true for 4 varieties in I cut and 5 varieties in II cut.

Significant b and S^2d values observed for 5 varieties in I cut and one variety in II cut for stem girth revealed that both linear and non-linear components accounted for major portion of genotype-environment interactions in these genotypes. Linear component for 2 varieties in I cut and 4 varieties in II cut and non-linear component for 2 varieties in I cut and 5 varieties in II cut mainly accounted for genotype environment interaction. IS 3201 showed the maximum stem girth (both cuts) and above average response in I cut and below average response in II cut and was stable. Four varieties in I cut and one variety in II cut showed average response. M. P. Chari in I cut and IS 3211 in II cut showed average performance and response and were stable Three varieties in I cut and 5 varieties in II cut were responsive to favourable environments and were mostly unstable.

Non significant b values in both cuts except for IS 3301 in I cut indicated that non-linear component was mainly responsible for major portion of the genotype-environment interaction for tillers/plant in these genotypes. The genotype/environment interactions were absent for 3 genotypes in I cut and one genotype in II cut. Varieties M. P. Chari in I cut and IS 3201 and, IS 3228 and Pipe Sudan in II cut showed average response and were unstable. Five varieties in I cut and 3 varieties in II cut showed above average response and were unstable whereas 4 varieties in I cut and 3 varieties in II cut showed below average response for this character.

For leaves/plant non-linear component of genotype-environment interaction was mainly important. Piper Sudan had above average performance and better response to favourable environments and was unstable. Five genotypes each in I and II cut had above average response whereas 5 genotypes in I cut and 4 genotypes in II cut showed below average response for leaves/plant.

Both b and S^2d values were significant for 2 genotypes in I cut and one genotype in II cut for leaf length which revealed that both linear and non-linear components accounted for genotype-environment interactions. Linear components for one genotype in I cut and 3 genotypes in II cut non-linear component for 7 genotypes in I cut and 6 genotypes in II cut mostly governed genotype-environment interaction for these genotypes. IS 3201, IS 3301, Piper Sudan and M. P. Chari in I cut and SSG 59-3 in II cut showed average response and were mostly stable, Two genotypes in I cut and 5 genotype in II cut had above average response and were generally unstable, where as 4 genotypes each in I and II cut showed average response for this character.

For leaf breadth the non-linear component was largely responsible for genotype-environment interaction observed whereas both linear and non-linear components counted for genotype - environment interactions in 4 genotypes in I cut and 1 genotype in II cut. Maximum leaf breadth was observed for IS 720 followed by IS 3279 in I cut and IS 3279 followed by IS 3201 in II cut. Genotypes IS 3228, Piper Sudan and M. P, Chari in I cut and IS 3228, in II cut showed average response and were mostly stable.

The significant negative correlation observed between $\bar{x}$ and b value for plant height indicated that heigher plant height would lead to instability of genotype. Significant positive correlation observed between $\bar{X}$ and S^2d in I cut and between all the parameters of stability in II cut for tillers/plant indicated that use of mean value can be made to judge the stability of these g notypes for tillers/plant. The stability parameter $\bar{x}$ was positively correlated with S^2d in I cut and b in II cut for leaf number and with b for leaf breadth in I cut which indicated the possible linkage between the genetic systems controlling these traits. Non - significant correlations observed between three paramenters of stability for stem girth (both cuts), leaf leng,h (both cuts), leaf breadth (II cut) suggested that independent genetic systems were responsible for the control of these parameters.

The authors are thankful to the Director of Campus, Gujarat Agriculture University, Anand and Director of Research Gujarat Agricultural University, Ahmedabad for facilities. The first author acknowledges the financial assistance provided by ASPEE Foundation, Malad, Bombay for pursuing his Ph. D. Studies.

REFERENCES

EBERHART, S. A. and W. A. RUSSEL, 1966. Stability parameters for comparing varieties. *Crop. Sci.*, 6: 33-40.

Table 1 Stability parameters for 6 yield components in forage sorghum and correlation coefficients among them

Variety	Plant height						Stem girth						Tillers/plant					
	I cut			II cut			I cut			II cut			I cut			II cut		
	$\bar{X}$ (cm)	b	S^2d	$\bar{X}$ (cm)	b	S^2d	$\bar{X}$ (cm)	b	S^2d	$\bar{X}$ (cm)	b	S^2d	$\bar{X}$ (cm)	d	S^2d	$\bar{X}$ (cm)	d	S^2d
M. P. Chari	233	1.42*	59.3**	253	2.31	218.0**	84	1.07**	2.0	91	1.[illegible]6	39.2**	1.62	1.04	0.04*	2.15	0.10	0.04
SSG 59-3	238	1.29*	35.0	225	1.56	351.5**	65	0.96	51.9	46	1.49**	-2.5	3.34	1.42	0.36**	4.68	2.01	4.81**
IS 3201	241	0.35*	76.0**	262	0.05	120.3**	104	1.18**	7.9	115	-0.37**	28.8**	1.81	0.15	0.14**	3.53	1.05	0.26**
IS 3211	216	0.51**	48.3**	216	1.15	22.1	85	0.82**	58.2**	83	0.97**	-6.7	1.97	1.60	0.04*	3.85	0.28	0.97**
IS 720	205	1.45	92.6**	215	0.76	10.6	94	1.19**	14.7*	83	1.17	88.2**	1.70	0.64	0.02	3.10	1.56	0.27**
IS 3301	201	0.05**	-4.6	196	0.09**	10.4	86	0.87**	-0.2	64	0.62	10.6	1.72	1.33*	-0.02	3.60	1.23	0.28**
IS 3228	224	1.53**	41.4**	222	0.89	260.0	99	1.09**	37.3	87	1.39	52.5	1.60	1.57	0.07**	2.75	0.92	0.93**
IS 3279	225	1.35**	34.2*	244	1.81	252.5	94	1.13**	26.2**	115	1.51	303.1	1.72	0.25	0.002	2.45	-0.30	0.19**
Piper Sudan	233	1.67*	139.4**	23[illegible]	-1.13**	36.6	90	0.99	68.9	95	0.61	10.8	1.32	0.46	0.02	2.95	0.95	1.32**
S 3318	221	0.37	59.6**	227	1.75	80.4	74	0.71**	37.9	65	1.36	80.2	1.49	1.49	0.06**	5.00	1.87	2.34**
Mean	224.2			229.7			88.0			84.9			1.83			3.41		
C.D. at 5%	4.4			5.6			2.8			3.6			0.18			0.26		
r (X, b)	0.32			-0.76*			0.59			-0.40			0.28			0.75*		
r (X, S²d)	-0.33			0.41			-0.33			0.50			0.89**			0.73*		
r (b, S²d)	0.36			0.53			-0.37			0.38			0.19			0.64*		

*, P=0.05 ; **, P=0.01

Table 1 Contd.

	Leaves/Plant (no.)					Leaf length (cm)						Leaf breadth (cm)					
	I cut		II cut			I cut			II cut			I cut			II cut		
$\bar{X}$	b	S²d	$\bar{X}$	b	S²d	$\bar{X}$	b	S²d	$\bar{X}$	b	S²d	$\bar{X}$	d	S²d	$\bar{X}$	d	S²d
12.3	0.51	2.22**	20.5	0.35**	9.74**	67.0	0.92**	0.11	64.8	1.52**	0.39**	3.7	0.95	0.04**	4.2	1.50	0.14**
19.7	1.55	10.08**	34.7	1.78**	2.03	65.1	0.87	36.97**	54.4	1.04	8.72**	2.9	-0.01**	0.01	2.5	0.36*	0.001
14.5	0.12	5.02**	33.4	1.45**	3.19*	71.9	1.09	5.74**	73.3	0.77	6.90**	4.1	1.14	0.19**	4.7	0.37**	0.02
13.9	0.64	1.55**	31.2	0.62	82.49**	71.0	0.8· **	2.35**	58.3	1.58	6.39**	3.6	0.99	0.26**	3.4	1.13	0.10**
12.9	0.49	1.94**	26.4	1.33	33.26**	67.0	1.47**	5.91**	55.1	-0.20	0.45	4.5	1.32*	0.09**	3.8	0.05*	0.09**
12.9	1.29	1.94**	29.1	1.10	3·.38**	65.2	0.93	5.09**	54.3	0.53	18.58**	3.4	0.53**	0.09**	3.1	0.64	0.10**
13.4	1.66**	0.35	24.2	0.78	40.51**	71.7	0.83	12.46**	61.8	1.74	15.64**	3.9	1.01	0.06**	3.6	1.09	0.03*
13.1	0.35	3.69**	23.9	-0.07**	3.72*	63.9	1.11	4.49**	61.4	1.42	14.65**	4.4	1.18*	0.06**	4.9	1.75	0.21**
12.8	1.69	3.69**	29.6	0.98	29.48**	68.6	1.02	9.31**	58.1	0.63**	2.43	3.8	1.05	0.05**	3.7	0.66	0.08**
10.8	1.25	2.15**	31.9	1.65	39.19**	59.8	0.80	8.60**	54.4	2.23*	4.56**	3.6	1.42**	0.09**	3.0	1.75	0.72**
	13.6			29.5			67.1			59.6			3.8			3.7	
	1.45			0.93			1.19			1.14			0.14			0.16	
	0.14			0.84**			0.11			0.10			0.80**			0.19	
	0.66			0.09			-0.16			-0.07			0.44			0.16	
	0.09			-0.06			-0.23			0.24			0.45			0.63	

*, P=0.05 ; **, P=0.01