of stability, the genotype with the least deviaition around the regression being the most stable and vice versa. It was evident that no variety was stable for the expression of all the eight traits over environments. The trait-wise analysis showed that some genotypes were stable for any one trait only. Five high yielding genotypes Viz., KS 6312, CSH1, CSH 5, COH 3 and K Tall had more than unit regression suggesting that these would be suitable for growing under favourable environments. Six genotypes Viz., Co 23, Co 35, KS 7078, CS 3541, SPV 544 TNS 33 had less than unit regression and least deviation from regression and these two would be preferred for growing under unfavourable environments. They were more responsive to less favourable growing conditions as reflected by low 'b' values. They were also stable as they had low deviation from regression. Further, the exploitation of these genotypes noted for their stability would be thought of for use in the breeding programme for transferring the stability attribute and thereby improving the productivity of sorghum.

Among the genotypes under study, CSH 1 recorded the highest grain yield (Table 3). The regression co-efficient of this genotype was more than unity and this suggests that this genotype would perform well under favourable environments.

The entries KS 6312, and SPV 472 were found to be unstable as they recorded highly significant deviation from regression, CSH 9 was found to be the most stable genotype with the least mean square deviation $(Sd)^{-2}$, 'b' value nearer to unity and high grain yield.

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GENOTYPIC STABLITY FOR PANICLE CHARACTERS IN GRAIN SORGHUM (*Sorghum bicolor* (L) Moench)

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ABSTRACT

Twenty grain sorghum entries comprising fifteen varieties and five hybrids evaluated under eight environments showed significant genotypic environment interactions for all the panicle characters studied. Based on genotypic stability parameters all the entires were unstable for number of rachis per panicle. The entries CS 3541 and TNS 31 are studied for varying environments while Co 25 and TNS 33 are studied for favourable environments.

The stability of yield in different environments is considered important in crop breeding progra mmes. Panicle characters *viz.,* panicle length, panicle breadth, peduncle length, peduncle girth, number of rachis perpanicle and grain yield are the important component of yield. Various procedures have been employed to characterize the behaviour of individual genotypes for varying environmental conditions (Eberhart and Russell, 1966; Tai, 1971)

Earlier studies on stability in sorghum were mostly based on phnoytpic stability (Rao and Harinarayana, 1969; Singh and Nayeem 1980; Singh and Singh, 1980).Studies on genotypic stability are limited in grain sorghum. Hence, the present investigation was undertaken with a view to work out the genotypic stability for panicle characters in grain sorghum *Sirghum bicolor* (L) Moench).

MATERIALS AND METHODS

Twenty grain sorghum entries comprising of fifteen varieties and five hybrids were evaluated for

Table 1. Analysis of variance for genotypic stability of panicle characters in grain sorghum

Source	d.f.	Mean square					
		Panicle length (cm)	Panicle breadth (cm)	Peduncle length (cm)	Peduncle girth (cm)	Number of rachis per panicle	Grain yield per panicle
Environments	7	55.26**	8.20**	681.86**	0.50	469.89**	282.2**
Replication within environments	8	2.69	0.20	14.81	0.01	38.91	13.47
Genotypes	19	319.67**	4.51**	213.37**	0.03**	827.88**	333.43**
Environment x genotype	133	7.39**	0.55**	26.32**	0.01	45.44**	35.18**
Linear response	19	7.46	0.88	54.29	0.01	65.06	56.31
Deviation from response	114	7.38	0.49	21.66	0.01	42.17	31.66
Error	152	1.55	0.12	2.89	0.001	14.38	11.29

** Significant at one per cent level

stability of panicle characters in eight environments at Agricultural Research Station, Kovilpatti during 1985-86. Eight environments were created for conducting the treial in a single location, two different soils-Vertisol and Alfisol, two fertility levels-High and low and two seasons-Summer and Monsoon.Application of N:P:K at the rate of 90: 45: 45kg/ha was a high fertility condition and application of 45: 22.5: 22.5 kg/ha was a low fertility condition. The eight environments E_1,E_2 E_3,E_4,E_5,E_6,E_7,E_8 are as under:

E_1 summer season Vertisol high fertility
E_2 summer season Vertisol low fertility
E_3 summer season Alfisol high fertility
E_4 summer season Alfisol low fertility
E_5 momsoon season Vertisol high fertility
E_6 monsoon season Vertisol low fertility

Table 2. Genotypic stability parameters for panicle characters in grain sorghum

Genotype	Panicle length (cm)			Panicle breadth (cm)			Peduncle length (cm)		
	Mean	$\hat{\alpha}$	$\hat{\lambda}$	Mean	$\hat{\alpha}$	$\hat{\lambda}$	Mean	$\hat{\alpha}$	$\hat{\lambda}$
Co. 21	16.65	-0.101	0.508	5.58	0.720	2.180	5.42	0.049	7.337
Co. 23	17.28	0.069	1.325	5.00	-0.975	0.810	2.49	-0.491	1.509
Co. 24	17.76	-0.165	1.575	5.28	-0.135	3.520	3.12	-0.570	1.365
Co. 25	20.16	0.873	4.245	5.02	-0.859	1.370	5.44	0.340	0.594
K 4	9.89	0.609	0.658	5.06	0.395	2.720	8.81	-0.498	32.201
IS 3541	17.64	0.471	5.004	4.04	-0.545	0.720	5.79	0.988	2.120
K 6	17.53	-0.552	1.718	5.77	1.790	1.330	12.17	0.239	2.443
KS 6312	23.15	0.903	12.007	4.78	-1.285	0.890	1.26	-0.941	0.040
KS 7078	21.04	-0.056	0.723	5.77	0.910	6.190	3.77	-0.405	3.274
CS 3541	21.47	-1.878	5.413	5.13	0.125	1.020	1.62	-0.682	0.794
SPV 544	22.45	-0.221	1.094	5.72	0.435	1.440	2.45	-0.497	1.735
TNS 31	18.02	0.800	2.697	4.70	-1.010	0.400	2.71	-0.483	0.228
TNS 33	15.68	-0.308	1.595	4.85	-0.595	0.820	1.70	-0.752	1.326
SPV 475	24.22	1.052	5.837	5.56	1.135	1.370	4.48	-0.155	5.387
SPV 472	17.73	1.125	2.410	4.91	0.865	3.530	1.53	-0.893	2.920
CSH 1	27.59	-1.239	13.692	5.97	1.330	2.720	5.57	0.893	2.020
CSH 5	27.55	0.004	0.749	4.85	0.350	2.070	11.07	1.486	26.514
CSH 9	25.28	-1.174	2.149	5.87	0.080	1.060	6.84	1.060	0.144
CoH 5	24.91	0.965	4.402	6.20	-0.275	6.910	13.30	0.177	10.762
K Tall	23.80	0.343	5.011	5.27	-0.400	0.75	7.83	0.857	4.805
Mean	20.49			5.27			5.36		
SE	0.67			0.18			1.28		

Table 3. Genotype stability parameters for panicle characters in grain sorghum

Genotype	Panicle girth (cm)			Number of rachis per Panicle (cm)			Grain yield per panicle (g)		
	Mean	$\hat{\alpha}$	$\hat{\lambda}$	Mean	$\hat{\alpha}$	$\hat{\lambda}$	Mean	$\hat{\alpha}$	$\hat{\lambda}$
Co. 21	0.84	-0.115	9.830	48.02	1.851	0.982	17.48	0.451	- 1.760
Co. 23	0.85	-0.649	44.650	54.13	-0.519	3.274	21.35	-0.826	1.024
Co. 24	0.85	0.169	65.093	55.25	0.206	2.284	19.40	0.174	0.779
Co. 25	0.83	-0.288	543.551	47.98	1.092	3.713	16.11	-0.719	0.415
K 4	0.81	0.199	43.084	61.16	0.485	1.708	21.05	-0.858	1.656
IS 3541	0.75	-0.553	18.552	38.56	-0.402	2.493	15.53	0.154	0.753
K 6	0.83	0.891	57.083	58.15	1.316	2.079	17.56	-0.688	3.118
KS 6312	0.84	-1.171	76.264	41.28	-0.790	1.238	25.41	3.039	10.740
KS 7078	0.88	0.415	10.160	43.16	0.357	0.724	22.30	-0.477	1.278
CS 3541	0.90	1.325	84.284	32.95	-0.715	4.603	20.27	-0.433	0.339
SPV 544	0.86	-0.303	22.644	43.61	-1.481	0.686	18.71	-0.555	0.646
TNS 31	0.82	-0.138	25.315	46.18	-1.643	0.184	14.76	-0.110	0.184
TNS 33	0.80	-0.510	41.665	39.75	0.429	2.037	12.49	-0.975	0.377
SPV 475	0.83	0.192	12.044	45.55	-1.402	0.559	16.95	-0.697	3.002
SPV 472	0.75	0.192	26.886	44.23	-0.670	1.512	20.16	0.747	3.320
CSH 1	0.84	0.234	123.43	51.13	1.001	0.418	28.88	1.063	0.472
CSH 5	0.82	-0.388	19.567	43.85	-0.438	0.872	21.56	0.046	0.671
CSH 9	0.90	0.756	14.893	56.61	0.927	0.854	28.01	-0.138	0.648
CoH 5	0.89	-0.273	27.670	53.30	0.785	3.923	28.27	0.909	1.462
K Tall	0.81	-0.334	78.304	47.84	0.165	0.925	21.71	1.316	2.043
Mean	0.84			47.62			20.39		
SE	0.02			1.69			3.11		

E_7 monsoon season Alfisol high fertility
E_8 monsoon season Alfisol low fertility

The experiment was conducted in a randomised block design replicated twice in each environment. Each experimental plot consisted of 4 rows of 3 m length in each replication with a spacing of 45 cm between rows and 15 cm between plants in the row. Measurements of panicle length, panicle breadth, peduncle length, peduncle girth, number of rachis per panicle and grain yield were made on 10 random plants per genotype. The combined analysis of variance (along with random replicate and environmental effects) was carried out for each series of trial. Stability statistics were estimated for each entry separately following the method suggested by Tai (1971).

RESULTS AND DISCUSSION

Pooled analysis of variance for genotypic stability for six panicle characters including yield in grain sorghum is presented in Table 1. The mean squares due to genotype were significant for all the characters. The components such as genotype x environment interaction, linear response and deviation from linear response were significant for all characters studied indicating enough variability among genotypes as well as environments.

The genotypic stability parameters are furnished in Table 2. Based on principle of structural relationship analysis (Tai, 1971), the genotype environment interaction effect of a variety was partitioned into two components *viz.*, linear response to the environmental effects as measured by α statistics and the deviation from the linear response which is measured by λ A perfectly stable variety has $(\lambda) = (1,1)$ and a variety with average stability was $(\alpha) = (0,1)$. The genotypic stability parameters which were estimated based on regression coefficient and pooled data indicated that the strains Co 21, Co 23, Co 24, K4, K6, KS7078, SPV544, TNS33 and CSH 5 possessed average stability for panicle length as these strains registered = 0 and = 1. CS3541 and CSH9 were the average stable strains for panicle breadth. Other strains viz., CO23, IS3541, TNS 33 and K.Tall also possessed above average stability for this character. Co 23, IS3541, K6, KS7078, SPV544, TNS33 and CSH1 possessed above average stability for peduncle length (Table 3). The estimates of $\hat{\alpha}$ and $\hat{\lambda}$ demonstrated that all the entries were unstable for number of rachis per panicle. The genotypic stability for grain yield showed that CS3541 and TNS 31 possessed average stability while CO 25 and TNS 33 had above average stability indicating their suitability to favourable environments.

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RESIDUAL EFFECTS OF INTERGRATED NUTRIENT MANAGEMENT IN RICE-RICE- PULSE CROPPING SEQUENCE

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ABSTRACT

A field experiment conducted with different N levels, $ZnSO_4$ sulphur, herbicide, organic manures, applied to the preceeding rice crops revealed that the residual effect of NPK plus organic manure particularly FYM significantly increased the available N, P and K contents of soil. The highest grain and haulm yield of black gram was obtained in the 100 per cent NPK plus $ZnSO_4$ applied once in a cropping sequence. The N, P, K uptake was highest in the same treatment.

Rice - rice - pulse is the general cropping sequence under wetland conditions in Tamil Nadu. In this cropping sequence, the first two rice crops are being fertilised and the third pulse is grown as rice fallow pulse without any fertiliser application. Integrated nutrient management through chemical fertilisers and organic manures play a great role in maintaining the soil fertility as well as plant crop and residual crop yield. Information on the influence of continuous application of manures and fertilisers and $ZnSO_4$ to rice - rice and also the application of herbicides and their residual effects are not fully available for the alfisols of southern districts and hence the present investigation was undertaken.

MATERIALS AND METHODS

This experiment was conducted at the Agricultural College and Research Institute, Killikulum. This experiment has been in progress since 1989 with 16 treatments replicated twice in a randomized block design. Annual crop rotation of rice - rice - pulse is being followed. The initial available nutrients status was low for N (175 kg/ha) medium for P_2O_5 and K_2O (19 kg/ha and 250 hg/ha respectively). The available NPK were estimated by following the standard procedure.

RESULTS AND DISCUSSION

Residual effect on soil available N content

The highest soil available N content in the past harvest stage of black gram was recorded in the NPK plus FYM treatment (Table 1). This might be due to continuous addition of 62.5 kg N through FYM every year and also by biological fixation of nitrogen in the FYM treatment. Similar results have also been reported by Mathan *et al.* (1978).

Residual effect on available P content of soil.

The highest available P content in the NPK plus herbicide treated plot might be due to stimulating effect of herbicide on the microorganisms which is responsible for