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Short Communications

Genotype x Environmental Interaction in Sorghum

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The study of genotype-environment interaction is important not only from genetical and evolutionary points of view but also has a relevance to crop production. In the present investigation an attempt has been made to study the differential g x e interactions using sorghum hybrids and their parents.

The experimental material comprising 99 hybrids alongwith 3 females (2077A, 2219A and 36A) and 33 males (derivatives of exotic x Indian crosses) was studied using randomized block design with three replications at three different environments namely Navsari (E_1), Surat (E_2) and Broach (E_3) during *kharif* 1978. Uniform agronomic practices were followed at all the locations. Observations on five random plants per plot were recorded in each of the replications. The data were analysed for estimation of g×e interaction using the model proposed by Perkins and Jinks (1968).

The joint regression variance of parents and hybrids, for grain yield per plant (Table 1) revealed that variation due to all sources except remainder (in parents) was highly significant. The linear components (heterogeneity of regression variance) accounted for more of

TABLE 1

Joint regression analysis for parents and hybrids. (Grain yield per plant).

Source of variation	*D.F.*	*Mean squares*
Parents:		
Lines	35	519.83**
Environments	2	1806.41**
g x e interaction		
Heterogeneity between regressions	35	2585.65**
Remainder	35	73.88
Hybrids:		
h (i ♀)'s	98	7408.23**
Joint regressions	2	14170.98**
g x e interaction		
Heterogeneity between regressions	98	820.79**
Remainder	98	856.90**
Error	804	87.57

**p=0.01

the g×e interaction than the remainder component for parents and the magnitude of linear component was higher for parents than that of the hybrids. Perkins and Jinks (1966) observed that the linear and non-linear components of g×e interactions were independent and subjected the control of different genetic systems. In the present study, the heterogeneity variance for parents alone was signi-

ficant against remainder component, indicating considerable g×e interaction based on the linear components while in case of hybrids, both heterogeneity and remainder components were significant against pooled error which did not rule out the possibility that regression of (h_{ij} g_{ij}) on E_j for some hyrbids taken individually may be highly significant when tested against their remainder component. For such hybrids, reliable prediction can still be made in this study as reported by Singhania and Rao (1976).

The estimates of d_i and B_i for females and males are presented in Table 2. The female 36A and 2077A and male M 1, M 5, M 6, M 9, M 20, M 25, M 27, M 28, M 30, M 32 and M 33 showed positive significant B_i indicating high response to environments. The remainder mean square was not significant for the parents. Hence all the significant g×e interactions between these parents, where β_i values were significant can be accounted for the three environments as a linear regression on additive environmental values.

The estimates of $\beta_{(il)}$ and $h_{(il)}$ for the various hybrids (Table 3) showed that the distributuion of the significant $\beta_{(il)}$ values was not entirely at random. The crosses with male parents M 1, M 6, M 13, M 9, M 25, M 28, M 32 and M 33 had significant B(il) values.

Thus, both parents and hybrids showed g×e interactions. The g×e interaction in case of parents was largely linear function of environmental values with regression slopes (β_{is}) differing from parent to parent. On the other hand, the hybrids exhibited significant g×e interactions due to both linear and non-

TABLE 2

Estimates of the various parameters for the parents (Grain yield per plant).

Parents		d_i	β_i
Females	2219 B	-31.9	-0.383
	36 B	3.1	1.954*
	2077B	2.0	1.112*
Males	M 1	11.8	0.543*
	M 2	- 8.2	-0.970
	M 3	- 4.0	-0.513
	M 4	- 9.2	0.392
	M 5	- 4.1	0.252
	M 6	- 0.8	0.936+*
	M 7	- 7.4	-0.187
	M 8	7.8	-0.817
	M 9	27.4	1.959+*
	M 10	-12.0	0.029
	M 11	13.3	-0.280
	M 12	- 0.5	-2.710+
	M 13	13.3	-0.081
	M 14	14.9	-1.460
	M 15	- 3.8	0.054
	M 16	- 7.8	0.368
	M 17	-10.9	-1.972*
	M 18	- 7.8	0.184
	M 19	- 4.5	-0.088
	M 20	5.7	0.890+*
	M 21	-10.3	-1.097
	M 22	- 3.3	-1.779
	M 23	14.7	-1.157
	M 24	- 9.7	-1.108
	M 25	23.7	1.792+*
	M 26	- 9.8	-1.064
	M 27	6.3	0.709*
	M 28	29.4	2.254+*
	M 29	-24.0	-0.365
	M 30	- 5.8	0.876+*
	M 31	- 7.7	-1.287
	M 32	18.7	2.087+*
	M 33	2.3	1.976+*

* +=Significant value of=β_i($+_p$=5.0 per cent) when tested against error mean squar

*=Significant value of β_i($*_p$=5.0 per cent) when tested against remainder mean square.

TABLE 3

Genetic and regression statistics for the F_1 hybrid.

Male	*Females*					
	ms 2219		*ms 36*		*ms 2077*	
	h (i♀)	β (i♀)	h (i♀)	β (i♀)	h (i♀)	β (i♀)
M 1	38.9	0.934+	78.0	−0.183+	86.8	1.476+
M 2	10.7	−1.803	40.2	−0.194	22.7	−0.875
M 3	17.4	−0.204	21.2	−0.742	22.5	−1.385
M 4	14.6	−1.016	45.1	0.596+	54.0	2.041+
M 5	17.8	0.031	66.7	0.893+	57.0	0.281+
M 6	37.0	2.196+	77.6	0.439+	69.0	1.344+
M 7	9.8	0.496+	40.3	0.580+	42.9	0.826
M 8	5.3	2.799	39.2	2.158+	101.3	−1.583
M 9	−1.7	−0.212+	24.1	0.075+	29.1	−0.525
M 10	12.6	0.621+	46.9	0.527+	21.8	−0.897
M 11	20.8	1.584	90.7	1.561	109.9	1.830+
M 12	18.3	−3.073+	34.3	1.392+	37.0	0.066
M 13	33.6	4.611	105.8	1.531+	116.6	2.471+
M 14	10.8	0.977	34.0	2.641+	44.1	4.566+
M 15	26.5	0.398+	58.3	−0.721	36.4	0.905+
M 16	23.9	−1.062	67.3	1.279+	71.6	1.999+
M 17	23.9	2.674	57.4	−0.538	61.2	3.800+
M 18	18.3	0.562	39.1	0.190+	34.4	0.035
M 19	28.6	0.914+	46.7	0.558+	49.0	0.550+ *
M 20	18.5	1.256	12.1	−0.515	24.3	−0.699
M 21	19.9	−3.404	29.5	3.288+	25.7	1.057
M 22	25.3	3.468	41.4	0.957+	50.1	−0.931
M 23	21.5	−0.227	37.6	1.027+	6.8	−2.815+
M 24	20.5	1.138	54.7	1.575+	50.2	1.982+
M 25	11.1	0.579+	90.0	0.964+	106.1	0.734+
M 26	19.7	5.324	38.1	0.404+	52.8	2.135+
M 27	−4.4	0.371	43.7	0.939+	38.0	1.297+
M 28	25.1	−0.152	96.6	0.834+	116.8	1.443+
M 29	18.2	−0.430	32.9	0.697+	23.1	0.287
M 30	4.5	0.402	36.5	0.933+	32.8	0.694+
M 31	20.1	1.002	68.7	0.146+	77.4	−1.217
M 32	7.2	0.904+	56.5	0.635+	86.2	3.473
M 33	11.2	0.572+	13.1	0.403+	26.0	−0.342

+ = Significant value of β_i($+_p$ = 5.00 per cent) when tested against error mean square.

* = Segnificant value of β_i($*_p$ = 5.00 per cent) when tested against remainder mean square.

linear components. The regression values for hybrids also widely dffer from hybrid to hybrid. Major portion of the additive x environemtal interaction was due to linear relationship and a large portion of dominance×environmental

interactions was non-linear (Petkins and Jinks, 1968). In the present investigation, the analysis showed that the (βi s) values differed among the crosses and the environmental variability of genetically homogeneous genotypes was related to their mean performance. The hybrids had high mean performance and higher slopes than the mean of their respective parents and heterosis was generally associated with greater sensitivity to environment.

REFERENCES

Perkins, J. M. and J. L. Jinks. 1968. Environmental and genotype environmental components of variability. III. Multiple lines and crosses. *Heredity*, **23** : 339-56.

Singhania, D. L. and N. G. P. Rao. 1976. Genetic analysis of some exotic x Indian crosses in sorghum. XIII. Environmental and genotype-environmental components of variability for grain yield in hybrids and their parents. *Indian J. Genet.* **36**: 111-117.