Indian J. Genet., **54** (3): 321–324 (1994)

PHENOTYPIC ADAPTABILITY OF BUNCH GROUNDNUT (*ARACHIS HYPOGAEA* L.) FOR POD YIELD DURING SUMMER

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(Received: August 8, 1994; accepted: October 15, 1994)

ABSTRACT

Twenty-nine bunch groundnut genotypes were evaluated for adaptability under summer condition across four environments for pod yield. Both linear and nonlinear portions of genotypes x environment (G x E) interaction accounted for the expression for pod yield. However, the predictable portion was significantly higher than the nonpredictable portion. Most of the genotypes were responsive to the fluctuations in agroclimatic conditions. The high yielding genotype J (E)-1 showed wider adaptability over environments. High yielding genotypes which exhibited greater response to favourable environments were also identified. High pod yield coupled with high response results in greater instability, while medium pod yield with average response leads to stability of the genotypes.

Key words: Adaptability, yield, groundnut.

Phenotypically stable lines are of great significance for a crop like groundnut which is considered to be an unpredictable oilseed legume. During the last decade, area under summer groundnut has been expanding fast (1.2 million ha) as productivity of the summer crop is almost double (1500 kg/ha) as compared to the kharif crop (800 to 900 kg/ha). Thus, there is an urgent need to identify high yielding stable genotypes suitable for summer cultivation. Therefore, an attempt has been made to study the nature and magnitude of genotype x environment G x E interaction and identify high yielding stable genotypes.

MATERIALS AND METHODS

Twenty-nine diverse bunch type groundnut (*Arachis hypogaea* L.) genotypes including 27 Spanish (ssp. *fastigiata* Waldron var. *vulgaris* Harz.) and two valencia (ssp. *fastigiata* Waldron var. *fastigiata*) obtained from the germplasm collection and advanced breeding lines, including six released cultivars, were grown in randomized complete block design in

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four replications in each of the four environments during summer. For this purpose, two locations were selected, namely Junagadh and Amreli, where the crop was sown on two different date, viz., 25 January and 10 February. Each genotypes was grown in 6.0 m long rows spaced at 60 cm, keeping plant-to-plant distance 10 cm. Uniform cultural practices were adopted. Data on pod yield were recorded on ten random plants in each plot and mean values were used to estimate stability parameters following [1].

RESULTS AND DISCUSSION

The joint regression analysis revealed that variation for pod yield was significant both among genotypes and environments (Table 1). This not only indicates the extent of variation over environments but also reflects the degree of genetic variability among the genotypes. The significant mean square due to G x E interaction shows that phenotypic expression of the genotypes varied in different agroclimatic conditions. The components of G x E interactions were also significant, indicating divergent linear response of genotypes to environmental changes. Similarly, significant remainder mean square also contributed to the difference in stability of genotypes. But when the magnitude of linear and nonlinear portion of G x E interactions were compared, the linear portion was found to be significantly higher than the nonlinear portion in the expression of pod yield. These findings are in close agreements with earlier studies [1–4].

Table 1. Pooled analysis of variance

Source	d.f.	Mean square
Genotype (G)	28	20.696*+
Environment (E)	3	298.607*+
G x E	84	1.300*+
Environment (linear)	1	895.820*+
G x E (linear)	28	2.425*+
Pooled deviation	58	0.712*
Pooled error	336	0.312

*Significant against pooled error at $\leq$ 0.05.
+Significant against pooled deviation at $P \leq 0.05$.

Considerable differences were observed for environmental mean (Table 2). The highest mean yield (13.54 g/plant) was obtained at Amreli in the crop sown on 25 January, followed by the 10 February sown crop. Twenty six genotypes were responsive to change in the environment as exhibited by their significant regression coefficient. Among these, 10 genotypes had $b>1.2$, 8 genotypes had $b \simeq 0.8$ to 1.2, and 11 had $b < 0.8$. They were categorized as high, medium and poorly responsive to changing environments, respectively.

The high magnitude of linear regression observed in joint regression analysis was also reflected in stability parameters. Thus, as many as 12 genotypes showed nonsignificant deviation from regression for almost all G x E interactions, therefore, prediction of performance was perfect as indicated by significant regression mean squares. On the other hand, linear and nonlinear portions of G x E interactions were important in 14 genotypes as

Table 2. Pod yield in four environments and estimates of stability parameters of groundnut genotypes

Genotype	Pod yield, g/plant						
	Junagadh		Amreli		$\bar{X}$	b	S^2_d
	25 Jan.	10 Feb.	25 Jan.	10 Feb.			
Germplasm accessions:							
u/4/4/10	3.75	8.28	12.93	9.48	8.61	1.166*	0.429*
26/5/1	3.38	5.88	8.88	7.18	6.33	0.707*	0.226
VRR-308	3.75	5.93	9.50	7.20	6.59	0.744*	-0.009
Starr	5.70	9.08	15.38	9.68	9.96	1.244*	0.154
u/2/4/5	3.80	6.70	8.20	7.68	6.59	0.552	0.950*
EC-100827	4.50	7.05	8.23	9.03	7.20	0.476	2.228*
21/1/2	3.73	9.60	14.35	9.10	9.19	1.325*	1.075*
Advanced breeding lines:							
NRGS-4	3.53	8.03	13.00	9.60	8.54	1.209*	0.504*
CGC-3	6.08	8.90	16.58	10.98	10.63	1.373*	0.342*
NRGS (E)-6	6.05	9.28	14.80	10.35	10.12	1.127*	-0.116
CS-9	4.98	7.15	10.25	9.65	8.01	0.691*	1.320*
CS-11	4.75	6.80	10.70	10.13	8.09	0.790*	2.126*
J (E)-2	3.78	6.53	9.53	7.10	6.73	0.730*	-0.003
JB-215	4.05	7.20	9.28	6.98	6.88	0.648	0.313*
JB-(E)-336	6.50	9.28	13.95	9.15	9.72	0.950*	0.321*
JB-223	3.85	6.63	9.18	7.28	6.73	0.674*	0.146
J-18	7.93	9.85	14.58	10.80	10.79	0.865*	0.032
J (E)-1	8.48	12.85	17.65	13.03	13.00	1.160*	0.171
J-17	8.90	12.80	19.50	12.15	13.34	1.349*	1.461*
JB-224	5.58	9.05	14.98	9.75	9.84	1.207*	-0.012
JB-210	9.28	13.30	19.65	13.23	13.86	1.322*	0.518*
JB-187	3.83	5.70	9.63	6.80	6.48	0.754*	-0.075
J (E)-3	9.15	12.83	18.78	12.78	13.38	1.327*	0.446*
Released cultivars:							
ICGS-11	6.35	9.43	15.28	10.13	10.29	1.149*	0.059
ICGS-44	6.28	9.08	15.15	10.75	10.31	1.154*	0.006
Girnar-1	6.98	8.20	16.65	10.50	10.58	1.288*	1.999*
GG-2	8.20	11.18	18.55	11.25	12.29	1.335*	1.482*
GAUG-1	6.70	8.58	14.63	10.48	10.09	1.043*	0.323*
J-11	7.25	8.23	12.88	8.80	9.29	0.739*	0.638*
Mean	5.76	8.74	13.54	9.69	9.43		
C.D.	0.77	1.06	1.06	1.05	1.59		

*Significant at $P \leq 0.05$.

reflected by significant remainder as well as regression mean squares. However, performance could not be predicted in three genotypes, namely, JB-210, U/2/4/5 and EC-100827. None of the genotypes showed complete absence of G x E interaction.

The genotype J (E)-1 showed wider adaptability across the environments as indicated by higher pod yield (13.0 g/plant) coupled with average responsiveness ($b \simeq 1$) and stable nature ($S^2d \simeq 0$). Mean pod yield of the genotypes JB-210, J (E)-3, J-17 and GG-2 was significantly high and coupled with high response, but they were unstable to environmental changes as indicated by significant S^2d values. The genotypes ICGS-11, ICGS-44, NRGS (E)-6, Starr and JB-224 exhibited medium adaption across the environments. From these findings it is concluded that high pod yield coupled with high response results in instability while medium yield in combination with medium response leads to greater stability. Similar relationship was also reported in pearl millet [6]. The genotype J (E)-1, a released variety for Gujarat state in the name of GG-4, showed wider adaptability across the environments as indicated by their higher mean performance, response coupled with stability.

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