Electronic Journal of Plant Breeding, 1(5): 1306-1308 (Sep 2010)
ISSN 0975-928X

Research Article

Genotype x Environment interaction for kernel yield in groundnut (*Arachis hypogaea* L.)

A. Mothilal, P. Vindhiya varman and N. Manivannan

(Received: 12 May 2010; Accepted: 12 Jul 2010)

Abstract:
Sixteen medium duration groundnut cultures were evaluated for kernel yield, stability and adaptation across four environments. The G X E interaction was highly significant and both linear and non-linear component are equally important for yield stability. The genotype ICGV 92004 was classified as highly stable genotype over four environments because of its high mean kernel yield, with a regression coefficient close to unity and non-significant deviation from linearity.

Key words:
Stability, Spanish bunch, groundnut, Arachis hypogaea, G x E interaction

Introduction

Kernel yield in groundnut is an expression of different yield components under given environmental condition. Yield stability is not depend on the genotype alone, but on interaction of genotype with the particular environment. Identification of genotypes that shows minimum interaction with the environment or possess greater yield stability is an important consideration in area where environmental fluctuations are considerable. The knowledge of yield stability is important not only in recommending a well stable variety for various zones but also helps in breeding programme to select desirable cultivars. The objective of the study was therefore, to assess the kernel yield performance and stability of 16 groundnut genotypes across different environments and select high yielding and stable varieties that interact less with the fluctuating environment.

Regional Research Station, Tamil Nadu Agricultural University, Vridhachalam 606 001.
Email: mothiezhil@gmail.com

Material and methods

The experimental material comprised 16 medium duration Spanish bunch groundnut (*Arachis hypogaea* L. subsp. *fastigiata* var *vulgaris*) genotypes obtained from ICRISAT, Patancheru for the purpose of conducting International Medium Duration Groundnut Varietal Trial at the New Farm of Regional Research Station, Vridhachalam. The genotypes were grown in 4 x 4 triple lattice design with three replications in four environments (*Rabi*/summer 1998-1999, *Kharif* 1999, *Rabi*/summer 1999-2000 and *Kharif* 2000). The plot size was 5.0 x 1.2 m with inter and intra row spacing of 30 cm and 10 cm, respectively. Recommended package of practices were followed to raise a healthy crop. Kernel yield was recorded in each replication and in each environment. The data were analysed for variance and pooled analysis as suggested by Panse and Sukhatme (1978). The stability analysis was carried out according to the method suggested by Eberhart and Russel (1966).

Results and discussion

Mean square due to genotype was highly significant and indicated that considerable amount of genetic variability for kernel yield among the 16 genotypes tested (Table 1). Genotype x Environment interaction effects were also statistically significant. It proves the existence of genotype and environment differences governing the expression of this trait and the significant contribution of G x E interaction in influencing the yield performance of genotypes. The genotypes manifested genetic differences for their regression on environmental index as evidenced by significant G x E (linear) component. Significant mean square of pooled deviation indicated the involvement of non-linear component for the differences in the stability among genotypes for kernel yield.

Six genotypes viz., VRI 4, ICGV 93128, ICGV 93135, ICGV 93136, ICGV 92035 and ICGV 92004) had higher yield, while, ICGV 93134 had moderate yield and remaining genotypes had poor kernel yield. According to Eberhart and Russel (1966) an ideal genotype is one which has high mean yield, a regression coefficient value of 1.0 and a deviation mean square of zero. Accordingly, the genotype ICGV 92004 was classified as highly stable over four environments because of its high mean kernel yield (1498 kg/ha), with a regression coefficient close to unit (b_i = 1.200) and non-significant deviation from linearity (-365.89). Naik and Dasaradha Rama Reddy (2004) and Mothilal *et al*. (2010) reported similar results for pod and kernel yield in groundnut. Though the genotype ICGV 93135 showing high mean kernel yield (1626 kg/ha) and significant S^2d_i was not suitable as its b_i (0.524) was much less than unity. Hence it is suited to poor environments.

Four genotypes *viz*., VRI 4, ICGV 93136, ICGV 93134 and ICGV 92035 registered high mean kernel yield, high bi and as well as high S^2di indicating that they are highly sensitive to environmental fluctuations i.e., they respond 3-4 times for a unit change in the environment. Hence, such genotypes may suit for superior or better environments. Other genotypes registered negative response to environmental changes.

From this study, evaluating genotypes for four seasons was found to be inadequate in identifying stable genotype. The genotype ICGV 92004 has been identified as stable genotype. The genotype should be tested over times and space before recommending for commercial cultivation in both *Rabi*/summer and *Kharif* seasons in Tamil Nadu for increasing the productivity of genotype.

References :

Eberhart, S.A and Russel, W.L. (1966). Stability parameters for comparing varieties. *Crop Sci.,* **6**: 36-40.

Mothilal, A. Vindhiyavarman, P and Manivannan, N. (2010). Phenotypic stability for kernel yield in groundnut (*Arachis hypogaea* L.). *Elect. J. Plant Breed.,* **1**(2): 173-176.

Naik and Reddy, D.R. (2004). Stability for pod yield and kernel triats under scarce rainfall condition in groundnut (*Arachis hypogaea* L.). P.59. Paper presented in the *"National symposium on enhancing productivity of groundnut for sustaining food and nutritional security"*, held at NRCG, Junagadh between October 11th to 13th 2004.

Panse, V.G and Sukhatme, P.V (1978). *Statistical Methods for Agricultural Workers*. Edn 2. 197 pp. Indian Council of Agricultural Research, New Delhi.

Table 1. Pooled analysis of variance for kernel yield in groundnut.

Source of variation	df	Mean sum of square
Genotypes (G)	15	324564.81**
Environment (E)	3	2083592.00*
G x E	45	46968.00**
E + (G x E)	48	174257.00**
Environment (Linear)	1	6250776.00**
G x E (Linear)	15	43784.56NS
Pooled deviation	32	45525.23**
Variety 1 (ICGV 92001)	2	12963.23**
Variety 2 (ICGV 92004)	2	2055.15NS
Variety 3 (ICGV 92015)	2	25005.93**
Variety 4 (ICGV 92022)	2	50541.84**
Variety 5 (ICGV 92023)	2	20399.71**
Variety 6 (ICGV 92027)	2	71605.44**
Variety 7 (ICGV 92028)	2	62824.25**
Variety 8 (ICGV 92033)	2	36031.70**
Variety 9 (ICGV 92035)	2	21263.59**
Variety 10(ICGV 92040)	2	150.895.10**
Variety 11(ICGV 93128)	2	16919.03**
Variety 12(ICGV 93133)	2	19705.12**
Variety 13(ICGV 93134)	2	21124.62**
Variety 14(ICGV 93135)	2	26326.50**
Variety 15(ICGV 93136)	2	62153.05**
Variety 16(VRI 4)	2	128589.40**
Pooled error	120	7263.16

*, ** significantly different at p=0.05 and p=0.01 levels, respectively

Table 2. Estimates of stability parameters for kernel yield in groundnut.

Genotype	Mean kernel yield (kg ha^{-1})	b_i	S^2d_i
ICGV 92001	862	0.422	10542.17**
ICGV 92004	1498	1.200	-365.89
ICGV 92015	1211	0.700	22584.87**
ICGV 92022	1218	1.039	48120.79**
ICGV 92023	1246	0.671	17978.65**
ICGV 92027	1236	0.683	69184.39**
ICGV 92028	1118	0.980	60403.20**
ICGV 92033	1210	0.834	33610.64**
ICGV 92035	1532	1.344	18842.53**
ICGV 92040	1303	1.297	148474.04**
ICGV 93128	1881	1.501	14497.97**
ICGV 93133	1319	0.991	17284.07**
ICGV 93134	1403	1.376	18703.57**
ICGV 93135	1626	0.524	23905.44**
ICGV 93136	1613	1.388	59731.99**
VRI 4	1969	1.043	126168.35**
Mean	1390		

*, ** significantly different at p=0.05 and p=0.01 levels, respectively