

Adaptability of Yield and its Components in Groundnut

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Abstract: An experiment was conducted over six seasons with five different bunch groundnut (*Arachis hypogaea* L.) genotypes to evaluate them for adaptability for a wide range of characters. The genotype VRI 2 attained wider adaptability for days to 50% flowering and pod yield. The variety TMV 2 possess stability for 100-pod weight, 100-kernel-weight and shelling per cent, while VRI 3 has buffering capacity for days to maturity and 100-kernel weight. The results further suggest that crossing of VRI 2 with TMV 2 and VRI 3 will produce better genotypes with new combination of genes.

Key words: Stability, G x E interaction, yield components.

A genotype is considered to be agronomically stable if it yields with respect to the productive potential of the test environment (Romagosa and Fox, 1993); statistically it could be defined as the cultivar that makes the smallest contribution to the genotype by environment interaction. Phenotypically stable genotypes are of great significance to any crop. Thus, an attempt was made to evaluate the nature and magnitude of genotype x environment interaction among five varieties of groundnut and to identify the stable varieties, which could be used in future breeding program.

Materials and Methods

Bunch-erect genotypes of groundnut viz., VRI 2, VRI 3, VRI 4, Local Red and TMV 2 were tested in six different seasons (kharif 1997, rabi/summer 1997-98, kharif 1998, rabi summer 1998-99, kharif 1999 and rabi/summer 1999-2000) in randomized block design with three replications. Each genotype was sown in 10 rows, comprising 200 plants in each replication with a plant-to-plant spacing of 15 cm and row-to-row spacing of 30 cm. Data on days

to 50% flowering, days to maturity, 100-pod weight, 100-kernel weight, shelling per cent and pod yield were recorded from 10 random plants from each replication and the mean values were utilized for the analysis. The stability parameters were calculated as per the method of Eberhart and Russell (1966).

Results and Discussion

The analysis of variance revealed that the variations in genotypes were significant for days to 50% flowering, days to maturity, 100-pod weight and 100-kernel weight indicating the existence of variation among the genotypes tested (Table 1). Further, partitioning of the genotype x environment interaction for these six traits into linear and non-linear components showed that the linear component was significant for 100-pod weight, confirming the reliability of regression coefficient (bi) pertaining to different genotypes on the basis of means of different seasons. Non-linear component was significant for days to 50% flowering, days to maturity, pod yield and 100-pod weight indicating the presence of genetic variability.

Table 1. *G x E ANOVA based on means over replicates*

Source of variation	df	Mean squares					
		DFE	DM	HPW	HKW	SP	PY
Total	29						
Genotype	4	23.82**	304.00**	1955.56**	281.54**	3.16	0.57
Environment	5	41.59**	46.21	186.80	48.56*	10.04	1.60*
<i>g x e</i>	20	2.58	22.76	246.74*	9.02	5.53	0.24
<i>e + (g x e)</i>	25	10.38	27.45	234.76	16.93	6.43	2.31
Environment (linear)	1	207.96	231.09	934.03	242.81	50.23	8.01
<i>g x e</i> (linear)	4	6.62	18.17	780.01*	8.74	8.86	0.31
Pooled deviation	20	1.26	19.13**	90.74**	7.27	3.75	0.18**
Variety	4	0.26	14.01**	41.09*	9.54	1.32	0.01
	4	1.54**	2.05	247.94**	3.21	6.95	0.15**
	4	1.19**	44.43**	124.20**	10.23	3.51	0.18**
	4	2.44**	10.24**	30.93*	11.46*	4.70	0.14**
	4	0.86*	24.90**	9.54	1.90	2.28	0.36**
Pooled error	48	0.26	1.33	11.91	4.45	2.73	0.01

DFE - Days to 50% flowering; DM - Days to maturity; HPW - Hundred pod weight; HKW - Hundred kernel weight; SP - Shelling per cent; PY - Pod yield *, ** significant at 5% and 1% level, respectively.

According to Eberhart and Russel (1996) a stable genotype is one which shows (i) a high mean, (ii) a regression co-efficient equal to unity ($b_i=1$), and (iii) a minimum deviation from regression (S^2_{di}). These were considered as the measure of stability.

Days to 50% flowering

Among the genotypes evaluated, VRI 2 did not show sensitivity to environmental changes for days to 50% flowering as it showed significant 'bi' values, and non-significant deviation from the regression which indicates that it is stable for flowering (Table 2). Raut *et al.* (1993) and Venkataravana *et al.* (2000) also reported similar response for this trait.

Days to maturity

The genotypes VRI 2, VRI 4, Local Red and TMV 2 exhibited non-significant

'bi' and significant S^2_{di} indicating that the responsiveness of the genotypes cannot be predicted over the environment with adequate precision (Table 2). Senapati and Roy (1991) and Kadam *et al.* (2000) supported the present findings. In contrast to the present results Raut *et al.* (1993) and Venkataravana *et al.* (2000) observed less influence of environment over maturity. The genotype VRI 3 registered 'bi' less than unity and non-significant S^2_{di} and low mean number of days to maturity indicating its above average stability and ability to perform better under poor environmental conditions.

100-pod weight

The genotypes VRI 3, Local Red and TMV 2 had above average response ($b_i > 1$), which indicated their suitability to only high management conditions (Table 2). Similar

Table 2. Stability parameters for six quantitative characters in five genotypes of groundnut

Genotype	Days to 50% flowering			Days to maturity			Hundred pod weight		
	X	bi	S ² di	X	bi	S ² di	X	bi	S ² di
VRI 2	27.5	1.3**	0.1	96.8	1.2	13.5**	108.4	-0.2	37.1*
VRI 3	27.1	1.0*	1.4**	88.8	0.1	1.6	83.5	4.1*	243.9**
VRI 4	31.7	1.2**	1.1*	107.2	1.8	43.9**	111.3	-1.2	120.2**
Local Red	29.2	0.3	2.3**	92.4	0.8	9.7**	84.3	1.2*	26.9*
TMV 2	27.0	0.9**	0.7*	92.1	0.9	24.4**	68.9	1.0*	5.5
General mean	28.5			95.5			91.3		
SEm±	0.29			1.95			1.99		
CD (0.05)	0.86			0.66			5.85		

Genotype	Hundred kernel weight			Shelling per cent			Pod yield		
	X	bi	S ² di	X	bi	S ² di	X	bi	S ² di
VRI 2	43.2	0.5	8.0*	69.4	2.0**	0.4	1.7	0.3	0.0
VRI 3	31.6	0.9*	1.7	71.3	0.1	6.0	1.5	0.9*	0.1*
VRI 4	46.6	0.6	8.7*	70.0	1.9*	2.6	1.8	0.7	0.1*
Local Red	38.9	1.5*	9.9*	70.8	0.2	3.7	2.2	1.3*	0.1*
TMV 2	31.3	1.3**	0.4	70.3	0.5	1.3	2.2	1.4*	0.3**
General mean	38.3			70.4			1.9		
SEm±	1.21			0.95			0.25		
CD (0.05)	3.58			2.80			0.73		

*, ** Significant at 5% and 1% level, respectively.

results were earlier reported by Sojitra and Pethani (1998). With regard to S²di, only TMV 2 with non-significant value was found stable for the character.

100-kernel weight

Among the five genotypes, TMV 2 and VRI 3 were stable for this trait as they possessed regression coefficient equal to unity and non-significant deviation from regression (Table 2). Raut *et al.* (1993), Reddy and Gupta (1994), Patra *et al.* (1995) and Mathur *et al.* (1997) reported similar results.

Shelling per cent

The genotypes Local Red and TMV 2 exhibited bi less than unity with non-significant S²di and high shelling per

cent indicating its above average stability and ability to perform better under poor environmental conditions. Similar results were earlier reported by Durgarani *et al.* (1991), Raut *et al.* (1993), Reddy and Gupta (1994), Patra *et al.* (1995) and Sojitra and Pethani (1998).

Pod yield

None of the genotypes was found stable. The genotypes Local Red and TMV 2 possess a very high bi coefficient, and a high mean pod yield. However, their deviations from the regression were significant, which indicates that these two genotypes responded to the favorable conditions. Senapati and Roy (1991) and Nagabhushanam and Prasad (1992) observed similar results. The genotype VRI 2 exhibited bi less than unity and non-

significant S^2d_i with moderate yield indicating its above average stability and to perform better under poor environmental condition (Table 2). Dwivedi *et al.* (1988), Brand and Hilderbrand (1989), Durgarani *et al.* (1991), Reddy and Gupta (1994), Patra *et al.* (1995), Patil *et al.* (1998) and Kadam *et al.* (2000) reported similar results in groundnut. The genotypes VRI 3 and VRI 4 had observed poor and moderate yields. The regression coefficient is below unity with significant deviation from the regression. These two varieties were designated as unstable varieties.

From the foregoing results it was concluded that none of the varieties evaluated possess stability for all the traits. However, VRI 2 exhibited stability for days to 50% flowering and pod yield. Similarly, the variety TMV 2 is stable for 100-pod weight, 100-kernel weight and shelling per cent. Stability for days to maturity and hundred kernel weight were observed in the genotype VRI 3. Better genotype with more stability for pod yield and other desirable agronomic traits could be obtained when crosses are made between VRI 2 with VRI 3 and TMV 2.

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