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EVALUATION OF COWPEA (Vigna unguiculata (L) Walp) CULTIVARS FOR STABILITY AND PERFORMANCE IN HUMID ENVIRONMENTS

K. OKELEYE, O. J. ARIYO[1] and V. I. OLOWE[2]

Dept. of Crop Production and Crop Protection
University of Agriculture, Abeokuta.

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ABSTRACT

Eleven cowpea cultivars were evaluated between 1991 and 1993 to determine their grain stability and the response patterns. Joint regression analysis indicated the absence of genotype x environment interaction, although the years and the varieties were significantly different.

The response pattern could not be determined but on the basis of high yield and co-efficient of variation, IT 88D-867-11 and IT 89KD-434 were high yielding. It was concluded that the trial should be conducted in more years if locations within the year cannot be increased.

INTRODUCTION

Cowpea (Vigna unguiculata (L) Walp) production in the humid tropics, particularly in developing countries of Africa, is beset with problem of low grain yields. This low yield of 200-400kg/ha is a function of many factors, which are high pest and disease incidences, poor nodulation, poor nutrition, erratic and early ceasation of rains (Taylor, 1969; Ngundo and Taylor, 1974).

Stability of performance of crop varieties across contrasting environments is essentials to the successful selection of high yielding and consistently performing varieties. A number of techniques have been employed to achieve this goal but regression techniques has been most prominent. Although the usual analysis of variance detects genotype and environment (GXE) interaction when genotypes are evaluated in different environments, only the joint regression analysis is able to furnish the responses of the

1. *Dept. of Plant Breeding and Seed Technology University of Agriculture, Abeokuta.*
2. *Research and Development Centre, University of Agriculture, Abeokuta.*

varieties. Despite the criticism of this technique (Baker, 1969; Hill 1975; Powel et al., 1986; Ariyo, 1987), it has proved valuable in cultivar development for a number of crops (Breese, 1969) in grass; Ntare and Aken'Ova (1985) in cowpeas.

The objectives of this study were to determine the effect of environment on the varieties and to determine the most desirable genotypes.

MATERIALS AND METHODS

This study was conducted at the Teaching and Research Farm of the University of Agriculture, Abeokuta, Nigeria (7^0 N, 3^0 23'E). Eleven cultivars from the All Nigeria Cowpea Multi-locational Trials were evaluated in a Randomised Complete Block Design in 1991, 1992 and 1993 late cropping seasons in four replications.

Each plot had an area of 4m x 2m and consisted of 5 rows. Spacing within the row was 20cm with 3 seeds per hole. This was later thinned down to 2 plants per stand, giving a plant population of 105 plants per lot, corresponding to 200,000 plants per hectare. Five weeks after planting, Monocrotophos (Azodrin) was sprayed at the rate of 50mls per 10 litres of water. Weeding was done manually three times in 1991 while a mixture of Galex and Gramoxone was used in 1992 and 1993. This was supplemented with one manual weeding before maturity.

Data were collected on grain yield. Data collected in each trial were subjected to combined analysis of variance to examine genotype x environment interaction effect. Joint regression analysis was also performed according to the procedure of Eberhart and Russel (1966) by regressing individual means on the environmental indices to determine the pattern of response. According to this method, a genotype with average sensitivity will have a unit regression coefficient (b=1.0), while a stable genotype will have zero.

RESULT

The mean yields of the genotypes are presented in Table 1. The average seed yields of 813.50kg/ha was recorded. Among the entries, only genotypes IT 87D-1629, IT 88D-867-11, IT 89KD-374 and IT 89KD-434 produce above average yield. Also only genotypes IT 86D-715, IT 87D-590-5, IT 88D-867-11 and IT 89KD-260 had above average co-efficients of variations (CV) and all the genotypes

which produced above average yields had below - average CV. In all, IT 89KD-374 with a yield of 1063.39 kg/ha was the most desirable as it also had the smallest CV. IT 87D-855 that combined the lowest yield with the largest CV was the most undesirable.

Table 1: Mean grain yield and co-efficients of variation (CV) for cowpea varieties evaluated

	Variety	Mean Yield (kg/ha)	CV (%)
1.	IAR 48	734.45	19.14
2.	IT 86D-715	791.31	30.43
3.	IT 87D-590-5	692.30	42.89
4.	IT 87D-885	685.27	19.28
5.	IT 87D-1629	957.20	14.69
6.	IT 88D-867-11	814.94	19.97
7.	IT 89KD-260	775.87	17.85
8.	IT 89KD-374	1063.39	1.69
9.	IT 89KD-434	861.44	14.0
10.	ART 91-1	780.81	20.42
11.	ART 91-2	791.50	13.90
	LSD	75.40	6.95
	MEAN	813.50	19.48

The mean yield and the CV of the varieties during the three years under consideration are presented in Table 2. The years 1991 and 1992 were equally favourable for the varieties as they produced mean yields of 865.74 and 861.01 kg/ha respectively. However, 1991 had a CV of 13.45 while 1993 had the highest CV of 28.32%.

Table 2: Mean grain yield and co-efficients of variation for the varieties evaluated for three years.

Year	Yield (kg/ha)	CV (%)
1991	865.74	13.45
1992	861.01	19.07
1993	713.74	28.32
LSD	214.96	18.68
MEAN	823.50	20.28

The combined analysis of variance for the varieties are presented in Table 3. Mean squares for all sown varieties except variety x year interaction were significant. Year mean squares was the largest while variety x year mean square was the lowest.

Table 3: Combine Analysis of variance for grain yield of cowpea varieties evaluated

Source	DF	MS
Variety	10	151,481.36*
Year	2	394,639.75**
Rep. Within year	9	324,779.72**
Variety x year	20	87,568.49
Error	90	93,386.24

The joint regression analysis of seed is also presented in Table 3. Additive and pooled deviation were not significant. Also the yields of the varieties were significantly different indicating the divergent genetic background of the varieties. The regression co-efficients (b) and the deviation from regression (S^2d) of the varieties evaluated are presented in Table 4. IT 87D-590-5 had the largest regression co-efficient of 3.28 while ART 91-2 had the largest regression co-efficient of -1.07. Since the mean square due to variety x year (linear) was not significant, all the regression co-efficients were not different from each other. Therefore, the response pattern of the varieties could not be determined. The non-significance of variety x year (linear) and deviation mean

square suggested the absence of variety x environment interaction. The deviation mean squares were not significant except for IT86D-715 which had a very 'large deviation'.

Table 4: Regression Co-efficient (b) and deviation mean square of the cowpea varieties evaluated

S/No	Variety	Regression	Deviation
1.	IAR	1.50	5,997.0
2.	IT 86D-715	0.14	115,688.54**
3.	IT 87D-590-5	3.28	15,516.27
4.	IT 87D-885	1.42	4,619.81
5.	IT87D-1629	0.03	39,522.13
6.	IT 88D-867-11	1.68	10,981.51
7.	IT 89KD-260	1.41	8,744.11
8.	IT 89KD-374	0.14	365.04
9.	IT 89KD-434	0.95	15,577.36
10.	ART 91-1	1.80	2,354.70
11.	ART 91-2	1.07	7,151.97

DISCUSSION

An essential step in variety development is the evaluation of lines in contrasting environments to determine their desirability or otherwise. It is expected that varieties will respond to increment in environmental conditions. Such responsive varieties are productive especially in good environments. Varieties with average responses over environments had a wide scope of cultivation. Successful evaluation of varieties is possible through genotype x environment interaction analysis. Eberhart and Russel (1966) emphasised the need to consider both linear regression co-efficients and non linear components of genotype x environment interaction anaylsis. Samuel et al (1970) and Paroda and Hayes (1971) reported that linear regression co-efficients which could be simply regarded as a measure of the response by particular

genotypes is a linear function of the environmental changes. When the sensitivity of a genotype is a linear function of the environment, the yield of such genotypes can be predicted (Ariyo, 1995).

The fact that variety x year interaction was not significant in this study indicated that the varieties responded consistently during the three years. This finding is similar to that of Alluri and Ariyo (1995) on their work on upland rice. There is, however, the need to increase the number of years of trial in this environment. The lack of significance of variety x year (linear) and pooled deviation indicated that joint regression technique was not adequate for the evaluation.

CONCLUSION

This study showed that of all the varieties investigated, only genotypes IT 87D-1629, IT 88D-867-11, IT 89KD-374 and IT 89KD-434 produced above average grain yields. Average grain yields over the three year period was 813.50kg/ha. Variety x year interaction was not significant in this study indicating that the varieties responded consistently during the three years.

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