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EVALUATION OF SOME COWPEA (*VIGNA UNGUICULATA* (L.) WALP) CULTIVARS ADAPTABLE TO ACID SOILS OF UYO, SOUTH EASTERN NIGERIA

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ABSTRACT

A two-year (1989 and 1990) study was carried out to assess the growth and yield components of some cowpea (*Vigna unguiculata* (L.) Walp) cultivars in the acid soils of Uyo, Southeastern Nigeria. Results revealed no significant differences in emergence percentage, plant height, number of flowers plant^{-1} and weight of 1000 seeds among cowpea cultivars. However, significant differences ($p<0.05$) were observed in pod number plant^{-1}, mean pod length, pod weight plant^{-1} and grain yield. Cultivars IAR81 – 40 (41.0) and L 43 (15.8) had the highest and lowest mean pod number plant^{-1}. Moreover, L43(18.0cm) and K28 (13.2cm) showed the highest and lowest mean pod length, respectively. Cultivars IAR81-40 (31.2g) and L43 (18.4g) indicated the highest and lowest pod weight plant^{-1}. In 1989, Ife Brown (714.8kg/ha) and IT81 D-1137 (43.0kg/ha) had the highest and lowest grain yield, while IAR 81-40 (1224.9 kg/ha) and L43 (914.1kg/ha) showed the highest and lowest in 1990, respectively. The means from the two year study revealed that Ife Brown (917.3kg/ha) had the heighest grain yield followed by IAR 81-40 (765.5kg/ha). Ife Brown was superior to the above three cultivars by 16.5, 26.9, and 31.3%, respectively. The study suggests that with appropriate agronomic practices in place, cowpea has a great potential in the agro-ecological.

Key words: Cowpeas, Cultivars, acid soils.

INTRODUCTION

Cowpea (*Vigna unguiculata (L.)* Walp) is widely recognized for its useful attributes. In Nigeria for instance, th grains are widely eaten in various forms (Philips, 1977). Aiyelari (1993) described cowpea as a cheap but important source of protein in the Nigerian diet. Cowpea grains are similarly valuable concentrate food for livestock, and are particularly good supplement to groundnut cake in balancing cereal concentrate, while the haulm and husks are good livestock fodder (Oyenuga, 1968). Ustimenko-Bakumovsky (1983) gave some nutritive values of cowpea grains as: 27-28% protein, 47-49% starch, 1.5% fat, and 2.8-5.2% cellulose.

Cowpea is also noted for its ability to establish in soils with low fertility as well as a source of organic materials for green manure on naturally poor soils or in the rejuvenation of those depleted from intensive use (IITA, 1986). This is achieved in part through its symbotic association with a strain of bacteria, *rhizobia*, which usually result in nitrogen fixation in the soil to the advantage of the gorwer (IITA, 1986). Moima (1993) sumarised that on account of its ability to fix nitrogen efficiently (up to 140kgNha^{-1}), it provides a high proportion of its own nitrogen requirements, besides leaving a fixed nitrogen deposit of up to 60-70kgha^{-1} in the soil for any succeeding crop.

However, cowpea yield performance had been found to depend on the variety grown, the prevailing climatic conditions, the agronomic practices used (Nangju, 1979; Singh and Rachie, 1985; Kwapata and Hall, 1990) and the soil type (Philips, 1977). Cowpea is adapted to a wide range of soils but thrives best on well drained sandy or clayed soils while saline or alkaline soils are unsuitable for cowpea (Kipps, 1971; Greensile, 1975). Mosarwe (1993) reported that varietal seed yields may fluctuate from one environment to another. In Nigeria, average yields under farmer's conditions from some agro-ecological zone had been estimated to range from 700-750kg per hectare (Philips, 1977).

Presently, scientists have become more interested in the possibility of evaluating available cultivars that could adapt to the acid soils of Nigeria's south-eastern ecological zone. The results of such evaluation, would indicate adaptable cultivars and would boost local production; and provide more food and income for the populace. Besides guaranteeing or improving the nutritive status of the citizens, cowpea can also maintain or restore the fertility status of the soil, thereby reducing the farmer's dependence on inorganic fertilizer. Against this background, studies were initiated to evaluate the adaptability and yield potentials of some cowpea cultivars to the acids soils of Uyo, southeastern Nigeria.

MATERIALS AND METHODS

The studies were carried out during the 1989 and 1990 cropping seasons at the University of Uyo Teaching and Research Farm located at Uyo (Latitude 4°30' and 5°30'N, Longitude 07°05' and 8°20'E and altitude, 100m above sea level). This rainforest zone receives about 2500mm rainfall anually during the rainy season extending from March to November. The rainfall pattern is bimodal, with long (March – July) and short (September –

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November) rainy seasons separated by a short dry spell of uncertain length, usually during the month of August. The mean relative humidity is 78%, atmospheric temperature is 30°C and the mean sunshine hours is 12 (Peters *et al.*, 1989). The soil is acidic and belongs to the broad soil classification group, Alfisol, with well drained coastal plain sands of Benin Formation. Table 1 shows the characteristics of the soil of the study site. These were similar to those reported by Peters *et al* (1989).

A randomised complete block design was used with four replicates. A replicate was 61 x 8m and 37 x 8m in 1989 and 1990, respectively, while a plot size was 8 x 5m, giving a total of 40 plots in 1989 and 24 plots in 1990. The interblock and plot spacing were 2 and 1m, respectively. The cowpea cultivars constituted the treatments. In the first year, ten cowpea cultivars (Popse 1, L43, IT81D- 1137, IT83D-951, IAR-72-69, IAR-81-40, K28, TVX 32-36, TVX 4557 and Ife Brown) obtained from International Institute of Tropical Agriculture (IITA) were evaluated. In the second year, the best six cultivars from those planted in 1989 (L43, IT8D-1137, IT83D-951 IAR81-40, K28 and Ife Brown) were selected for further evaluation,.

In both years, sowings were done in June at a spacing of 60 x30cm. Three seeds were sown per hole at about 3cm depth but later thinned to two plants per stand at 14 days after sowing, giving a population of 55, 554 stands per hectare. Weeding was carried out twice manually at 21 and 60 days after sowing. Pest attack, which would have been above threshold level, was controlled by the use of the insecticide nuvacron 40scw (*monocrotophos*). The rate was 2.5mm to 1 litre of water using a knapsack sprayer, sprayed at three weeks interval, from 21 days after sowing. Some of the dominant pests found were *Ootheca mutabilis, Luperodes lineata, Maruca testulalis, Zonocerus variegatus and Nezera viridula.* A compound fertilizer (NPK – 15:15:15) was applied once, using ring method, at the rate of 370kg per hectare at 30 days after sowing.

The emergence count was taken seven days after sowing by counting the total number of seeds planted and expressed in percentage. Ten plants were randomly tagged per plot for the determination of plant height, number of flowers per plant, number of pods per plant, pod length, pod weight per plant and weight of 1000 seeds. The grain yields per hectare were assessed by harvesting all the pods per plot and measuring the grain weight after shelling and dry to 12% moisture content using top loading balance.

Data collected were subjected to analysis of variance procedure and treatment means that indicated significant differences were separated using the Least Significance Difference at 5 percent level of probability (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Emergence, Plant Height And Number of Flowers

The emergence percentage, plant height and number of flowers per plant of the cowpea cultivars are presented in Table 2. Cowpea emergence, plant height and number of flowers per plant showed no significant differences in both years. However, on the average, cowpea emergence ranged from 60-91% in 1989 and 89.9-97.3% in 1990. Cultivars L43 and IT81D-1137 had the highest and least emergence in 1989, while Ife Brown and IT83D-951 showed the highest and least emergence in 1990, respectively. Also, cowpea height ranged from 50-100cm in 1989 and 81-110cm in 1990. K28 and Popse 1 cultivars exhibited the highest and least height in 1989, while IAR 81-40 and L43 were the highest and lowest in 1990, respectively. The number of flowers per plant ranged from 15-33 in 1989 and from 14.7-25.21 in 1990. The least and highest number of flowers per plant were observed under IT81D and Ife Brown, respectively in 1989, while in 1990, L43 and IAR81-40 exhibited the least and highest number of flowers per plant, respectively. On the whole, Ife Brown cultivars appeared more stable for the above three parameters than other cultivars.

TABLE 1. Some Soil Physico-Chemical Properties of The Study Site at 0-30 cm Depth

Chemical Analysis	Values	Exch. cations (meg/ 100g)	Values	Soil particle analysis (%)	Values
pH (1:1) H_2O	5.50	Ca	2.2	Sand	89.80
Organic matter (%)	1.39	Mg	1.60	Clay	4.80
Electrical Conductivity (ds/m)	0.04	Na	0.20	Silt	5.40
Total N (%)	0.12	K	0.20		
Av. P (mgkg^{-1})	199.66	Exch. acidity	3.00		
		CEC	7.00		
		Base saturation (%)	57.40		

The non-significant effect observed in percentage emergence could be due to favourable soil moisture and temperature.

There were two days of rain before sowing in the second year. Nangju (1979) and Ndaeyo *et al* (1995) reported no significant effect on cowpea emergence with adequate soil moisture and favourable temperatures. Similarly, the absence of significant differences in plant height and number of flowers among the cultivars could be ascribed to adequate soil moisture, optimum temperature and perhaps favourable photoperiod during the vegetative phase. A similar observation had been reported by Nangju (1979) and Squire (1990).

Number of pods, pod length, pod Weight And Weight of 1000 Seeds

Results of number of pods per plant, mean pod length, pod weight per plant and weight of 1000 seeds are shown in Table 3. There was no significant difference among the cowpea cultivars when the mean weights of 1000 seeds were compared. However, the number of pods per plant, pod length and pod weight per plant varied significantly ($P<0.05$) among the cowpea cultivars. Cultivars L43 (15.8) and IAR81-40 (41.0) had the least and highest number of pods per plant, respectively. K28 (13.2cm) and L43 (18.0cm) had the least and highest pod length, respectively, while L43 (18.4g) and IAR81-40 (31.2g) had the least and highest pod weights per plant, respectively. Generally, IAR81-40, K28 and Ife Brown were more stable than other cultivars.

The similar performance observed in weight of 1000 seeds might be because the cowpea cultivars had uniform conversion rate of assimilates as well as partitioning and supplying abilities of photosynthates for dry matter accumulation in the seeds. On the other hands, the significant differences observed in the number of pods per

TABLE 2:Cowpea Percent Emergence, Height And Number Of Flowers Per Plant As Affected By The Cultivars

Cultivars	1989 Emergence (%)	1989 Height(cm) at 35 DAS*	1989 No of flowers plant^{-1}at 42 DAS*	1990 Emergence (%)	1990 Height(cm) at 35DAS*	1990 No. of flowers plant^{-1} at 42 DAS*
L43	91	50	33	90.2	110	23.7
IT81D	60	80	15	94.8	85	14.7
IT83D-951	84	80	27	89.9	90	24.0
IAR 81-40	85	70	16	94.4	81	15.8
K28	84	70	23	97.3	90	25.1
Ife Brown	66	70	23	-	-	-
Popse 1	74	50	22	-	-	-
IAR-72-69	90	20	-	-	-	-
TVX 32-36	90	80	17	-	-	-
TVX 4557	77	70	21	-	-	-
LSD(P<0.05	NS	NS	NS	NS	NS	NS
CV(%)	13.6	16.2	19.2	6.1	14.3	10.9

*DAS = Days after sowing
NS = Not significant.

TABLE 3: Number Of Pods, Pod Length, Pod Weight And Weight Of 1000 Seeds As Affected By Cultivars (1990 Growing Season Only).

Cultivars	Number of pods plant^{-1}	Pod length plant^{-1}(cm)	Pod Weight plant^{-1}(g)	Weight of 1000 seeds
L43	15.8	18.0	18.4	150.0
IT81D-1137	16.2	16.2	27.6	166.7
IT83D-951	24.9	13.9	24.3	100.0
IAR 81-40	41.0	14.0	31.2	116.7
K28	27.4	13.2	28.6	133.3
Ife Brown	27.3	14.5	27.7	116.7
LSD (P<0.05)	8.1	0.8	5.4	NS
CV (%)	15.3	10.5	17.8	17.6

NS = Not significant

plant, pod length and weight can be ascribed to a possible partitioning and distribution of more photosynthates to some other plant components (e.g haulm and husk) in some cultivars than to their seeds. This, in addition to their differential response to climatic conditions, perhaps gave room for proper and complete pod and seed formation in some cultivars than others. Also, it is possible that some of the flowers than could have given rise to pods in some cultivars were actually defective and/or redundant. Hay and Walker (1992) had reported similar findings. Squire (1990) and Hay and Walker (1992) however has indicated that genetic variations exist between and within species in response to soil and climatic factors. Mosarwe (1993) reported that medium-maturing cultivars are environment specific while late-maturing cultivars tended to be adapted to more adverse environments than early-and-medium maturing cultivars.

Grain Yield

The grain yield performance of the cultivars are shown in Table 4. grain yields varied significantly ($P<0.05$) among the cultivars in both years. In 1989, the four best or highest grain yields were observed under the following cultivars: Ife Brown (714.8kg/ha) followed by K28 (338.8kg/ha),L43 (324.5kg/ha) and IAR 81-40 (306.0kg/ha); while in 1990, it was in the order: IAR 81-40 (1224.9kg/ha), Ife Brown (1119.8 kg/ha), K28 (1019.4kg/ha) and IT81D-1137 (1018.7kg/ha). The mean grain yield for the two years revealed that Ife Brown was superior to the above thee cultivars by 16.5, 26.0 and 31.3%, respectively.

TABLE 4: Cowpea Grain Yields As Affected By Cultivars (Kgha^{-1})

Cultivars	1989	1990	Mean
L43	324.5	914.1	619.3
IT81D-1137	43.0	1018.7	530.9
IT83D-951	240.7	1010.9	629.8
IAR 81-40	306.0	1224.9	765.5
K28	338.8	1019.4	679.1
Ife Brown	714.8	1119.8	917.3
Popse	164.2	-	-
IAR-72-69	126.4	-	-
TVX32-36	182.1	-	-
TVX4557	142.0	-	-
LSD ($P<0.05$)	115.3	51.2	61.6
CV (%)	19.8	14.3	13.2

The difference in grain yields among the cultivars is attributed mainly to the differences observed in some growth and yield parameters. More leaves, flowers an pods were observed in some cultivars (e.g Ife Brown, IAR 81-40, K28, ITD-1137) as growth progressed and at full bloom. These observations perhaps explain the non-correlation of the number of flowers (Table 2) taken at 45 days after sowing, with the subsequent grain yield. In addition, rate of foliage senescence was observed to be slower in some cultivars (e.g. Ife Brown and IAR 81-40) than others. This probably gave some cultivars more functional leaves at a particular time than others; and longer duration to manufacture and partition more photosynthates for dry matter and seed production. Also, it is possible that some leaves of some of the cultivars were redundant (Hay and Walker, 1992). It was observed in the course of the study that some flowers aborted before pod initiation on some cultivars (e.g. IAR-72, TVX 32-36 and TVX 4557) than others (L43, IAR – 72, TVX 32-36 and TVX 457) than others (L43, IAR81-40 and Ife Brown) than others. This probably gave some cultivars more functional longer duration to manufacture and partition more photosynthesis for dry matter and seed production. Also, it is possible that some leaves of some cultivars were redundant (Hay and Walker, 1992). It was observed in the course of the study that some flowers aborted before pod initiation on some cultivars (e.g IAR-72, TVX 32-36 and TVX 4557) than others (L43, IAR81-40 and Ife Brown). The prevailing soil and climate conditions might have favoured some cultivars than others. Similar observation had been made by several authors (Nangju, 1979; Singh and Rachie, 1985; Kwapta and Hall; 1990; Masarwe, 1993).

The findings of the study have strongly indicated that cowpea production has a future in the acid soils of Uyo. With good agronomic practices in place; some of the cultivars viz: Ife Brown, IAR 81-40 and K28, could express their full potentials and hence contribute meaningfully to the improvement of protein intake of the populace in the agro-ecological zone.

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