



Evaluation of eight varieties of cowpea (*Vigna unguiculata* (L.) Walp) in Asaba agro-ecological environment, Delta State, Nigeria

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Abstract

A study was conducted during the early planting season of 2011 at Asaba, Delta State, Nigeria to evaluate eight varieties of cowpea (IT80D-699, IT82 (e-18), Ife Brown, IT870-9411 and TVX3236, IT90K-277-2, IT870-9411 and IT828-146) for adaptation in the altisol of Asaba agro ecological zone with a view to recommending the suitable varieties to farmers in the area for planting. The results showed that significant differences ($P \leq 0.05$) existed among the varieties tested in all the growth characters measured. Ife Brown, IT8482246-4 and TVX3236 varieties performed significantly better both in the growth and yield as well as yield related parameters when compared to IT800D-699, IT82(e-18), IT870-9411 and IT828-146 varieties. This study hereby recommends Ife Brown, IT848-2246-4 and TVX3236 varieties which performed appreciably better to farmers in Asaba agro ecological zone for planting.

Key words: Cowpea varieties, growth, yield parameters, Asaba, Nigeria.

Introduction

Cowpea is a dicotyledonous plant belonging to the family Fabaceae and sub-family, Fabioideae. It is grown extensively in the low lands and mid-altitude regions of Africa (particularly in the dry savanna) sometimes as sole crop but more often intercropped with cereals such as sorghum or millet (Agbogidi, 2010a). World production of cowpea was estimated to be 2.27 million tons of which Nigeria produces about 850,000 tones (FAO, 2002; Adaji *et al.*, 2007). Cowpea is of major importance to the livelihoods of millions of relatively poor people in less developed countries of the tropics (FAO, 2002). Islam *et al.* (2006) emphasized that all parts of the plant used as food are nutritious providing protein and vitamins, immature pods and peas are used as vegetables while several snacks and main dishes are prepared from the grains (Duke, 1981; Bittenbender *et al.*, 1984). Egho (2009) reported that Nigeria is the 2nd greatest consumer of cowpea in the whole world. Among the legumes, cowpea is the most extensively grown, distributed and traded food crop consumed, more than 50% (Philips and McWalters, 1991; Ogbo, 2009; Agbogidi, 2010a). This is because the crop is of considerable nutritional and health value to man and livestock (Agbogidi, 2010b). They form a major staple in the diet in Africa and Asian continents (Awe, 2008). The seeds make up the largest contributor to the over all protein intake of several rural and urban families hence Agbogidi (2010b) regarded cowpea as the poor man's major source of protein. Their amino acid complements those of cereals (Fashokin and Ojo, 1988; Fashokin and Fansaya, 1988; Asumugha, 2002). Their mineral contents: calcium and iron are higher than that of meat, fish and egg and the iron content equates that of milk; the vitamins- thiamin, riboflavin, niacin (water soluble) and their levels compare with that found in lean meat and fish (Platt, 1962; Adams, 1984; Rachie *et al.*, 1985; Achuba, 2006) which make them very useful in blood cholesterol reduction (Johnson *et al.*, 1983; Anderson, 1985). Many researchers including Anderson (1983), Adaji *et al.* (2007) and Adeniji (2007) have showed that daily consumption of 100– 135gm of dry beans reduces serum cholesterol level by 20% thereby, reducing the risk for coronary heart diseases by 40% (Anderson, 1985; Ofuya, 1993). Besides its health related benefits, beans are inexpensive, considerably cheaper than rice or any other dietary fibre type (Ayenlere *et al.*, 2012). It is a good food security item as it mixes well with other recipe (Singh and Rachie, 1985; Muoneke *et al.*, 2012). Cowpea fixes atmosphere nitrogen through symbiosis with nodule bacteria (Shiringani and Shimeles, 2011). It does well and most popular in the semi-arid of the tropics where other food legumes do not perform well (Sankie *et al.*, 2012). It is an extremely resilient crop and cultivated under some of the most extreme agricultural conditions in the world (Owolade *et al.*, 2006; Muoneke *et al.*, 2012).

In Nigeria cowpea is majorly produced in the North in the savannah belt. Its yield in the South is affected by some environmental factors including rainfall hence it is seasonal. The high demand for this leguminous multipurpose crop plant is not met in the Southern part of Nigeria. The production of cowpea all year round basis in all parts of Nigeria is expected to boost production, thereby improving nutrition, contributes to food security as well as increase revenue of the producers and creates employment opportunities

and enhancing the efficiency of utilization of labour. It is against this background that a study as this has been undertaken to evaluate eight varieties of cowpea in altisol (Asaba agro-ecological environment with a view to selecting the variety (ies) that will best adapt to the conditions in the Southern part of Nigeria using Asaba agro-ecological environment as case study.

Materials and Methods

Study Area - The experiment was conducted at the Teaching and Research Farm of the Agronomy Department, Delta State University, Asaba Campus between May and August, 2011. Asaba is located at 06° 14' N, longitude 06° 49' E, temperature: 28 ± 6°C, rainfall: 1500– 1849mm, relative humidity: 77.2 – 80% and sun shine: 4.8 hours (Asaba Meteorological Station, 2010).

Pre-planting soil analysis

Soil samples from the study area were analysed prior to experimentation after collection with the aid of auger from each block. The samples were bulked and air-dried at room temperature of between 25 and 27°C for five days, crushed to pass through a 2mm sieve before they were neatly packed in a properly labeled air tight polythene bags for physio-chemical analysis at the National Institute for Oil Research (NIFOR) near Benin-City, Edo State using the standard methods. Data collected were subjected to analysis of variance (ANOVA) while significant means were separated with the Duncan's multiple range tests using SAS (2005).

Source of plant materials: The eight varieties of cowpea: IT80D-699, IT82 (e-18), Ife Brown, IT848-2246-2, TVX3236, IT90K-277-2, 17870-941-1 and IT828-146 were purchased as a single batch from IITA, Ibadan, Oyo State, Nigeria.

Procedure and experimental design: The land was ploughed with a tractor and harrowed after one week. The layout was marked using tape, pegs and ropes. The plots measured 5m in length and 3m in width. Spacing between plots was 1.5m and planting spacing was 60cm x 30cm following the procedure of Reminson *et al.* (1980). Two seeds of cowpea from each variety were planted per hole in May (early cropping season). Thinning of seedlings to one stand per hole was done at 10 days after emergence. Each plot consisted of 6 rows of 36 cowpea stands per row. The experimental area was hoe-weeded regularly before maturity to enable the plants develop under non-limiting condition. Insect pests were controlled with Karate 2.5EC at 2 weeks after seedling emergence and thereafter, at 10 days' intervals following the procedure of Reminson *et al.* (1980) and Awe (2008). The experiment was laid down in a randomized complete block design (RCBD), with four replications while subsequent examination followed. Growth parameters measured were plant height, leaf area, number of leaves, stem diameter and yield and yield related parameters. The plant height was measured using measuring tape from soil level to terminal bud at two weeks interval after transplanting, number of leaves was determined by visual counting of the number of leaves for each seedlings per variety, leaf area measurement was achieved by tracing the leaves on a graph paper and the total area per plant was obtained by measuring the maximum leaf and the length and breadth of the leaf was multiplied by the correction factor 0.75 following the formula of (Agbogidi and Ofuoku., 2005), collar diameter was measured using veneer caliper every two weeks. Other parameters measured were 100 seed weight, number of pods per plant, pod length, number of seeds per pod, pod load, and dry grains yield (kg ha⁻¹). 100 seed weight yield were weighed with triple beam balance (Haus Model) and extrapolated to hectares. Number pods per plant were determined following the method of Egho (2009). One meter length of cowpea row was taken with 1 meter ruler. The length was marked with 2 sticks and the pods and plants that fell within this distance were counted. The number of pods was then divided by the number of cowpea plants.

$$\frac{\text{Number of pods}}{\text{Number of plants}} = \text{No. of pods per plant}$$

At maturity, that is, at about 65 – 70 days after planting (DAP), pods were harvested with hand, sun dried for one week and later shelled. The dry grain yields in each plot were weighted and recorded. One hundred seeds were picked from the grains in each plot and weighed. Pod load was assessed in the field by visual rating on a scale of 1 – 9 following the procedure of Egho (2009). It was done by rating the scale from the two central rows of each plot. Assessment was done in the field at 60 days after planting when pods were fully filled and matured but still green. Data collected were exposed to analysis of variance (ANOVA) while significant means were separated with the Duncan's multiple range tests using SAS (2005).

Results and Discussion

The initial pre-planting soil properties of the area under study are shown in Table 1. Generally, the results of the pre-planting soil analysis showed that the soil is marginally fertile which implies that the soil is low in N content, organic matter, available phosphorus exchangeable bases and exchangeable cations following Federal Ministry of Agriculture and Natural Resources (FMANR, 1990). This further implies that the soil is poor in nutrients and of low productivity therefore, response to organic manure would be encouraged (Table 1). The observed 6.20 value of the pH of the soil indicates that the soil is slightly acidic and this can be attributed to the high rainfall prevalent in the area leading to leaching of the basic cations from the surface area of the soil. The low organic matter content and total nitrogen could be attributed to the effects of soil erosion, leaching and bush burning predominant in the study

area. Similarly, the low exchangeable cations may be due to the low clay activity and low organic content of the soil. The CEC was average (15.20 cmol/kg-1) while the base saturation indicates that the study area has low fertility status which may be due to the long usage of the area for serious cropping without replenishing the lost nutrients through fertilizer application. The results of the pre-planting soil analysis agree with the findings of Enwezor *et al.* (1991) and Egbuchua (2007). The soil is sandy loam in texture with characteristics of 84.60% sand, 6.92% silt and 8.48% clay. The result of the soil experimental site confirms to the findings of Egbuchua (2007) on the nutrient status of Anwai/Asaba soil. This observation could be as a result of basic macronutrients such as N, P, K, Ca, Mg, S and the biological production of acid which limits plant growth and development (Agbogidi *et al.*, 2006; Agbogidi and Okonmah, 2011a; Agbogidi and Okonmah, 2011b).

The performance of the various varieties of cowpea in terms of plant height, number of leaves, leaf area, stem diameter and yield and yield components are presented in Table 2, 3, 4 and 5 respectively. Significant differences at the 5% probability level were observed in all the varieties of cowpea studied with Ife Brown, IT848 – 2246-4 and TVS3236 performing significantly better in all the growth and yield characters measured when compared to the other varieties. For example, for number of seeds per pod, TVS3236 had value of 8.2; IT848-2246-4 had 7.8 while Ife Brown produced 7.0 seeds. These were significantly ($P \leq 0.05$) higher than IT870-9411, IT80D-699 and IT828-146 that had 4.8, 4.0 and 3.8 seeds respectively. Similarly, IT848-2246-4 had the highest dry grain yield (biomass production 148.7kg ha^{-1} which was significantly ($P \leq 0.05$) higher than Ife Brown (146.5) and TVX3236 (126.3). These three varieties had appreciable yield accumulation when compared to IT828-246 and IT80D-699 varieties that produced as low as 29.1 and 28.4kg ha^{-1} respectively (Table 6). The observed significant performance in Ife Brown, IT848-2246-4 and TVX32-36 show variable differences in the anatomical, morphological and physiological structures which made these varieties readily able to absorb nutrients and water from the soil, carried out effective photosynthetic process and able to store photosynthates which other varieties like IT80D-699 and IT828-146 could not do. This observation supports the earlier reports of Agbogidi and Ofuoku (2005) that plants respond differently to environmental factors based on their genetic make up and their adaptation capability indicating that variability among species.

Table 1. Physio-chemical properties of soil before experimentation

Parameters	Values
Sand (%)	94.5
Silt (%)	2.1
Clay (%)	3.4
Soil pH	5.60
Textural class	Sandy loam
Organic carbon (%)	0.91
Organic matter (gkg-1)	2.64
Total N (%)	0.06
Available p (mg/kg)	30.00
Ca ²⁺ (cmol/kg)	331.31
Mg ²⁺ (cmol/kg)	0.16
Na ⁺ (cmol/kg)	0.25
K ⁺ (cmol/kg)	0.17
H ⁺ (cmol/kg)	0.45
Al ³⁺ (cmol/kg)	0.08
ECEC (cmol/kg)	2.42
Base saturation (%)	78.10

Table 2. Plant height of cowpea as influenced by varietal differences

Cowpea Variety	Plant height/WAP					Means
	3	5	7	9	11	
IT 80D-699	19.1	22.6	24.3	26.7	27.0	23.94c
IT 82(e-18)	18.7	21.7	23.4	25.6	25.9	23.06d
Ife Brown (SL)	22.6	28.6	30.1	32.0	33.9	29.44a
IT 848-2246-2	23.2	27.6	28.7	31.6	32.7	28.76b
TVx3236	29.6	28.2	29.0	30.9	31.9	28.92b
IT 90k-277-2	20.3	21.9	24.3	25.0	25.8	22.46c
IT 870-9411	18.6	19.7	22.4	23.7	24.6	21.8d
IT 828-146	14.3	15.6	19.8	21.6	22.1	18.68e

Means with different letters are significantly different ($p \leq 0.05$) with the Duncan's multiple range tests

Table 3. Number of leaves of *Vigna unguiculata* as affected by varietal differences

Cowpea varieties	Number of leaves/WAP					Means
	3	5	7	9	11	
IT 80D-699	5.3	5.4	7.9	8.8	9.0	7.28b
IT 82(e-18)	5.4	5.6	6.8	7.1	8.6	6.70c
Ife Brown	6.9	7.9	8.7	9.6	11.7	8.96a
IT 848-2246-2	6.7	7.2	9.6	9.9	11.3	8.94a
TV x32-36	6.8	7.7	8.8	9.4	10.9	8.72a
IT 90k-277-2	6.2	6.8	7.1	7.9	8.2	7.24b
IT 870-9411	5.2	5.8	6.8	7.0	7.8	6.52c
IT 828-146	5.0	5.7	6.6	7.2	7.6	6.42c

Means with different letters are significantly different ($p < 0.05$) with the Duncan's multiple range tests

Table 4. Leaf area of *Vigna unguiculata* influenced by varietal differences

Cowpea varieties	Leaf area/WAP					Means
	3	5	7	9	11	
IT 80D-699	24.4	30.7	35.6	42.0	68.7	40.32e
IT 82(e-18)	36.1	38.4	40.1	41.6	60.3	43.3d
Ife Brown	46.2	58.7	67.3	80.4	12.7	74.66a
IT 848-2246-2	46.7	62.6	74.4	76.2	100.8	72.14b
TVx3236	50.4	56.4	67.4	75.6	11.6	72.08b
IT 90k-277-2	30.2	42.1	48.7	56.7	69.8	49.50c
IT 870-9411	29.3	38.1	42.8	50.2	53.7	42.82d
IT 828-146	28.8	37.0	40.3	48.7	49.9	40.94e

Means with different letters are significantly different ($p \leq 0.05$) with the Duncan's multiple range tests

Table 5. Stem diameter of *Vigna unguiculata* as affected by varietal differences

Cowpea varieties	Stem diameter/WAP					Means
	3	5	7	9	11	
IT 80d-699	1.1	1.2	1.4	1.5	1.6	1.36b
IT 82(e-18)	1.2	1.3	1.4	1.5	1.6	1.40b
Ife Brown	1.6	1.7	1.9	2.1	2.3	1.92a

IT 848-2246-2	1.5	1.6	1.8	2.2	2.4	1.90a
Tvx32-36	1.4	1.8	1.9	2.3	2.4	1.96a
IT 90k-277-2	1.2	1.3	1.3	1.4	1.5	1.34b
IT 870-9411	0.9	1.0	1.0	1.2	1.3	1.08c
IT 828-146	0.8	1.0	1.1	1.2	1.3	1.08c

Means with different letters are significantly different ($p \leq 0.05$) with the Duncan's multiple range tests

Table 6. Yield and yield related parameters of cowpea influenced by varietal differences

Cowpea varieties	100 Seed weight	No of pods/ Plant	Pod length (cm)	No of seeds/ pod	Pod load	Dry gram yield (kg ha-1)
IT 80D-699	11.4c	4.0e	6.5d	4.0e	3.2c	23.4f
IT 82(e-18)	11.3c	4.3d	4.4e	4.2e	3.0c	34.8d
Ife Brown	13.8b	8.2a	9.8b	7.0c	6.9a	146.5b
IT848-2246-4	14.2b	7.7b	10.6a	7.8b	6.8a	148.7a
TV x 3236	14.9a	7.4b	10.8a	8.2a	6.7a	126.3c
IT 90k-277-2	10.3d	6.6c	8.3c	6.9c	4.2b	82.0d
IT 870-9411	10.0d	4.2d	6.8d	4.8d	3.1c	31.6e
IT 828-146	6.8e	3.5e	4.3e	3.8e	2.2d	29.1f

Means with different letters within the same measured parameters (column) are significantly different ($p \leq 0.05$) using the Duncan's multiple range tests

Conclusion

This study evaluated the performance of eight varieties of cowpea in Asaba agro-ecological environment in terms of plant height, number of leaves, leaf area and yield and yield components. The results show that Ife Brown, IT848-2246-4 and TVX3236 differed significantly ($P \leq 0.05$) in their performance when compared to the other varieties especially IT828-146 and IT80D-699 that had the lowest values for all parameters assessed. Ife Brown, IT848-2246-4 and TV3236 had the highest yields over the others hence they are recommended to farmers in Asaba agro-ecological environment for cultivation.

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