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AGRO-MORPHOLOGICAL CHARACTERIZATION, CORRELATION AND PRINCIPAL COMPONENT ANALYSIS OF ELITE GROUNDNUT (*Arachis hypogaea L.*) VARIETIES IN UYO, SOUTHEASTERN NIGERIA

Ofose, G. E., Bassey, E. E., and Udom, G. N.

Department of Crop Science, Faculty of Agriculture, University of Uyo, Akwa Ibom State, Nigeria

ABSTRACT

Field experiment was conducted at the University of Uyo Teaching and Research Farm, Uyo, Southeastern Nigeria during the 2021 cropping season to evaluate agro-morphological characters, and determine correlation coefficients and principal components in 10 groundnut varieties. The experiment which occupied a land area of 21.8m x 4.12m was laid out in a randomized complete block design in three replications. Characters studied were plant height (cm), number of leaves, leaf area (cm^2), number of branches, length of petioles (cm), days to first flowering, number of pods per plant, number of seeds per plant, length of pods (cm), circumference of pods (cm), weight of pods per plant (g), harvest index (%), weight of 100 seeds (g), pod yield (tha^{-1}) and seed yield (tha^{-1}). Significant differences ($p>0.05$) were observed among the groundnut varieties for all the characters. The variety, RC-128B was superior over all other varieties in nine characters, namely number of leaves, leaf area (cm^2), number of branches, number of pods per plant, number of seeds per plant, weight of 100 seeds (g), harvest index (%), pod yield (tha^{-1}) and seed yield (tha^{-1}), followed by RC-128S in seven, namely number of leaves, number of branches, number of pods per plant, number of seeds per plant, harvest index (%), seed yield (tha^{-1}) and pod yield (tha^{-1}), while RMP-24 was superior over the rest in six characters, namely plant height (cm) length of petioles (cm), plant biomass (g), weight of haulm (g), fresh weight of pods (g) and number of pods per plant. Six characters correlated significantly and positively with seed yield, namely number of pods per plant, number of seeds per plant, circumferences of pods (cm), weight of pods (g), weight of 100 seeds (g), harvest index (%) and pod yield (tha^{-1}). First 3PC with Eigen values greater than 1.0 jointly explained 77.6% of the total variations in the accession. The large variability observed in many of the characters, coefficient of variation, and correlation suggests crosses among the three varieties to obtain hybrid varieties for the area. For short-term measure, RC-128B could be recommended for cultivation by groundnut farmers in Uyo, Southeastern Nigeria.

Keywords: Agro-morphological characterization, coefficient of variation, correlation coefficient, groundnut, principal components

***Correspondence to Author:**

Bassey, E. E.

Department of Crop Science, Faculty of Agriculture, University of Uyo, Akwa Ibom State, Nigeria

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INTRODUCTION

Groundnut, also called peanut (*Arachis hypogea* L.) with 2n=44 is a self-pollinated [1], annual underground pod bearing plant[2] which belongs to the legume family Fabaceae (Bassey, 2021) [3]. Groundnut is not a nut per se in the scientific sense but a type of pea (Bassey, 2021) [3]. It is widely cultivated important food and cash crop in the warm tropical and subtropical areas [2,4], on 22.2 million hectare [5] principally for its edible oil and protein rich seeds[19]. Groundnut is a major food crop grown either for its nut, oil or vegetative residue [6] and its use has increased substantially in the recent years [7]. Groundnut contains about 50% oil, 30% protein, 20% carbohydrate and 5% fibre and ash. It ranks fourth in oil production after soyabean (Glycine max L.), cotton seed (Gossypium spp), and rapeseed (*Brassica napus* L.) [8]. Groundnut ranks 13th in economic importance among the world food crops [3]. Groundnut is grown in nearly 108 countries [5,9]. Its distribution across the continents of the world attests of its general acceptance for snack and dessert [3]. In West Africa, Nigeria, Senegal, Ghana and the Gambia are the major producers. The top ten largest producers of groundnut in the world in 2020 were China (18.7 million metric tonnes, mmt), India (6.8 mmt), USA (Texas, Alabama, Virginia, Florida, North Carolina and Oklahama produce 99% of the total groundnut for the country, USA produces 4.1 mmt, Nigeria (3.8 mmt), where Kano, Taraba, Bauchi and Bornu are the major producers, Maynmar (2.0 mmt), Indonesia (1.9 mmt), Argentina (1.1 mmt), Chad (0.8 mmt), Senegal (0.6 mmt) and Ghana (0.4 mmt) (Bassey, 2021).

Groundnut production in the tropics is constrained with low yield and yield attributes [10]. Many varieties with high seed yields and other desirable attributes have been developed by research institutes [3] which should be explored through evaluation and characterization, breeding and selection [7]. Maximum yields of 2.85 tha^{-1} was obtained in Calabar [11], which is comparable to the best yield of 3.03 tha^{-1} obtained by Rasekh *et al*. (2010) [12] in Iran, but better than the maximum yield of 2.3 tha^{-1} recorded by Lado *et al*. (2015) [13] in Sudan savanna area of Nigeria, where the crop is traditionally cultivated. Freeman *et al*. (1999) [14] reported that higher yields of 3-4.5 tha^{-1}may be secured under good management with improved varieties.

Determination of the interrelationship among yield and yield contributing characters and using the information to work out the most efficient and combination of character will give maximum yield when used in selection programme [15]. Yield, being a complex quantitative trait, is influenced by various component traits. For effective improvement, simultaneous selection of the most important yield components is necessary. Therefore, the purpose of this study was to evaluate the agro-morphological characteristics and determine correlation and principal component analysis of elite groundnut varieties in Uyo, southeastern Nigeria.

MATERIALS AND METHODS

The experiment was conducted in 2021 cropping season at the University of Uyo Research and Teaching Farm, Uyo, Akwa Ibom State, Nigeria. Uyo situated within latitude 5° 17' and 5° 27' N and longitude 7°25' and 7°58'E and 55 – 57m above sea level [18]. The area lies within the tropical rainforest zone of southeastern Nigeria with average annual rainforest of 2500mm, mean monthly sunshine of 3.5 hours and mean annual temperature of 27°C. It has a mean relative humidity of 78%. The soil is acidic and belongs to a broad classification group, ultisol formed from acid plain sand [16]. The experiment which occupied a land area of 27.8 m x 4.12 m was laid out in a randomized complete block design and replicated three times. Each plot measured 2.5 m x 1.04 m and separated with 50 cm paths. There were 30 plots altogether and each replicate was separated by 1m paths. The treatments were ten groundnut varieties, RC-128s, RC-128b, RMP-12, RMP-24, RMP-86, M21, RSK-59, JLPS-01, JLP-2 and SDR-2, all obtained from National Seeds Service Liaison Office, NRCRI, Umudike, Abia State, Nigeria.

The land was manually cleared with machete and the trash packed along the alleys. The land was tilled and constructed with beds measuring 1.04 m x 2.5 m using spade. Sowing was done on 4th June, 2021 with spacing of 25cm x 50cm, giving plant population of 250 in the experimental farm, equivalent to 80,000 plants per hectare. The seeds germinated 4-6 days after sowing and began flowering 6-7 weeks later. The crop took 4 – 5 months to mature from planting to harvesting. Weeding was done manually with hoe at 2 and 4 weeks after sowing, thereafter weeds were hand pulled to prevent damage to the pegs (gynophores). Since groundnut can synthesize its nitrogen requirement, a minimal application of NPK (15:15:15) at 200kg/ha was done to enhance growth of the crop.

Four groundnut plants were randomly selected and tagged at the centre of each plot for data collection. The following growth data were collected plant height (cm), number of leaves per plant, number of branches per plant, days to first flowering, leaf area (cm^2), and length of petioles (cm). Yield and yield components were collected following the procedures described by Fageria *et al*. (2000): number of pods per plant, length of pods (cm), number of seeds per pod, circumference of pods (cm), weight of 100 seeds (g), pod yield (tha^{-1}), seed yield (tha^{-1}) and harvest index. Harvest index was determined as

$$Havest\ index = \frac{Economic\ yield\ (kg)}{Biological\ yield\ (kg)}\ x\ 100$$

Data collected were subjected to analysis of variance and the means separated with Duncan Multiple Range Test at 5% probability level. Pearson Product Moment Correlation (PPMC) and Principal Component Analysis were determined using the procedure described by King and Jackson (1999).

RESULTS

Table 1 shows plant height of groundnut varieties with significant differences ($p<0.05$) at 1, 2 and 3 months after sowing (MAS). The tallest plants were produced at 1 MAS by RMP-24 (13.53 cm), followed by RMP-86 (11.35 cm), SDR-2 (11.13 cm), while the shortest plants were obtained from RMP-12 (8.03 cm). At 2 MAS, RMP-24 produced the tallest plants (32.88cm) followed by RMP-86 with 28.29 cm and SDR-2 (27.50 cm), while the shortest plants were obtained from RMP-12 (17.25cm). The same trend was observed at 3 MAS. The coefficient of variation at 1 MAS was 16.39% which increased to 18.84% at 2 MAS and decreased to 16.84% at 3 MAS.

Number of leaves of groundnut was statistically significant at 1, 2 and 3 MAS ($p<0.05$). The highest number of leaves was produced by RC-128B (39.33), followed by RC-128s (37.75) and JLP-2(37.75), while the least number of leaves was produced by RMP-12 (22.83). At 2MAS, RC-128B also produced the highest number of leaves (96.75) which was not statistically different ($p<0.05$) from RC-128S (96.42), while the lowest number of leaves was produced by RMP-12 (37.33). The same trend was observed at 3MAS, with RC-128B leading with 151.75 mean number of leaves followed by RC-128S (136.75) and RMP-86 (136.17) which were not statistically different ($p>0.05$), while the lowest was produced by RMP-12 (64.25). Coefficient of variation was lowest at 1 MAS (19.62%) and highest at 2 MAS (29.16%).

Leaf area (cm^2) of groundnut showed statistical differences at 1, 2 and 3 MAS ($p>0.05$), with the largest leaves produced by RC-128B (40.15 cm^2), followed by RMP-24 (30.57 cm^2) while the smallest leaves were from JLP-2, (19.94 cm^2) at 1 MAS. At 2MAS, RC-128B produced the largest leaves (57.60 cm^2) followed by RMP-24 (53-69cm^2), SDR-2 (51.18cm2), while the smallest leaves were obtained from JLP-2 (36.54 cm^2). A similar trend was observed at 3MAS, with RC-128B observed with largest leaves (62.58 cm^2), followed by RMP-24 (56.8 cm^2), SDR-2 (54.98 cm^2), while the smallest leaves were obtained from JLP-2 (40.14cm^2). Coefficient of variation was highest at 1 MAS and lowest at 3MAS (Table 1).

Table 2 shows number of branches per plant 1, 2 and 3MAS which were statistically different (p>0.05). At 1MAS, RC-128B produced the highest number of branches (3.25) followed by RC-128S (3.08), while the lowest was observed in RMP-12 (2.38). At 2MAS, RC-128B produced the highest number of branches (3.50), followed by RC-128S (3.25), while the lowest number of branches was produced by RMP-12 (3.0). At 3MAS, the same trend was observed with RC-128B producing the largest number of branches (3.50), followed by RC-128S (3.25), while the lowest number of branches was observed in RMP (3.17). The lowest coefficient of variation (8.10%) was observed among the groundnut varieties at 3MAS, while the highest (26.67%) was produced at 2MAS.

Number of days to first flowering was statistically significant (p>0.05). The lowest number of days to first flowering was given by RMP-86 (24.17), followed very closely by M21 (24.67) while the longest flowering plants were observed of RMP-24 (27.33). Very small variation of 3.0% was observed among the groundnut varieties for days to first flowering.

Yield and yield components of groundnut varieties were statistically significant (p>0.05). Plant biomass (g) ranged from 39.54g to 198.58g. The highest biomass was produced by RMP-24 (198.58g) followed by RMP-86 (155.61g), while the lowest was given by SDR-2 (39.54g). Weight of haulm varied significantly (p<0.05), the highest being given by RMP-24 (169.43g), followed by RC-128B (126.80g), while the least was obtained from SDR-2 (31.60g). Similarly, the highest number of pods per plant was produced by RC-128B (28.75), followed by RC-128S (21.50), while the least was recorded in SDR-2 (5.75). Other characters also followed the same trend. For example, the highest number of seeds per plant was produced by RC-128B (51.25), followed by RC-128S (42.20), while the lowest number of seeds per plant was recorded in SDR-2 (8.50). The longest pods were produced by JLP-02 (3.93 cm), followed by RSK-59 (3.88 cm), while RMP-12 produced the shortest pods (2.38 cm) (Table 2). Also, the largest pod circumference was recorded in JLP-02 (5.10 cm), followed closely by RC-128B (4.95cm) and RSK-59 (4.93cm) while the smallest pod circumference was recorded in RMP-12 (3.65cm). The highest weight of pods (g) was produced by RMP-24 (37.28g), followed very close by RC-128B (36.20g), while the least was obtained from M21 (5.98g). Similarly, weight of 100 seeds (g) was statistically significant (p>0.05), the highest being given by RC-128B (4.20g), followed by JLP-02 (4.08g), while the least was given by M21 (2.13g). Similarly, the highest harvest index (%) was produced by RC-128B (52.77%), followed by RC-128S (40.59%), while the least was recorded in M21 (6.15%). The highest pod yield of 3.84 tha^{-1} was produced by RC-128B, followed by RC-128S (3.54 tha-1) while the least was M21 (1.47 tha^{-1}). Also, the highest seed yield was produced by RC-128B (2.90 tha^{-1}), followed by RC-128S (2.39 tha^{-1}), while the lowest seed yield was given by M21 (0.65 tha^{-1}). The highest coefficient of variation (CV%) was produced by harvest index (59.37%), followed by fresh weight of pods (55.74%), number of seeds per pod (55.43%), while the least was recorded in circumference of pods (12.80%) (Table 2). Correlation coefficient was carried out to determine character that vary in the same or opposite direction with yield and other characters.

The result of correlation analysis reveal both positive and negative relationships among the morphological traits and yield in groundnut. Many characters correlated significantly with both pod yield and seed yield in groundnut. For example, pod yield (tha^{-1}) was positively and significantly correlated with number of pods per plant (r = .546*), number of seeds per plant (r = .546*), weight of pods (r = .556*) and harvest index (r = .666**), but negatively with circumference of pods (r= –.575*) and weight of seeds (r = .517*). Similarly, seed yield (tha^{-1})

Table 1: Plant height (cm), mean number of leaves per plant, leaf area, length of petioles, number of branches, number of days to flowering as influenced by groundnut genotypes

Groundnut genotype	Plant Height (cm)			Mean Number of Leaves			Leaf Area (cm^2)			Length of Petioles			Number of Branches			Number of days to first flowering
	Months After Planting			Months After Planting			Months After Planting			Months After Planting			Months After Planting			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
RC-128s	9.38^{g}	23.88^{f}	28.69^{g}	37.75^{b}	96.42^{a}	136.75^{b}	21.12^{b}	44.84^{b}	49.53^{c}	5.57^{b}	5.60^{h}	5.97^{g}	3.08^{b}	3.25^{b}	3.92^{b}	25.33^{c}
RC-128B	8.59^{h}	26.54^{e}	32.88^{e}	39.33^{a}	96.75^{a}	151.75^{a}	40.15^{b}	57.60^{b}	62.58^{a}	5.26^{i}	5.94^{e}	5.94^{h}	3.25^{a}	3.50^{a}	4.98^{a}	26.00^{b}
RMP-12	8.03^{j}	17.25^{j}	23.42^{i}	22.83^{i}	37.33^{g}	64.25^{d}	22.94^{b}	41.16^{b}	43.55^{c}	5.22^{j}	5.30^{i}	5.60^{j}	2.38^{g}	3.00^{f}	3.17^{h}	25.00^{c}
RMP-24	13.53^{a}	32.88^{a}	50.21^{a}	28.17^{f}	61.75^{d}	101.33^{c}	30.57^{b}	53.69^{a}	56.84^{b}	11.12^{a}	12.78^{a}	12.78^{a}	2.92^{d}	3.17^{d}	3.25^{g}	27.33^{a}
RMP-86	11.35^{b}	28.29^{b}	36.92^{b}	30.58^{d}	74.17^{b}	136.17^{b}	27.95^{b}	40.39^{b}	44.78^{c}	6.18^{b}	6.30^{b}	6.64^{b}	2.92^{d}	3.17^{d}	3.40^{f}	24.17^{c}
M21	8.29^{j}	21.96^{g}	30.17^{f}	29.88^{e}	43.42^{f}	70.17^{d}	20.44^{b}	37.77^{b}	42.57^{c}	5.72^{g}	5.72^{g}	5.72^{i}	3.00^{c}	3.08^{e}	3.42^{e}	24.67^{c}
RSK-59	10.39^{f}	26.88^{d}	34.92^{d}	23.33^{b}	73.92^{c}	92.83^{c}	19.64^{b}	41.16^{b}	45.96^{c}	6.15^{c}	6.05^{d}	6.10^{e}	3.00^{c}	3.17^{d}	3.75^{c}	25.33^{c}
JLP-01	10.78^{e}	21.07^{h}	26.92^{h}	32.50^{c}	59.33^{f}	114.58^{c}	25.00^{b}	37.53^{b}	43.72^{c}	5.76^{e}	6.28^{c}	6.32^{d}	2.92^{h}	3.17^{d}	3.50^{f}	26.00^{b}
JLP-2	10.88^{d}	20.07^{i}	26.92^{h}	37.75^{b}	60.03^{e}	111.33^{c}	18.94^{b}	36.54^{b}	40.14^{c}	5.73^{f}	5.73^{f}	6.05^{f}	2.83^{f}	3.17^{d}	3.75^{e}	25.33^{c}
SDR-2	11.13^{c}	27.50^{c}	35.78^{c}	25.42^{g}	65.58^{c}	123.58^{c}	26.60^{b}	51.18^{a}	54.98^{b}	6.05^{d}	6.05^{d}	6.54^{c}	3.00^{c}	3.22^{c}	3.67^{d}	25.67^{d}
Mean	10.31	24.63	31.68	30.78	66.87	110.28	25.56	44.19	48.17	6.23	6.58	6.78	2.93	3.19	3.68	25.55
CV	16.39	18.84	16.84	19.62	29.16	26.00	25.61	16.81	14.56	31.40	32.43	7.78	22.12	26.67	8.10	3.09

Table 2: Yield and yield components of groundnut as influenced by groundnut genotypes in Uyo, Southeastern Nigeria

Groundnut genotypes	Plant biomass (g)	Weight of haulm (g)	No. of pods per plant	No. of seed per plant	Length of pods (cm)	Circumference of pods (cm)	Fresh weight of pods (g)	Weight of 100 seeds (g)	Harvest index (%)	Pod yield (t/ha)	Seed yield (t/ha)
RC-128s	123.37^{c}	69.33^{b}	21.50^{a}	42.20^{a}	3.25^{a}	3.88^{a}	24.10^{b}	3.83^{a}	40.59^{b}	3.54^{a}	2.39^{a}
RC-128B	129.13^{c}	126.80^{b}	28.75^{a}	51.25^{a}	3.65^{a}	4.95^{a}	36.20^{a}	4.20^{a}	52.77^{a}	3.84^{a}	2.90^{a}
RMP-12	101.99^{d}	83.08^{b}	18.25^{a}	25.75^{ab}	2.38^{a}	3.65^{b}	19.08^{bc}	2.66^{b}	21.86^{e}	2.72^{b}	1.48^{ab}
RMP-24	198.58^{a}	169.43^{a}	18.75^{a}	21.50^{bc}	3.70^{a}	3.90^{b}	37.28^{a}	3.11^{ab}	25.68^{d}	3.34^{ab}	2.02^{ab}
RMP-86	155.61^{b}	116.10^{b}	21.25a	34.50^{ab}	3.03^{a}	3.95^{b}	30.83^{a}	3.53^{a}	13.53^{g}	2.35^{b}	1.26^{b}
M21	121.38^{c}	94.30^{b}	6.0^{a}	10.0^{c}	3.55^{a}	4.90^{a}	5.98^{c}	2.13^{b}	6.15^{h}	1.47^{bc}	0.65^{c}
RSK-59	146.93^{b}	87.54^{b}	9.0^{a}	15.0^{bc}	3.88^{a}	4.93^{a}	11.28^{bc}	3.95^{a}	7.83^{h}	2.11^{bc}	1.29^{b}
JLP-01	57.23^{e}	43.35^{c}	10.50^{a}	17.25^{bc}	2.98^{a}	4.13^{b}	13.60^{bc}	3.16^{ab}	30.50^{c}	3.21^{ab}	2.02^{ab}
JLP-2	145.40^{b}	109.55^{b}	20.75^{a}	25.5^{ab}	3.93^{a}	5.10^{a}	21.68^{b}	4.08^{a}	18.78^{f}	2.43^{b}	0.96^{c}
SDR-2	39.54^{f}	31.60^{c}	5.75^{a}	8.50^{c}	2.85^{a}	4.25^{b}	6.44^{c}	3.37^{ab}	19.60^{f}	2.25^{bc}	1.27^{b}
Mean	121.92	93.11	16.05	25.13	3.32	4.32	20.65	3.40	23.73	2.73	1.66
CV	38.29	43.43	48.54	55.43	15.06	12.80	55.74	19.41	59.37	27.11	43.37

Table 3: Correlation Analysis of plant biomass, weight of haulm, number of pods per plant, number of seed per plant, length of pods, circumferences of pods, weight of pods per plant, weight of seeds, harvest index, pod yield and seed yield

	Plant characters										
	Plant biomass (g)	Weight of haulm (g)	No of pods per plant	No. of seed per plant	Length of pods (cm)	Circumferences of pods (cm)	Weight of pods per plant (g)	Weight of seeds (g)	Harvest index (%)	Pod yield (tha^{-1})	seed yield (tha^{-1})
Plant biomass											
Weight of haulm	.913**										
No. of pods	.641**	.371**									
No. of seed per plant	.540**	.241	.947**								
Length of pods	.320*	.275*	.084	.103							
Circumference of pods	.204	.252	-.198	-.325*	.501**						
Weight of pods	.615**	.362*	.943**	.951**	.155	−.241					
Weight of 100 seeds	.219	.369**	−.269*	.373**	.294*	.641**	−.234				
Harvest index	−.152	−.201	.278*	.257	−.581**	−.603**	.225	−.488**			
Pod yield	.196	.101	.553**	.546**	−.101	−.575**	.556**	−.517*	.666**		
Seed yield	.071	−.008	.546*	.564*	−.094	−.512**	.577**	−.531	.702**	.964**	

**. Correlation is significant at the 0.01 level. *. Correlation is significant at the 0.05 level.

Table 4: Principal component analysis (PCA) of groundnut in Uyo, Southeastern Nigeria

Groundnut Character	Components		
	PCA 1	PCA 2	PCA 3
Plant biomass	.588	.733	.001
Weight of haulm	.373	.745	.167
No. of pods per plant	.982	.218	-.297
No. of seed per plant	.881	.109	-.394
Length of pods	.038	.609	.190
Circumference of pods	-.386	.696	.299
Weight of pods	.892	.218	-.286
Weight of 100 seeds	-.375	.654	.383
Harvest index	.593	-.234	.581
Pod yield	.756	-.348	.469
Seed yield	.687	-.441	.521
Total	4.54	2.85	1.45
% of variance	41.25	25.92	13.21
Cumulative (%)	41.249	67.169	80.380

was positively and significantly correlated with number of pods per plant (r = .546*), number of seeds per plant (r = .564*), weight of pods per plant (r = .577*), harvest index (r = .702**) and pod yield (r = .964**), but negatively though significantly with circumference of pods (r = –.512*) (Table 3).

Principal Component Analysis was carried out to partition the variables into three main component axes (PC1, PC2 and PC3). First 3PC with Eigen values greater than 1.0 jointly explained 80.4% of the total variations in the accessions. PC1 with the Eigen value of 4.54 contributed 41.25% of the total variability in groundnut. PC2 with Eigen value of 2.85 contributed 25.92% of the total variability while PC3 with Eigen value of 1.45 accounted for 13.21% of the total variability observed among the ten groundnut varieties in Uyo, Akwa Ibom State. In PC1, the traits that accounted for most of the 41.25 observed variability among the 10 groundnut varieties included number of pods per plant with vector loading of .892, weight of pods per plant, with vector loading of .892, number of seeds per plant with vector loading of .881, pod yield with vector loading of .756, seed yield with vector loading of .687, and plant biomass with vector loading of .588. In PC2, the traits that accounted for most of the 25.92 observed variability among the 10 groundnut varieties included weight of haulm with vector loading of .745, plant biomass with vector loading of .733, length of pods with vector loading of .609, circumference of pods with vector loading of .696 and weight of 100 seeds with vector loading of .654. Similarly, in PC3, the traits that accounted for most of 13.21 observed variability among the 10 varieties of groundnut included harvest index with vector loading of .581, pod yield with loading of .469 and seed yield with vector loading of .521 (Table 4)

DISCUSSION

Variability in all the agro-morphological characters and yield was observed among the groundnut varieties used in this study. This agrees with the result obtained by Onwubiko *et al.* (2011) and Saijan *et al.* (2002) on legumes and Okra, respectively, attributing the sources of variability to genetic cause, than environment. They reported that agro-morphological characterization and evaluation are capable of revealing inherent variability in a population. In this study, the variety RC-128B exhibited superiority over all the varieties in nine desirable characters, namely number of leaves, leaf area (cm^2), number of branches per plant, number of pods per plant, number of seeds per plant, weight of 100 seeds (g), harvest index (%), pod yield (tha^{-1}) and seed yield (tha^{-1}), followed by RC-128S in seven characters, namely number of leaves per plant, number of branches per plant, number of pods per plant, number of seeds per plant, harvest index (%), pod yield (tha^{-1}) and seed yield (tha^{-1}) and was consequently ranked second. The variety RMP-24 showed superiority in five characters, namely, plant height (cm), length of petioles (cm), plant biomass (g), weight of haulm (g), and number of pods per plant and was ranked third. Two varieties, M21 and SDR-02 exhibited very poor performance in 6 and 4 desirable characters, respectively and could be eliminated from the list of groundnuts varieties for the area. This findings agree with Alam *et al.* (1998) who suggested for the elimination of inferior sweet potato from further trials to have a restricted list.

Seed yield obtained from the variety RC-128B, being 2.90 tha^{-1} was greater than 2.8 tha^{-1} obtained by Shiyam *et al.* (2016) [11] in Calabar, Cross River State, Nigeria and comparable to the seed yield of 3.0 tha^{-1} obtained in Iran by Rasekh *et al.* (2010) [12] and by far greater than the maximum yield of 2.3 tha^{-1} obtained by Lado *et al*. (2015) [13] in the Sudan savanna area of Nigeria where the crop is traditionally cultivated.

High positive and significant correlation coefficient obtained among the characters and with yields (pod and seed) attest to the possibility of achieving simultaneous improvement in the characters and yields of groundnut in Uyo, Nigeria. Also, large coefficients of variation for some of the characters are indicative of the existence of sufficient genetic variability in the population which could facilitate improvement in groundnut. The positive and significant correlations between seed yield and pod yield and six desirable characters (number of pods per plant, number of seeds per plant, circumference of pods, weight of pods, weight of seeds and harvest index) show that pod and seed yields are governed by many genes which are linked together. It shows that improvement in one and all the characters may lead to a simultaneous improvement in pod and yields in groundnut. This finding is in tandem with the result obtained by Asfaw (2006) [17] on taro yields. Similarly, characters which accounted for most of the observed variability in PC1, PC2 and PC3 are similar to those which correlated positively and significantly with pod and seed yields in groundnut varieties used in this study. This finding further suggests the need for improvement in groundnut by crossing only those varieties with superior traits than others. In this case, three varieties RC-128B, RC-128S and RMP-24 could be crossed to obtain hybrid varieties with recombinant genes, while M21 and SDR-02 are eliminated from the list of groundnut for Uyo, southeastern Nigeria. These findings agree with (2016) who suggested recombination of genes only from superior genotypes in a population and the elimination of inferior types.

CONCLUSION

Variety RC-128B with superior performance in nine desirable characters could be recommended for the area. The varieties RC-128B, RC-128S and RMP-24 could be crossed to obtain superior hybrid varieties with recombinant genes. Significant and positive correlations of seed yield with growth characters and yield components identify characters necessary for yield improvement. Observed variability in characters in PC1, PC2 and PC3 affirm the need for crossing of high yielding genotypes for the development of hybrid varieties for the area.

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