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ESTIMATE OF VARIABILITY FOR YIELD AND ITS CHARACTERS IN NIGERIAN SESAME (*Sesamum indicum*) GENOTYPES

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ABSTRACT

Thirteen genotypes of sesame (*Sesamum indicum*) were evaluated in field trials for two years in the field in a randomized complete block design with three replications. The results showed year effect to be highly significant for all the characters except 1000-seed weight, and genotype effect was highly significant for all the characters except height of first capsule. Also genotypes x year interactions were significant for number of days to flower and 1000-seed weight. Genotype Packqueno, NCRI-Ben-03L, Yandev and NCRI-Ben-01M had highest seed yield per hectare (0.229; 0.209; 0.204 and 0.206t/ha respectively). Close resemblance between genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) was observed for all traits except number of days to flower indicating that selection for these traits would be effective. Heritability estimates in general were high for all the nine characters studied except number of days to flower. Most characters showed significant positive correlation with grain yield except 1000-seed weight which showed negative correlation with seed yield. The PCA identified height at maturity (94%), number of capsule per plant (93%), height of flowering (92%), height of first capsule (85%), capsule weight per plant (78%) and number of seeds per capsule (93%) as the characters that contributed significantly to variations found in the sesame genotypes. Highest heritability coupled with high genetic advance was observed for capsule weight per plant, height of first capsule and seed yield per hectare. Thus, these traits could be used as selection criteria for yield improvement in sesame.

Key words: *Sesamum indicum*; variability; yield components; correlation coefficients; principal component analysis.

INTRODUCTION

A total of 3.66 million tons of sesame produced is produced in the world, out of which Asia and Africa account for 2.55 and 0.95 million tons respectively (Anon, 2008). In Africa, Nigeria is the third largest producer after Sudan and Uganda with about 165.1 hectares (harvested area) that produced 83 tons (FAO, 2005). In Nigeria, sesame crop is cultivated mainly for its seeds that contain approximately 50% oil and 25% protein (Burden, 2005). Sesame oil is a good source of vitamins (panthothetic acid and vitamin E) and also a significant amount of linoleic acid that can control blood cholesterol levels can be found in the oil. The presence of some anti-oxidant (Sesamum, Sesamolin and Sesamol) makes the oil to be one of the most stable vegetable oils in the world. The seed cake is a valuable and nutritious feed for cattle (Balasubramaniyan and Palaniappan, 2001).

Sesame crop is grown between latitudes 60° and 10° in the derived and Guinea Savannah zones of Nigeria and the crop is produced both for export (Agboola, 1979) and local consumption (Busari et al., 1998) with average yield of 300kg ha^{-1} (Adeyemo and Ojo, 1993) which is very low as compared to other leading countries of the world like China, India and Myanmar.

Variation is a necessary criterion for selection programme aimed at improving some desirable characters in sesame. Sandipan *et al.*, (2010) reported low to moderate GCV and PCV for all the characters evaluated. Adeyemo and Ojo (1993) reported days to flowering, plant height, height of first capsule, number of capsule per plant and seed yield per plant as important characters to be considered in the evaluation of germplasm of sesame. Mehrotra *et al.,* (1976) reported that for yield improvement in sesame, efforts should be concentrated mainly on improvement of yield morphological traits like number of capsules and 1000-seed weight. Thus, progress in crop improvement depends to a great extent on the ability of the breeder to select high yielding varieties with good plant characteristics. However, yield is a dependable complex heritable character resulting from interaction of several contributing characters that may be related or unrelated. As seed yield is a polygenic character, direct selection for this character may be misleading. Hence, characters that determine yield are the best indices for selection. However, not much information is available concerning their variability and correlation studies, thereby hindering genetic improvement practices on the crop. Adebisi *et al.,* (2001) reported that for effective yield improvement, simultaneous improvement of the most important yield components is necessary. In this regard, knowledge of association between important morphological characters and seed yield may be helpful to identify suitable donors for successful breeding programme. Ganesh and Sakila (1999) stressed that plant breeders must evaluate and identify the relationship between yield and yield contributing characters and their association with yield.

To evaluate relationships, correlation analyses are used such that the values of two characters are analysed on a paired basis, results of which may either be positive or negative. The result of correlation is of great value in the determination of most effective statistic(s) for selection of superior genotypes. When there is positive association of major yield characters, component breeding would be very effective but when these characters are negatively associated, it would be difficult to exercise simultaneous selection for them in developing a variety.

To view the above facts, the present study was undertaken to determine the performance and variability of sesame genotypes for yield and its components and to assess correlations among various traits. Also, to identify the genotypes that can be advanced for further improvement.

MATERIALS AND METHODS

The field trial was conducted at the Teaching and Research Farm of the University of Agriculture, Abeokuta (7°15`N; 3°25`E), Ogun State, Nigeria, under rain fed conditions in 2006 and 2007 planting seasons. The site was well drained with sandy loam soil having pH range from 6.8 to 7.8, Percentage N between 0.07 and 0.14% and organic matter from 0.82 to 1.66%. The average annual rainfall for the two seasons was 850mm in 2006 and 600mm in 2007. Mean temperature ranged from 23.7°C in 2006 experimental period to 27°C in 2007.

Thirteen sesame genotypes sourced from the National Centre for Genetic Resource and Biotechnology, Ibadan, Oyo State, Nigeria were used for this study. The experiment was arranged in a randomized complete block design with three replications. Each genotype was planted in a four-row plot of 3 meter length with a plot size of 5.4m^2. Sowing of sesame seeds were done by hand-drilling after mixing with sand. The seedlings were thinned to 10 plant-plant spacing at 10-15cm height stage at three weeks after planting. Fertilizer was not applied during the course of the study, and no serious disease or insect pest infestation noticed and thus no crop protection measures were taken.

Biometric observation commenced when the plants began to bloom. Data were collected on days to flowering, height of flowering, final plant height, first capsule height, number of capsule per plant, capsule weight per plant, number of seeds per capsule, 1000-seed weight and seed yield per hectare. In each plot, 20 plants were randomly selected in the two inner rows, tagged and used as representative sample.

The data were subjected to combined analysis of variance using SPSS 12.1 statistical package. Treatment means were compared using Duncan Multiple Range Test of 5% probability level. Phenotypic and genotypic variances were calculated by the methods suggested by Burton and Devane (1953):

$\delta^2 p = \delta^2 g + \delta^2 e$

$\delta^2 g = MSg - Mse/r$

where:

$\delta^2 p$ = phenotypic variance

$\delta^2 g$ = genotypic variance

$\delta^2 e$ = Environmental variance (error mean square)

The genotypic (GCV) and phenotypic (PCV) coefficients of variation were estimated according to the procedure outlined by Johnson, *et al.* (1955) thus:

$$PCV = \frac{*\delta^2 p}{X} \times 100 \quad *\delta^2 p = \delta p$$

where X = grand mean

$$GCV \quad \frac{*\delta^2 g}{X} \times 100 \qquad *\delta^2 g = dg$$

Broad sense heritability and the genetic advance expected under selection, assuming the selection intensity of 5% were calculated as suggested by Allard (1960):

$$H^2 = \frac{\delta^2 g}{\delta^2 p} \times 100$$

where:

H^2 = Heritability in broad sense (in percentage)

$$GA = (K)\ \sigma_A\ (H^2)$$

where:

GA = Expected genetic advance

K = Selection differential (2.06 at 5% selection intensity)

σ_A = Phenotypic standard deviation

Genetic advance as percent of mean (GAM) was calculated using the formular:

$$GAM = \frac{G}{X} \times 100$$

where

G = genetic advance

X = grand mean

Correlation coefficients of all biometric observation were estimated from the mean value of the traits according to Millers *et al*. (1958). The principal component analysis (PCA) produced a score for each principal component for the first three extracted components.

RESULTS

Mean square from combined analysis of variance (ANOVA) of seed yields and related characters are presented in Table 1. Significant effect of replication was observed in seed yield per hectare. Highly significant differences were observed among genotypes for all the traits except height of first capsule from the ground level and number of seeds per capsule. There was high significant difference between the years for all characters except 1000-seed weight. Highly significant interaction effects between genotypes and years were only observed for number of days to flowering and 1000-seed weight. Although, the magnitude of the interactions mean square was relatively small in comparison to main effect.

Table 2 shows the mean performance of the thirteen Nigerian sesame genotypes evaluated for grain yield and yield related characters in two years. Mean value ranged from 0.19 for seed yield per hectare to 119.3 for height at maturity. Genotypes NGB/04/026, Ben/Dim and Packqueno were among the genotypes with the highest height of first capsule from ground level (52.62; 56.90 and 59.00cm respectively). Mean number of days to flower ranged between 56.33 for genotype NGB/04/026 and 56.67 for genotype NCRI-BEN-01M. Genotype MGB/04/026 recorded the tallest height at flowering (74.98cm) while cross 95 was the shortest at flowering (55.13cm). Genotypes (Packqueno, NGB/04/026 and Ben Dim) recorded tallest height at maturity (130.83; 130.17 and 129.50cm respectively). Packqueno had the highest number of capsule per plant (73.17) and capsule weight per plant (48.77g). Ben/Dim had the highest number of seeds per capsule (70.33) while the lowest value was recorded in Packqueno and Kyandi. Kyandi genotype had higher seed weight (3.43) compared to the two recently released varieties [NCRI-BEN-01M (3.02g)] and [NCRI-BEN-03L (3.23g)] whereas packaqueno recorded higher seed yield per hectare (0.229t) compared to other genotypes.

Mean performance, variance components and heritability estimates as well as genetic advance of grain yield and other characters are presented in Table 3. The results revealed differences phenotypic, genotypic and environmental variations among the genotypes for all the traits under consideration. For all characters under the study, PCV values were greater than GCV values. However, in most cases the two values differ in narrow. Genotypic variance for the characters ranged from 0.01 for seed yield per hectare to 48.37 for final plant height. Phenotypic variance ranged from 0.02 for seed yield per hectare to 61.73 for final plant height. Environmental variance ranged from 0.01 for seed yield per hectare to 16.49 for final plant height. Number of days to flower showed the lowest heritability estimates of 4.77% whereas moderate to high heritability values of 54.23; 60.22; 61.91 and 69.17% were recorded for capsule weight per plant, 1000-seed weight, height of flowering and number

Table 1: Combined analysis of variance (ANOVA) for seed yield and yield related characters of sesame genotypes evaluated in two years

		Mean square								
Source of variation	DF	HFC	NOD-FLO	Height at flowering (cm)	Final plant height (cm)	NCPPLT	CWTPPLT	NOSPC	1000 seed wt (g)	Seed yield t/ha
Replication	2	37.195	13.42	12.48	47.78	13.47	48.27	68.17	0.09	0.001**
Year (Y)	1	2840.49**	357.55**	3509.47**	2760.41**	1606.62**	5336.96**	554.67**	0.006NS	0.22**
Genotype (G)	12	162.51	20.97**	176.63**	370.37**	198.21**	157.93**	69.61	0.27**	0.001**
G x Y	24	43.21	19.97**	67.27	80.12	61.12	72.29	71.44	0.109**	0.00
Error	38	86.90	6.65	43.94	96.94	45.33	59.46	48.59	0.04	0.00
Total	7.8									

HFC= Height of first capsule; NODFLO=Number of days to flowering; NCPPLT=Number of capsules per plant; CWTPPLT=Capsule weight per plant; NOSPC=Number of seeds per capsule

Table 2: Mean values of seed yield and yield related characters in sesame genotypes over two years

Cultivars	HFC	NOD-FLO	Height at flow-ering (cm)	Final plant height (cm)	NCPPLT	CWTPPLT	NOSPC	1000 seed weight (g)	Seed yield t/ha
Kano-05	49.85ab	52.67bcd	64.73bcd	114.33bc	56.17d	38.63abcd	66.17ab	3.38abc	0.195bc
NGB/04/026	57.62a	53.33abcd	74.98a	130.17a	68.67ab	44.28abcd	63.83ab	3.37abc	0.188cd
NCRI-BEN-03L	42.47b	56.33a	63.58cde	119.0abc	57.00cd	37.88bcd	62.50ab	3.23abcd	0.209b
Yendev	48.15ab	55.50ab	61.38de	114.17bc	58.00cd	38.68abcd	62.33ab	2.70e	0.204b
NCRI-BEN-O/M	49.08ab	50.67d	63.43cde	113.83bc	57.17cd	35.63cd	64.67ab	3.03d	0.206b
E8	54.83ab	55.17ab	66.77abcd	121.17abc	62.67bcd	41.10abcd	66.67ab	3.03d	0.189cd
SM 11	50.18ab	52.50cd	62.40cde	111.17c	58.33cd	35.70cd	61.88ab	3.15cd	0.185cd
BEN/DIM	56.90a	52.50bcd	70.85abc	129.50a	69.33ab	45.82abc	70.33a	3.42ab	0.185cd
Packqueno	59.00a	52.17bcd	73.12ab	130.83a	73.17a	48.77a	57.50b	3.32abc	0.229a
Kyandi	47.53ab	50.83d	63.43cde	117.83abc	65.67abc	48.18ab	58.33b	3.43a	0.186cd
Cameroun white	51.67ab	51.67cd	60.02de	109.5c	58.00cd	35.92cd	63.50ab	3.47a	0.174d
Cross 95	42.80b	54.50abc	55.13e	110.33c	57.3cd	34.30d	64.50ab	3.18bcd	0.182cd
BEN-OM	49.47ab	54.67abc	65.57bcd	126.83ab	65.17abcd	45.70abc	61.17ab	3.23abcd	0.187cd

HFC= Height of first capsule; NODFLO=Number of days to flowering; NCPPLT=Number of capsules per plant; CWTPPLT=Capsule weight per plant; NOSPC=Number of seeds per capsule

[a,b,c,d,] means with common letters is same column are not significantly different

Table 3: Mean performance, variance components, heritability and genetic advance as percent of mean for grain yield and yield related characters of thirteen sesame genotypes over two years

Variance components	HFC	NODFLO	Height at flowering (cm)	Final plant height(cm)	NCPPLT	CWTPPLT	NOSPC	1000 seed wt(g)	Seed yield t/ ha
Mean	50.73	53.19	65.00	119.13	62.05	40.48	63.33	3.23	0.19
Phenotypic variance	27.09	3.49	29.44	61.73	33.03	26.32	11.60	0.05	0.02
Genotypic variance	19.88	0.17	18.23	48.37	22.85	14.27	9.31	0.03	0.01
Environmental variance	14.94	1.15	7.37	16.49	7.21	10.07	8.38	0.01	0.01
Heritability (HB)	73.41	4.77	61.91	78.37	69.17	54.23	80.25	60.22	86.56
Genetic advance of mean	15.51	0.35	10.64	10.65	13.20	14.04	20.64	8.22	13.41

HFC= Height of first capsule; NODFLO=Number of days to flowering; NCPPLT=Number of capsules per plant; CWTPPLT=Capsule weight per plant; NOSPC=Number of seeds per capsule

Table 4: Estimates of phenotypic and genotypic coefficient of variation of yield and yield related characters of thirteen sesame genotypes over two years

Components of coefficient of variation	HFC	NODFLO	Height at flowering	Final plant height	NCPPLT	CWTPPLT	NOSPC	1000 seed wt (g)	Seed yield t/ha
PCV (%)	10.26	3.51	8.35	6.60	9.26	12.57	5.38	6.62	7.52
GCV (%)	8.79	0.77	6.57	5.84	7.70	9.26		5.14	7.00

PCV = Phenotypic coefficient of variation

GCV = Genotypic coefficient of variation

HFC= Height of first capsule; NODFLO=Number of days to flowering; NCPPLT=Number of capsules per plant; CWTPPLT=Capsule weight per plant; NOSPC=Number of seeds per capsule

of capsule per plant respectively. Very high heritability estimates of 73.41; 78.37; 80.25 and 86.56% were respectively obtained for height of first capsule, final plant height, number of seeds per capsule and seed yield per hectare. The expected genetic advance for nine characters of sesame genotypes revealed that progress that could be expected from selecting the top 5% of the genotypes ranged from 0.35% for number of days to flower to 20.64 for number of seeds per capsule. Comparatively, the highest genetic advance as percent of mean was recorded for number of seeds per capsule (20.64) followed by height of first capsule (15.51) and seed yield per hectare (13.41).

Table 4 presents phenotypic and genotypic coefficients of variation for the nine characters. Phenotypic coefficient of variation was highest (12.57) for capsule weight per plant and this was followed by height of first capsule from the ground (10.26). These two characters also exhibited highest genotypic coefficient of variation of 9.26% and 8.79% respectively. The PCV and GCV were relatively moderate for the remaining characters except number of days to flower which recorded the lowest PCV and GCV estimate of 3.51% and 0.77% respectively.

Table 5 presents correlation matrix among the nine characters. Significant differences were observed in the correlation coefficients in terms of magnitudes and direction. Seed yield per hectare showed highly significant positive correlation with height at first capsule (r = 0.364**), number of days to flower (r = 0.422**), height at flowering (r = 0.492**), number of capsule per plant (r = 0.400**) and capsule weight per plant (r = 0.531**). Conversely, non-significant negative correlation was observed between seed yield and 1000-seed weight (r = -0.084). Capsule weight per plant showed highly significant positive correlation with height at first capsule (r = 0.529**), number of days to flower (r = 0.317**), height at flowering (r = 0.659**), final plant height (r = 0754**) and number of capsule per plant (r = 0.765**). Also number of capsule per plant showed highly significant positive correlation with height of first capsule (r = 0.716**), height at flowering (r = 0.790**) and final plant height (r = 0.880**). Equally, final plant height had highly significant positive correlation with height of first capsule (r = 0.759**), number of days to flower (r = 0.260**) and height at flowering (r = 0.863**). Also number of days to flower had positive and highly significant correlation with height of flowering (r = 0.267**) and height at flowering also had positive and highly significant correlation (r = 0.861**) with height of first capsule.

The results of the principal components analysis (PCA) of yield and yield related characters in two years are presented in Table 6. In this study, PCA technique separated the nine variables into three axes. The three components explained 75.51% of the total genetic variation. It can be seen that nine characters contributed 47.57 to the total variance as PC 1 and a further 15.51% and 12.43% as PC 2 and PC 3 respectively. The remaining components contributed relatively small amount to the total variance. PC 1 was strongly associated with final plant height (0.948), number of capsule per plant (0.93) and height at flowering (0.92). In this axis, the remaining characters were loaded with positive sign. PC 2 was dominated by number of days to flower (0.69), seed yield per hectare (0.62) and 1000-seed weight was loaded with opposite sign (-0.69). Seed per capsule (0.94) accounted for significant con-

Table 5: Correlation coefficients between yield and yield related characters in sesame grown during two years at Abeokuta in Ogun State, Nigeria

Characters	NODFLO	Height at flowering (cm)	Final plant height (cm)	NCPPLT	CWTPPLT	NOSPC	1000 seed wt (g)	Seed yield t/ha
HFC	0.195	0.861**	0.759**	0.716**	0.529**	0.158	0.129	0.364**
NODFLO		0.267**	0.260*	0.165	0.317**	0.173	-0.100	0.422**
Height of flowering (cm)			0.863**	0.790**	0.659**	0.206	0.184	0.492**
Final plant height (cm)				0.880**	0.724**	0.131	0.150	0.414**
NCPPLT					0.763**	0.066	0.156	0.400**
CWTPPLT						0.163	0.57	0.531**
NOSPC							0.45	0.078
1000 seed wt (g)								-0.084

HFC= Height of first capsule; NODFLO=Number of days to flowering; NCPPLT=Number of capsules per plant; CWTPPLT=Capsule weight per plant; NOSPC=Number of seeds per capsule

Table 6: Results of principal components analysis showing scores of the major characters of the first three axes for yield and yield related characters in sesame genotypes over two years

Traits	Component Score		
	1	2	3
HFC	0.852	-0.110	0.104
Number of days to flower	0.201	0.685	0.352
Height of flowering	0.922	0.054	0.163
Final plant height	0.953	0.052	0.061
NCPPLT	0.929	0.010	-0.036
CWTPPLT	0.788	0.272	0.092
NOSPC	0.058	0.230	0.937
1000 seed wt (g)	0.248	-0.685	0.249
Seed yield t/ha-1	0.493	0.615	0.057
Eigen value	4.480	1.40	1.12
Total variation %	47.57	15.51	12.43
Cumulative variation	47.57	63.08	75.51

Bolded: Traits with significant contribution to variation

HFC= Height of first capsule; NODFLO=Number of days to flowering; NCPPLT=Number of capsules per plant; CWTPPLT=Capsule weight per plant; NOSPC=Number of seeds per capsule

tribution to the discrimination among the genotypes in PC 3.

DISCUSSION

The fact that only seed yield per hectare out of the nine traits, had significant replication effects in the current study suggested that increasing the number of replication was not important for most yield related characters. Highly significant treatment effects for all the characters except height of first capsule indicated that future selection of good promising genotypes in relation to yield and yield related characters is highly realistic. Other studies had reported similar results (Hoor-ul Islam *et al.* 2001; Adebisi *et al*. 2005; Ong'Injo and Ayiecho (2009).

Significant difference in genotype x year interaction for number of days to flowering and 1000-seed weight is an indication that variable factors associated with years such as amount of rainfall, temperature and solar radiation were important. This reveals the achievable result in any improvement programme especially in enhancing higher yield and genotype specific agro-ecology adaptation. However, the performance of genotypes with respect to other characters like height of first capsule, height at flowering, height at maturity, number of capsule per plant, number of seeds per capsule and seed yield per hectare is stable.

Phenotypic variance includes the genotypic and environmental variances. Heritability estimates are said to be satisfactory tools for selection based on phenotypic performance.

In the present study, very high heritability estimates (Hb) obtained for all the characters evaluated with the exception of number of days to flower suggested that environmental influence was very low on these characters. It also suggests that genotypic variance and genetic variability component (Borojevic, 1990) were very high. High heritability estimates according to Ojo and Amanze (2001) strongly suggests that there is potential for large genetic determination for this characters which can be exploited for genetic improvement of seed yield. Although, high heritability estimates provides the basis for selection on phenotypic performance, the estimates of heritability and genetic advance should always be considered simultaneously as high heritability will not always be associated with high genetic advance (Johnson *et al.,* 1955). Estimates of genetic advance helps in the understanding of type of gene action involve in the expression of various polygenic traits. High values of genetic advance are indicative of additive gene action whereas low values are indicative of non-additive gene action (Singh and Marayanan, 1993). Thus, heritability estimate will be reliable if accompanied by high genetic advance. The expected genetic advance for sesame characters was highest for number of seeds per capsule followed by height of first capsule, capsule weight per plant and seed yield per hectare, while the remaining characters exhibited moderate to very low genetic advance. This indicates that selecting the top 5% of the genotypes can make an advance of 20.64, 15.51, 14.24 and 13.41% in number of seeds per capsule, height at first capsule, capsule weight per plant and seed yield per hectare, respectively.

Although, the genotypic variance revealed the extent of genetic variation present among the genotypes for various traits, it does not provide a means of assigning heritability. High heritability in addition to high genetic advance is therefore an important tool for predicting the resultant effect of selecting the best individual. In this study, high heritability and genetic advances obtained for number of seeds per capsule, height of first capsule, capsule weight per plant and seed yield per hectare will go a long way in predicting heritable traits for further improvement. Hence, selection for number of seeds per capsule, height of first capsule, capsule weight per plant and seed yield per hectare would prove quite effective since these characters seemed to be governed by additive gene action. Bhambe *et al.* 1994; Bishmas *et al*. (1995) and Noor-Ul Islam (2001) reported similar results. On the other hand, characters such as height at flowering and height of first capsule gave high heritability estimates. The presence of high heritability and moderate genetic advance has been reported to suggest the effect of equal contribution of additive and non-additive gene action (Shelby, 2000). Number of days to flower which show low heritability coupled with low genetic advance obscured the chance of early selection for this trait due to involvement of non-additive genetic effect in the inheritance of this character.

High magnitude of genetic diversity gives free hand to plant breeder for selection of any character or the genotype that have specific character. Coefficient of variation also known as ‘relative variability’ calculated as percentage is measured to investigate how much variability exists for selection. Genotypic (GCV) and phenotypic (PCV) coefficients of variation were the highest for capsule weight per plant followed by height of first capsule. This indicated maximum variability that can be subjected to selection for these parameters. High GCV along with high heritability and genetic advance will provide better information than single parameter alone (Sahao *et al.,* 1990). Hence, in this study, capsule weight per plant, height of first capsule and seed yield per hectare that exhibited high GCV, heritability and relatively high genetic advance equally provided additive genetic effects.

Correlation coefficient is a measure of interdependence between pairs of characters (Ali *et al.,* 2009). Knowledge of correlation is required to obtain expected response to other characters when selection is applied to the character of interest in a breeding programme (Kalconer, 1989). The positive and significant associations between capsule weight and seed yield per hectare on one hand and between capsule weight and number of capsule per plant on the other hand suggests that sesame genotypes with increased number of capsule per plant will always give high seed yield per hectare. Positive and significant association that existed between seed yield per plant and most yield related characters suggests that seed yield can be improved through simultaneous selection for these characters. The positive association between seed yield and number of seeds per capsule according to Ariyo *et al.* (1987) may be related to greater photosynthase that have accumulated in each of the seeds in a capsule. Consequently total number of capsule per plant could provide a good selection index for high yielding sesame genotypes. These findings are in agreement with those of earlier workers who found a positive association between seed yield and various yield components in sesame (Backiyarami *et al.,* 1998; Adebisi *et al.,* 2005). Conversely, 1000-seed weight showed negative but non-significant correlation with yield. This indicates that high seed weight may not necessarily mean high seed yield per hectare in sesame. This is in agreement with the reports in Ojo *et al.* (2006) in maize.

The principal component analysis was used for determination of high genetically variable traits as a beneficial criterion for use in the screening of sesame genotypes. It helps in the interpretation of results as the latent root associated with each component measure the contribution of each principal component to the total variance, while the coefficient of latent vector associated with a given principal component indicates the degree of contribution (loading) of each original variable to the principal component in question. The component correlation matrix estimated height at maturity (94%), number of capsules per plant (93%), height at flowering (92%), height of first capsule (85%) and capsule weight per plant (78%) in PC 1. Numbers of days to flowering and 1000-seed weight (69%) in PC 2, and in PC 3 number of seeds per capsule (93%) were estimated and mostly responsible for variation in sesame genotypes examined. Hence, the characters can be worked upon in subsequent future breeding.

CONCLUSION

Top yielding sesame genotypes (Packqueno, NCRI-Ben-03L, Yandev and NCRI-Ben-01M) could be used as seed producing parents in crop improvement programmes. Seed yield in sesame was observed to be a product of number of capsule per plant and capsule weight per plant because these two characters had highly significant positive correlation with yield besides having high heritability and genetic advance estimates. Implicit of this is that these parameters could be used as predictors of seed yield in selection programme, since they had significant roles in yield enhancement.

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