Short communication

Selection criteria for Nigerian sesame (*Sesamum indicum* L.) genotypes

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Abstract

Thirteen genotypes of sesame (*Sesamum indicum* L.) were grown in a randomized complete block design experiment at Abeokuta to determine the selection criteria for seed yield improvement in Nigerian sesame genotypes. Simple correlation coefficients for nine characters indicated that sesame seed yield was significantly and positively correlated with number of days to flowering, height of first capsule, capsule weight per plant, and capsule number per plant. Path coefficient analyses revealed that capsule weight per plant had the highest positive direct effect on seed yield relative to other variables. Step-wise multiple regression showed that 86.4% of the total variations in seed yield could be explained by variations in capsule weight per plant, seed weight, and capsule number per plant, implying that capsule weight per plant could be used as primary selection criterion for improving seed yield in Nigerian sesame genotypes.

Keywords: Capsule weight, Seed yield improvement, Selection criteria, Step-wise multiple regression.

Sesame (*Sesamum indicum* L) is one of the world's oldest oil seed crops grown primarily for its seed that contains approximately 50% oil and 25% protein (Burden, 2005). Its production, however, is not sufficient to meet the consumption requirements of Nigeria. Use of landraces with low yield potential in addition to other production constraints are predisposing factors in this respect (Adebisi, 2005). In sesame breeding programmes, selection for seed yield, a polygenic trait, often leads to changes in other characters. Therefore, improvement through breeding should realistically assess the contribution of various yield components. Correlation studies enable the breeder to know the strength of the relationship between various characters as well as the magnitude and direction of changes expected during selection (Ariyo, 1995). Correlation, path coefficient, and step-wise regression analyses would assist in the choice of characters whose selection would result in the improvement of a complex character such as yield. Although several workers (e.g., Adebisi, 2005; Biabani and Pakniyat, 2008) have assessed the characters on which selection for high yield can be made, the results differ widely from trait to trait owing to differences in the genetic material used and the environment in which the study was carried out, or both. The present study was undertaken to evaluate the interrelationships of seed yield and yield related components in Nigerian sesame genotypes using simple correlation, path coefficient, and step-wise regression analyses and to arrive at a set of reliable and efficient selection criteria.

Thirteen sesame genotypes (Kano-05, NGB/04/026, NCRI-BEN-03L, NCRI-BEN-O/M, E8, SM 11, 'Packqueno', 'Kyandi', 'Yandell', Cross 95, BEN/OM, Cameroun white, and BEN/DIM) sourced from the National Centre for Genetic Resource and Biotechnology, Ibadan, Oyo State, Nigeria, were grown during the rainy seasons of 2007 and 2008 at the Teaching and Research Farm, Abeokuta, Ogun-State, Nigeria (7°15`N; 3°25`E). The site was well drained with sandy loam soil with low organic matter status (1.6%) and having a pH range from

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6.8 to 7.8. The experiment was laid out in a randomized complete block design with three replicates. Each plot consisted of four rows, 3 m long, 60 cm apart, and with a plant to plant distance of 10 cm. Sesame was sown at three seeds per hole to ensure adequate crop stand. Plants were later thinned to single seedling when 10 to 15 cm tall. All recommended agronomic and plant protection practices were followed from sowing till harvest (Adebisi, 2005). At maturity, the two inner rows were utilized for yield data collection. Characters evaluated were height to first capsule formation, number of days to flowering, height at flowering, height at maturity, capsule number per plant, capsule weight per plant, number of seeds per capsule, 1000 seed weight, and seed yield.

The two year data were combined and simple phenotypic correlation coefficient among all observed components were calculated using the SAS statistical programme. Coefficients were later separated into direct and indirect effects via path coefficient analyses based on the procedure of Ahmed et al. (2002). Step-wise multiple regression analysis was carried out using SAS statistical programme by assessing the cumulative effect of yield components on seed yield, taking seed yield as the dependent variable and other traits as independent variables.

As can be seen from Table 1, seed yield had a positive and significant correlation with capsule weight per plant, capsule number per plant, number of days to flowering, and height of first capsule suggesting that seed yield could be improved by selecting for these characters. Height to first capsule also was positively correlated with the height of flowering, height at maturity, and capsule weight per plant, indicating that tall plants will ordinarily produce more capsules which could eventually result in more seed yields. The negative correlation of number of capsules per plant and number of seeds per capsule(r=–0.237*) may lead to some undesirable selection based on these characters. To improve the yield components that have negative association with one another, suitable recombinants may be obtained through biparental mating, mutation breeding, or diallel selective mating by breaking undesirable linkages.

Path coefficient analysis showed that capsule weight per plant had the largest positive direct effect on seed yield with its largest indirect effect through reduction in 1000 seed weight (Table 2). The adverse effects of flowering height and seed number per capsule on seed yield was largely masked by plant height and capsule weight respectively. Step-wise multiple regression analysis showed that 86.4% of total variation in seed yield could be explained by variations in capsule weight per plant, 1000-seed weight, and capsule number per plant (Table 3). Capsule weight per plant alone accounted for 84.1% of the total variation, giving a multiple correlation coefficient of 0.917. Selection based on capsule weight per plant and 1000-seed weight gave a coefficient of determination of 85.4%. However, high correlation among components that affect seed

Table 1. Correlation coefficients for yield and yield related characters in 13 Nigerian sesame cultivars (averages for two years).

Characters	Seed yield	NODFLO	HFFC	HTFLO	FPLTHT	CWTPPLT	NCPPLT	Seed/cap
NODFLO	0.295**							
HFFC	0.227*	0.188						
HTFLO	0.141	0.227*	0.781**					
FPLTHT	0.156	0.075	0.609**	0.743**				
CWTPPLT	0.917**	0.318**	0.264**	0.233*	0.139			
NCPPLT	0.751**	0.266*	0.166	0.151	0.238*	0.746**		
Seed/cap	0.006	0.213	–0.049	–0.183	–0.216	0.051	–0.237*	
1000SWT	0.106	0.116	0.018	0.321**	0.308**	0.238*	0.175	0.011

NODFLO = Number of days to flowering; HFFC = Height of first capsule; HTFLO = Height at flowering; FPLTHT = Height at maturity; CWTPPLT = Capsule weight per plant; Seed/cap = Number of seeds per capsule; 1000 SWT = 1000 seed weight; Seed yield = seed yield; NCPPLT = Capsule number per plant; *$p < 0.05$, **$p < 0.01$.

Table 2. Phenotypic path coefficient showing direct (bold diagonal values) and indirect (normal values) effects of different components on seed yield (averages of two years) of 13 Nigerian sesame cultivars.

Characters	NODFLO	HFFC	HTFLO	FPLTHT	CWTPPLT	NCPPLT	Seed/cap	1000SWT	Corr. with yield
NODFLO	**0.047**	0.005	–0.050	0.014	0.291	0.013	–0.011	–0.014	0.295
HFFC	0.009	**0.027**	–0.173	0.114	0.242	0.008	0.003	–0.002	0.227
HTFLO	0.011	0.021	**–0.222**	0.140	0.213	0.007	0.009	–0.038	0.141
FPLTHT	0.004	0.017	–0.165	**0.188**	0.127	0.012	0.011	–0.037	0.156
CWTPPLT	0.015	0.007	–0.052	0.026	**0.915**	0.037	–0.003	–0.029	0.917
NCPPLT	0.013	0.005	–0.034	0.045	0.683	**0.041**	0.012	–0.021	0.751
Seed/cap	0.010	–0.001	0.041	–0.041	0.047	–0.012	**–0.051**	0.013	0.006
1000SWT	0.004	0.001	–0.071	0.058	0.219	0.009	0.006	**–0.119**	0.106

Residual = 0.345; NODFLO = Number of days to flowering; HFFC = Height of first capsule; HTFLO = Height at flowering; FPLTHT = Height at maturity; CWTPPLT = Capsule weight per plant; Seed/cap = Number of seeds per capsule; 1000 SWT = 1000 seed weight; Seed yield = seed yield; NCPPLT = Capsule number per plant.

Table 3. Summary of stepwise multiple regression analysis of seed yield and yield components in 13 Nigerian sesame cultivars.

Regression equations	Coefficient of determination (R^2)
SY = 0.111 + 0.003 CWTPPLT	84.1
SY = 0.150 + 0.003 CWTPPLT – 0.013 seed wt.	85.4
SY = 0.13g + 0.003 CWTPPLT – 0.013 seed wt + 0.001 NCPPLT	86.4
Multiple correlation coefficient = 0.930	

SY = Seed yield; CWTPPLT = Capsule weight per plant; Seed wt = 1000 seed weight; NCPPLT = Capsule number per plant

yield in sesame genotypes alone may be insufficient selection criteria for seed yield improvement. Although the path coefficient analysis of variables showed that there were direct and indirect effects of some traits on seed yield, our results indicated that sesame breeding studies should focus more on capsule weight per plant, which to a large extent, is determined by capsule number per plant and individual seed weight.

References

Adebisi, M.A. 2005. Variation, stability and correlation studies in seed quality and yield of sesame (*Sesame indicum* L.). PhD thesis. University of Agriculture, Abeokuta, Ogun-State, Nigeria.

Ahmed, S.T., Asiribo, O.E., and Ahmed, M.K. 2002. Path analysis affecting Vesico Vaginal Fistula in Nigeria. In: *Biometry and Quality of Life*. Proceeding of meeting SAUSAN-IBS 23-27 August, 1999. Nokoei, S. (ed.). Ibadan, Nigeria, pp 114–119.

Ariyo, O.J. 1995. Correlation and path-coefficient analysis of components of seed yield in soybeans. Afr. Crop Sci. J., 3 (1): 29–33

Biabani, A.R. and Pakniyat, H. 2008. Evaluation of seed yield-related characters in sesame (*Sesamum indicum* L.) using factor and path analysis. Pak. J. Bio. Sci. 11(8): 1157–1160.

Burden, D. 2005. Sesame profile. Available at http//www. cropprofile.mht. Accessed 15 January 2008.