Journal of Tropical Agriculture 31 (1993) : 143 - 146

GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE IN SESAME

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Abstract: One hundred sesame genotypes were evaluated in a simple lattice design at the College of Agriculture, Vellayani, Trivandrum during rabi in uplands. The data collected on yield and component characters were statistically analysed and genetic parameters viz., GCV, H and genetic advance were estimated. High values of GCV, H and genetic advance were obtained for the yield component characters such as number of capsules on main stem, number of branches and number of capsules on branches. Selection for these characters during rabi will therefore be effective for crop improvement.

INTRODUCTION

A study of variability is the primary step in any variety improvement programme. Among the three estimates of variability, the genotypic variability is the most important to the plant breeder. The progress in any breeding programme depends upon the extent to which the desirable traits are heritable (heritability). However, heritability along with the genetic advance is more effective and reliable in predicting the resultant effect of selection than heritability alone. This study aims to estimate the genetic variability, heritability and genetic advance in sesame during rabi in uplands.

MATERIALS AND METHODS

Two hundred and fifty two types of sesame (*Sesamum indicum* L.) were collected from different parts of India. Based on the general performance, 100 types were selected for detailed evaluation at the College of Agriculture, Vellayani, Trivandrum during rabi (August to December) 1981 in a simple lattice design replicated twice in 'a' and 'b' type of randomisation. The data on number of days to flowering and maturity, height of the plant, height up to first capsule, number of branches, number of capsules on main stem and branches, total number of capsules per plant, number of fruiting axils per unit length, length and circumference of capsule, number of seeds per capsule, seed yield per plant, weight of 1000 seeds and seed oil and protein content were collected. The data were analysed statistically and the genetic parameters like genotypic and phenotypic coefficient of variation (GCV and PCV), heritability in the broad sense (H^2) and genetic advance as percentage of mean for the best 5% of the value (GA) were worked out as per Panse and Sukhatme (1978).

RESULTS AND DISCUSSION

The statistical parameters such as mean, range, SE and CV estimated on 16 characters are presented in Table 1. The analysis of variance for 16 characters indicated highly significant differences in respect of 14 characters. This indicated the inherent differences among the 100 types under study. The coefficient of variation for each character indicates the extent of variability between the types. The highest coefficient of variation was for number of capsules on branches (84.40) followed by yield of seeds per plant (63.04) and number of capsules on main stem (51.15). The lowest coefficient of variation was for number of days to maturity (4.79) followed by seed oil content (6.46).

The genetic parameters viz., genotypic and phenotypic coefficient of variation, heritability in the broad sense and genetic advance estimated on 16 characters and presented in Table 2. In general, the phenotypic coefficients of variability (PCV) were higher than the respective genotypic coefficients of variability (GCV) for all the 16 characters. The GCV was highest for no. of capsules on branches (45.69). Large values of GCV were also observed for yield of seeds per plant (38.85), no. of capsules on main stem (33.61), number of capsules per plant (28.30) and number of branches (27.29). This indicates that variation in genotype contributed markedly to the total variability for the above characters. Similar reports of high GCV were made by Yadava *et al.* (1980) for number of branches, Paramasivum and Prasad (1981) for yield of seeds per plant and Yadava *et al.* (1980) for number of capsules on main stem. Contrary to these, lower genotypic coefficients of variation were reported by Shukla and Verma (1976) for number of capsules on main stem and number of branches.

The lowest GCV was expressed by no. of days to maturity (1.74). A similar report of low GCV was made by Kumar *et al.* (1967) for the character. Contrary to this, a high GCV for the character was reported by Mohammad (1970).

With the help of GCV alone, it is not possible to estimate the amount of heritable variation and the effectiveness of selection for any character. Burton (1952) suggested that genotypic coefficients of variation along with heritability would provide a better picture of the amount of advance to be expected by phenotypic selection. The seed protein content had the highest H^2 values (99.80) followed by seed oil content (97.14). The H^2 values were more than 50 per cent in respect of eight out of 16 characters studied. These were, therefore, less influenced by the environment. High heritability for polygenically controlled characters as those mentioned above are useful to plant breeders for making effective selection. Similar reports of high heritability were made by Solanki and Paliwal (1981) for weight of 1000 seeds, Zhan (1983) for number of branches and heigh t of the plant and Dabral and Holker (1971) for number of seeds per capsule. The H^2 value was the lowest for no. of fruiting axils per unit length (7.34) followed by no. of days to maturity (15.21). These characters have therefore high degree of non-heritable variations.

However, heritability values alone may not provide a clear predictability of the breeding value. Johnson *et al.* (1955) suggested that heritability in conjunction with genetic advance is more effective and reliable in predicting the resultant effect of selection than heritability alone. High values of heritability and genetic advance together indicate the additive gene action for the character as suggested by Panse (1957). Yield of seeds per plant had the highest genetic advance (62.29) followed by no. of capsules on main stem (60.31) indicating the involvement of additive gene effect. High heritability for no. of capsules on main stem, no. of branches and yield of seeds per plant are associated with high genetic advance. Similar reports of high genetic advance were made by Paramasivum and Prasad (1981) for no. of branches and yield of seed. Hence no. of capsules on main stem and no. of branches are the most important characters which can be relied upon for genetic improvement for higher productivity in sesame during rabi in uplands.

Eventhough seed oil content, seed

Table 1. Mean, range, SE and CV of 100 sesame types during rabi in uplands

Sl. No.	Characters	Mean	Range	SE	CV
1	No. of days to flowering	43.48	36.2 - 55.8	0.42	14.88
2	No. of days to maturity	82.63	75.0 - 92.2	0.34	4.79
3	Height of the plant, cm	80.45	58.3 - 124.9	1.00	23:20
4	Height up to first capsule, cm	41.91	28.4 - 59.4	0.51	23.16
5	No.of branches	2.32	0.3 - 3.8	0.04	43.04
6	No.of capsules on main stem	10.50	2.6 - 20.9	0.20	51.15
7	No. of capsules on branches	5.25	0.1 - 13.6	0.29	84.40
8	No. of capsules per plant	15.75	5.6 - 36.8	0.50	50.99
9	No. of fruiting axils per unit length	9.68	7.7 - 15.0	0.11	12.11
10	Length of the capsules, cm	2.33	1.4 - 3.3	0.03	16.84
11	Circumference of the capsule, cm	2.49	1.8 - 3.0	0.02	14.97
12	No.of seeds per capsule	59.42	40.0 - 108.0	1.07	29.16
13	Yield of seeds per plant, g	2.14	0.8 - 4.4	0.07	63.04
14	Weigh t of 1000 seeds, g	2.83	2.3 - 4.1	0.01	17.13
15	Seed oil content (%)	45.44	40.5 - 51.5	0.04	6.46
16	Seed protein content (%)	22.61	16.9 - 27.5	0.01	13.41

Table 2. GCV, PCV, heritability and genetic advance of 100 sesame types during rabi in uplands

Sl. No.	Characters	Coefficients of variation			Herit-ability	Genetic advance
		Geno-typic	Pheno-typic	Environ-mental		
1	No.of days to flowering	8.03	12.53	9.61	41.15	10.62
2	No.of days to maturity	1.74	4.46	4.11	15.21	1.40
3	Height of the plant	13.88	18.61	12.39	55.68	21.34
4	Height up to first capsule	13.89	18.53	12.25	56.25	21.46
5	No. of branches	27.29	32.71	18.04	69.60	47.07
6	No. of capsules on main stem	33.61	38.57	18.93	75.91	60.31
7	No. of capsules on branches	45.69	71.84	55.44	40.45	59.89
8	No. of capsules per plant	28.30	42.64	31.90	44.04	38.69
9	No. of fruiting axils per unit length	3.17	11.70	11.27	7.34	1.77
10	Length of the capsule	8.58	14.35	12.14	31.78	9.73
11	Circumference of the capsule	8.63	12.22	8.64	50.00	13.08
12	No. of seeds per capsule	16.23	24.22	17.97	44.94	22.42
13	Yield of seeds per plant	38.85	49.74	31.11	60.87	62.29
14	Weight of 1000 seeds	11.45	12.21	3.53	87.98	22.18
15	Seed oil content	4.53	4.60	0.78	97.14	9.20
16	Seed protein content	9.48	9.46	0.43	99.80	19.50

protein content and weight of 1000 seeds had very high H^2, the expected genetic advance was low. Similarly, Chandramony and Nair (1985) had reported very high H^2 and very low genetic advance for seed oil content in sesame. The estimate of high H^2 does not always signify an increased genetic advance (Johnson *et al.*, 1955). High heritability value associated with low genetic advance is attributed to the presence of non-additive gene effects which include epistatis and dominance and genotype x environment interaction as well (Tikka *et al.*, 1977).

ACKNOWLEDGEMENT

This paper forms a part of Ph.D. thesis of the senior author submitted to the Kerala Agricultural University, 1986. The senior author acknowledges the Indian Council of Agricultural Research, New Delhi for the award of Senior Research Fellowship.

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