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Genotype x Environment Interactions in Okra *(Abelmoschus esculentus* (L.) Moench)

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Genotype x environmental interactions play a very important role in crop improvement programme and much expected genetic advance could be predicted after eliminating all such influences. This gives meaningful and real estimates of genetic advance under selection. This is illustrated with reference to the data on yield in okra conducted over two seasons at College of Agriculture, Dharwar. The practical implications of these interactions and genetic parameters have been brought out for considerations and genetic parameters have been brought out for consideration of the plant breeders. It is suggested from the study to increase the number of locations testing rather than increasing the years of testing.

Genotype x environment interactions play a very important role in crop improvement programmes. The nature and magnitude of such interactions will aid the plant breeder in his breeding programmes. With the above object in mind, a study was conducted in *okra* and results are presented in this paper.

MATERIAL AND METHODS

Six parents and 15 hybrids of 6 x 6 diallel crosses in *okra* were grown at the College of Agriculture, Dharwar during kharif 1973-74 and 1974-1975 using randomised block design with a spacing of 45 x 30 cm. The data on yield as measured by number of pods per plant were collected on five randomly selected plants. The analysis was carried out as suggested by Kempthorne (1957, 1966).

RESULTS AND DISCUSSION

The yield data for two years are given in Table I. The performance of six parents was consistent for both the years as AE 107 and Red wonder were best and poor performers respectively. But the hybrids have performed differently. The cross 3 x 4 showed the highest yield during the first year. During the second year 4 x 5 hybrid showed the best performance. The cross 3 x 4 performed poorly during the second year whereas 2 x 3 and 1 x 2 crosses were consistent in their performances. An examination of the relevant meteorological data indicated that 1973-74 season is normal and conducive environment while the poor environment prevailed in 1974-75 as there was considerable stress and strain. Parents were stable in their yielding ability irrespective of environments while it was not so in case of hybrids. The analysis of variance revealed significant and nonsignificant differences during the first and second years respectively (Table I). The pooled analysis of variance (Table I) revealed highly significant variance for genotypes,

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TABLE I. Mean performance, individual and pooled analysis of variance of parents and hybrids for two seasons for yield as measured by number of pods per plant.

Treatment	1973	1974
Seven dhari	25.80	9.40
Red wonder	11.50	4.90
Pusa sawani	18.90	9.40
Dwarf green	19.30	6.90
White velvet	24.60	10.80
AE 107	35.00	12.40
1 x 2	8.40	8.80
1 x 3	23.10	12.70
1 x 4	23.50	12.80
1 x 5	19.60	10.20
1 x 6	23.70	12.20
2 x 3	9.60	5.80
2 x 4	15.10	7.70
2 x 5	11.30	9.30
2 x 6	16.20	10.10
3 x 4	24.60	8.80
3 x 5	20.80	8.70
3 x 6	23.10	12.80
4 x 5	19.60	13.50
4 x 6	21.70	13.40
5 x 6	23.70	12.60
M.S.S. for genotypes	121.86**	16.86
-do- error	16.85	13.04
M.S.S. for genotypes	33.10**	
-do- years	1011.36**	
-do- G x Y interaction	13.40**	
-do- Pooled error	0.37	

** Significant at 1%

year and interaction components. The contribution of years, genotypes and interaction component was greater in the order mentioned. There is greater magnitude of interaction between genotypes and years as its variance was also greater. This is very clearly reflected on the inconsistency of hybrids over seasons (Table I).

The evidence in support of the above facts is further substantiated by an examination of the data on genetic parameters (Table II). It is clear that different genetic parameters are very much lowered in the second season as compared to the first. The influence of environmental interactions on the genotypes is further clear from coefficients of variations. The differences between phenotypic and genetic coefficients of variations which is a measure of role of the environment on the character is very less in the first season while there was wide differences between them in the second season indicating the major role of environment. This is true in respect of heritability values, genetic advance and expected genetic advance also. It is evident that the estimates of genetic parameters are much lowered from the pooled data due to elimination of various interaction components. These values are precise, accurate and reliable as it takes into account only available heritable variation of the total variance. Hence, it would be worth while for plant breeders to estimate the genetic variance precisely after removing such environmental influences. This supports the views of Comstock *et al* (1952), Johnson *et al* (1955), Hanson *et al* (1956) and Nei (1960).

TABLE II. Genetic parameters in different generations and seasons.

Parameters	1973-74	1974-75	Pooled data	F_2
Phenotypic coefficient of variation	31.83	25.12	19.60	23.50
Genotypic coefficient of variation	30.74	15.86	12.60	14.70
Heritability per cent (broad sense)	93.23	40.25	37.30	39.80
Genetic advance	12.27	2.11	2.25	0.31
Expected genetic advance in per cent	61.15	20.78	14.90	9.91

The breeding material were advanced to next generation and the genetic parameters were also estimated for comparison and also with a view to check the predicted mean of the character. The data showed close agreement of expected and observed mean values of the character in F_2 generation. Thus, the prediction of mean was accurate and possible due to reliable estimates of heritability and genetic advance. Such predictions will be more useful to breeders in practical plant breeding work.

The components of variance are as follow :

	Variance
Genotype	3.28**
G x E interaction	10.91**
Significant at	0.01%

The variance due to genotypes and interaction between genotypes and environment are highly significant thereby suggesting the presence of considerable degree of first order interactions. This has to be kept in view in formulating the future breeding programmes. This falls in line with the earlier reports of Miller *et al.* (1962) and Rasmusson and Lambert (1961).

It is therefore suggested to increase the locations rather than increasing the years so that considerable time is reduced in the final release of a crop variety. Because little would be gained by testing the material in the same location more than two years as also suggested by Kaltsikes and Larter (1969).

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