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COMBINING ABILITY FOR GRAIN YIELD AND ITS COMPONENTS IN MAIZE *(Zea mays* L.)

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Six maize inbred were crossed in complete diallel fashion to evaluate their general and specific combining ability for yield and its components. Variance components due to specific combining ability (SCA) were higher than general combining ability (GCA) variances for ears per plant, kernel rows per ear, kernels per row and 100 grain weight which manifested non-additive gene action. The magnitude of GCA variance for yield was higher than SCA variance showing the predominance of additive gene action.

KEY WORDS: Maize; Inbred lines; diallel cross; General and specific combining ability.

INTRODUCTION

Estimation of combining ability is a pre-requisite in maize breeding whether it is aimed at the development of hybrid or improvement of populations. Grain yield and its components were reported to be controlled by additive genes (Zieger, 1988; Baktash *et al., 1985;* Qadri *et al, 1983).*

However some workers (Saleem *et al.,* 1978; Inoue, 1984; Anees, 1987) have reported dominant genetic effects for yield and yield components. These differences generally arise due to differences in genetic material and the environment under which the experiments were performed. In the present study all possible crosses of six elite inbred lines were evaluated to determine the mode of inheritance of yield and yield components under Faisalabad conditions.

MATERIALS AND METHODS

The experimental material was comprised of six maize inbred lines viz; A41-2, AYP-l7, Q-97, IC-648, B42-2 and Pb-96-3. The inbred lines were crossed to obtain all possible crosses during spring 1991. In the following season (Autumn, 1991) all the crosses alongwith the parental lines were sown in the field using a randomized complete block design with three replications. The plant-to-plant and row-to-row distances were 23 and 60 cm., respectively. Ten guarded plants from each entry per replications were ear-marked for recording data pertaining to grain yield and its components like ear number, kernel rows, kernels per row and grain weight. The data were subjected to analysis of variance (Steel and Torrie, 1980) and analysis of combining ability (Griffing, 1956) using method 1, model I.

RESULTS AND DISCUSSION

Analysis of variance (Table I) revealed significant differences among the genotypes for all the characters under study. Analysis of combining ability showed that inbred lines had significant differences (P > 0.01) for their

Table 1: Analysis of variance of combining ability for grain yield and its components.

S.O.V.	df	Number of ears per plant	Number of kernel rows per ear	Number of kernels per row	100-grain weight	Grain yield per plant
Genotypes	35	0.04*	1.75**	15.30**	9.92**	632.69**
Error	70	0.03	0.41	7.56	4.57	305.78
GCA	5	0.015	0.71	2.27	0.66	599.69**
SCA	15	0.11	0.29*	4.74*	5.18**	136.12
Reciprocals	15	0.02*	0.98"	6.40**	2.31	155.98
Error	70	0.01	0.14	2.52	1.52	101.93

Table 2: Estimates of relative general combining ability effects for grain yield and its components of six inbred lines.

Inbred lines	Number of ears per plant	Number of kernel rows per ear	Number of kernels per row	100-grain weight	Grain yield per plant
A 41-2	- 0.046	-0.05	-0.08	0.01	3.13
AYP-17	0.001	-0.09	-0.79	-0.43	-2.60
Pb 96-3	0.004	-0.18	0.22	0.20	-0.02
Q-97	0.015	0.24	0.04	0.05	-1.67
IC-648	0.056	-0.02	0.70	-0.03	11.30
B 42-2	-0.029	0.10	-0.09	0.20	-10.14

Table 3: Specific combining ability effects for yield and its components in 15 possible single crosses among six inbred lines.

Crosses	Number of ears per plant	Number of kernel rows per ear	Number of kernels per row	100-grain weight	Grain yield per plant
A 41-2 x AYP -17	- 0.01	-0.25	-28.31	-0.37	-0.92
A 41-2 x Pb96-3	-0.09	0.46	1.31	-1.84	-4.67
A 41-2 x Q-97	0.08	0.33	0.50	0.07	7.76
A 41-2 x IC-648	0.03	-0.09	0.24	0.64	16.34
A 41-2 x B42-2	0.08	0.34	0.21	-0.34	13.29
AYP -17 x Pb96-3	0.01	0.15	0.26	-1.23	-1.27
AYP -17 x Q-97	-0.04	0.27	0.01	3.24	2.89
AYP-17 x IC-648	-0.02	-0.48	-1.01	1.32	-16.59
AYP -17 x B42-2	-0.12	0.47	-2.64	-1.88	16.85
Pb96-3 x Q-97	0.05	-0.51	0.83	1.48	0.52
Pb96-3 x IC-648	0.06	0.17	-1.88	-0.89	-3.01
Pb96-3 x B42-2	0.05	0.01	0.44	0.39	10.27
Q-97 x IC-648	-0.05	0.18	-0.09	-2.23	3.97
Q-97 x B42-2	-0.03	0.33	-1.35	0.17	5.42
IC-648 x B42-2	-0.05	-0.04	0.51	1.01	6.11

Table 4: Estimation of reciprocal effects for yield and its components from 15 possible reciprocal crosses among six inbred lines,

Crosses	Number of ears per plant	Number of kernel rows per ear	Number of kernels per row	100-grain weight	Grain yield per plant
AYP -17 x A41-2	- 0.05	0.21	1.26	0.83	14.83
Pb96-3 x A41-2	-0.02	0.18	-0.36	0.27	2.33
Q-97 x A41-2	-0.10	0.26	0.37	0.59	0.55
IC-648 x A41-2	-0.18	-0.85	-0.62	-0.24	-19.00
B42-2 x A41-2	0.115	-0.03	-1.15	-0.85	-16.68
Pb96-3 x AYP -17	0.10	-0.51	-0.76	-0.20	6.66
Q-97 x AYP -17	0.08	-0.60	1.635	0.65	5.85
IC-648 x AYP -17	-0.01	-0.91	0.31	0.00	-8.00
B42-2 x AYP -17	0.001	-0.81	-2.65	-0.60	4.00
Q-97 x Pb96-3	-0.12	-0.80	-0.85	0.71	-2.07
IC-648 x Pb96-3	-0.07	0.05	-0.75	0.25	-1.16
B42-2 x Pb96-3	0.03	0.36	-0.22	-2.29	1.00
IC-648 x Q-97	0.20	0.68	2.30	0.73	-9.16
B42-2 x Q-97	-0.03	0.15	-2.55	0.03	-3.50
B42-2 x IC-648	-0.02	-1.75	-3.80	2.87	6.161

Table 5: Estimates and relative propotions (percent) of variance components for GCA, SCA, reciprocals and error for grain yield and its components.

Variance Components	Number of ears per plant.	Number of kernel rows yer ear.	Number of kernel per row	100-grain weight	Grain yield per plant
σ^2_g	0.0003 (2.22%)	-0.05 (-5.25%)	-0.21 (-3.60%)	-0.37 (-9.98%)	38.72 (20.65%)
σ^2_s	0.0012 (7.61 %)	0.44 (46.19%)	1.23 (23.27%)	2.12 (57.80%)	19.86 (10.59%)
σ^2_r	0.0047 (31.15%)	0.42 (44.39%)	1.94 (34.96%)	0.39 (10.76%)	27.03 (14.41%)
σ^2_e	0.009 (59.02%)	0.14 (14.67%)	2.52 (45.37%)	1.52 (41.42%)	101.93 (54.35%)

general combining ability effects (GCA) for grain yield per plant. Specific combining ability (SCA) effects were significant for kernel rows per ear, kernels per row and grain weight. Reciprocal effects were significant for all the traits except 100 grain weight and grain yield per plant.

Estimates of relative GCA effects (Table 2) associated with each inbred line showed that inbred line IC-648 was a good general combiner for grain yield per plant, ears per plant and kernels per row whereas inbred line AYP-17 was poor combiner for most of the characters. Specific combining ability effects (Table 3) revealed that cross combination

AYP-17 x B42-2 was maximum (16.85) for grain yield per plant and fol1owed by A41-2 x IC-648 with an effect of 16.34. Cross combination AYP-17 x A41-2 showed maximum reciprocal effects for grain yield and IC-648 x Q-97 for number of kernels per row (Table 4).

Estimates of variance components for GCA, SCA and reciprocal effects (Table 5) showed that GCA variance for grain yield was relatively higher than SCA variance, indicating dominant gene action for general combining ability effects for grain yield. Baktash *et al.(1985)* and Ali (1986) reported higher effect of GCA for grain yield. Specific combining ability effects were relatively higher than GCA effects for 100 grain weight showing the preponderance of non-additive gene effects in the inheritance of grain weight.. Piovarci (1975) reported non-additive genes in the expression of 100 grain weight.. For the remaining characters both SCA and reciprocal effects were higher than GCA effects, showing the contribution of non-additive gene in the expression of these traits (Table 5).

It may be inferred from the results that grain yield per plant was controlled by additive genes, therefore, it may be improved through mass selection. Inbred lines IC-648 and A41-2 were good combiners and could be used as parents for further breeding programmes.

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