Madras Agric. J., 87(7-9): 447-449 July - September 2000
https://doi.org/10.29321/MAJ.10.A00497

Combining ability for grain traits in maize

K. GEETHA
Dept. of Plant Breeding & Genetics, Agricultural Engineering College and Research Institute, TNAU, Kumulur-621 712.

Abstract : Combining ability studies for grain traits revealed additive gene action for plant height, number of grain rows per cob, number of grains per row, cob weight, days to 50% silk and hundred grain weight. Based on the per se performance and effects UMI 760, Prabhat - 1 and JM 3181 - 1 were found to be the best parents for improvement of grain traits besides grain yield. Prabhat-1 x UMI 492, UMI 760 x JM 3181 and UMI 805 x UMI 805 x UMI 760 are suitable for recombination breeding. *(Key Words : Maize, combining ability, Grain yield).*

For exploitation of heterosis and recombination breeding, it is very much essential to understand the genetic architecture of the selected parents and to asses their performance for utilizing them effectively in breeding. Combining ability of parents gives useful genetic information regarding the selection of parents in terms of the performance of their hybrids. Many studies have been made on the combining ability for yield and component traits in maize but information on the combining ability for grain traits is limited. In the present study an attempt was made to study the combining ability of grain characters through diallel analysis.

Materials and Methods

The studies were conducted on ten diverse maize genotypes viz., UMI 492, UMI 561, UMI 743, UMI 760, UMI 805, Kesri-1, Prabhat-1, Pratap-1, Sartaj-1 and JM 3181-1 crossed in diallel fashion with reciprocals during *Kharif* season of 1996 at Millet Breeding Station, Tamil Nadu Agricultural University, Coimbatore in two rows of 5m length adopting a spacing of 40 x 20 cm. Observation were recorded on ten randomly selected plants per replication both in parents and in hybrids for plant height (cm), number of grain rows per cob, number of grains per row, cob weight (g), hundred grain weight (g) and grain yield (g). Analysis for combining ability was carried out following Debnath and Sarkar (1990).

Results and Discussion

The variances due to GCA were greater in magnitude than SCA for all the characters studied indicating the presence of additive gene action (Table 1). Additive gene effect for grain traits and yield was also reported earlier (Ferrao *et al.* 1995).

High mean value was the criterion among the breeders for a long time. Earlier report (Griffing, 1956) suggested that parents with good *per se* performance would result in better genotypes. Further, the parents having high *gca* effects could be useful since the *gca* effect is due to additive gene action and is fixable. Hence, the parents were evaluated based on *per se* performance and *gca* effects (Table 2).

Prabhat-1 showed positive significant *gca* effects for cob weight, hundred grain weight and grain yield per plant while JM 3181-1 showed positive significant *gca* effect for number of grain rows per cob, cob weight and grain yield per plant. UMI 760, UMI 492 and UMI 805 which were selected as best parents also showed significant *gca* effects for grain yield per plant. Based on the *per se* performance and *gca* effects for grain yield and the ability to produce potential hybrids, the parents Prabhat-1, JM 3181-1, UMI-760, UMI 492 and UMI 805 were selected as best combiners (Table 3). Therefore crosses involving Prabhat-1, JM-3181, UMI-760, UMI 492 and UMI-805

Table 1. Analysis of variance for combining ability in maize.

Source due to	d.f.	Mean Squares: Plant height (cm)	No. of grain rows / cob.	No. of grains / row	Gob weight (g)	Days to 50% silk	Hundred grain wt. (g)	Grain yield / plant (g)
g.c.a.	9	462.323**	3.745**	8.931**	700.927**	13.281**	7.919**	323.516**
s.c.a.	45	86.659**	2.183**	8.659**	559.453**	3.269**4	7.662**	217.408**
Reciprocal effect	45	112.744**	1.506**	6.607**	654.727**	4.528**	4.692**	168.636**
Error (M'e)	99	6.593	0.635	2.496	9.867	0.117	0.501	3.040
GCA/SCA		5.335:1	1.716:1	1.031:1	1.253:1	4.063:1	1.034:1	1.488:1

*,** Significant at 5% level & Significant at 1% level respectively.

Table 2. Mean and general combining ability effects of parents for different grain traits in maize

Parents	No. of Grain rows / cob		No. of Grains / row		Cob weight (g)		Hundred grain weight (g)		Grain yield / plant (g)	
	mean	gca	mean	gca	mean	gca	mean	gca	mean	gca
UMI 492	10.97	-0.47	24.50	0.53	104.00	6.14**	25.96	0.30*	71.00	3.80**
UMI 561	12.17	-0.12	23.56	1.09**	110.00	-0.69	26.57	-1.11**	67.33	-3.08**
UMI 743	11.27	-0.11	23.16	-1.17**	98.00	-1.55**	25.49	0.42**	66.53	-5.06**
UMI 760	12.05	-0.08	22.85	0.56	83.82	-2.55*	22.06	0.46**	60.74	5.67**
UMI 805	13.20	0.24	25.69	1.18**	131.67	4.26**	28.10	-0.12	95.33	0.81*
Kesri-1	12.73	0.32	28.26	-0.53	143.00	6.80**	21.10	-0.22	74.88	-0.29
Prabhat-1	13.40	0.36	22.08	0.27	130.50	5.62**	26.65	0.80**	76.25	4.89**
Pratap-1	11.20	-0.56**	23.67	-0.58	86.12	-12.20**	25.31	-0.57**	67.10	6.25**
Sartaj-1	15.62	-0.40*	22.48	-0.38	99.50	-1.80**	21.95	0.46**	75.29	-0.68
JM 3181-1	13.27	0.81**	21.75	0.02	127.00	4.51**	22.35	-0.41**	63.44	0.90*
SE		0.169		0.335		0.666		0.370		0.171
CD at%%		0.335		0.665		1.323		0.298		0.734
CD at 1%		0.444		0.880		1.749		0.394		0.972

*,** Significant at 5% level & Significant at 1% level respectively.

would result in identification of superior segregants with favourable genes for the grain traits besides grain yield. This is in agreement to the general expectation that *per se* performance of the parents and hybrids is a direct reflection of their respective *gca* effects (Mohammed, 1995).

Hybrids for recombination breeding

The criterion for the selection of hybrids for recombination breeding is that the parents have significant *gca* effects. The parents Prabhat-1, JM3 181-1, UMI 760, UMI 805 and UMI 492 possessed favourable and significant *gca* effects for heterosis breeding. Exploitation of hybrids for heterosis breeding is best judged by mean performances, *sca* effects and magnitude of heterosis. In the present study also the crosses namely, Prabhat - 1 x UMI 492, UMI 805 x UMI 1760 and UMI 760 x JM 3181-1 were selected as the best based on their per se performance, good heterotic response and high *sca* effects for grain yield and are presented in Table 4 .

Table 3. Combining ability of parents to produce potential hybrids

Parents involved	Number of hybrids	
	Exceeding hybrid mean for grain yield	With significant positive sca effect for grain yield
UMI 492	7	9
UMI 561	5	4
UMI 743	4	9
UMI 760	10	8
UMI 805	9	7
Kesri-1	6	7
Prabhat-1	10	9
Pratap-1	5	4
Sartaj-1	6	9
JM 3181-1	11	10

Rererences

Debnath, S .C . and Sarkar , G (1990) . Combining ability analysis of grain yield and some of its attributes in maize (Zea mays L.) . *Indian J. Genet.* **50** (1): 57-61.

Ferrao, R.G. Goes Egama, H.W. I. Carvalo and De Ferraro, M.A.G. (1995). Evaluation of combining ability of twelve maize lines in a partial diallel cross. *Maize Abst., 11:1666.*

Gilbert, N. E. (1958). Diallel cross in breeding. *Heredity.* **12** : 477-492.

Table 4. Hybrids identified based on mean performance, heterosis and sca effects for grain yield.

Mean Performance	Positive and significant heterosis	sca effects
Prabhat-1 x UMI 492	Prabhat-1 x UMI 492	UMI 492 x UMI 760
UMI 805 x UMI 760	Sartaj-1 x Pratap-1	Kesri-1x Prabhat-1
Prabhat-1 x Kesri-1	JM 3181-1 x Prabhat-1	UMI 492 x Sartaj-1
JM 3181-1 x Prabhat-1	JM 3181-1 x UMI 743	UMI 805 x UMI 760
UMI 760 x JM 3181-1	UMI 760 x JM 3181-1	Prabhat-1 x UM 492
	UMI 805 x UMI 760	UMI 760 x JM 3181-1

Griffing, G. N. (1956). Concept of general and specific combining ability in relation to diallel crossing systems. *Aust . J.Biol. Sci.*, **9** : 463-493.

Mohammed. A.A. (1995). Effects of nitrogen fertilization levels on the performance and combining ability of maize hybrids (*Zea mays* L.) *Maize Abst.* : **4.**

(Received August : 1998, Revised January : 2001)

Madras Agric. J., 87(7-9): 449-452 July - September 2000

Analysis of variability for seed yield and related characters in safflower (*Carthamus tinctorius* L.)

R.H. KAVANI, P.T. SHUKLA AND R.B. MADARIYA

Oilseeds Research Station, Gujarat Agricultural University, Junagadh Campus, Junagadh - 362 001.

Abstract : Thirty five genotypes of saffower are grown under four diverse environments. High genotypic coefficient of variation for yield per plant and number of seeds per capitulum was observed at all the environments and only for yield per plant over environments. Moderate coefficient of variation for number of primary branches per plant, number of secondary branches per plant, number of capitula per plant and harvest index was observed in pooled analysis. High heritability estimates were observed for days to maturity, number of capitula per plant, number of seeds per capitulum, yield per plant and hull content. Seed yield per plant, number of seeds per capitulum and harvest index had high genetic advance coupled with high heritability under individual environment, indicating scope for the improvement of these characters through selection. (***Key Words*** : *Safflower, Variability, Yield).*

Safflower is one of the most accepted crops in dry land agriculture and has been grown in different parts of India for high priced oil. Success in crop improvement depends on the magnitude of genetic variability and the extent to which the desirable characters are heritable. The estimates of variability for yield and its heritable components in the material with which the breeder is working are, prerequisites for any breeding programme. Hence, it becomes necessary to split the phenotypic variability into heritable and non-heritable components with the help of certain genetic parameters such as genotypic and phenotypic coefficients (GCG and PCV), heritability and genetic advance. Improvement in yield is an ultimate aim of the plant breeder which calls for selection on the basis of yield components which are heritable. Therefore the present investigation was undertaken to determine genetic variability, heritability and genetic advance for seed yield and related characters under four different environments.

Materials and Methods

The material for the present investigation consisted of 35 genotypes of safflower. The experiment was laid out in four environments (season: 1991-92, sowing dates: 11-10-91, 11-11-91 and season: 1992-93, sowing dates: 09-10-92, 07-11-92) adopting a randomized block design with three replications in each environment. Each genotype was grown in a single row plot of twenty five plants spaced at 45 x 20 cm. Five competitive plants were selected at random for taking observations on eleven plant characters, *viz.,* days to first flowering, days to maturity, plant height, number of primary branches per plant, number of secondary branches per plant,