

## Discriminating Ability of Different Testers in Maize

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### Abstract

The present research was aimed to study relative efficiency of tester parents in maize. The four inbred testers viz. T<sub>1</sub> (Jogia local + S<sub>3</sub>-4-2-8), T<sub>2</sub> (Jogia local + S<sub>3</sub>-10-2-13), T<sub>3</sub> (Jogia local + S<sub>3</sub>-12-1-15) and T<sub>4</sub> (Jogia local + S<sub>3</sub>-72-1-39) were used for discriminating the combining ability of ten inbred lines of maize of different genetic origin. Among the four testers *per se*, the tester T<sub>3</sub> (Jogia local + S<sub>3</sub>-12-1-15) was discriminating the lines better than other three. On the basis of W statistic values, the tester T<sub>3</sub> had higher magnitude than the other three testers for the character grain yield.

**Key words :** *Zea mays* L., Discriminating ability, Combining ability, Inbred testers.

Maize breeders are confronted with the problem of choice of tester parents for measuring the general combining ability (gca) of lines. There are diverse opinion on the use of testers for judging the combining ability of inbred lines (Hull 1947, Keller 1949, Rawling and Thompson 1962). For grain yield, the crosses included in the combining ability study was used to test the relative efficiency of tester parents. Therefore, the present investigation was carried out to study the discriminating ability of different testers in maize.

### Methods

The experimental material consisted of forty hybrids developed from crossing ten lines with four testers in line × tester mating design (Table 1). The forty crosses along with 14 parents and standard check (CM 300 × CM 400) single cross were evaluated at the research farm of T.C.A. Dholi, Rajendra Agricultural University, Pusa, Bihar, during the *kharif* 1994 in a randomized block design with three replications. Each entry was provided a two-row plots of 5m length. Inter row and inter plant distances were kept at 75 cm and 25 cm, respectively. All the recommended cultural practices were followed to obtain normal growth of the crop. Observations were recorded on five randomly selected competitive plants in each plot of all the treatments. Observations were recorded on

plant height (cm), days to 50% tassel, days to 50% silk, days to maturity, ear diameter (cm), ear length (cm), number of ears per plot, 1,000-grain weight and grain yield (kg/ha). Combining ability analysis was carried out following the standard method. In the present investigation, grain yield, for the crosses included in the combining ability study was used to test the relative efficiency of tester parents. Analysis of variance for the crosses of each tester parents was

**Table 1.** List of materials used as parents and their codes.

Designation and Parentage	Code
<b>Lines</b>	
M <sub>9</sub> + S <sub>4</sub> -2-1	L <sub>1</sub>
M <sub>9</sub> + S <sub>4</sub> -36-1	L <sub>2</sub>
M <sub>9</sub> + S <sub>4</sub> -37-1	L <sub>3</sub>
M <sub>9</sub> + S <sub>4</sub> -37-2	L <sub>4</sub>
M <sub>9</sub> + S <sub>4</sub> -37-3	L <sub>5</sub>
Pant 7421 + S <sub>3</sub> -107-1	L <sub>6</sub>
Pant 7421 + S <sub>3</sub> -16-1	L <sub>7</sub>
Pant 7421 + S <sub>3</sub> -22-1	L <sub>8</sub>
Pant 7421 + S <sub>3</sub> -76-1	L <sub>9</sub>
Pant 7421 + S <sub>3</sub> -93-1	L <sub>10</sub>
<b>Testers</b>	
Jogia local + S <sub>3</sub> -4-2-8	T <sub>1</sub>
Jogia local + S <sub>3</sub> -10-2-13	T <sub>2</sub>
Jogia local + S <sub>3</sub> -12-1-15	T <sub>3</sub>
Jogia local + S <sub>3</sub> -72-1-39	T <sub>4</sub>

**Table 2.** Analysis of variance for combining ability in maize. \*, \*\* Significant at 5 and 1% levels, respectively.

Source	df	Plant height (cm)	Ear height (cm)	Days to tassel	Days to silk	Days to maturity	Ear length (cm)	Ear diameter (cm)	Ears/plot	1000-grain weight (g)	Grain yield (kg/ha)
Treatment	53	732.99**	247.87**	4.07	4.69*	3.61	11.09**	0.42**	72.38**	0.0056*	0.87**
Crosses	39	402.86*	140.30	4.33	5.19*	3.62	8.78**	0.16**	50.50**	0.0047**	0.51**
Parents	13	583.56**	145.86	2.65	3.21*	3.45	11.00**	0.50**	84.67**	0.0046**	0.70**
Parents vs crosses	1	15550.50**	5769.43**	12.43	4.74	5.26	102.32**	9.51**	765.97**	0.0535**	17.11**
Error	106	258.01	103.92	3.60	3.68	3.83	4.00	0.05	15.42	0.0034	0.18

conducted separately. Capability of testers in detecting the inherent differences of lines under investigation was judged by comparing the variances between the crosses of each tester parents. The W statistic was calculated to measure the relative sensitivity of the testers in discriminating the lines for general combining ability.

$$W = \frac{F_i}{F_j}$$

Where,  $F_i$  = variance ratio for the crosses of *i*th tester  
 $F_j$  = variance ratio for the crosses of *j*th tester.

### Results and Discussion

The analysis of variance revealed significant differences among entries for all the characters except days to tassel and days to maturity, indicated the existence of variability among the genotypes (Table 2). The parents and crosses also showed significant differences for all the characters except ear height, day to tassel and days to maturity. However, mean squares due to parents vs crosses were highly significant for plant height, ear height, ear length, ear diameter, ears per plot, 1,000-grain weight and grain yield. The general performance of the lines were considered on the basis of performance level for the ten characters. The line  $L_{10}$  (Pant 7421 +  $S_3$ -93-1) was found to be of good performer for all the characters followed by  $L_6$  (Pant 7421 +  $S_3$ -107-1). This was advocated by Sprague (1946) and Lonnquist (1950) for early detection of superior lines.

Among the testers  $T_3$  (Jogia local +  $S_3$ -12-1-15) was found to be good performer for all the characters followed by  $T_1$  (Jogia local +  $S_3$ -4-2-8). The results are

in agreement with the findings of Mutzinger (1953) for selection of suitable tester to use in breeding program. The cross with good general performance was  $L_{10}$  (Pant 7421 +  $S_3$ -93-1) ×  $T_3$  (Jogia local +  $S_3$ -12-1-15) for majority of the characters. Akhter and Singh (1981) have reported a close association between the performance of parents and their hybrids. The grain yield data for individual lines into tester crosses were analyzed and the compiled data were subjected to ascertain the discriminating ability of the individual tester. The W values and the variance ratio of the testers are presented in Table 3. In the present investigation four inbred testers viz.  $T_1$  (Jogia local +  $S_3$ -4-2-8),  $T_2$  (Jogia local +  $S_3$ -10-2-13),  $T_3$  (Jogia local +  $S_3$ -12-1-15) and  $T_4$  (Jogia local +  $S_3$ -72-1-39), were used for discriminating the combining ability of ten inbred lines of maize of different genetic origin. The variance ratio of the individual testers was found to be significantly variable for tester  $T_2$  white, the tester  $T_3$  discriminated the lines at highly significant level. The testers,  $T_1$  and  $T_2$  did not discriminate the line significantly. Among the four testers *per se* the tester  $T_3$  (Jogia local +  $S_3$ -12-1-15) was discriminating the lines better than other three. The W values for the individual testers revealed that on the basis of magnitude of W values the testers  $T_3$  is discriminating the lines effectively. The tester  $T_3$  had higher magnitude than the rest three testers for

**Table 3.** Variance ratio of testers and W values for all possible combinations.

Tester	Variance	W-values			
		$T_1$	$T_2$	$T_3$	$T_4$
$T_1$	0.06	—	41.33	72.66	31.8333
$T_2$	2.48*	0.0241	—	1.7580	0.7701
$T_3$	4.36**	0.0138	0.5688	—	0.4381
$T_4$	1.91	0.0314	1.2984	2.2817	—

the character grain yield.

Thus, the tester T<sub>3</sub> (Jogia local + S<sub>3</sub>-12-1-15) was found to be a good discriminator of the gca for grain yield of the inbred lines. This tester was also found to be good mean performer for number of other characters with poor gca for yield had genetically diverse to the lines.

The use of low performing testers has been advocated by Rawling and Thompson (1962), Mutzinger (1953) and Homer et al. (1973) who also suggested the use of inbred testers. The use of low susceptible inbred lines as tester for disease resistance has been suggested by Russel (1961), Hayes (1963) and Akhter et al. (1983) who suggested that the testers should be genetically diverse to the lines but Singh (1958) reported no difference due to related or unrelated testers with the lines.

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