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COMBINING ABILITY ANALYSIS FOR YIELD IN MAIZE (*Zea mays L.*)

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The gene action and combining ability for important yield components in maize were analysed through Line X Tester mating design using 29 lines and 5 testers. The study revealed the predominant role of dominant and epistatic gene action for plant height, height upto ear, cob length, cob girth, number of rows/cob and number of grains/row. Grain yield was found to be influenced by both additive and non additive gene action. The inbreds UMI 108, 123, 140, 29, 182/1, 53, 54, 150, 242, 262 and 287 were identified as potential sources of yield improvement and the specific combinations with good sca effect that could be of immediate practical value have been reported. They are UMI 46 X KI UMI 123 X UMC 6 and UMI 287 X Co. 1.

Major break through in the yield of corn came with the release of a eries of, hybrids with high yield potential. Combining ability is the sirst step in identifying potential parents of hybrids. Since a large number of inbred lines are available with the breeder, a study was made to identify good general combiners among the inbred lines and good specific combiners among the hybrids.

MATERIALS AND METHODS

Twenty nine inbreds of maize were each crossed to the five testers viz., K 1, Kissan, Co 1, UMC 6 and CoH 1 to obtain 145 hybrids. These hybrids were grown in a randomised block design replicated twice. Observations on plant height, height upto ear, cob length, cob girth, number of rows per cob, number of grains per row and grain yield per plant, were recorded on five randomly selected plants in each variant. The data were analysed using the method developed by Kempthorne (1957) based on experiment of Comstock and Robinson (1952).

RESULTS AND DISCUSSION

The analysis of variance (Table 1) for combining ability revealed that mean squares due to males is of larger magnitude in comparison with those due to females or females and males for all the traits except for number of grains per row and cop girth indicating greater diversity among males for these characters. The mean squares due to females X males is of lower magnitude than that of both males and females for all the characters except for grains per row indicating that hybrids are more uniform. The variance components revealed that there is preponderance of specific combining ability variance and thus the non additive gene action could be capitalised by heterosis breeding. Among

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Table 1. Analysis of variance for combining ability

Source	d. f.	Height	Height up to ear	Cob length	Cob girth	Number of rows per cob	Number of grain/ row	Grain Yield per plant
				(mean squares)				
lines	28	1174.47**	519.35**	8.25**	0.26**	3.68**	46.29**	1768.68**
teste	4	2870.33**	1049.92**	8.99**	0.20**	9.50**	7.46	2159.76**
line X testers	112	557.12**	187.33**	2.69*	0.13*	1.29	17.07*	528.25
error	178	244.52	99.45	1.19	0.09	0.06	7.77	387.93
GCA		32.74	17.57	0.25	0.007	0.13	1.23	54.73
SCA		156.30	32.74	0.75	0.02	0.34	4.65	70.16
GCA : SCA		0.21	0.54	0.33	3.37	0.38	0.26	0.78

** Significant at 1% level

* Significant at 5% level

the characters studied, only for grain yield, variance of general combining ability were considerable indicating that this trait may be controlled predominantly by additive variance. Mukherji *et al.* (971) also observed that variances of general and specific combining ability were of equal magnitude for grain yield in maize. predominance of specific combining ability for plant height. height upto ear. cob length, cob grith, number of rows per cob and number of grains per row observed in this investigation was also reported by Narwar and Hosary (1984). The increase in the specific combining ability effects may be due to genetic diversity among the parental inbreds as proposed by Inoue (1984). Khotyleva and Polonetskaya [1985] observed that in more advanced inbred generations, different types of gene interaction played the major role in determining the combining ability. The combining ability values depended on the degree of inbreeding of the lines crossed. In lines of early inbred generations the main role in the expression of combining ability was played by additive gene effects. In the present study the combining ability for all characters studied was predominantly by non additive gene effects since al the parents are more advanced inbred generations. In contrast to the present study, Qudari *et al.* [1983] observed that additive genetic variance predominated for all the characters studied by them in maize.

The general combining ability effects of the parents are presented in Table 2. Among the inbred lines studied, UMI 60 had maximum significant positive gca effect for plant

Table 2. General combining ability effects of parents

Parents Lines	Plants height	Height up to ear	Cob length	cob grith	Number of row/cob	Number of grains/row	Grain yield
1	2	3	4	5	6	7	8
UMI 14	- 5,02	2,40	-0,80	0,04	0.07	- 2.68**	- 2,13
UMI 15	15,42**	7,52	1.69**	−0.03	0,23	1,34	23.17**
UMI 27	9.14	-2.04	-2 09**	-0.07	-0 63	-1.32	-5.83
UMI 29	-15.78**	-3 38	0.31	-0.19	-0.25	-1.02	3.75
UMI 46	6 63	5 21	1.77**	-0.05	-0.67	4,92**	25.47**
UMI 50	-15 71**	8.58	-0 01	0 04	-1 05**	3.82**	-17.03
UMI 53	8.72	3.70	0 24	-0.07	0 23	0.1[illegible]	- 5.60
UMI 54	- 2.54	-6.20	-0.63	-0.05	-0.29	-0.36	-16 83
UMI 60	21,14**	15.56**	0 78	0.27	0.24	-0.60	20 07**
UMI 62	0,78	0.02	0.47	0,13	-0.65	0.28	7.87
UMI 65	6.64	5.34	-0.45	0 06	0 41	−[illegible].83	4,33
UMI 90	−0,12	− 0.24	−0.61	0.13	1.67**	−1 91	−1,23
UMI 93	−14,44	− 2 92	−0.43	−0.17	−0 69	−0 53	−11.93
UMI 108	−3,80	0,21	0.53	0 06	−0 77	2,88**	12.87
UMI 123	9.90	14,36**	0,08	−0.01	1.31**	1,84	5.47
UMI 140	− 4,00	−1,95	−0 03	0.18	−0.09	−1.70	0.77
UMI 150	3.96	2.62	- 0.55	-0.11	0.23	- 1.80	- 2,83
UMI 160	−5,80	−4.21	- 0.48	-0.14	0.15	1,94	1,77
UMI 179	−14 10	−6.94	- 1,13**	-0.15	0.67	3.38**	0.37
UMI 182/1	− 5.82	- 1.72	0.18	0.22	0.28	1,88	9.87
UMI 210	− 1.52	- 0.36	1,09**	-0 37	-0,45	0,16	-12,93
UMI 235	8 15	7.93	0,59	0.30	-0 13	0 96	- 4,53
UMI 242	−10.24	- 6.80	- 0 38	0.05	0.16	- 1.9	- 4.23
UMI 261	12 92	4.85	0 56	0.27	0 55	- 0.06	19.37**
UMI 763	- 20.70**	- 20.04**	- 1.94**	- 0.07	0.29	- 2 39	-36.53**
UMI 267	20.24**	4,20	1.09**	- 0.17	0.31	3.76**	6,47
UMI 269	0 34	2.92	0.30	0 14	-0.15	0.50	4 67
UMI 285	3,29	- 0,68	0 66	0 20	0.47	-3 01**	−1,73
UMI 287	0.10	−6 66	0 53	7 24**	0,57	0:58	14.03
SE	4,94	3.15	0.36	0 10	0,37	0.88	6 23
Testers							
K.1	−7 20**	3.66	0.24	0 03	− 0.45	0 09	− 3,02
Kissan	5,46	5 39**	0.02	0.02	0.59	0.28	4.20
Co 1	6.93**	3 72	0.78	0.09	− 0.25	− 0.50	5.94
UMC 6	2·48	−1.92	−0.68**	- 0.06	−0.07	− 0.22	−9.11
CoH 1	−2.71	−3.53	0.14	−0.04	0.17	0.35	1.98
SE	2,05	1.31	0:14	0.04	0.21	0,37	2,59

** : Significant at 1% level

heightand height upto ear which can be utilised in breeding tall types of maize. Tall types are preferred when straw yield is of concern. However dwarf or medium tall hybrids are more preferable. UMI 253 had the maximum significant negative effect for height and height upto ear which can be utilised for breeding dwarf types. Among the testers, Co I will be of use for tall hybrids. Cob length and number of grains are the major yield components and improvement of these traits will directly lead to higher yield. UMI 46 was the best of all that showed maximum positive gca effects for these two traits This inbred had also goo combining ability for grain yield. It has a wide genetic base. The inbred lines UMI 287 and UMI 90 with maximum positive *gca* effects for cob girth and number of rows per cob respectively will also serve as potential parents for these traits. Data on specific combining ability effects indicated that most crosses exhibited high *sca* effects. Among them, the combinations UMI 108 X Kissan, UMI 123 X UMC 6 and UMI 140 X UMC 6 showed significant positive *sca* effect for cob length (Table 3). The cross UMI 29 X Kissan showed significant *sca* effect

Table 3. Specifc combining ability effects of promising hybrids

Hybrids	Character	Sca effect	Sca effect Max.	Sca effect Min.
UMI 108 X Kissan	Cob length	2.97**	2.97	−4.08
UMI 123 X UMC 6	-do-	1.76**	2.97	−4.08
UMI 140 X UMC 6	-do-	1.78**	2 97	−4 08
UMI 29 X Kissan	Cob girth	8.28**	8.28	−0.56
UMI 182/1 X Kissan	No of rows/cob	5 52**	5.52	−2.58
UMI 53 X K.1	No. of grains/row	4.1:**	5.94	−7 54
UMI 54 X CoH 1	-do-	4.00**	5.94	−7.54
UMI 150 X UMC 6	-do-	4 72**	5.94	−7.53
UMI 182/1 X CoH. 1	-do-	4.06**	5 94	−7 54
UMI 242 X CoH 1	-do-	4.34**	5.94	−7.54
UMI 263 X CoH 1	-do-	5.14**	5.94	−7.54
UMI 287 X Kissan	-do-	5.94**	5.94	−7.57
UMI 46 X K 1	Grain yield	23 72**	46.77	−51.54
UMI 123 X UMC 6	-do-	32·3:**	46.77	−51.54
UMI 287 X Co 1	-do-	46.7.**	46.77	−51.54

** Significant at 1% level.

for cob girth. Considering the number of rows per cob, the combination UMI 182/1 X Kissan expressed the maximum significant positive *sca* effect. The crosses UMI 53 X K 1, UMI 54 X CoH. 1, UMI 150 X UMC 6, UMI 182/1 X CoH 1, UMI 242 X CoH 1, UMI 263 X CoH 1 and UMI 287 X Kissan showed significant positive *sca* effect for number of grains per row. The *sca* effects of cross combinations UMI 46 X K 1, UMI 123 X UMC 6 and UMI 287 X Co 1 are noteworthy as for as grain yield is considered. UMI 287, UMI 46 and UMI 123 are inbreds developed from populations of exotic origin which when crossed with locally adapted testers showed significantly higher yield. This is in accordance with Ahloowalia and Dhawan (1973) who reported that significantly higher yield can be obained by crossing inbreds of distant origin.

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