Table 5. Genetic components of additive and dominance variances for yield and yield components

Characters	σ^2A		σ^2A	
	F = 0	F = 1	F = 0	F = 1
Plant height	9.48	4.74	693.32	150.83
No. of primary branches	0.016	0.008	12.20	3.05
No. of secondary branches	0.12	0.06	15.80	3.95
Photosynthetic efficiency	72727.72	36363.86	3591592.40	897898.10
No. of capsules/plant	34.76	17.38	1398.56	349.64
Seed yield per plant	0.48	0.24	27.00	6.75
Thousand seed weight	0.0096	0.0048	1.16	0.29
No. of days to maturity	1.24	0.62	74.72	18.68
Dry matter production	5.00	2.50	236.92	59.23

σ^2A - additive variance σ^2D - f emale parent F - inbreeding coefficient

biparental mating followed by recurrent selection might hasten the genetic improvement of these traits in sesame.

REFERENCES

CHANDRAMOHAN, P. 1979. Inheritance of earliness and yield components in a six parent diallel cross of ice (**Oryza sativa** L.) M.Sc. (Ag.) thesis, Tamil Nadu Agri. Univ., Coimbatore (Unpubl)

KEMPTHORNE, O. 1957. **An Introduction to Genetic Statistics.** John Wiley and Sons, Inc. New York. pp 458 - 471.

KRISHNADOSS, D. 1984. Studies on combining ability and heterosis in sesame (**Sesamum indicum** L.) M.Sc. (Ag.) thesis, Tamil Nadu Agri. Univ., Coimbatore (Unpubl)

PANSE, V.G. and SUKHATME, P.V. 1964. **Statistical Methods for Agricultural Workers.** 2nd Ed., ICAR, New Delhi.

REDDI, M.B., REDDI, M.V., NAGESWARA RAO, G. and MURALIMOHAN REDDI B. 1982. Line x tester analysis of combining ability in sesamum (**Sesamum indicum** L.). **Andhra Agric. J., 29,** 18- 21.

SHRIVAS, S.R., and SINGH, S.P. 1978. Heterosis and combining ability in Sesamum (**Sesamum orientale** L.) Paper presented at the All India Sesame Kharif Workshop from 24th to 27th April, 1978 at JNKVV Jabalpur.

SINGH, V.K., SINGH, H.G. and CHAUHAN, Y.S. 1983. Combining ability in Sesame. **Indian J. agric. Sci., 53:** 305 - 310.

THENMOZHI, P. 1983. Studies on heterosis and combining ability in **Lablab purpureus** (L.) Sweet. M.Sc. (Ag.) thesis, Tamil Nadu Agri. Univ., Coimbatore (Unpubl.,)

Madras Agric. J. 77, (9-12): 489-492 (1990)

https://doi.org/10.29321/MAJ.10.A02003

GENETICS OF YIELD AND ITS COMPONENTS IN MAIZE (*Zea mays* L.)

E. SATYANARAYANA, R. SAIKUMAR, and G. KOTESWARA RAO

Agrl. Research Station, Amberpet, Hyderabad - 13.

ABSTRACT

Combining ability for yield and yield components in all ten characters were studied in a set of 10 inbred lines and their all possible direct single crosses. Non additive gene action was predominant for plant height, ear height, ear length, ear girth, number of rows per ear, number of grains per row, number of grains per ear, 1000 grain weight, grain weight of 5 ears and yield per plot, though both GCA and SCA variances were significant. Three inbreds **viz.**, X 102, A-670 and H - 98 were found to be good general combiners for grain yield. Single crosses 1 x 4, 8 x 9 and 2 x 8 had exhibited high sca effects as well as high yields. The selection of inbreds may be made based on their **gca** and **sca** effects simultaneously and breeding approaches which exploit both these genetic parameters may be practised in the materials reported.

KEY WORDS : Maize, Yield, Genetics, Combining ability.

Combining ability analysis is usually employed to identify the desirable parents and to study the nature of genetic variation. There is a continuous need to evolve new hybrids which should exceed the existing hybrids in yield and other agronomic characters. Hence in the present investigation, a study was made to evaluate the combining ability and to develop superior hybrids through a diallel crossing from ten selected inbreds.

MATERIALS AND METHODS

The experimental material consisted of 10 inbred lines and their 45 single crosses along with 3 checks for comparison. In all, therefore, 58 entries were grown in randomized block design with three replications, during rabi 1982-83. Each entry was represented by single 5 m. row spaced 75 cm apart, with plant to plant distance of 25cm. 100 kg N, 60 kg P_2O_5 and 20 kg K_2O per hectare were given.

Five plants were selected at random from each plot and data were recorded on days to 50% pollen shed, days to 50% silking, plant height , ear height, ear length, ear girth, number of grain rows, number of grains per row, number of grains per ear, grain weight of five ears, 1000 grain weight and yield per plot.

Combining ability analyses using F_1 and parental data were carried following method 2 and model I (fixed effects) as given by Griffing (1956). For the prediction of yields of double cross hybrids based on the mean values of four non parental single crosses as suggested by Jenkins (1934) and the mean yield of two non parental single crosses was taken as the yield for each of the predicted three way cross hybrids as suggested by Jugenheimer (1976) was followed.

RESULTS AND DICUSSION

Studies on combining ability revealed that signicifant differences existed among genotypes for all the characters. The analysis of variance for combining ability showed that both general (*GCA*) and specific combining ability (*SCA*) mean squares were significant for all the characters and it was seen that *SCA* variance was higher than *GCA* variance for all the characters indicating non additive gene action was higher than the additive component in the material under study (Table 1).

Singh and Asnani (1979) reported that yield per plot, 100 grain weight, kernal rows per ear, ear length and ear diameter had exhibited significant *GCA* and *SCA* variances. Kumar (1974) observed

Table 1. Analysis of variance for combining ability

Source	df	Plant height (cm)	Ear height (cm)	Ear length (cm)	Ear girth (cm)	No.of rows per ear	Number of grain per row	Number of grain per ear	1000 grain weight (g)	Grain weight of 5 ears (g)	Yield per plot (g)
GCA	9	1117.3**	272.7**	3.7**	1.2**	9.3**	12.3**	10654.0**	1743.1**	8448.2*	152646.9**
SCA	45	223.9**	67.2**	1.4**	0.8**	2.2**	14.5**	6212.8**	537.9**	7468.5**	218781.6**
Error	114	54.4	25.5	0.6	0.3	1.3	5.7	2323.5	262.5	1958.5	37125.1
Gca		90.7	22.2	0.3	0.08	0.8	0.7	692.5	125.8	544.3	8958.1
Sca		175.4	43.5	0.9	0.7	1.2	8.6	3982.5	273.9	5837.6	183341.7
$S2/2xg^2$		0.96	0.97	1.5	4.37	0.75	6.14	2.87	1.08	5.36	10.23
Heritability		45.40	37.5	27.4	14.8	38.8	6.4	20.3	33.5	13.5	8.2

*, ** Significant at 5 and 1% probability levels, respectively.

significant *GCA* and *SCA* variances for yield per plant, ear weight, kernel number and cob weight, and further indicated the predominance of *sca* effects.

The higher *GCA* values were observed for the inbreds, X 102 A-670 and H-98 respectively in respect of grain yield per plot (Table 2), while the lower values were observed for inbreds X 114, CM 202 and CM 105. There was no clearcut association between good general combiner for yield with other yield components, except X 102 which had high *GCA* value for yield. In addition it also exhibited high *GCA* values for yield components like ear height, number of rows per ear and 1000 grain weight, where as A-670 showed high *GCA* values for plant height, ear length and number of rows per ear (Table 2).

Hybrid combinations 1 x 4, 8 x 9, 2 x 8, 5x10, 3x7 and 2x9 recorded high *sca* effects as well as higher yields, but all these good specific combiners did not show good *sca* effects in their yield components (Table 3). However crosses 1 x 4 and 3 x 7 exhibited high *sca* effects for grain yield per plot and 1000 grain weight, where as 2 x 8 showed high *sca* effects for ear length, number of grains per row and no. of grains per ear in addition to grain yield per plot (Table 3). In single cross 8 x 9, the inbred 9 (CM 105) which had low *gca* is involved. Inbred 8 (CM 104) had high *gca* as against this, the *sca* value for this single cross was very high. Therefore, the single cross 8 x 9 was of high *gca* x low *gca* but was a high yielding single cross. Johnson and Hayes (1940) had concluded that single cross. between two low combiners may be expected to yield some what lower yielding. They also stated that crosses between low x high or high x low were as high yielding as those between high x high combiners. These data indicate that certain crosses may be highly vigorous and may have high *sca* effects for yield, but it may not be so for other characters. This could be explained by the fact that the gene action for one character may be different from the gene action for the other character.

The heritability for the yield per plot and number of grains per row were the lowest observed among the characters under study (Table 1). Perhaps this further confirms the complexity of these

Table 2. **General combining ability effects of ten inbred lines.**

Source	Plant height	Ear height	Ear length	Ear girth	No.of rows per ear	Number of grain per row	Number of grain per ear	1000 grain weight)	Grain weight of 5 ears	Yield per plot
RN - 6	1.0	7.2**	0.3	-0.4**	-1.7**	0.8	-38.7**	7.8	-14.3	-48.6
X 108	-21.3**	-7.1**	0.6	-0.2	0.3	-1.3	-7.3	2.5	-23.5	13.5
H - 98	-6.7**	-0.5	0.08	0.2	0.3	-0.8	-5.6	6.8	20.3	91.6
B - 57	-9.1**	-1.5	-0.2	0.5*	-0.1	1.2	11.5	-2.5	61.3**	75.9
A - 670	7.1**	-2.7*	0.7**	-0.2	0.7*	0.7	19.5	4.1	5.0	95.7
X 102	3.9	4.8**	-1.0	-0.2	1.6**	-0.5	-53.5**	24.9**	-9.7	137.6*
CM 202	12.1***	3.1*	-0.09	0.5**	0.8*	1.0	51.3**	-19.3*	0.6	-131.5*
CM 104	0.8	-5.8***	0.5**	-0.2	-1.0*	1.4*	35.7**	3.1	12.5	72.3
CM 105	-2.4	-2.7	-0.4*	0.3*	0.3	-0.2	5.3	-11.7*	-5.7	-61.2
X 114	14.6**	4.4**	0.5*	0.3*	-1.2*	-2.3**	-18.2	-15.7	-46.5	-245.3**
S.E. (gi)	2.1	1.5	0.2	0.2	0.4	0.8	13.6	4.7	13.2	54.2
S.E. (gi-gj)	3.2	2.2	0.3	0.3	0.5	1.1	20.5	7.1	20.3	80.5

Significant at 5 and 1% probability levels, respectively.

Table 3. Specific combining ability effects of top ten single crosses for ten characters in $\frac{10 \times 9}{2}$ diallel ...

Single	Plant height (cm)	Ear height (cm)	Ear length (cm)	Ear girth (cm)	No.of rows per ear	Number of grain per row	Number of grain per ear	1000 grain weight (g)	Grain weight of 5 ears (g)	Yield per plot (g)
1 x 2	3.2	1.2	0.9	0.5	0.5	3.6*	68.6	19.3	79.3*	414.5*
1 x 4	1.8	-3.9	0.6	0.4	-0.4	0.2	1.2	41.2**	52.8	705.3**
1 x 6	15.4*	0.3	0.9	2.1**	1.1	4.9*	75.7*	23.8	85.8*	311.4
2 x 8	-2.7	-6.3	1.4*	0.5	1.2	2.7*	81.5	-1.6	93.8*	603.6**
2 x 9	2.1	-17.3**	1.6*	0.9*	0.5	5.7*	98.8*	-6.9	75.8*	483.4**
3 x 6	7.1	3.2	-0.6	0.2	0.4	-2.8	-37.4	5.2	3.5	251.5
3 x 7	2.3	-1.6	-0.2	-0.7	-2.1*	0.5	-32.0	55.3**	71.5	487.3**
4 x 5	12.3*	6.2	-0.2	0.5	0.6	1.3	43.5	-15.2	35.2	357.5*
6 x 10	11.2	9.9*	2.5**	0.9*	-1.0	3.2	5.9	4.1	49.3	593.4**
8 x 9	-2.2	9.2*	0.4	0.3	2.1	-0.3	-34.2	11.5	-7.3	652.7**
S.E. (Si)	6.1	4.2	0.7	0.4	1.1	2.2	41.3	14.2	38.5	157.8
S.E. (Sij-Sik)	10.2	6.7	0.9	0.6	1.5	3.5	64.1	23.5	62.5	261.2

*, ** Significant at 5 and 1 percent probability levels, respectively.

characters, thereby denoting the involvement of more number of genes than for the remaining characters.

The yields of top ten best double crosses and three way cross hybrids were predicted as per the methods suggested by Jenkins (1934) and Jogenheimer (1976) respectively. The yield estimated were 30.25% to 36.56% in case of double cross hybrids and 32.50% to 46.65% higher yielding in three way cross hybrids respectively than DHM - 103, the standard check.

REFERENCES

GRIFFING, B. 1956. Concept of general and specific combining ability in relation to diallel crossing systems. Aust. J. Biol. Sci. 9: 463-93.

JENKINS, M.T. 1934. Methods of estimating the performance of double crosses in corn. J. Amer. Soc. Agron., 26: 199-204.

JOHNSON, I.J. and HAYES, H.K. 1940. The value of hybrid combinations of inbred lines of Corn Selected from single crosses by the pedigree method of breeding. J. Amer. Soc. Agron., 32: 479-85.

JUGENHEIMER, R.W. 1976. Corn Improvement Seed production and Uses. John Wiley and Sons, New York p. 389.

SATISH KUMAR. 1974. Correlation between yield and yield components and their combining abilities in Maize (Zea mays) Madras. Agric. J. 61 (5) : 111-17.

SINGH, I.S. and ASNANI, V.L. 1979. Combining ability analysis for yield and some yield components in maize. Indian J. Genet., 39: 154-157