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Studies on combining ability for earliness, yield and quality traits in baby Corn (*Zea mays* L.)

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SUMMARY

The experimental material of baby corn comprised of 15 inbred lines, 3 testers and their 45 crosses generated by line x tester mating design. The experimental material was raised in Randomized Block Design with three replications during *Kharif*, 2008 at Varanasi. Sixteen characters were studied namely, plant height, cob height, days to first picking, days to second picking, cob length, cob diameter, cob yield with husk and without husk per plot, cob yield with husk and without husk per plant, number of cobs per plant, green fodder yield per plot and quality characters (total soluble sugars, ash content, protein content and phosphorus content). On the basis of desirable gca effects, parental lines namely, HUZM-221, HUZM-217, HUZM-69 and tester CM-119 were suitable for height, maturity, yield and yield attributing traits with quality characters. Hybrids, HUZM-221x CM-119, HUZM-217 x HKI-1105, HUZM-227-1-1x CM-119, HUZM-69 x HKI-323 were found to be suitable on the basis of their desirable sca effects for most of yield and quality traits.

Key words : Baby corn, Cob yield, Combining ability, Earliness, Line x tester

Corn is queen of cereals, baby corn is a specialized corn. It can be grown throughout the year. It is young finger like unfertilized cob of maize harvested two to three days of silk emergence, depending upon the developmental condition of plant and size of the cob. It is high valued vegetable crop help in diversification in maize cultivation. The prime objective of any breeding programme is to enhance the yield. Yield is a complex character, as it comprises of a number of componential traits (Johnson, 1973), which are polygenic in nature and influenced by environment. Baby corn in nature is cross pollinated crop but its product is unfertilized. For successful exploitation of genetic manipulation of baby corn crop involving tall, medium and dwarf genotypes, the knowledge of type of gene effects involved in expression of the trait is essential. Line x tester analysis helps in testing a large number of genotypes to assess the gene action and combining ability. The present experiment was therefore, planned to study combining ability in baby corn.

MATERIALS AND METHODS

The 15 lines, 3 testers, their 45 F_1S with standard check variety 'Prakash' were planted in Randomized Block Design with three replications. Each entry had one row of 4m length in each replication. The plants were spaced 60 cm apart between rows and 15 cm with in the rows. All the recommended cultural practices were followed to raise a healthy crop. Data were recorded on 10 randomly selected plants in each row with respect plant height (PH), cob height (CH), days to first picking (DFP), days to second picking (DSP), cob length (CL), cob diameter (CDM), cob yield with husk per plot(CYH/PT) cob yield without husk per plot (CY/PT), cob yield with husk per plant (CYH/PL) Cob yield without husk per plant(CY/PL), number of cobs per plant (NC/PL) and green fodder yield per plant(GFY/PT). The quality parameters, total soluble sugars (T.S.S), ash content (AC), protein content (PC), phosphorus content (PHC) were analyzed under laboratory condition. Mean values were subjected to statistical analysis as per model suggested by Kempthorne (1957) and procedure of Singh and Chaudhary (1985).

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RESULTS AND DISCUSSION

The general combining ability effects of parents (lines and testers) for different characters during *Kharif* season are given in Table 1. The positive and significant estimates of gca effects were desirable for all the traits except cob height, days to first and second picking, where negatively significant estimates were more desirable for reduced cob height and early maturity. Lines HUZM-221, HUZM-217, HUZM-329 and testers CM-119, HKI-323 exhibited good gca effects for earliness, yield and quality traits, whereas, lines HUZM-91-1, HUZM-210-2 were good general combiner for early maturity and yield. For most of the

Table 1: Estimates of general combining ability (gca) effects of parents during *Kharif* season

Parents	Characters														
	PH	CH	DFP	DSP	CL	CDM	CYH/PT	CY/PT	CYH/PL	CY/PL	NC/PL	GFY/PT	T.S.S	AC	PC	PHC
HUZM-55 (L_1)	0.28	2.44**	-0.79**	-1.66**	-0.05	0.05*	-26.74**	-71.13**	1.38	-0.73	-0.17*	0.65**	0.31**	0.05**	0.99**	-1.14**
HUZM-68 (L_2)	-4.94**	11.88**	1.22**	0.79**	-0.85**	0.09**	21.88**	-16.80**	14.44**	7.89**	-0.04	-0.94**	0.11**	-0.01	-0.59**	-14.60**
HUZM-69 (L_3)	14.73**	19.77**	-0.12	-0.66*	0.54**	0.01	98.77**	5.24**	7.58**	1.61**	0.20**	1.04**	-0.51**	-0.07**	1.24**	1.05**
HUZM-70-1 (L_4)	-18.27**	6.66**	0.55	0.23	0.67**	-0.14**	109.19**	-8.77**	-2.76	0.92**	0.23**	0.46**	-0.69**	0.31**	-1.73**	6.30**
HUZM-77 (L_5)	6.28**	17.99**	0.10	-0.22	0.95**	0.07**	-98.41**	-27.10**	-11.94**	-4.81**	-0.33**	2.03**	-0.42**	0.21**	1.31**	-9.98**
HUZM-78 (L_6)	-10.94**	-10.90**	-0.56	-0.77**	-0.86**	0.03	45.48**	-15.34**	-1.51	-4.74**	0.01	-0.25**	1.16**	-0.08**	1.24**	-14.08**
HUZM-79 (L_7)	-11.83**	-14.12**	-1.12**	-0.88**	-0.14	-0.04	-293.50**	-60.91**	-24.46**	-7.83**	0.32**	-0.34**	0.14**	-0.06**	-0.41**	14.47**
HUZM-91-1 (L_8)	-6.39**	-10.01**	-1.56**	-1.88**	-0.48**	-0.04	144.49**	18.21**	-10.52**	-6.02**	-0.17*	-0.43**	-0.66**	-0.06**	-0.67**	-11.86**
HUZM-175-2 (L_9)	-4.94**	-10.01**	2.55**	4.01**	1.03**	-0.03	-180.22**	10.60**	-20.91**	-3.97**	-0.26**	-0.83**	0.28**	0.07**	-0.96**	-1.92**
HUZM-210-2 (L_{10})	13.83**	-14.67**	-1.45**	-0.44	-0.55**	-0.12**	-155.87**	-6.70**	-17.75**	3.29**	-0.17*	-0.40**	0.22**	-0.06**	-0.38**	-9.90**
HUZM-211-1 (L_{11})	10.95**	10.88**	0.88**	1.01**	-0.97**	-0.09**	121.99**	47.86**	1.71	1.99**	-0.15*	-0.07	-0.02	-0.11**	-0.71**	-15.79**
HUZM-217 (L_{12})	5.17**	4.22**	1.22**	1.45**	1.20**	0.21**	179.91**	1.51	41.79**	7.82**	0.65**	0.99**	0.08	-0.10**	1.15**	11.80**
HUZM- 221(L_{13})	8.95**	2.88**	-0.79**	-1.33**	-0.95**	0.10**	122.04**	46.44**	29.32**	6.05**	0.56**	0.59**	0.84**	-0.07**	-1.14**	25.20**
HUZM-227-1-1 (L_{14})	-0.94	-7.79**	0.66*	0.90**	-0.32**	-0.07**	62.28**	42.18**	0.75	1.33**	-0.37**	-0.68**	-0.28**	-0.02**	0.21**	30.25**
HUZM-329 (L_{15})	-1.94	-9.23**	-0.79**	-0.55	0.79**	-0.04	-151.29**	34.72**	-7.14**	3.76**	-0.28**	-1.82**	-0.56**	0.01	0.46**	-9.80**
CM-119 (T_1)	6.42**	1.99**	-0.76**	-0.57**	0.05	0.04**	127.25**	22.53**	6.48**	0.70**	0.56**	0.27**	-0.09**	-0.02**	-0.04**	2.39**
HKI-1105 (T_2)	-4.85**	-3.25**	0.66**	0.76**	0.30**	-0.05**	-135.76**	-22.44**	-9.56**	-1.82**	-0.29**	0.01	-0.29**	0.04**	0.06**	-1.30**
HKI-323 (T_3)	-1.56**	1.26**	0.10	-0.19	-0.35**	0.01	8.51**	-0.10	3.08**	1.12**	-0.28**	-0.26**	0.39**	-0.02**	-0.02	-1.09**
SE(g_i)	±1.14	±0.65	±0.29	±0.28	±0.08	±0.03	±1.06	±1.78	±2.48	±0.41	±0.07	±0.05	±0.04	±0.01	±0.03	±0.20
SE(g_j)	±0.51	±0.29	±0.13	±0.13	±0.04	±0.01	±0.47	±0.80	±1.11	±0.18	±0.03	±0.02	±0.02	±0.01	±0.01	±0.09
SEd (g_i-g_k)	±0.72	±0.41	±0.18	±0.18	±0.05	±0.02	±0.67	±1.13	±1.57	±0.26	±0.05	±0.03	±0.03	±0.01	±0.02	±0.13
SEd (g_j-g_l)	±1.61	±0.92	±0.41	±0.40	±0.11	±0.04	±1.50	±2.52	±3.50	±0.58	±0.10	±0.07	±0.06	±0.01	±0.04	±0.28

* and** indicate significance of value at P=0.05 and 0.01, respectively

Table 2: Best five parents selected on the basis of their sca effects

Characters	*Kharif* season		
	Parents on the basis of sca effects	Sca effect	gca status of parents
Plant height(cm)	HUZM-91-1 x HKI-1105	18.30** ± 1.97	Poor x Poor
	HUZM-78 x CM-119	14.25** ± 1.97	Poor x Good
	HUZM-77 x HKI-323	10.67** ± 1.97	Good x Poor
	HUZM-79 x CM-119	10.14** ± 1.97	Poor x Good
	HUZM-55 x HKI-323	10.01** ± 1.97	Poor x Poor
Cob height(cm)	HUZM-79 x HKI-1105	-14.30** ± 1.13	Good x Good
	HUZM-221 x CM-119	-9.55** ± 1.13	Poor x Poor
	HUZM-211-1 x CM-119	-8.22** ± 1.13	Poor x Poor
	HUZM-329 x CM-119	-8.10** ± 1.13	Good x Poor
	HUZM-91-1 x HKI-323	-7.59** ± 1.13	Good x Poor
Days to first picking	HUZM-227-1-1 x CM-119	-2.68** ± 0.50	Poor x Good
	HUZM-79 x HKI-1105	-2.33** ± 0.50	Good x Poor
	HUZM-175-2 x CM-119	-1.57** ± 0.50	Poor x Good
	HUZM-210-2 x HKI-323	-1.44** ± 0.50	Good x Poor
	HUZM-91-1 x HKI-1105	-1.24* ± 0.50	Good x Poor
Days to second picking	HUZM-227-1-1 x CM-119-	-3.87** ± 0.49	Poor x Good
	HUZM-79 x HKI-1105	-3.43** ± 0.49	Good x Poor
	HUZM-175-2 x CM-119	-2.99** ± 0.49	Poor x Good
	HUZM-210-2 x HKI-323	-2.92** ± 0.49	Poor x Poor
	HUZM-91-1 x HKI-1105	-2.10** ± 0.49	Good x Poor
Cob length(cm)	HUZM-227-1-1 x HKI-323	1.48** ± 0.14	Poor x Poor
	HUZM-210-2 x HKI-1105	1.45** ± 0.14	Poor x Good
	HUZM-78 x CM-119	1.32** ± 0.14	Poor x Poor
	HUZM-55 x HKI-323	1.30** ± 0.14	Poor x Poor
	HUZM-221 x HKI-323	1.00** ± 0.14	Poor x Poor
Cob diameter(cm)	HUZM-69 x HKI-323	0.17** ± 0.04	Poor x Poor
	HUZM-78 x HKI-323	0.12** ± 0.04	Poor x Poor
	HUZM-210-2 x HKI-1105	0.11* ± 0.04	Poor x Poor
	HUZM-91-1 x HKI-1105	0.10* ± 0.04	Poor x Poor
	HUZM-221-2 x CM-119	0.10* ± 0.04	Poor x Poor
Cob yield with husk per plot(g)	HUZM-175-2 x HKI-323	305.31** ± 1.83	Poor x Good
	HUZM-221 x HKI-1105	226.24** ± 1.83	Good x Poor
	HUZM-211-1 x HKI-1105	213.64** ± 1.83	Good x Poor
	HUZM-78 x HKI-1105	198.10** ± 1.83	Good x Poor
	HUZM-69 x CM-119	197.94** ± 1.83	Good x Good
Cob yield without husk per plot(g)	HUZM-55 x CM-119	76.33** ± 3.09	Poor x Good
	HUZM-79 x CM-119	57.25** ± 3.09	Poor x Good
	HUZM-329 x HKI-1105	55.17** ± 3.09	Good x Poor
	HUZM-227-1-1 x HKI-1105	54.59** ± 3.09	Good x Poor
	HUZM-210-2 x CM-119	52.33** ± 3.09	Poor x Good
Cob yield with husk per plant(g)	HUZM-221 x CM-119	35.26** ± 4.29	Good x Good
	HUZM-69 x HKI-323	33.04** ± 4.29	Good x Good
	HUZM-79 x CM-119	24.80** ± 4.29	Poor x Good
	HUZM-70-1 x HKI-323	21.56** ± 4.29	Poor x Good
	HUZM-68 x HKI-1105	21.40** ± 4.29	Good x Poor

Table 2 Contd.......

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	HUZM-221 x CM-119	9.41** ± 0.71	Good x Good
	HUZM-227-1-1 x HKI-1105	9.31** ± 0.71	Good x Poor
Cob yield without husk per plant(g)	HUZM-55 x HKI-323	6.44** ± 0.71	Poor x Good
	HUZM-70-1 x HKI-323	5.46** ± 0.71	Poor x Good
	HUZM-68 x HKI-1105	5.26** ± 0.71	Good x Poor
	HUZM-221 x CM-119	1.15** ± 0.12	Good x Good
	HUZM-217 x HKI-323	0.89** ± 0.12	Good x Poor
Number of cobs per plant	HUZM-69 x HKI-323	0.88** ± 0.12	Good x Poor
	HUZM-68 x HKI-1105	0.73** ± 0.12	Poor x Poor
	HUZM-55 x HKI-323	0.45** ± 0.12	Poor x Poor
	HUZM-91-1 x HKI-1105	1.19** ± 0.09	Poor x Poor
	HUZM-78 x CM-119	1.13** ± 0.09	Poor x Good
Green fodder yield per plot(kg)	HUZM-79 x CM-119	1.02** ± 0.09	Poor x Good
	HUZM-69 x HKI-323	0.97** ± 0.09	Good x Poor
	HUZM-217 x CM-119	0.89** ± 0.09	Good x Good
	HUZM-227-1-1 x HKI-323	0.62** ± 0.08	Poor x Good
	HUZM-329x HKI-323	0.61** ± 0.08	Poor x Good
Total soluble sugars(g/100g)	HUZM-91-1 x HKI-323	0.53** ± 0.08	Poor x Good
	HUZM-210-2 x CM-119	0.50** ± 0.08	Good x Poor
	HUZM-221 x CM-119	0.48** ± 0.08	Good x Poor
	HUZM-78 x HKI-1105	0.06** ± 0.01	Poor x Good
	HUZM-211-1 x HKI-1105	0.05** ± 0.01	Poor x Good
Ash content(g/100g)	HUZM-55 x HKI-1105	0.04** ± 0.01	Good x Good
	HUZM-210-2 x HKI-1105	0.04** ± 0.01	Poor x Good
	HUZM-55 x HKI-323	0.03* ± 0.01	Good x Poor
	HUZM-221 x HKI-1105	0.99** ± 0.05	Poor x Poor
	HUZM-211-1 x HKI-323	0.64** ± 0.05	Poor x Poor
Protein content(g/100g)	HUZM-55 x CM-119	0.62** ± 0.05	Good x Poor
	HUZM-70-1 x HKI-323	0.62** ± 0.05	Poor x Poor
	HUZM-211-1 x CM-119	0.58** ± 0.05	Poor x Poor
	HUZM-175-2 x HKI-1105	6.79** ± 0.35	Poor x Poor
	HUZM-175-2 x CM-119	5.87** ± 0.35	Poor x Good
Phosphorus content(mg/100g)	HUZM-55 x HKI-323	3.67** ± 0.35	Poor x Poor
	HUZM-91-1 x HKI-323	2.52** ± 0.35	Poor x Poor
	HUZM-55 x HKI-1105	2.11** ± 0.35	Poor x Poor

quality traits line, HUZM-55 was found to be suitable parent in hybrid breeding. The promising hybrids for early maturity, yield and quality traits are ranked on the basis of their sca effects and presented in Table 2. Crosses, HUZM-221x CM-119, HUZM-55x HKI-323 were found to be good for yield and quality traits and HUZM-69 x HKI-323, HUZM-79 x CM-119 for yield traits, HUZM-91-1 x HKI-1105 for early maturity, good plant height and most of the yield attributing traits. Most of the crosses with high sca effects involved parents with poor x poor and poor x good general combiners followed by good x poor. The crosses with the parents having poor x poor general combining ability indicate the importance of non-additive gene effects for these crosses. The other crosses with poor x good and good x poor general combining ability, obviously due to concentration of opposing alleles in the parents, which in F_1 showed high allelic interaction. Transgressive segregants can be obtained in such cases, if the additive genetic system present in good combiner and the complementary way to optimize desirable plant attributes.

In some cases crosses with poor specific combining ability involved good x good parents, this could be due to accumulation of similar analogous alleles in them or due to eco-geographical similarities among the parental material. Thus the selection of such crosses having high sca effect and have at least one parent with high gca effects must be done for further breeding programme.

The cross combinations HUZM-221 x CM-119, HUZM-217 x CM-119, HUZM-217 x HKI-1105, HUZM-91-1 x HKI-1105 may be utilized in hybrid breeding for better yield and early maturity or efficiently in population improvement programme.

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