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COMBINING ABILITY ANALYSIS FOR YIELD COMPONENTS OF PEARLMILLET IN DIFFERENT ENVIRONMENTS

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ABSTRACT

Genetics of yield components was investigated from combining ability in line X tester design under different environmental conditions in Pearlmillet. The variance due to females was significant for number of tillers, number of grains and single plant yield. The males were also significantly different in respect to panicle length and grain yield. Both additive and non-additive gene effects were important for the expression of yield characters. 732A and PT1650 were best general combiners for grain yield. Best cross combinations for various components were selected and their use in breeding programmes has been advocated.

KEY WORDS : Combining Ability, Pearl Millet, Yield Components, Environments

For maximising the efficiency of crop breeding plants over time and space and for evolving superior genotypes, importance of information on gene effects controlling various characters is essential. The present investigation was undertaken to determine the mechanism of gene action involved in the inheritance of five important yield components of pearlmillet *Pennisetum glaucum* (L) R.Br.).

MATERIALS AND METHODS

Five male sterile line (732A,861A, ICMA 1 862 A and 302 A) were crossed with three pollinators PT8 11/9, PT 1650 and PT2086) in a line x tester mating design to produce 15 F_1 'S. These F_1 'S were grown in randomised block design with two replications during three seasons *viz., kharif, rabi* and summer 1991 designated as environments E_1, E_2 and E_3 respectively. Each F_1 was grown in one row of 4m length. The rows were spaced at 45 cm and distance between plants were kept at 15 cm. All the recommended cultural practices were followed before and after sowing. Five competitive plants were used for recording of data for number of productive tillers, panicle length, number of grains per cm length of panicle, 100 grain weight and single plant yield. Combining

Table 1. Analysis of variance for combining ability over environments.

Source	df	Mean squares				
		Number of tillers	Panicle length	Number of grains	100 grains weight	Grain yield
Females	4	1.88**	4.28	4536.08**	0.06	99.86**
Males	2	0.11	20.21*	67.77	0.01	30.21*
Females x Males	8	0.22	9.90	3518.03**	0.06	41.41**
Females x Environments	8	0.80	17.90*	1022.53**	0.14**	55.64**
Males x Environments	4	0.10	9.26	1582.75**	0.02	5.76
Females x Male x Environments	16	0.21	9.69	2657.05**	0.05	40.37**
Pooled error	42	0.24	7.10	231.27	0.03	9.26
Components of variance						
σGCA (Females)		0.06	-0.77	147.36	-0.01	2.40
σGCA (Males)		0.01	0.36	-79.20	0.01	0.78
σGCA (Parents)		0.02	-0.06	5.76	-0.01	1.39
σSCA		0.05	-0.02	442.02	0.01	3.29
σGCA : σSCA (Females)		1.2:1.0	38.5:1.0	6.39:1.0	1.0:1.0	0.61:1.0
σGCA : σSCA (Males)		0.2:1.0	18.0:0	0.18:1.0	1.0:1.0	0.20:1.0
σGCA : σSCA (Parents)		0.4:1.0	3.0:1.0	0.01:1.0	1.0:1.0	0.35:1.0

* Significant at P = 0.05 ** Significant at P = 0.01

Table 2. Estimates of general combining ability effects for different characters.

Female Parents (Lines)	Number of tillers	Panicle length	Number of grains	100 grain weight	Grain yield
732A	0.40**	-0.17	10.10**	0.03	3.27**
861A	0.19*	-0.57	-21.62**	-0.06	0.93
ICMA1	0.04	-0.28	-8.07**	0.02	-2.45**
862A	-0.22**	0.55	19.32**	0.07	-2.12**
302A	-0.41**	0.47	0.27	-0.06	0.38
S.Em ±	0.08	0.45	2.59	0.03	0.52
Male Parents (Testers)					
PT 811/9	0.02	0.46	1.22	0.01	0.10
PT 1650	0.07	-0.95*	0.46	0.00	0.95*
PT 2086	0.05	0.49	-1.68	0.00	-1.05**
S.Em ±	0.06	0.32	1.83	0.02	0.37

* Significant at P = 0.05 ** Significant at P = 0.01

Table 3. Crosses showing significant sca effects for different characters.

Grain yield	100 grain weight	Panicle length	Number of grains	Number of tillers
861A x PT 811/9	861A x PT 811/9	732A x PT 1650	732A x PT 811/9	732A x PT 811/9
$ICMA_1$ x PT 811/9	862A x PT 1650		861A x PT 811/9	
302A x PT 811/9	862A x PT 2086		$ICMA_1$ x PT 811/9	
$ICMA_1$ x PT 1650	302A x PT 2086		862A x PT 811/9	
862A x PT 1650			302A x PT 811/9	
862A x PT 2086			861A x PT 1650	
302A x PT 2086			862A x PT 1650	
			302A x PT 1650	
			732A x PT 2086	
			$ICMA_1$ x PT 2086	

ability analysis was done following Kempthrone (1957).

RESULTS AND DISCUSSION

The analysis of variance for various characters indicated that the variances due to females were significant for number of tillers, number of grains and single plant yield showed greater variation among the female parents selected for the study. The males were also significantly different from each other in respect to panicle length and grain yield. The differences between females X males were significant for number of grains and grain yield. The variance due to interaction between females X males was significant showing their high specific combining ability effects for these characters (Table 1). The differences between females X environments were significant for all the characters. The variance due to interaction between males X environments was significant for number of grains and Females X males X environments interaction for number of grains and grain yield.

The GCA variances (females) were higher in magnitude than the SCA variance for all the characters except for 100 grain weight and grain yield, indicating the preponderence of additive gene action. While considering the performance of male and female parents, the SCA variances for all the characters except for panicle length and 100 grain weight were greater than GCA variance revealed the importance of non-additive gene action. For the character 100 grain weight both the variances were equal indicated the prevalance of both additive and non-additive gene action.

The estimates of gca effects of parents (Table 2) reveal that among the parents, 732A and PT 1650 were best general combiner for grain yield. Besides 862 A and 732 A were also high combiners for number of grains, $ICMA_1$ showed negative gca effects for panicle length, number of grains and grain yield. In general the [illegible]

grain yield in 732A also appeared to show high combining ability effects in one or other characters such as number of tillers. number of grains.

The estimates of sea effects presented in Table 3 for those crosses only which showed significant effects. A perusal of this table revealed that only seven crosses exhibited high sea effects for grain yield. The number of crosses showing high sea effects were ten for number of grains, four for 100 grain weight and one each for panicle length and number of tillers.

The predominance of non-additive gene action for grain yield was evident from the greater value of SCA variance than GCA variance (0.35:1). This situation was reported earlier by Mithila (1987), Vijayalakshmi (1990) and Kandasamy (1992).

The present investigation has helped in identification of parents of pearl millet for exploitation through heterosis breeding.

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HETEROSIS FOR GRAIN YIELD IN PEARL MILLET

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ABSTRACT

Pronounced heterosis in grain yield with different degree and magnitude was expressed in various individual crosses under varied environments. Environment-specific as well as widely adaptable hybrids and parents were identified. The hybrid 732 A X PT 1650 was versatile for providing heterotic hybrid in individual as well as a cross the environments. Differential behaviour of heterosis under varying environments and breeding value are discussed.

KEY WORDS : Heterosis, Pearl millet, Grain Yield

Pearl millet *(Pennisetum glaucum)* is the most important food and fodder crop of dry land agriculture in India. In order to realise substantial production and improvement in this allogamous crop, studies on heterosis deserve special consideration. The scope for exploitation of hybrid vigour depends on the direction and magnitude of heterosis in the crosses of newly developed parents. The present report describes the extent and nature of heterosis in hybrids of such parents for grain yield under three environments.

MATERIALS AND METHODS

The research material comprised five male sterile lines (732 A, 861A, ICMA1, 862A, 302A) used as females, 3 inbred lines used as males and their 15 F_1 hybrids. These 23 entries were sown in randomised block design with two replications. The experimental material was sown in three environments with a spacing of 45 cm along with hybrid check. X5.

Each entry was sown in a single row plot (4m) The sowing was done by dibbling the seeds at 15 cm. Nonexperimental rows were planted all around the experiment to eliminate the border effects. All agronomic operations were carried out as per norms. After sun drying, the ears of five random plants were hand threshed and grain yield per plant recorded.

The degree of heterosis in F_1 over midparent, female parent, male parent and standard heterosis were calculated for individual environment as well as over the three environments (pooled) and expressed in per cent (Turner, 1953).