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COMBINING ABILITY OF CERTAIN POPULATIONS AND LANDRACES OF PEARL MILLET, PENNISETUM AMERICANUM (L.) LEEKE

ABSTRACT

A diallel cross study involving 12 parental populations of pearl millet originating from India and Africa, indicated predominantly additive gene action for various traits studied. The significant specific combining ability variances for head number and grain yield, indicated the importance of non-additive genes for these characters. The maternal effect was high for the head length. Examination of parents with high gca and high sca crosses revealed that most productive combination of crosses involved the unrelated parents from the diverse origin.

The choice of parental genotypes is critical in the crossing programme to combine their desirable attributes (Murty et al, 1967). This problem is more complex when the breeders have to chose parents from a large collection of germplasm accessions an populations including the open pollinated landraces. To examine these aspects, the population diallel cross study was conducted and the results are summarised in this paper.

MATERIALS AND METHODS

The origin of the populations and the landraces used in the present study is described below :

1. ICMS 7845 : a synthetic developed from ICRISAT center, India,
2. ITMV' 8004 : a variety developed by ICRISAT/INRAN Niger,
3. Comp. 6A : a composite developed from Serere, Uganda,
4. TGBS : a short headed, early maturing population derived from Log bulk,
5. Boudouma : a short headed, early maturing landrace from Niger,
6. Ankutess 1 : a thick headed landrace from north-eastern Niger,
7. Ankutess 2 : similar to Ankutess 1, but with shorter heads,
8. Souna Mali : thick and short headed popular landrace variety from Mali,
9. Ex-Bornu : a variety developed from landraces from Bornu state of Nigeria,
10. Nigerian Composite : a composite developed in Nigeria from several landraces,
11. CIVT : a composite developed in Niger involving inter-varietal crosses among the four land races and
12. Guereguera : a landrace from central Niger.

A complete diallel set of crosses were made during off-season (January-April, 1982) with irrigation. The care was taken to sample intra population variability while making crosses by using bulk pollen and pollinating several heads.

The diallel progenies consisting of parents, F_1 and reciprocal F_1, were evaluated during 1982 rainy season at the Centre National de Recherches Agronomique du Niger (CNRA), Maradi in the Republique of Niger, West Africa. The experiment was layedout in a randomised block design with two replications. The plot size was of four rows of 5m each. As per the local recommendations, the seeds were sown in hills at the distance of 1m x 1m. The three plants per hill were maintained after thinning three week old seedlings. The trial was conducted in rainfed condition with the application of 25 kg P_2P_5 and 30 kg N per hectare. Observations were recorded on : days to 50% flowering, plant height, head length, head numbers per plot, straw, head and grain yield in g/10m^2. The data thus recorded was subjected to combining ability analysis following Griffing's (1956) model 1, method 1.

RESULTS AND DISCUSSION

The variance due to general combining ability (gca) was found to be significant for all the characters studied (Table 1). This indicated predominance of additive genes for these characters and the possibilities of improvement of parental populations performance through selections. As each of the parental populations included in the present study were the open pollinated varieties and heterogenious, intra population improvement following an appropriate selection method should improve the performance of these populations landraces.

The variance due to specific combining ability (sca) was highly significant for head number and grain yield. Exploitation of hybrid vigour utilising the inbreds derived from the complementary populations may result in to high level of performance for these characters (Bains et al, 1967; Nanda and Gupta, 1967). The reciprocal effect was sig-

TABLE 1 : Analysis of variance and effects for combing ability.

Source	d.f.	Mean sum of squares						
		Days to 50% flow ering	Plant height x 10^2	Head length x 10	Head number x 10^2	Straw yield x 10^5	Head yield x 10^3	Grain yield x 10^4
gca	11	208.2**	26.2**	48.6**	7.35**	197.1**	93.4**	38.8**
sca	66	6.0*	1.7	2.5	2.06**	22.1	29.3	15.5**
Reciprocal	66	6.5**	1.5	4.8	1.61	19.9	23.1	9.7
Maternal	11	6.3	2.2	18.7**	1.38	32.0	11.7	6.1
Mat.	143	3.9	1.8	4.6	1.08	23.3	20.4	9.7
Non-mat	55	6.5**	1.3	2.0	1.65	1.7	25.4	10.4
		Coefficients of determination (R)						
Parents per se and gca		.94	.95	.77	.72	.71	.77	.53
Crosses per se and sca		.40	.54	.52	.79	.65	.81	.84

*, ** indicates significance at p=0.05 and p=0.01, respectively.

nificant only for days to flowering which appeared to be due to non-maternal influence. The variance due to maternal influence was highly significant for head length, indicating that the head length of the hybrids are determined by the female parent. The examination of the coefficient of determination (R) between the performance of parents per se and their gca effects revealed high value for all the characters studied except for the grain yield, indicating the complex nature of inheritance of grain yield. The coefficients of determination between the mean performance of cross per se and their sca, were high for head length, straw, head and grain yields. The higher R's for these characters indicated better expressivity of these characters at the level of hybrids as compared to parental level. Earlier results on this aspect in pearl millet are not available.

The best three general combining parents and three best specific combining crosses for various character have been presented in Table 2. ICMS 7845 appeared to be the best parent with regards to earliness, reduced plant height and head number per unit area. Composite 6A and TGBS also appeared promising for these characters. It was interesting to note that those parents which were the best general general combiners were the most common in crosses with best sca effects. The populations CIVT, Ankoutess 1, Ankoutess 2, Guerguera, Souna Mali and ITMV 8004 were the best parents for head length, straw, head and grain yields. It was interesting to observe further that these parents which originated in west Africa, in crosses with populations like ICMS 7845 developed in India and Composite 6A developed from east Africa, exhibited high sca for various characters. This moight have been due to complementary nature of the genes controlling these characters in the parental populations which originated from the diverse regions such as India, east and the west Africa. The most productive crosses involved the parents from the diverse geographic origin. Earlier results (Basavaraju et al, 1980; Bains et al 1967; Nanda and Gupta, 1967; Reddy and Arunachalam, 1980; Mukherji et al, 1981) were in agreement to these obtained through the present investigation involving populations representing much greater variability.

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TABLE 2 : Better gca parents and the best sca crosses.

	Days to flowering	Plant height	Head length	Head number	Straw yield	Head yield	Grain yield
Best 3 gca parents	ICMS 7845 Comp.6A Boudouma	ICMS 7845 Comp.6A TGBS	Guerguera ITMV 8004 CIVT	ICMS 7845 Boudouma TGBS	Ankutess 1 Guerguera CIVT	CIVT Guerguera ITMV 8004	CIVT Guerguera Souna Mali
Best sca crosses	(ICMS 7845 xComp.6A)	(ICMS 7845 xTGBS)	(ICMS 7845 xSouna Mali)	(ICMS 7845 xBoudouma)	TGBS x Ankutess 1	(Comp.6A x Ankutess 2)	(Comp.6A x Ankutess 2)
	(ITMV 8004 xSouna Mali)	(TGBS x Boudoma)	(TGBS x Gureguera)	(Comp.6A x Boudouma)	(ICMS 7845 x S. Mali)	(TGBS x Ankutess 1)	(Nigerian C. x Guerguera)
	(ICMS 7845 x Boudouma)	(Comp.6A x Ankutess 1)	(Ankutess 2 x CIVT)	(Comp.6A x CIVT)	(Ankutess 2 xEx-Bornu)	(ITMV 8004 xComp.6a)	(ICMS 7845 x CIVT)

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YELLOWING SYNDROME IN F_4 GENERATION OF RICE (Oryza sativa L.)

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ABSTRACT

An unusual epidemic form of leaf yellowing associated with stunted growth in rice varieties was observed in some parts of Tamil Nadu during 1984-85. An experiment was carried out to know whether varietal factors has got any influence on yellowing syndrome or not. The incidence of yellowing syndrome was less in IR 50, Co 41 and in the F_4 cross derivaties involving IR 50 and CO 41 as parents. Since the syndrome being genetically controlled developing resistant lines for this stress condition could be possible through recombination breeding utilizing IR 50 and CO 41 rice varieties.

Rice crop in various districts of Tamil Nadu was affected by varying degrees of a strange yellowing disease and affected the yield considerably during 1984-85. The leaves turned to palegreen and then to yellow and reduced tillering and plant height (Anon, 1985 a). More than one factor either singly or incombination were reported to be the cause for the sudden occurrence of the wide spread yellowing (Jayaraj and Subramanian, 1985). The present study was therefore undertaken to investigate the influence of rice genotypes on yellowing syndrome and the results discussed.

MATERIALS AND METHODS

The investigation was carried out at the wetland Farm, Agricultural College and Research Institute, Madurai. F_4 generations involving seven intervarietal cross combinations were formed the materials for this study. Out of twenty five F_3 families studied in each cross combination, six families were selected in each group of high, medium and low family mean yield to serve as bulk selections. The seeds from the entire family row from all the replications were bulked in each group of selection and random sample of seeds was drawn for

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