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PHENOTYPIC STABILITY IN RICE

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ABSTRACT

A field study was conducted for four metric traits with 15 genotypes of rice in four significantly different environments *viz kar* 1989, *kar* 1991, *Pishanam* 1991 and advance *kar* 1992. The genotype ACK 85 which is a natural mutant from IR 50, could be recommended for favourable environments in view of its above average stability for plant height, productive tillers and grain yield.

KEY WORDS : Rice, Phenotypic Stability

Phenotypically stable varieties are usually sought for commercial production of crop plants. In any breeding programme, it is necessary to screen and identify phenotypically stable genotypes which could perform more or less uniform under different environmental conditions with high mean performance. Rice is grown under widely different edaphic and environmental conditions in Tamil Nadu and it is known to exhibit a high degree of genotype- environment interaction. There is, therefore, a need to develop varieties with stable performance over a wide range of environmental conditions. The present study was taken up to evaluate promising breeding lines and varieties of rice in four different environments to identify high yielding and stable genotypes.

MATERIALS AND METHODS

A total of ten promising breeding lines and five cultivated varieties of rice was raised in four seasons *viz., kar* 1989, *kar* 1991, *pishanam* 1991 and advance *kar* 1992 at the Agricultural College and Research Institute, Killikulam under randomised block design with three replications. The plot size was 5 x 4 m with the spacing of 15 x 10 cm. Stability parameters were worked out using Ebehart and Russell (1966) and Katiyar (1988) models with the means of four metric traits *viz.*, plant height, days to maturity, productive tillers and grain yield.

RESULTS AND DISCUSSION

Pooled analysis of variance revealed the existence of significant genetic differences among the genotypes for all the four metric traits. The environment appeared to be significantly different from one another as the mean square component due to environment was highly significant (Table 1). The genotypes interacted significantly with the environment. The results were in confirmity with the earlier reports of Ganesh and Soundara Pandian (1988).

Table 1. Analysis of variance for stability pooled over four environments

Source	Plant height	Productive tillers	Days to maturity	Grain yield
Genotype (G)	1219.7**	11.6**	48.6**	16.4**
Environment (E)	55.0**	6.7*	361.5**	83.1**
G x E	58.3**	2.3**	16.6**	2.4**
E + (GxE)	58.1	2.6	39.6**	7.8**
E linear	165.3	20.1**	1084.4**	249.3**
G x E (linear)	47.7	1.7	13.0	3.6*
Pooled deviation	59.4	2.4	17.1	1.8
Pooled error	21.9	1.0	0.2	0.5

* Significant at 5 percent level, ** Significant at 1 percent level.

Finlay and Wilkinson (1963) considered linear regression slope as a measure of stability. Eberhart and Russel (1966) emphasised the need of considering both the linear (b) and non-linear ($\overline{S}^2d$) components of genotype environmental interaction in judging the stability of a genotype. Later, Breese (1969) and Paroda and Hayes(1981) reported that linear regression could simply be regarded as a measure of response of a particular genotype whereas the deviation around the regression line is considered as a measure of stability. Hence, a variety is said to be stable if it has high mean, regression co-efficient equal or close to one (b =1) with low deviation ($S^{-2}d$) from the regression co-efficient (Maurya and Singh, 1977).

In the present study, based on Katiyar's (1988) classification the genotypes ACK 31 and ACK 48 possessed average stability for days to maturity and productive tillers as revealed by non-significant 'b' and $\overline{S}^2d$ values. The varieties *viz.*, ADT 36, ASD 17 and TKM 9 were with average stable but with moderate mean performance. The performance of the above said varieties could be easily predictable inspite of the fluctuating environments. The significant 'b' value and non-significant $\overline{S}^2d$values reflected the above average stability. The genotype ACK 85 which is a natural mutant from IR 50, could be recommended for favourable

Table 2. Stability parameters for four traits of rice in four environments

Culture/ variety	Plant height (cm)			Days to maturity			Productive tillers (No)			Grain yield (g)		
	$\overline{X}$	b	$\overline{S}^2d$	$\overline{X}$	b	$\overline{S}^2d$	$\overline{X}$	b	$\overline{S}^2d$	$\overline{X}$	b	$\overline{S}^2d$
ACK 30	69.4	1.8*	-2.1	107.9	1.3**	28.1**	13.8	0.1	10.1**	11.0	1.6*	1.2
ACK 31	126.0	1.0**	-10.9	111.3	0.4	1.1	10.8	2.0	1.9	4.5	0.8**	2.9**
ACK 37	110.7	5.7	520.3**	109.3	0.7**	0.2	10.7	2.4	0.1	5.9	0.4	4.8**
ACK 43	70.5	-1.1	-16.2	114.5	1.0**	3.0	11.5	0.5	0.1	11.4	2.0	3.2**
ACK 45	71.9	-0.1	-21.0	113.9	1.8*	28.3**	11.6	0.2	-0.9	12.8	1.5*	1.3
ACK 46	70.5	0.1	-14.6	113.11	1.2**	17.0**	10.3	1.4*	2.5*	9.3	0.9**	0.6
ACK 47	68.5	0.2	-14.5	110.5	0.8**	14.2**	11.9	-0.1	0.5	8.8	1.0**	-0.2
ACK 48	62.8	0.8**	4.5	111.6	0.6	3.5	11.4	-0.1	-0.7	8.3	1.3*	1.2
ACK 49	69.3	0.1	-5.8	117.2	1.0**	19.8**	13.4	3.4	1.3	8.4	0.7**	2.0**
ACK 85	72.1	1.4*	-21.5	115.4	1.2**	12.1**	10.3	0.9**	1.4	9.1	0.8**	0.7
ADT 36	86.2	-3.6	157.0**	114.2	0.5	4.1	8.6	0.1	2.5*	8.0	0.3	-0.2
ASD 16	85.1	2.1	-16.4	113.1	0.4	5.0	7.2	0.9**	-0.6	9.4	1.0**	0.2
ASD 17	88.5	3.3	33.3*	103.2	1.1**	58.5**	10.0	1.0**	2.4*	8.3	0.6	0.5
IR 50	69.6	1.2**	-16.8	114.5	1.7*	18.2**	10.5	2.3	0.2	9.5	0.9**	0.8
TKM 9	79.0	1.6*	-12.6	110.1	0.8**	39.3**	9.0	-0.4	0.1	7.9	0.5	-0.1
Overall mean	80.0			112.0			10.7			8.8		

* Significant at 5 per cent level
** Significant at 1 per cent level

b regression coefficient
$\overline{S}^2d$ deviation from regression co-efficient

Table 3. Genotypes possessing stable performance in rice cultivars for the selected traits

Character	Average stability b=NS, $\overline{S}^2d$=NS	Above average stability b=S, $\overline{S}^2d$=NS
Plant height	ACK 43, ACK 45 ACK 46, ACK 47 ACK 49 and ASD 16	ACK 30, ACK 31, ACK 48, ACK 85 IR 50 and TKM 9
Days to maturity	ACK 31 and ACK 48	ACK 37 and ACK 43
Productive tillers	ACK 31, ACK 43, ACK 45, ACK 47, ACK 48 and ACK 49	ACK 85 and ASD 16
Grain yield	ADT 36, ASD 17 and TKM 9	ACK 30, ACK 45, ACK 46, ACK 85, ASD 16 and IR 50

S : Significant NS : Non-significant
b : regression coefficient $\overline{S}^2d$: deviation from regression coefficient

environments in view of its above average stability for plant height, productive tillers and grain yield (Table 2,3)

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INTERCROPPING PEARL MILLET WITH PIGEONPEA UNDER RAINFED CONDITION

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ABSTRACT

Field experiments conducted during *kharif* seasons of 1986, 1987 and 1988 showed that intercropping of pearl millet and pigeonpea was better than raising pure crops as indicased by higher LER. It was higher with 1:1 ratio of pearl millet and pigeonpea. But the net return was the highest with pure crop of pigeonpea. Among the intercropping system, the net return was the highest with 1:2 ratio with coir pith and was followed by 1:3 ratio without coir pith. The ratio of 1:2 can be recommended considering both the LER and net return.

In India mixed cropping and intercropping are age old practices (Chowdhury, 1979). Crop mixtures or intercrops have several advantages such as risk distribution, better utilisation of labour, resources and natural endowments, better quality product and higher productivity and income. In Tamil Nadu, mixed cropping of sorghum and pigeonpea is common. But reduction in yield of pigeonpea due to intercropping of sorghum was reported (Saraf *et al.*, 1972). But several trials under All India Co- ordinated Research Project for Dryland Agriculture have shown that intercropping of pearl millet and pigeonpea had very high productivity and high return apart form giving staple food of millet and protein source (Chetty, 1983). Hence the present study was made to find out suitable intercropping system of pearl millet and pigeonpea for Tiruchirapalli region of Tamil Nadu.

MATERIAL AND METHODS

Field experiments were conducted at the Soil Salinity Research Centre, Tamil Nadu Agricultural University, Tiruchirapalli, during *kharif* of 1986, 1987 and 1988 under rainfed condition. The rainfall received during the cropping season are given in Table 1. The soil type was sandy loam with a pH of 8.2 andEc 0.16 dSm^{-1}. Available N status was low and that of P and K were medium.

Pearl millet X5, a hybrid and pigeonpea Co 3, a short duration variety, were the test crops in 1986. Pearl millet Co6, and pigeonpea SA 1, a long duration variety, were the test crops in 1987 and 1988. Pearl millet and pigeonpea, were grown as pure and mixed stands with different ratios such as 1:1, 1:2, 2:1, 1:3 and 3:1. These treatments were tried with and without applications of coir dust 5 t ha^{-1}.

The experiment was conducted in randomised block design with three replications. A manurial schedule of 45 kg N, 22.5 kg P205 and 22.5 kg K20 were applied uniformly to all treatments splitting N alone into two. For comparison of treatments, landequivalent ratio (LER) was worked out based