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PHENOTYPIC STABILITY FOR GRAIN YIELD AND ITS COMPONENTS IN RAINFED AUTUMN RICE (*ORYZA SATIVA*)

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ABSTRACT

Thirteen autumn rice genotypes were evaluated in three environments under rainfed and direct seeded conditions. Both linear and nonlinear components of G x E interaction were significant for productive tillers/m^2 and grains per panicle, while only linear component was significant for grain yield. Under medium yielding environment suitable genotypes were China, Tulashi, Annada and Culture 1 for grain yield; IET 10898, IET 10895, Tulashi, Annada and CR 635-49 for productive tillers/m^2, and China and Annada for grains per panicle. Rangadoria, a local genotype, was suitable for grain yield under low yielding environment.

Key words: Autumn rice, grain yield, productive tillers, grains per panicle, stability.

Any genotype possessing considerably high yield potential coupled with stable performance in different environments has great value in plant breeding programme. Autumn rice (*Oryza sativa* L.), an important seasonal class of rice, is mostly grown under direct seeded and rainfed conditions in Assam. In general, cultivars of this crop experience high fluctuations of climate in Assam, for example, heavy monsoon rainfall to intermittent drought resulting in low yield [1, 2]. In this context, a widely adaptable variety with stabilised yield will be highly appreciated. Therefore, an attempt was made to identify promising genotype with stable performance of grain yield and its components under rainfed conditions.

MATERIALS AND METHODS

Thirteen promising medium (90–116 days) rice genotypes were grown in randomized block design with three replications during rainy seasons (kharif) of 1990, 1991 and 1992

under direct seeded and rainfed conditions. Each plot consisted of 12 rows of 5.0 m length, spaced 20.0 cm apart. Fertilizer dose @ 40 : 20 : 20 kg N : P_2O_5 : K_2O per ha was applied and normal package of practices were followed. Data were recorded on three yield attributes. For computation of stability parameters, pooled analysis over environments was carried out following the regression approach of Eberhart and Russell [3].

RESULTS AND DISCUSSION

Pooled analysis of variance (Table 1) indicated significant differences among varieties for all the characters under study, revealing the presence of sufficient variability in the genetic materials. Significant mean squares due to environment + genotype x environment interaction showed differential response of genotypes with respect to environments. Both linear and nonlinear components of G x E interactions were significant for productive tillers/m^2 and grains per panicle, indicating that the genotypes responded linearly to environmental changes in respect of these characters. In the case of grain yield, only the linear component was significant, suggesting that its performance across the environments can be predicted more precisely. These results were in agreement with previous observations in rice [4–7].

Table 1. Pooled analysis (mean squares) of variances for grain yield and its components in autumn rice

Sources	d.f.	Grain yield	Productive tillers/m^2	Grains per panicle
Genotypes (G)	12	62.6**	798.3**	379.6**
Environments (E) + G x E	26	153.9**	3518.1**	455.5**
Env. (linear)	1	3409.1**	78678.3**	7897.2**
G x E (linear)	12	31.3**	523.6*	168.2**
Pooled deviation	13	16.6	500.7*	148.3**
Vanaprobha	1	3.1	88.9	87.8
Annada	1	0.0	16.2	55.3
CR 635-49	1	19.9	23.1	0.0
Prasanna	1	16.6	1343.7*	380.8*
Srinivas	1	12.5	1755.7**	146.2
Culture-1	1	0.0	200.9	96.1
Tulashi	1	2.9	131.3	7.6
IET 10895	1	1.0	359.4	64.3
IET 10896	1	54.0*	309.5	357.8*
IET 10898	1	11.3	266.2	32.7
TTB 4/7	1	70.3*	1845.7**	82.0
China	1	23.0	72.6	120.6
Rangadoria	1	0.7	95.9	495.9**
Pooled error	78	11.6	251.6	60.8

*P = 0.05; **P = 0.01.

Estimates of mean performance ($\bar{X}$), regression coefficient (b_i) and deviation from regression (S^2_{di}) of thirteen varieties for grain yield, productive tillers/m^2, and grains per panicle are presented in Table 2. Simultaneous consideration of the three parameters

Table 2. Stability parameters of grain yield and its components in autumn rice

Genotype	Grain yield (q/ha)			Productive tillers/m^2			Grains per panicle		
	$\bar{X}$	b_i	S^2_{di}	$\bar{X}$	b_i	S^2_{di}	$\bar{X}$	b_i	S^2_{di}
Vanaprobha	25.4	1.20	- 8.6	243.4	1.26	- 162.7	76.2	1.31	27.0
Annada	33.8	1.21	- 11.6	292.0	0.63	- 235.5	93.8	0.73	- 5.5
CR 635-49	26.7	1.02	8.2	287.5	1.08	- 228.6	63.8	0.58	- 60.8
Prasanna	25.7	0.97	4.9	297.1	1.32	1092.1*	71.4	0.75	320.0*
Srinivas	20.8	0.95	1.0	281.1	0.90	1504.1**	64.6	0.28	85.4
Culture-1	28.1	1.14	- 11.6	283.0	1.63*	- 50.7	73.6	0.96	35.3
Tulashi	34.2	1.22	- 8.8	293.6	0.90	- 120.4	77.9	0.69	53.2
IET 10895	27.9	0.68	- 10.7	295.3	1.10	107.8	69.8	1.24	3.5
IET 10896	21.6	0.68	42.4*	279.6	0.95	57.9	71.3	1.36	297.0*
IET 10898	27.9	0.75	- 0.3	298.5	0.86	14.6	77.0	1.26	- 28.1
TTB 4/7	25.8	1.57*	58.7*	298.6	0.90	1594.1**	73.1	2.01	21.2
China	36.0	1.36	11.4	278.4	0.99	- 179.0	97.3	1.62	59.8
Rangadoria	28.9	0.25*	- 10.9	259.7	0.48	- 155.7	95.9	0.21	435.1**
Mean	27.9	1.00		283.7	1.00		77.4	1.00	
SE_m	2.9			15.8			8.6		
$SE_{(b)}$		0.25			0.29			0.49	
$CD_{0.05}$	8.1	0.54		44.5	0.63		24.2	NS	

*P = 0.05, **P = 0.01.

revealed that, the genotype Annada had high mean performances with unit regression and least deviation from regression for all the characters studied. Similar results were observed in genotype China for grain yield and grains per panicle, Tulashi for grain yield and productive tillers/m^2, Culture-1 for grain yield only, and IET 10895, IET 10898 and CR 635-49 for productive tillers/m^2.

However, in plant breeding, it is desirable to identify genotypes suited for different environmental conditions. Therefore, in the present investigation, a classification was tried based on the concepts of both Finlay and Wilkinson [8] and Eberhart and Russell [3]. The genotypes with high mean performance and deviation from regression approaching zero ($S^2_{di} = 0$), are categorised under medium yielding ($b = 1$) and low yielding ($b < 1$)

environments. Table 3 shows that, amongst the genotypes found suitable for medium yielding environment, Annada was superior due to its suitability for all the characters studied. Likewise, Tulashi was suitable for grain yield and productive tillers/m^2, while China was for grain yield and grains per panicle. Similarly, Culture-1 was suitable only for grain yield under medium yielding environment. On the other hand, the local genotype Rangadoria proved better in lowyielding environment for grain yield only.

Table 3. Classification of genotypes with higher mean performance and least deviation from regression

Environment	Grain yield	Productive tillers/m^2	Grains per panicle
Medium yielding, b=1	China	IET 10898	China
	Tulashi	IET 10895	Annada*
	Annada*	Tulashi	
	Culture-1	Annada* CR 635-49	
Low yielding, b<1	Rangadoria	Nil	Nil

*Annada is the most promising variety with maximum stability and high performance for all three economic traits.

Based on the present investigation, the genotypes China, Tulashi and Annada were found suitable in respect of grain yield in medium environmental conditions; and thus, they can be used in future breeding programme for further improvement.

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