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Periodic Research

Stability analysis in upland rice

Abstract

The genotype x environment interaction was studied in 10 rice varieties for yield and yield contributing characters. Highly significant differences among genotypes, environments and G x E interaction for all the characters were observed except days to maturity and length : Breadth ratio. Linear and non-linear components of G x E interaction were highly significant for all the characters. None of the genotype was found to be average stable for all the characters. Thus from this investigation it was concluded that the genotypes Jaya, Pusa basmati,-1, Bhogavati, Ratna and Phule Radha were found to be promising for seed yield and yield contributing characters which can be used for commercial cultivation between 30th May to 15th June.

Keyword: Genotype, Genetic Variability, Spikelet Sterlity.

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Introduction

The interaction of genes and environments is of vital significance in the expression of trait. The sensitivity to environmental variations points to the need of using multiple environments instead of single environment to study the nature of genetic variability controlling the transmission of components of adaptation. With this objective 10 rice varities were studied for yield and yield contributing characters over 6 varying environments.

Material and methods

The experiment comprised of 10 varieties of rice laid out in randomized block design with three replications over six environments (Table-1) in the field. Each variety was planted in six rows with 22.5 x 22.5 cm spacing accommodating of 16 plants in each row. All recommended practices were carried out as and when required to maintain good stand of the crop. The data were analysed statistically for stability parameters (1)

Results and discussion

The analysis of variance for stability parameters (Table-2) revealed the presence of significant variation due to environment (E) for all the characters, indicating considerable additive environmental variance. Genotypic variances (G) were significant for all the traits, which indicated prevalence of lot of genetic variability among the rice genotypes under study. These results are in agreement with the results reported by (2)

The G x E interaction when tested against pooled deviation and pooled error was found to be significant for all the traits, explaining that the major portion of interaction was linear in nature and prediction over environments was possible. The similar results were reported by (3)

Further partitioning of E +(G x E) into E(linear) was found to be significant for all the traits, indicating differences between environments and their influence on genotypes for expression of these traits. This is in accordance with previous reports made by (4). The G x E (linear) component showed significance for all the characters. This revealed the linear relationship for expression of these traits with different environments. The similar trend was observed by (5).

Pooled deviation tested against pooled error found to be significant for all the traits, indicating presence of non predictable components for grain yield and yield related traits. These results are in agreement with the previous findings reported by (6)

Thus in present study, both linear and non-linear components were significant for yield and yield contributing characters. Similar findings were reported by (7). The environment E2 (30th May) followed by E3 (15th June) found to be most suitable for better expression of yield and yield contributing characters.

The observed magnitude of genotype x environment (linear) component could lead to the identification of genotypes deviating from the regression line of unit slope. Accordingly, three kinds of linear responses

(Table 3) viz bi=1, bi>1 and bi<1 have been observed for days to 50% flowering while for rest of the characters all the genotypes were classified as average stable (bi=1 and non significant) and below average stable (bi>1) except for length of panicle (cm.) and panicles per square meter. Such type of linear response could be attributed to inadequacy of the scale used for the analysis or inherent behavior of the genotypes under study (8).

In the present investigation genotype Bhogawati was appeared to be average stable (suitable for all environments) for major yield contributing characters viz. number of tillers per plant, length of panicle (cm) spikelet sterility (%) panicles per square meter and 1000 grain weight followed by Jaya for number of tillers per plant, panicles per square meter, 1000 grain weight (g), yield per plant (g) and yield per plot (kg). While Pusa basumati – 1 had exhibited stable performance for length of panicle (cm) panicle per square meter, yield per plant (g) and yield per plot kg. It is also observed that there is lack of general association between mean performance (x) and stability (S^2di) and regression co-efficient (bi) and S^2 di. From this it is appeared that separate genetic mechanism is involved in control of these parameters. Therefore consideration of only mean performance to decide the stability of genotypes may not be sufficient unless it is correlated with other parameters (bi and S^2di) to decide the breeding strategies in Rice.

Table – 1
Different Environments and sowing dates

Environment	Date of sowing
E_1	15 th May 2010
E_2	30 th May 2010
E_3	15 th June 2010
E_4	30 th June 2010
E_5	15 th July 2010
E_6	30 th July 2010

Table-2 : Anova for stability as per Eberhart and Rusell model (1966) in Rice:

Sr .No.	Sources	G	E	G x E	E + G x E	E (Li)	G x E(Li)	Pooled deviation	Pooled error
1	Days to 50 % flowering	262.74 ++,**,##	122.58 ++,**,##	3.63 * ,##	15.52	612.92 ** , ##	1.52 * , #	3.74 ##	3.26
2	Number of tillers per plant	3.87 * , #	72.14 ++ ,** , ##	3.18 * , ##	10.07	360.72 ** , ##	2.14 * , #	3.09 ##	1.57
3	Length of panicle (cm)	7.11 ++,**,##	16.27 ++,**,##	1.88 *, #	3.32	81.39 **,##	1.48 *, #	1.78 ##	1.57
4	Number of spikelets per panicle	7752.22 ++,**,##	487.91 ++,**,##	47.14 *, #	91.21	2439.56 **, ##	70.76 *, #	37.11 ##	29.06
5	Spikelet sterility (%)	43.47 ++,**,##	51.35 ++,**,##	2.08 *, ##	7.01	256.79 **, ##	1.25 *, #	2.06 ##	0.86
6	Panicles per meter square	2841.66 ++,**, ##	323.16 ++,**, ##	18.55 *, #	49.01	1615.81 **, ##	4.42 *, #	19.87 ##	28.95
7	1000 grain weight (g)	97.37 ++,**, ##	9.89 ++,**, ##	0.94 *, #	1.83	49.49 **, ##	1.49 *, #	0.72 #	1.57
8	Yield per plant (g)	108.19 ++,**, ##	393.44 ++,**, ##	12.12 *, #	50.25	1967.23 **, ##	7.31 *, #	11.99 ##	7.40
9	Yield per plot (Kg)	0.46 *, #	2.25 *, #	7.98 *, #	0.29	11.28 *, #	0.04 *, #	7.95 ##	6.49

+ , ++ = Significant at 5% and 1% level of significance, respectively against G x E
* , ** = Significant at 5% and 1% level of significance, respectively against the pooled deviation (P.D.)
# , ##= Significant at 5% and 1% level of significance, respectively against the pooled error (P.E.)

Table-3:
Nature of stability of rice genotypes under different environments

Sr. No.	Character	Genotypes showing stability		
		Average wider stability (bi=1) (suitable for all environments)	Above average (bi<1) (suitable for stress environment)	Below average (bi>1) (suitable for favourable environment)
1	Days to 50 % flowering	Ratna , Karjat-184	Ratnagiri-24	Ratnagiri-73 , Phule radha
2	Number of tillers per plant (hill)	Ratnagiri-73, Jaya, Bhogawati	---	Ratna, Phule radha, Pusa basmati-I
3	Length of panicle (cm)	Karjat-184, Bhogawati, Pusa basmati-I	---	---
4	Number of spikelets per panicle	Phule radha	---	Ratna
5	Spikelet sterility (%)	Ratna, Ratnagiri-73, Karjat-184, Phule Samruddhi,	---	Jaya
6	Panicles per square meter	Ratna, Ratnagiri-73, Phule-radha, Jaya, Indrayani, Bhogawati, Pusa basmati-I	---	---
7	1000 grain weight (g)	Karjat-184, Ratnagiri-73, Jaya, Indrayani, Bhogawati,	---	Phule samruddhi
8	Yield per plant (g)	Jaya, Pusa basmati-1	---	Ratna, Phule radha, Bhogawati
9	Yield per plot (Kg)	Jaya, Pusa basmati-I	---	Ratna, Bhogawati

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