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Genetic Variability in Local Lowland Rice (*Oryza sativa* L.) Germplasm of Nagaland

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Abstract

Variability and character association were studied in 32 local and three improved rice genotypes for grain yield and its ten attributing characters. Wide genetic variability was observed for panicle weight, effective tillers per plant and yield per plant. High heritability accompanied with high genetic advance was observed for panicle weight, effective tillers per plant, days to 50% flowering, 50% flowering to maturity, yield per plant, length-breadth ratio, 1,000 grain weight, plant height and grains per panicle. Seed yield per plant was positively and significantly correlated with effective tillers per plant indicating relative utility of this trait for selection. Path analysis indicated a greater contribution of effective tillers per plant to seed yield.

Key words : Genetic variability, Local lowland rice, Germplasm, Grain yield, Attributing characters.

For more than half of humanity, rice is life. It is the grain that has shaped the cultures, diets and economies of billions of people. Given the fact that rice consuming population will increase by additional 80—100 million every year, it is estimated that the world's unmilled rice production has to increase by about 65% by 2030 to keep pace with the population growth and income induced demand for food (1). Therefore, there is need to enhance the productivity potential of rice by evolving high yielding genotypes, which depends on the availability of variability for yield and its component traits in the population. Further apart from nature and magnitude of genetic variability information on the association of yield attributes with yield and among themselves is also essential for selection program. Keeping these in view, the present study was undertaken to assess the nature and magnitude of genetic variability present in different indigenous collections of rice. An attempt was also been made to study the correlation and path coefficient which are helpful in selecting the desirable traits.

Methods

The present investigation was conducted on the experimental farm of ICAR Research Complex NEH Region (Jharnapani) during 2003-2004. Thirty-two lo-

Table 1. Analysis of variance for 11 characters of rice (*Oryza sativa* L.). **Significant at 1% level.

Sources of variation	Degree of freedom	Mean squares: Days to 50% flowering	50% flowering to maturity	Effective tillers per plant	Plant height	Panicle weight	Panicle length
Replication	2	53.625	15.238	0.319	65.375	0.227	11.464
Genotype	34	394.09**	72.55**	10.44**	1833.30**	11.936**	12.378**
Error	68	11.236	3.855	0.271	198.851	0.195	4.329

Table 1. Continued.

Sources of variation	Mean squares: Grains per panicle	Grain filling percent	Length-breadth ratio	1000 grains weight	Yield/ plant
Replication	97.062	40.125	0.036	27.093	0.340
Genotype	1348.506**	212.112**	0.344**	36.132**	37.301**
Error	169.272	49.761	0.025	3.741	1.997

cal genotypes of rice namely Mekrilha, Ngoba, Mekninya Khol, Thevuru (Kelo-u), Kuki Chaushi, Wonder rice, Krumiavinya, Tevuru (white), Keituo-ulha, Nyapie, N. S. Keniese-u, Kewhi Vuru, Rulonya, Rhineinya, Khezharhi, Ngobanya, Mekrilha (Kepei-u), Thevuru (Kezha-u), Chamben (N. S. Kumelo-u), Kencnya Kumui (Red), Tsorenya, Rosholha, Khenou, Nyuceimo, Kemony Kehnau (white), Kekhnie-LHE-Kenelo-u, Thevurie Tieca, Petkoti, Malong, Teke, Aboru, Mehuru along with three improved genotypes Ranjit, Bahadur and Poilee were grown in randomized complete block design with three replications in plots of 2 m × 1 m size at spacing of 20 cm between rows and 15 cm between plants in a row. All the recommended agronomic practices were followed for raising a good crop. Observations were recorded on five plants sampled randomly in each replication for days to 50% flowering, 50% flowering to maturity, effective tillers per plant, plant height, plant weight, panicle length, grains per panicle, grain filling percent, length-breadth ratio, 1,000 grains weight and yield per plant.

Analysis of variance was done by using the standard statistical procedure. Heritability (broad sense) was estimated according to Allard (2). Genotypic and phenotypic coefficients of variation were estimated

Table 2. Mean, range, variance, coefficient of variation, heritability, genetic advance and GA as percent of mean.

Characters	Mean+SE	Range	Variance: 6^2_g	6^2_e	6^2_p	Coefficient of variation (GCV)	(PCV)	Heritability (broad sense) (%)	Genetic advance	GA as % of mean
Days to 50% flowering	105.11+2.73	82.00–124.00	127.62	11.23	138.85	10.74	11.21	91.90	22.31	21.22
50% flowering to maturity	29.12+1.60	20.33–38.67	22.89	3.85	26.74	16.43	17.76	85.6	9.12	31.31
Effective tillers/plant	5.76+0.42	3.13–10.40	3.39	0.27	3.66	31.97	33.23	92.6	3.65	63.37
Plant height (cm)	136.99+11.51	76.33–187.33	544.90	198.85	743.75	17.04	19.91	73.3	41.16	30.04
Panicle weight (g)	4.83+0.36	1.88–9.53	3.91	0.20	4.11	40.93	41.96	95.13	3.96	81.98
Panicle length (cm)	27.19+1.69	24.33–32.33	2.68	4.33	7.01	6.02	9.73	38.23	2.08	7.64
Grains per panicle	115.43+10.62	79.33–169.67	393.07	169.27	562.34	17.17	20.54	69.89	34.13	29.56
Grain filling percent	74.88+5.75	58.47–87.41	54.11	49.76	103.87	9.81	13.61	52.09	10.93	14.59
Length-breadth ratio (mm)	2.70+0.12	1.90–3.16	0.11	0.03	0.14	12.28	13.85	78.57	0.60	22.22
1000 grains weight (g)	27.18+1.57	22.48–33.80	10.79	3.74	14.53	12.06	14.01	74.26	5.82	19.42
Yield per plant (g)	12.75+1.15	9.17–23.55	11.76	1.99	13.75	26.82	29.01	85.55	6.52	51.13

Table 3. Estimates of genotypic and phenotypic correlation coefficients between different characters of rice. *, ** significant at 5 and 1% levels respectively.

Characters		Days to 50% flowering	Flowering to maturity	Effective tillers/ plant	Plant height	Panicle weight	Panicle length	Grains per panicle	Grain filling percent	Length-breadth ratio	1000 grains weight	Yield per plant
Days to 50%	**G**	0.154	0.021	0.475**	-0.136	0.227	0.021	-0.524**	0.225	0.250	-0.626**
flowering	**P**	0.059	0.025	0.411*	-0.113	0.082	-0.022	-0.335*	0.186	0.239	-0.527**
50% flowering		**G**	-0.083	0.036	0.149	0.075	0.151	-0.066	0.299	0.178	-0.160
to maturity		**P**	-0.085	-0.001	0.121	0.038	0.129	-0.113	0.250	0.113	-0.179
Effective			**G**	0.111	-0.248	-0.107	-0.173	-0.092	0.193	-0.166	0.356*
tillers/plant			**P**	0.089	-0.231	-0.090	-0.145	-0.050	0.158	-0.142	0.316
Plant height				**G**	0.196	0.609**	0.392*	-0.245	0.298	0.519**	-0.325
				P	0.170	0.268	0.280	-0.125	0.232	0.378*	-0.245
Panicle weight					**G**	0.113	0.310	0.313	-0.123	0.633**	0.152
					P	0.088	0.244	0.233	-0.131	0.566**	0.142
Panicle length						**G**	-0.047	-0.192	0.339*	0.368*	-0.437*
						P	0.093	-0.014	0.180	0.233	-0.258
Grains per							**G**	0.185	0.198	0.378*	-0.048
panicle							**P**	0.107	0.181	0.258	-0.044
Grain filling								**G**	0.033*	-0.016	0.298
percent								**P**	0.017	-0.028	0.245
Length-breadth									**G**	0.150	-0.360*
ratio									**P**	0.093	-0.334*
1000 grains										**G**	-0.231
weight										**P**	-0.133

following Burton (3). Genetic advance as per cent of mean was estimated according to Johnson et al. (4). Genotypic and phenotypic correlation coefficients for all possible comparisons were computed by formulae suggested by Al- Jibouri et al. (5). The partitioning of genotypic correlation coefficient of traits into direct and indirect effects was carried out using the procedure suggested by Dewey and Lu (6).

Results and Discussion

The analysis of variance revealed significant differences among the genotypes for all characters studied (Table 1), indicating a high degree of variability in the material. The estimates of phenotypic coefficient of variation (PCV) were higher than those of genotypic coefficient of variation (GCV) for all the traits indicating environmental factors influencing the characters (Table 2). The results are in agreement of earlier reports of Singh et al. (7) and Singh et al. (8). The highest PCV and GCV were recorded for panicle weight followed by effective tillers per plant and yield per plant indicating the presence of ample variation for these traits in the present material.

In the present study high estimates of heritability and genetic advance were recorded for panicle weight, effective tillers per plant, days to 50% flowering, 50% flowering to maturity, yield per plant, length-breadth ratio, 1000 grain weight, plant height and grains per panicle. Thus, selection for these traits is likely to accumulate more additive genes leading to further improvement of their performance and these traits may be used as selection criteria in lowland breeding program. Similar observations were reported by Singh et al. (7, 8).

The genotypic and phenotypic correlation coefficients between grain yield and its components are presented in Table 3. The grain yield exhibited significant positive correlation with effective tillers per plant indicating relative utility of this trait for selection. Similar results were also reported by Goswami (9). Grain yield was also significantly and negatively associated with days to 50% flowering, panicle length and length- breadth ratio. This was in conformity with the findings of Goswami (9) for days to 50% flowering.

The path analysis (Table 4) revealed that effective tillers per plant had the highest positive direct effect on yield (0.404), followed by panicle weight

Table 4. Direct and indirect effect of different characters at genotypic level in rice. Residual = 0.3108.

Characters	Days to 50% flowering	50% flowering to maturity	Effective tillers/ plant	Plant height	Panicle weight	Panicle length	Grains per panicle	Grain filling percent	Length-breadth ratio	1000 grains weight	Genotypic correlation for yield/ plant
Days to 50% flowering	**-0.546**	0.003	0.008	0.058	-0.033	-0.060	0.000	0.021	-0.049	-0.029	-0.626
50% flowering to maturity	-0.084	**0.021**	-0.033	0.004	0.036	-0.020	-0.002	0.003	-0.065	-0.021	-0.160
Effective tillers/ plant	-0.011	-0.002	**0.404**	0.014	-0.061	0.028	0.002	0.004	-0.042	0.019	0.356
Plant height	-0.259	0.001	0.045	**0.123**	0.048	-0.162	-0.005	0.010	-0.065	-0.060	-0.325
Panicle weight	0.074	0.003	-0.100	0.024	**0.244**	-0.030	-0.004	-0.012	0.027	-0.073	0.152
Panicle length	-0.124	0.002	-0.043	0.075	0.028	**-0.266**	0.001	0.008	-0.074	-0.042	-0.437
Grains per panicle	-0.012	0.003	-0.070	0.048	0.076	0.012	**-0.012**	-0.007	-0.043	-0.044	-0.048
Grain filling percent	0.286	-0.001	-0.037	-0.030	0.076	0.051	-0.002	**-0.040**	-0.007	0.002	0.298
Length-breadth ratio	-0.123	0.006	0.078	0.037	-0.030	-0.090	-0.002	-0.001	**-0.217**	-0.017	-0.360
1000 grains weight	-0.136	0.004	-0.067	0.064	0.155	-0.098	-0.005	0.001	-0.033	**-0.115**	-0.231

(0.244) and plant height (0.123). Effective tillers per plant exerted positive direct effect and exhibited significant positive correlation with yield indicating a true relationship among the traits. This suggests that direct selection for effective tillers per plant would be effective in increasing seed yield. The residual effect estimated were 0.3108 indicating that the traits are not sufficient to account for variability in grain yield and there might be a few more pertinent characters other than those studied in the present investigation. The present study suggests that while selection, emphasis should be given for effective tillers per plant for improvement in seed yield.

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