Content list available at http://epubs.icar.org.in, www.kiran.nic.in; ISSN: 0970-6429

Indian Journal of Hill Farming

December 2022,Volume 35, Issue 2, Page 92-96

Genetic variability, correlation and path coefficient studies in upland rice (*Oryza sativa* L.) genotypes of Nagaland

Lalen Phom• H. P. Chaturvedi

Department of Genetics and Plant Breeding, Nagaland University, SASRD, Medziphema- 797106

ARTICLE INFO

Article history:
Received:09 October, 2022
Revision:28 October, 2022
Accepted:02 November, 2022

Key words:*GCV, PCV, rice, genotypes, heritability, genetic advance, correlation, path coefficient*

DOI: 10.56678/iahf-2022.35.02.13

ABSTRACT

Eighteen genotypes of rice were evaluated in randomized complete block design at SASRD, Medziphema during kharif season of 2019 with two replications. The ANOVA showed significant differences among genotypes for all the characters studied, indicating high degree of variability in the material. High genotypic coefficient of variation and phenotypic coefficient of variation were recorded for panicle weight followed by yield per plant and 100 seed weight indicating presence of variation for these traits in the present population. High heritability coupled with high genetic advance as percent of mean was recorded for days to 50% flowering days to 80% maturity, panicle weight, number of seeds per panicle, 100 seed weight and yield per plant. At genotypic level, characters like panicle weight showed positive correlation with yield/plant indicating relative utility of this trait for selection. Path analysis revealed that panicle weight should be given more importance while selection for improvement of yield.

1. Introduction

The world's most important crop for staple foods is rice (*Oryza sativa* L.). It is the main food grain crop in the North Eastern states and feeds more than 60% of India's population. North eastern region of India is home to diverse genetic resources of rice which forms the basis of yield improvement. The rice yield is governed by a number of characters notable among them are grain number and the panicle numbers (Gauda *et al.* 2019). Simultaneous improvement of plant height, panicle length, number of filled grains per panicle test weight etc. leads to yield increase in rice improvement program. Variation is the basis of any improvement program. Diverse landraces not only sustain in changing climate but also provide variation for rice improvement program (Huang *et al.*, 2018). Estimates of genetic parameters such as range, genotypic and phenotypic coefficient of variation, heritability and genetic advance helps in assessment of genetic variability. Therefore, the present study was undertaken to assess the nature and magnitude of genetic variability, correlation and path coefficient studies in upland rice (*Oryza sativa* L.) genotypes of Nagaland

2. Materials and Methods

The experimental farm of Nagaland University, Medziphema was used to carry out the present investigation following randomized complete block design with two replications and 18 genotypes. The experimental material comprises of eighteen genotypes (SHENGYA, CHAUNYAK, KEREBE, TENGAKADU, TOILANG, REUDINE, ONGSHO, ONGPANG, AWONGLU ASHUH, KILU SHUH, ONGCHANG, TANGHA, MYNRI, JWAIN, KEREBE, TENGAKEZE, ONGMEI, and TANGHA-1) of rice. All the recommended agronomic practices were followed for raising a good crop. The data were recorded on five randomly sampled plants in each plot for 9 characters viz., Days to 50% flowering, effective tillers/plant, days to 80% maturity, plant height, panicle length, panicle weight, number of seeds per panicle, test weight and yield/plant. The analysis of variance was worked out for all the characters as suggested Panse and Sukhatme (1957). The PCV, GCV and ECV were calculated according to Burton and De Vane (1953). The calculations of heritability and genetic advance was done according to Allard (1960) and genetic gain as per Johanson *et al.* (1955). Phenotypic and genotypic correlation coefficients were worked out as suggested by Al-Jibouri *et al.*

*Corresponding author: hpchaturvedi68@gmail.com

(1958) and the path coefficient analysis as suggested by Dewey and Lu (1959).

3. Results and Discussion

The ANOVA revealed significant differences among the genotypes for all characters studied indicating high degree of variability present in the material. PCV (phenotypic coefficient of variation) was found to be higher than those of GCV (genotypic coefficient of variation) for all the characters under study (Table-1) indicating the role of environmental variance in the total variance. The highest genotypic coefficient of variation and phenotypic coefficient of variation were recorded for panicle weight followed by yield per plant and 100 seed weight indicating the presence of ample variation for these characters under study. Konate *et al.* (2016) and Adhikari *et al.*2018 also reported similar results.

Assessment of genetic variability is important to estimate the magnitude of improvement that can be achieved in breeding material for various characters. It has been suggested that estimates of Coefficient of variation i.e. genotypic coefficient of variation and heritability together provide a better portrait of amount of genetic gain expected under phenotypic selection (Burton and De Vane, 1953). Heritability is a quantitative character, which considers the role of heredity and environment determining the expression of trait (Allard, 1960). In the present study, high estimates of heritability coupled with high estimates of genetic advance were observed for panicle weight, number of seed per panicle, 100 seed weight and yield per plant (Table-1). Thus, selection for these traits is likely to accumulate more additive genes leading to further improvement of their performance. Roy, Shil (2020) reported similar observation for panicle weight and 100 seed weight.

The nature and magnitude of association between yield and its component characters are an essential pre-requisite in a sound breeding programme. Correlation coefficient analysis measures the mutual relationship and is used to determine the component character on which selection can be done. Interrelationship between the characters is important for the utilization of various quantitative characters in breeding programme, (Lerner, 1958). Therefore, in the present study, correlations between nine characters were studied at genotypic and phenotypic level (Table- 2 and 3). The yield per plant showed positive and significant correlation with panicle weight at genotypic level.

Path coefficient analysis revealed direct and indirect effect of yield contributing characters on yield at genotypic level (Table 4). The path analysis showed that panicle weight contributed maximum positive direct effect on yield followed by days to 50% flowering and effective tillers per plant. Panicle weight showed positive direct effect and also exhibited significant positive correlation with yield indicating a true relationship between the characters. This suggested that while selection emphasis should be given on panicle weight in increasing seed yield. Similar result was also reported by Chaubey *et al* (1993). The residual effect estimated was 0.1528 indicating that the characters under study were sufficient to account for variability. The present study suggested that while selection emphasis should be given on panicle weight for improvement in seed yield.

4. References

Adhikari , B.N ., Joshi, B.P., Shrestha, J., and Bhatta, N.R. (2018) Genetic variability, heritability, genetic advance and correlation among yield and yield components of rice (Oryzasativa L.) . *Journal of Agriculture and Natural Resources,* **1**(1), 149-160

Al-Jibouri, H. A., Miller, P. A. and Robinson, H. F. (1958) Genotypic and environmental variances, covariances in upland cotton cross of interspecific origin. *Agronomy Journal*50: 633-636.

Allard, R.W. (1960) Principles of plant breeding. John Wiley & Sons, New York.

Burton, G. W. and De Vane (1953) Estimating heritability in tall Fescue (*Festucaarundinaceae)* from replicated clonal material. *Agronomy Journal*45: 478-485.

Chaubey, P.K., Richharia, A.K. 1993. Genetic variability , correlations and path-coefficients in indicarices. *Indian J.Genet.* **53**(4): 356-360

Dewey, D. R. and Lu, K. H., (1959) A correlation and path coefficient analysis components of crested wheat grass seed production. *Agronomy Journal*51: 515-518.

Gouda, G., Parida, M., Donde, R., Gupta, M.K., Kumar, J., Mohanty, S., Panda, R.S., Dash, S.K., Pradhan, S.K., Mohapatra, T. And Behera, L. (2019) Identification of high grain number genes and assessment of genetic diversity in high and low grain number rice genotypes useful for marker-assisted selection breeding programs. Annals of Plant and Soil Research 21 (4): 301-311.

Huang, L., Zhang, R., Huang, G., Li, Y., Melaku, G., Zhang, S., Chen, H., Zhao, Y., Zhang, J., Zhang, Y. And Hu, F. (2018) Developing superior alleles of yield genes in rice by artificial mutagenesis using the CRISPR/ Cas9 system. The Crop Journal 6: 475-481.

Johnson, R.E., Robinson, H.W. and Comstock, H.F. (1955) Estimates of genetic and environmental variability in soyabean. *Agronomy Journal* **47**: 314-318.

Konate, A.K., Zongo, A., Kam, H., Sanni, A. and Audebert, A. 2016. Genetic variability and correlation analysis of rice (*Oryzasativa* L.) inbred lines based on agro-morphological traits. *African Journal of Agricultural Research*. **11**(35): 3340-3346.

Lerner, I.M. 1958. The genotype in Mendalian population. *Proc. 9th intl. Cong. Genet.* Pp 124-125.

Panse, V. G. and Sukhatme, P. V. (1957) Statistical methods for agricultural workers. Indian Council of Agricultural Research, New Delhi.

Roy, S.C., Shil, P. Assessment of Genetic Heritability in Rice Breeding Lines Based on Morphological Traits and Caryopsis Ultrastructure. *Sci Rep* **10**, 7830 (2020)

Table 1. Estimates of Mean, range, coefficient of variation, heritability and genetic advance as % of mean

Characters	Mean ± S.E	Range	Coefficient of variance			Heritability h^2 (broad sense)	Gen. Adv.as % of mean
			Genotypic	Phenotypic	Environmental		
			GCV	PCV	ECV		
Days to 50% flowering	134.0 ±1.11	128.5-161.6	2.70	2.94	1.15	84.57	5.09
Effective tillers/plant	4.59 ±0.41	3.6-5.6	8.15	14.45	12.51	31.81	9.22
Days to 80% maturity	159.6 ±0.75	157.3-163.7	1.31	1.46	0.66	79.54	2.39
Plant height (cm)	123.8 ±6.40	87.65-139.32	8.44	11.16	7.31	57.14	13.10
Panicle length (cm)	25.82 ±1.30	22.54-29.86	4.53	8.45	7.14	28.72	4.87
Panicle weight (g)	2.28±0.03	1.151-3.359	27.70	27.77	1.96	99.50	56.64
No. seeds/panicle	153.7 ±9.06	115-197.9	16.08	18.12	0.34	78.80	29.11
100 seed wt (g)	2.16 ±0.04	1.376-3.176	23.76	23.89	2.53	98.87	47.65
yield per plant(g)	10.53 ±1.09	5.278-15.383	24.83	28.85	14.68	74.10	43.98

Table 2. Estimates of genotype (r_g) correlation coefficient between different characters of rice:

Characters	Effective Tiller per plant	Days to 80 % maturity	Plant height (cm)	Panicle Length (cm)	Panicle weight (g)	No. of seeds/ panicle	100 seed wt (g)	Yield per plant(g)
Days to 50% flowering	0.051	0.923**	-0.252	-0.122	0.227	0.082	0.272	0.270
Effective tillers/plant		0.400*	0.312	-0.235	-0.092	-0.349	0.012	0.146
Days to 80% maturity			-0.230	0.098	0.100	0.041	0.189	0.243
Plant height (cm)				-0.043	-0.330	0.128	-0.133	-0.244
Panicle length (cm)					-0.343	-0.316	0.165	-0.454*
Panicle weight (g)						-0.028	0.062	0.978**
No. seeds/panicle							0.271	-0.183
100 seed wt (g)								0.041

Table 3. Estimates of phenotypic (r_p) correlation coefficient between different characters of rice :

Characters	Effective Tiller per plant	Days to 80 % maturity	Plant height (cm)	Panicle Length (cm)	Panicle weight (g)	No. of seeds/ panicle	100 seed wt (g)	Yield per plant(g)
Days to 50% flowering	0.184	0.902**	-0.179	0.062	0.196	0.146	0.255	0.280
Effective tillers/plant		0.229	0.067	0.279	-0.043	-0.060	0.021	0.444*
Days to 80% maturity			-0.114	0.109	0.087	0.082	0.157	0.204
Plant height (cm)				0.257	-0.236	0.097	-0.098	-0.182
Panicle length (cm)					-0.165	-0.133	0.126	-0.003
Panicle weight (g)						-0.033	0.062	0.851**
No. seeds/panicle							0.242	-0.103
100 seed wt (g)								0.043

Table 4. Direct and indirect effect of different characters on yield of rice at genotypic level

Characters	Days to 50% flowering	Effective Tiller per plant	Days to 80 % maturity	Plant height (cm)	Panicle Length (cm)	Panicle weight (g)	No. of seeds/ panicle	100 seed wt (g)	Yield per plant(g)
Days to 50% flowering	0.2515	0.0128	-0.1982	-0.0050	0.0050	0.2167	-0.0078	-0.0048	0.2709
Effective tillers/plant	0.0129	0.2497	-0.0775	0.0061	0.0105	-0.0881	0.0328	-0.0002	0.1462
Days to 80% maturity	0.2574	0.1000	-0.1936	-0.0045	-0.0044	0.0956	-0.0039	-0.0033	0.2432
Plant height (cm)	-0.0636	0.0780	0.0447	0.0196	0.0019	-0.3154	-0.0121	0.0023	-0.2444
Panicle length (cm)	-0.0309	-0.0587	-0.0190	-0.0008	-0.0446	-0.3274	0.0297	-0.0029	-0.4547
Panicle weight (g)	0.0572	-0.0231	-0.0194	-0.0065	0.0153	0.9538	0.0027	-0.0011	0.9790
No. seeds/panicle	0.0209	-0.0873	-0.0080	0.0025	0.0141	-0.0275	-0.0939	-0.0048	-0.1839
100 seed wt (g)	0.0685	0.0032	-0.0366	-0.0026	-0.0074	0.0594	-0.0255	-0.0175	0.0413

Residual effect- 0.1528