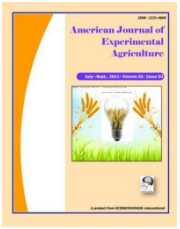

American Journal of Experimental Agriculture
2(2): 233-239, 2012

SCIENCEDOMAIN *international*
www.sciencedomain.org

Genetic Variability and Inter Relationship between Yield and Yield Components in Some Rice Genotypes

A. E. Idris[1*], F. J. Justin[1], Y. M. I. Dagash[1] and A. I. Abuali[2]

[1]Sudan University of Science and Technology (SUTECH), Khartoum, Sudan.
[2]Desertification Research Institute, National Center for Research, Khartoum, Sudan.

Research Article

Received 24th October 2011
Accepted 10th January 2012
Online Ready 20th March 2012

ABSTRACT

The study was conducted at the Sudan University of Science and Technology; College of Agricultural Studies, Shambat farm during the season 2009/10 to study genetic variability and correlation between yields, yield components in some rice genotypes. The experiment was laid out in a randomized complete block design (RCBD) with three replications. Seven characters were measured including yield, yield components. Phenotypic ($\delta^2 ph$) and genotypic ($\delta^2 g$) variances, phenotypic (PCV) % and genotypic (GCV) %, coefficients of variation were estimated. Phenotypic and genotypic correlation between characters was determined. The results showed that there were highly significant differences ($p \leq 0.01$) between the most of the characters under study except for percentage of unfilled grains per panicle (%). The highest values of phenotypic and genotypic variance were recorded by yield kgha^{-1} Also grain yield was attained the highest values of phenotypic and genotypic coefficients of variation. Positive phenotypic and genotypic correlation coefficient was detected between grain yield and number of filled grains per panicle, harvest index, panicle length and number of grains per panicle. The present study revealed that there was highly genetic variability among the tested genotypes, indicating that it could be used for further improvement in rice breeding.

Keywords: Rice; genotype; variability; correlation.

**Corresponding author: Email: atifelsadig@yahoo.com;*

1. INTRODUCTION

Rice, *Oryza sativa* L. is the world's second most important cereal crop, grain production of rice being exceeded only by that of wheat. Rice is the major caloric source, with nearly 2.5 billion people depending on it as their main food (FAO, 2004). Rice is cultivated in at least 114, mostly developing countries and is the primary source of income and employment for more than 100 million households in Asia and Africa (FAO, 2004). In the Sudan, rice has been grown since 1905, but on limited acreage and information about methods of reproduction is lacking (Farah, 1981). Rice in Sudan is grown on 7.60 thousand hectares producing 30 thousand tones. However, Sudan produce an average of 3947 kg/ha (AOAD, 2008). Swamp and upland varieties were first tried at the Gezira research farm in 1951. Later, extensive rice trials were carried out at Malakal. Since 1974 up to 1979 rice research at Gezira research station has identified many of the major constraints to high yields, despite this, the Agricultural policies did not encourage its production (Ghobrial, 1981). Recently, different genotypes from West African Rice Development Association (WARDA) and International Rice Research Institute (IRRI) are being evaluated for yield and earliness although, 82 aerobic rice varieties and lines were introduced in an attempt to save irrigation water and to reduce human diseases risks in the irrigated schemes. Also, FAO is planning to rehabilitate the White Nile research farm to improve rice production. The present study, therefore, is aimed at assessing genetic variability and heritability of yield and yield components in some rice genotypes and to estimate phenotypic and genotypic correlation coefficient between yield and its components that contributed to increase yield potential.

2. MATERIALS AND METHODS

The experiment was conducted during 2008/ 2009 season at Shambat location, Faculty of Agriculture, University of Sudan (15° 30´N; 32° 31´E),) to evaluate eight rice genotypes (Table 1). The genetic material used in this study was provided from Agricultural Research Corporation (ARC) at White Nile State, Sudan.

Table 1. List of eight genotypes of rice (*Oryza sativa* L.) used in the study

Genotype	Source
WITA4	IRRI introduced by ARC
IR3240	IRRI introduced by ARC
WITA5	IRRI introduced by ARC
NERICA	WARDA introduced by ARC
ITA252	IRRI introduced by ARC
WITA7	IRRI introduced by ARC
TOX3081	IRRI introduced by ARC
IR2042	IRRI introduced by ARC

A.R.C. refers to Agricultural Research Corporation

The genotypes were tested in a randomized complete block design with three replicates. Seeds were directly sown in 16 m^2 plot with a spacing of 20x20 cm. Nitrogen, in the form of urea, was applied in one dose; after 21 days from sowing at the rate of 150 kg N/ha. Five plants were selected randomly from each plot, and the following agronomic traits were

measured viz. Panicle length (cm), Grain length (mm), Number of grains per panicle, Number of filled grains per panicle, Percentage of unfilled grains per panicle (%), Weight of 100 grain (g), Grain yield (Kg/ha), Harvest index (%).

Analysis of variance (ANOVA) of the data was carried out according to the procedure described by Gomez and Gomez (1984), for each season separately, and broad sense heritability values were calculated as suggested by Johnson et al. (1955).

3. RESULTS AND DISCUSSION

The analysis of variance revealed significant difference among the genotypes for all the characters studied (Tables 2 and 3). A wide range for all the traits indicates the existence of variation among genotypes for different traits. Similar results were obtained by Jayasudha and Sharma (2010).

The present investigation revealed considered amount of variable among the tested genotypes with respect to all the traits studied. Over all mean values the genotypes WITA 7 was recorded higher grain yield kg/ha.

GCV (Table 4) was found to be highest for grain yield kg/ha followed by number of filled grain per panicle, no of grains per plant. Similar trend was observed for PCV. Close relationship between GCV and PCV was found in all the characters and PCV values were slightly greater than GCV, revealing very little influence of environment for their expression. High GCV were observed for grain yield kg/ha. Hence, Johnson et al. (1955) also suggested that, Heritability plays a vital role in deciding the suitability and strategy for selection of a particular character. All the eight characters under study exhibited high broad sense heritability (Table 4) of more than 50%, except panicle length which is (2010) less than 50%. Similar results have been reported by Bhandarkar et al. (2002), Kuldeep et al. (2004), Patra et al. (2006), Sabesan et al. (2009) and Jayasudha and Sharma (2010). Although, the presence of high heritability values indicates the effectiveness of selection on the basis of phenotypic performance, it does not show any indication to the amount of genetic progress for selecting the best high GCV along with high heritability and genetic advance gave better picture for the selection of the genotypes. Similar results were also reported by Singh and Singh (2005), Sarkar et al. (2007), Anbanandan et al. (2009) and Sabesan et al. (2009).

Complete knowledge on interrelationship of plant character like grain yield with other characters is of paramount importance to the breeder for making improvement in complex quantitative character like grain yield for which direct selection is not much effective. Hence, association analysis was undertaken to determine the direction of selection and number of characters to be considered in improving grain yield.

Phenotypic and genotypic correlation coefficients among the nine characters were assessed and are presented in Table 5. The present investigation indicated that, the genotypic correlation coefficients were higher than the phenotypic correlation coefficients demonstrating that, the observed relationships among the various characters were due to genetic causes. This is also in confirmation with the findings of Radhidevi et al. (2002), Najeeb and Wani (2004), Sarkar et al. (2007), Anbanandan et al. (2009), Sabesan et al. (2009) and Jayasudha and Sharma (2010).

Table 2. Mean squares from individual analysis of variance for yield traits and it's components of eight genotypes of rice (*Oryza sativa* L.) grown at Shambat

Characters	Blocks	Genotypes	Error
Panicle length (cm)	2.389^{ns}	6.602*	2.434
Grain length(mm)	0.177^{ns}	1.475**	0.158
No. of grains/panicle	525.343^{ns}	1050.283**	200.434
No. of filled grains/panicle	253.062^{ns}	526.780**	70.522
Percentage of unfilled grains/panicle (%)	360.474^{ns}	285.985^{ns}	136.360
Weight of 100 grains(g)	0.004^{ns}	0.327**	0.007
Grain yield kg/ha	54444.863^{ns}	1234271.575**	122380.922
Harvest index (%)	0.001^{ns}	0.016**	0.002

**, **= significant difference at p= 0.05 and p=0.01, respectively.*
Ns= not significant

Table 3. Means of different traits of eight rice genotypes grown at Shambat, 2009/2010

Genotype	Panicle length (cm)	Grain length (mm)	No. of grains/ panicle	No. of filled grains/panicle	Percent of unfilled grain/panicle	Weight of 100 grains (g)	Grain yield kg/ha	Harvest index
WITA4	19.4	8.1	94.6	33.8	62.9	1.7	880.9	0.10
IR3240	17.6	7.5	76.6	24.3	68.1	1.8	954.1	0.11
WITA5	17.2	8.6	74.1	23.8	66.7	1.9	904.8	0.11
NERICA	21.4	9.4	58.9	17.5	70.5	2.7	741.7	0.15
ITA252	20.4	8.3	116.2	50.4	56.4	1.7	1639.7	0.15
WITA7	19.6	8.1	89.4	51.7	41.2	1.9	2611.5	0.29
TOX3081	20.6	8.6	94.8	43.1	52.4	2.0	1590.0	0.21
IR2042	18.5	7.2	64.6	24.3	63.4	1.6	848	0.08
Grand means	19.3	1.9	83.7	33.6	60.2	1.9	1271.4	0.15
C.V.	8.07	4.84	16.92	24.99	19.40	4.47	27.52	28.49
SE±	0.39	0.15	4.51	3.06	2.89	0.07	137.67	0.02
LSD	2.72	0.70	24.82	14.71	22.45	0.15	675.33	0.08

Table 4. Phenotypic (PCV) % and genotypic coefficients of variation (GCV) %, phenotypic and genotypic variance, for the different characters studied on eight genotypes of rice evaluated at Shambat in Season 2009/2010

Traits	Phenotypic variance	Genotypic variance	Heritability h^2	Phenotypic coefficients of variation PCV%	Genotypic coefficients of variation GCV%
Panicle length(cm)	3.82	1.39	0.43	10.11	6.10
Grain length (mm)	0.597	0.44	0.73	9.40	8.06
No. of grains/panicle	475.48	283.28	0.60	26.29	20.12
No. of filled grains/panicle	222.6	152.09	0.68	44.40	36.70
Percentage of unfilled grains/panicle	185.57	49.21	0.27	22.63	11.66
Weight of 100 grain (g)	0.11	0.12	0.100	17.84	17.27
Grain yield kg/ha	49311.4	37063.02	0.75	55.23	47.88
Harvest index (%)	0.01	0.01	0.100	0.53	0.45

Table 5. Estimation of genotypic correlation (above the diagonal) and phenotypic correlation (Bellow the diagonal) of eight rice genotypes

Traits	Panicle length	Grain length	No. of grain/ panicle	No. of filled grain/ panicle	Percentage of unfilled grain/panicle	100 grain weight	Grain yield kg/ha	Harvest index
Panicle length	-	0.79**	0.30	0.56	-0.70*	-0.75*	0.27	0.99**
Grain length	0.44	-	-0.07	-0.04	0.07	0.96**	-0.01	0.32
No. of grain/panicle	0.12	0.01	-	1.01**	-1.11**	-0.46	0.61	0.40
No. of filled grain/panicle	0.12	-0.06	0.67*	-	-104**	-0.38	0.93**	0.70*
Percentage of unfilled grain/panicle	-0.01	0.10	-0.16	-0.83**	-	0.45	-1.29**	-1.01**
100 grain weight	0.42	0.77**	-0.38	-0.26	0.11	-	-0.16	0.27
Grain yield kg/ha	0.26	-0.02	0.46	0.81**	-0.66	0.10	-	0.94
Harvest index	-0.07	0.29	0.19	0.67*	0.32	0.26	0.83**	-

**, ** Significant difference at p=≥ 0.05, p=≥ 0.01 respectively*
Ns: no significant difference.

COMPETING INTERESTS

Authors have declared that no competing interests exist**.**

REFERENCES

Bhandarkar, S., Ravindra, V., Kumar, A. (2002). Genetic variability and correlation analysis in early duration rice. Plant Arch., 2(1), 95-98.

Kuldeep, T., Bathshwar, K., Ramesh, B., Tomer, A. (2004). Genetic variability and correlations for some seedlings and mature plant traits in 70 genotypes of rice. Res. Crops, 5(1), 60-65.

Anbanandan, V., Saravanan, K., Sabesan, T. (2009). Variability heritability and genetic advance in rice. (*Oryza sativa* L.). Int. J. Plant Sci., 3(2), 61-63

Sarkar, K.K., Bhutia, KS., Senapathi, B.K., Roy, S.K. (2007). Genetic variability and character association of quality traits in Rice (*Oryza sativa* L.). Oryza, 44(1), 64-67.

Singh, R.K., Singh, O. (2005). Genetic variation for yield and quality characters in mutants of aromatic rice. Ann. Agric. Res., 26(3), 406- 410.

Sabesan, T., Suresh, R., Saravanan, K. (2009). Genetic variability and correlation for yield and grain quality characters of rice grown in coastal saline low land of Tamilnadu. Electronic J. Plant Breed., (1), 56- 59.

Najeeb, S., Wani, S.A. (2004). Correlation and path analysis studies in barley. Natl. J. Plant Improv., 6(2), 124-125.

Radhidevi, R.P., Nagarajan, P., Shanmugasundram, P., Chandrababu, R., Jayanthi, S., Subramani, S., (2002). Combining ability analysis in three line and two line rice hybrids. Plant Arch., (2), 99-102.

Johnson, H.W., Robinson, H.F., Comstock, R.E. (1955). Genotypic, and phenotypic, correlations in soybeans and their implications in selection. Agron, J., (47), 477-482.

Jayasudha, S., Sharma, D., (2010). Genetic parameters of variability, correlation and path-coefficient for grain yield and physiological traits in Rice (*Oryza sativa* L.) under shallow lowland situation. Electronic J. Plant Breed., 1(5), 33-38.