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Correlation studies for grain yield with growth parameters in aerobic rice (*Oryza sativa* L.) genotypes

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Abstract

Fourteen rice genotypes were evaluated including two check varieties for association of grain yield with growth parameters in upland rice genotypes. This trial was conducted during *Kharif* 2024 at Quality Seed Production Farm, Shendra 'A', Vasantao Naik Marathwada Krishi Vidyapeeth (VNMKV), Parbhani, Maharashtra. The experiment was laid out in a randomized block design with 14 rice genotypes and three replication. Evaluation performed for correlation studies in fourteen promising rice genotypes.

Growth parameters *viz.* LA, LAI, Plant dry weight, CGR, RGR and NAR varied significantly among the rice genotypes. Also, it is concluded that higher yields were associated with leaf area, leaf area index, plant dry weight, number of grains per panicle, number of filled grains per panicle, high number of grains per plant and harvest index. Significant and positive association was observed between grain yield and growth parameters like Plant dry weight, NAR and HI. This association indicates increase in one or more of these traits results in an increase in grain yield. Hence, due consideration should be given to the traits while selecting rice genotypes. Among the fourteen genotypes studied genotypes *viz.* PBNR 21-3 and PBNR 21-7 recorded better performance and these are considered as the superior genotypes.

Keywords: Correlation, Grain yield, CGR, RGR, NAR, LAI, HI, Genotypes, etc.

Introduction

Rice (*Oryza sativa* L.) is a primary cereal crop for nearly half of the global population. Rice is a staple food for a large portion of the global population, particularly in less developed countries. In India, archaeological evidence shows rice cultivation dating back to 1500-1000 BC across the humid regions of Asia and West Africa, rice has sustained human civilizations since ancient times. Its introduction to Europe and the Americas has led to a steady increase in its dietary use.

The rice plant can grow to a height of 1 to 1.8 m (3 to 6 feet), depending on the variety and soil fertility. It features long, narrow leaves that range from 50 to 100 cm in length (20 to 40 inches) and 2 to 2.5 cm in width. The plant produces a branch with a pendulous inflorescence, 30 to 50 cm long (12 to 20 inches) which carries small, wind-pollinated flowers. The edible seed is a grain (caryopsis) that measures 5 to 12 mm in length and 2 to 3 mm in thickness.

India is the world's second-largest producer of rice, and the largest exporter of rice in the world. In India rice is grown on an area of 478.32 lakh hectares with production of 1357.55 lakh tons with productivity of 2838 kg/ha for year 2022-23 (Annual Report, Ministry of Agriculture, Government of India 2023-24). The area under rice during *kharif* 2024-25 in Maharashtra is 15.25 lakh hectares with production of 35.89 lakh tons and productivity of 2.26 tons/ha (Chief Statistician, Commissionerate of Agriculture, Pune). West Bengal, Uttar Pradesh and Punjab are top three rice producing states.

Yield component traits such as panicles per hills, panicle length, numbers of filled and unfilled grains per panicle, 1000 grain weight and total grain weight per panicle are important and also essential fundamental task before making any successful breeding program (Oladosu *et al.* 2018) [9]. Yoshida (1983) [11] reported that the major yield components in rice are number of panicles per unit area, spikelet numbers per panicle, spikelet fertility percentage and grain weight normally expressed as 1,000 grain weight.

International Rice Research Institute (IRRI), (1997) stated that traits contributing to yield potential in rice include leaf length, leaf width, number of leaves, number of panicle length of grain and number of grains on the panicle.

Rice yield might be increased by selecting for the component of yield and that parental varieties should be selected on the basis of component attributes (Tsehaye *et al.* 2018) ^[10]. Yield is a complex quantitative character and is greatly influenced by environmental fluctuations; hence, the selection for superior genotypes based on yield is important.

A well define research programme based on physiological analysis of rice genotypes to research correlations between various growth parameters and yield variability, yield-contributing traits. In view of above mention fact experiment entitled “Correlation studies for grain yield with growth parameters in aerobic rice (*Oryza sativa* L.) genotypes” with following objective:-

- To assess correlation between growth parameters and yield contributing traits of rice genotypes.

Materials and Methods

The current study, “Correlation studies for grain yield with growth parameters in aerobic rice (*Oryza sativa* L.) genotypes”. This trial was conducted in Kharif 2024 at the Quality Seed Production Farm, Shendra ‘A’, VNMKV, Parbhani. The material for this present study comprised of 14 promising genotypes of rice including 2 check genotypes viz., PBNR-03-2 and Avishkar in Table 1. The experimental material was collected from Upland Paddy Research Scheme, VNMKV, Parbhani. The experimental material was tested in randomized block design (RBD) with three replications.

The observations were recorded on growth parameters viz., LA, LAI, plant dry weight, CGR, RGR, NAR, HI and yield attributes viz., panicle length, number of grains per panicle, number filled grains per panicle, number of unfilled grains per panicle, test weight, grain yield per ha, grain yield per plot and harvest index. Five random plants were selected from the two rows for recording observations. The average value was determined from these plants and these values were used for analysis. The field data were analyzed statistically as per randomized block design and laboratory data were analyzed. Data of all entries in the experiment was subject to analysis of variance (Panse and Sukhatme, 1985) for testing the significance of genotypes.

Table 1: List of entries

Sr. No	Genotypes	Sr. No	Genotypes
1	PBNR 21-1	8	PBNR 21-8
2	PBNR 21-2	9	PBNR 21-9
3	PBNR 21-3	10	PBNR 21-10
4	PBNR 21-4	11	PBNR 21-11
5	PBNR 21-5	12	PBNR 21-12
6	PBNR 21-6	13	PBNR 03-2
7	PBNR 21-7	14	Avishkar

Results and Discussion

Correlation coefficient is a statistical measure used to know the degree and direction of relationship between two or more variables. Correlation was studied in order to find out the inter-relationship of different growth parameters with grain yield per plot in rice genotypes. The degree of association also affects an effectiveness of the selection

process. Thus, correlation indicates the degree of relationship existing among various attributing character.

Correlation

The results of correlation analysis under upland conditions indicated that among all the associations, 16 associations were highly significant and all of them were positively correlated and the same associations were significant and positively correlated. Besides 44 associations were positive and non-significant, 13 were non-significant and negatively correlated and 3 were significant and negatively correlated. The investigation revealed that the grain yield was significantly and positively correlated with plant dry weight (0.696**) and net assimilation rate (0.662**). Harvest index was also found to be highly and positively correlated with grain yield (0.729**). These findings are consistent with the reports of Dwivedi *et al.* (2012) ^[3], who also observed a highly significant positive correlation between grain yield and harvest index.

Leaf area demonstrated a highly significant positive correlation with leaf area index (0.940***), dry weight (0.694*) and crop growth rate (0.585**). These findings are consistent with the results reported by Lopez Bellido (2008) ^[6]. Additionally, leaf area was positively and significantly correlated with panicle length (0.677*) and test weight (0.626*).

Leaf area index exhibited a highly significant positive correlation with plant dry weight (0.579*), panicle length (0.570*) and test weight (0.586*).

Plant dry weight showed a strong positive correlation with crop growth rate (0.879***), net assimilation rate (0.821***), and grain yield (0.696**). These findings similar with those of Chandrasekhar (2001) ^[1], who reported a significant positive relationship between grain yield and both panicle dry weight and total plant dry weight.

Crop growth rate also displayed a highly significant positive correlation with relative growth rate (0.767**) and net assimilation rate (0.854***), these results are in agreement with the findings of Lopez-Bellido (2008) ^[6]. Additionally, Mineo and Ujihara (1991) ^[7] reported a close association between crop growth rate and net assimilation rate, further supporting the present observations.

Net assimilation rate exhibited a highly significant positive correlation with grain yield (0.662**). The number of grains showed a very strong positive correlation with the number of filled grains per panicle (0.997***).

The significant and positive correlations among characters suggest interrelation between growth traits and yield. The negative and non-significant correlations revealed there may be inherent relationships among the genotypes.

Conclusions

- From the study it is concluded that higher yields were associated with plant dry weight, number of panicles per plant, number of grains per panicle, number of filled grains per panicle, leaf area, leaf area index, CGR, RGR, NAR and harvest index.
- However, the grain yield was significantly and positively associated with plant dry weight, NAR and harvest index.

The genotype PBNR 21-3 and PBNR 21-7 could be utilized in further breeding programme.

Table 2: Association of grain yield with growth parameters in upland rice genotypes

	LA	LAI	DW	CGR	RGR	NAR	NOG	FG	UFG	LOP	TW	HI	YPP
LA	1	0.940***	0.694**	0.585*	0.321	0.334	0.175	0.166	0.013	0.677**	0.626*	-0.072	0.451
LAI		1	0.579*	0.463	0.261	0.2	0.102	0.088	0.103	0.570*	0.586*	-0.246	0.28
DW			1	0.879***	0.442	0.821***	0.229	0.249	-0.338	0.471	0.364	0.328	0.696**
CGR				1	0.767**	0.854***	0.047	0.071	-0.285	0.261	0.367	0.22	0.491
RGR					1	0.492	-0.183	-0.185	0.112	-0.073	0.125	-0.152	-0.071
NAR						1	0.256	0.294	-0.551*	0.301	0.185	0.443	0.662**
NOG							1	0.997***	-0.454	0.414	-0.415	0.298	0.359
FG								1	-0.524	0.414	-0.406	0.342	0.395
UFG									1	-0.202	0.104	-0.637*	-0.578*
LOP										1	0.508	0.071	0.502
TW											1	-0.184	0.266
HI												1	0.729**
YPP													1

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