The Pharma Innovation Journal 2023; 12(10): 553-555

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(10): 553-555

www.thepharmajournal.com
Received: 23-08-2023
Accepted: 25-09-2023

Manoj MS
Department of Genetics and Plant Breeding, College of Agriculture, University of Agricultural Sciences, Dharwad, Karnataka, India

P Surendra
Professor (GPB)/Principal Scientist (GPB), AICRIP (VC), College of Forestry, Sirsi, University of Agricultural Sciences, Dharwad, Karnataka, India

Nadaf SK
Professor and Advisor, Plant Genetic Resources, Gene Bank, Research and Innovation, Ministry of Higher Education, Research and Innovation, SQU Campus, Muscat, Sultanate of Oman

BR Patil
Professor and Head, Department of Genetics and Plant Breeding, College of Agriculture, University of Agricultural Sciences, Dharwad, Karnataka, India

Chitti Bharatkumar
Scientist (Plant Breeding), AICRP on Chickpea, Vijayapur, University of Agricultural Sciences, Dharwad, Karnataka, India

Nandini B
Assistant Professor (GPB), College of Horticulture, Kolar, University of Horticultural Sciences, Bagalkot, Karnataka, India

Abhishek K Gowda
Department of Genetics and Plant Breeding, College of Agriculture, University of Agricultural Sciences, Dharwad, Karnataka, India

Mallikarjun PK
Department of Genetics and Plant Breeding, College of Agriculture, University of Agricultural Sciences, Dharwad, Karnataka, India

Corresponding Author:
Manoj MS
Department of Genetics and Plant Breeding, College of Agriculture, University of Agricultural Sciences, Dharwad, Karnataka, India

Phenotypic correlation analysis for grain yield and its attributes in the F_2 population of rice (*Oryza sativa* L.)

Manoj MS, P Surendra, Nadaf SK, BR Patil, Chitti Bharatkumar, Nandini B, Abhishek K Gowda and Mallikarjun PK

Abstract
Rice serves as a global staple, sustaining nearly half of the world's population. Therefore, gaining better insight into the association between grain yield and its component traits can be helpful in improving rice yield. An experiment was conducted during the summer of 2023 at AICRIP, ARS (Paddy), Sirsi, UAS, Dharwad to assess the correlation between grain yield and six yield attributing traits in the F_2 population obtained by crossing two indica rice varieties, *viz*., BPT-5204 (non-pigmented) and HY-256 Purple (pigmented). A positive and significant association between grain yield per plant and traits such as plant height, number of panicles per plant, panicle length, grain length and grain L/B ratio was observed. A highly significant positive correlation was found between the traits *viz*., plant height, number of panicles per plant and panicle length. The grain L/B ratio exhibited significant positive and negative correlations with grain length and breadth, respectively.

Keywords: Correlation, F_2 population, grain yield and *Oryza sativa*

Introduction
Rice (*Oryza sativa* L.) is an ancient agricultural crop belonging to the grass family Graminae (Poaceae), with a chromosome number of 2n=24 and a genome size of 389 Mb. It serves as a staple food for nearly half of the world's population due to its high carbohydrate content. It is a natural diploid derived from a single ancestor, *Oryza perennis*, with autogamy as its mode of pollination, and is believed to have originated in South East Asia (Falvey, 2010) [3]. Beyond its nutritional value, rice finds applications in various industries including animal nutrition, brewing, cosmetics, fuel, medicine, oil, paper, pharmaceuticals, and more. In India, rice holds the prominent position of being the primary food crop, covering a quarter of the nation's total cultivated area and providing sustenance to nearly half of its population. India not only assumes the role of the largest exporter of rice but also secures its position as the second largest global producer.
Correlation is the degree and direction of association between two traits, a concept initially proposed by Galton (1889) [5] and further elaborated by Fisher (1918) [4] to initiate an effective selection process aimed at genetic improvement in the economic yield of crops. The rice grain yield, being the most dynamic and complex characteristic, depends on various phenotypic traits in addition to external environmental factors. The degree of association between yield and its attributing traits may vary with the environment, the genotype under consideration, or both. Correlation coefficients are used to determine the strength and direction of association between two or more variable characteristics, helping to identify the traits that significantly influence grain yield. They evaluate the rationale behind the association between two variables based on simple correlations among traits and determine the contribution of each individual trait to the total grain yield. Therefore, the present experiment was conducted to study the association between grain yield and its attributing traits.

2. Materials and Methods
The present investigation was conducted at the All India Coordinated Rice Improvement Project (Voluntary Centre), Agricultural Research Station (Paddy), Sirsi, University of Agricultural Sciences, Dharwad, during summer 2023. The two *Oryza sativa* subsp. indica varieties *viz*., BPT-5204 and HY-256 Purple were used as female and male parents respectively to develop successive filial generations as they share various contrasting

characters in terms of anthocyanin pigmentation, maturity duration and grain yield. BPT-5204 is a semi dwarf mega rice variety, devoid of anthocyanin pigment on any of its plant parts with a yield potential of 5.5 to 6.0 t ha^{-1} whereas HY-256 Purple has a unique feature of purple coloured pigmentation in most of the aerial plant parts with grain yield of 2.5 to 3.0 t ha^{-1}.

Hybridization between the female parent, BPT-5204 and male parent, HY-256 Purple was done during summer 2022 and the obtained seeds from the cross constituted F_1 generation, which were sown during *kharif* 2022 and the same were subjected for selfing to obtain seeds to generate F_2 population. The third season involving the evaluation of F_2 population was conducted during summer 2023 with a total of 1320 plants constituted the F_2 generation. Observations regarding plant height (cm), number of panicles per plant, panicle length (cm), grain length (mm), grain breadth (mm), grain length breadth ratio and grain yield (grams per plant) were documented at appropriate growth stages.

Karl Pearson's simple correlation coefficients were computed for phenotypic data recorded on the seven different traits. The significance of correlation coefficients was tested using the student's T statistics at n-2 degrees of freedom and chosen α. Phenotypic correlation were computed using the formulae given by Webber and Moorthy (1952) [13].

$$\text{Karl Pearson's correlation coefficient } r_p = \frac{\text{Cov}(X, Y)}{\sqrt{\sigma^2 p_x} \times \sqrt{\sigma^2 p_y}}$$

Where,

Cov (X, Y) = Covariance of characters say X and Y.

$\sigma^2 p_x$ and $\sigma^2 p_y$ are phenotypic variances for characters X and Y.

3. Results and Discussion

Complete knowledge of the relationship between plant characters like grain yield and other quantitative characters is vital for a breeder to improve the performance of any variety for which natural selection is not very effective (Manoj, 2019) [7]. Hence, association analysis was undertaken to determine the direction of the association and the number of characters to be considered in improving the grain yield of the genotype. Complex traits such as yield are greatly influenced by their component traits. In this case, it is crucial to know the correlation between the different component traits of yield, both among themselves and with the grain yield, to ease the selection for improvement in yield. The phenotypic correlation coefficients were estimated among seven characters *viz*., plant height, number of panicles per plant, panicle length, grain length, grain breadth, grain L/B ratio and grain yield of the F_2 population derived from the cross BPT-5204 × HY-256 Purple to find out the association between grain yield and other yield contributing characters (Table 1).

Plant height exhibited a highly significant positive correlation with the number of panicles per plant (0.473**), panicle length (0.549**), grain length (0.121*) and grain yield (0.327**), whereas two other characters *viz.*, grain breadth (0.066^{NS}) and grain length breadth ratio (0.051^{NS}), showed no any correlation. The characters *viz.*, panicle length (0.408**), grain length (0.190**), grain L/B ratio (0.191**) and grain yield (0.466**), showed a significant and positive correlation with the number of panicles per plant. Grain breadth (-0.035 ^{NS}) exhibited a negative correlation with the number of panicles per plant. The results indicated that panicle length was positively and highly significantly associated with grain length (0.239**), grain L/B ratio (0.139*) and grain yield per plant (0.286**). However, panicle length exhibited no association with grain breadth (0.043 ^{NS}). There was a significant positive correlation of grain length with grain L/B ratio (0.662**) and grain yield (0.233**), while grain breadth (0.084^{NS}) had a non-significant association with grain length. Grain breadth exhibited a highly significant negative correlation with grain L/B ratio (-0.557**), whereas there was a non-significant association with grain yield per plant (0.025^{NS}). Grain yield per plant (0.143**) showed a highly significant positive correlation with grain length to breadth ratio.

The overall result of correlation studies revealed that grain yield per plant had a positive and significant association with the traits *viz*., plant height, number of panicles per plant, panicle length, grain length and grain L/B ratio, indicating that selection for any of the aforementioned traits will eventually improve grain yield. Hence, these characters should be given due consideration while selecting for increased yield. Similar results were documented by Swapnil *et al.* (2020) [11], Bhargava *et al.* (2021) [2], Muthuvijayaragavan and Jebaraj (2022) [8] and Patel *et al.* (2023) [9].

A highly significant positive correlation was observed between the traits, *viz*., plant height, number of panicles per plant and panicle length, as reported by Balat *et al.* (2018) [1], Seneega *et al.* (2019) [10], Bhargava *et al.* (2021) [2], Muthuvijayaragavan and Jebaraj (2022) [8] and Patel *et al.* (2023) [9]. The grain length breadth ratio exhibited significant positive and negative correlations with grain length and breadth, respectively. It indicated that improvement in grain length breadth ratio can be achieved by practising selection for higher grain length combined with lesser grain breadth. Similar conclusions were drawn by Venkanna *et al.* (2014) [12], Seneega *et al.* (2019) [10], Swapnil *et al.* (2020) [11] and Patel *et al.* (2023) [9]. On the contrary, grain breadth had a non-significant association with all the other remaining traits, indicating the independent nature of the trait, as reported by Kiani and Nematzadeh (2012) [6], Swapnil *et al.* (2020) [11] and Patel *et al.* (2023) [9].

In summary, the results of this investigation indicated that the plant height, number of panicles per plant and panicle length could be considered as critical for yield improvement in segregating generations of rice.

Table 1: Phenotypic correlation coefficients for grain yield with its attributes in the F_2 population of BPT-5204 × HY-256 Purple in rice

Character	PH	PN	PL	GL	GB	L/B	GY
PH	1	0.473**	0.549**	0.121*	0.066^{NS}	0.051	0.327**
PN	0.473**	1	0.408**	0.190**	-0.035^{NS}	0.191**	0.466**
PL	0.549**	0.408**	1	0.239**	0.043^{NS}	0.139*	0.286**
GL	0.121*	0.190**	0.239**	1	0.084^{NS}	0.662**	0.233**
GB	0.066^{NS}	-0.035^{NS}	0.043^{NS}	0.084^{NS}	1	-0.557**	0.025^{NS}
L/B	0.051^{NS}	0.191**	0.139*	0.662**	-0.557**	1	0.143**
GY	0.327**	0.466**	0.286**	0.233**	0.025^{NS}	0.143**	1

Legend: PH-Plant height, PN-Number of panicles per plant, PL-Panicle length, GL-Grain length, GB-Grain breadth, L/B-Grain length breadth ratio, GY-Grain yield, *-Significant at 0.05 probability level and **-Significant at 0.01 probability level

Acknowledgment
The authors are thankful to the Department of Genetics and Plant Breeding, College of Agriculture, Dharwad, All India Coordinated Rice Improvement Project (Voluntary Centre), Agricultural Research Station (Paddy), Sirsi, University of Agricultural Sciences, Dharwad for providing facilities to conduct this research.

References

1. Balat JR, Patel VP, Visat ML, Bhagora RN. Variability analysis in F2 population of rice (*Oryza sativa* L.) for yield and related traits. Indian Journal of Pure and Applied Biosciences. 2018;6(1):1021-1027.
2. Bhargava K, Shivani D, Pushpavalli SNCVL, Sundaram RM, Beulah P, Senguttuvel P. Genetic variability, correlation and path coefficient analysis in segregating population of rice. Electronic Journal of Plant Breeding. 2021;12(2):549-555.
3. Falvey JL. History of rice in Southeast Asia and Australia. In: Rice: Origin, Antiquity and History (Ed. Sharma SD), Science Publishers, Boca Raton, 2010, 37.
4. Fisher RA. The correlations among relatives on the supposition of mendalian inheritance. Transactions of the Royal Society of Edinburgh. 1918;52:399-443.
5. Galton F, Natural Inheritance, McMillan, London, 1889.
6. Kiani G, Nematzadeh G. Correlation and path coefficient studies in F2 populations of rice. Notulae Scientia Biologicae, 2012;4(2):124-127.
7. Manoj MS. Studies on stability for yield and yield attributes, resistant gene homologue polymorphism and diversity in Indian mustard [*Brassica juncea* (L.) Czern and Coss.], M. Sc. (Agri.) Thesis, Univ. of Agric. Sci. Dharwad, (India); c2019.
8. Muthuvijayaragavan R, Jebaraj S. Correlation and path coefficient analysis in F2 families of rice (*Oryza sativa* L.) under direct seeded condition. Journal of Genetics, Genomics & Plant Breeding. 2022;6(2):44-53.
9. Patel SN, Sakriya SG, Vaja S, Patel VP. Correlation analysis in F2 segregating generation of rice (*Oryza sativa* L. var. *indica*). The Pharma Innovation Journal. 2023;12(6):4927-4929.
10. Seneega TVA, Gnanamalar RP, Parameswari C, Vellaikumar S, Priyanka AR. Genetic variability and association studies in F2 generation of rice (*Oryza sativa* L.). Electronic Journal of Plant Breeding. 2019;10(2):512-517.
11. Swapnil, Prasad K, Chakraborty M, Singh DN, Kumari P, Ekka JP. Genetic variability, correlation and path coefficient studies in F2 generation of rice (*Oryza sativa* L.). International Journal of Chemical Studies. 2020;8(4):3116-3120.
12. Venkanna V, Rao MVB, Raju CHS, Rao VT, Lingaiah N. Association analysis of F2 generation in rice (*Oryza sativa* L.). International Journal of Pure & Appliied Bioscience, 2014;2(2):198-203.
13. Webber CR, Moorthy BR. Heritable and non-heritable relationship and variablity of oil content and agronomic characteristics in the F2 generation of soybean. 1952;44:202-209.