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Unraveling correlation pattern for yield and its component traits in rice (*Oryza sativa* L.) genotypes

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Abstract
Correlation analysis is a powerful tool for identifying the interrelationship among yield and its component traits in rice (*Oryza sativa* L.), thereby facilitating effective selection strategies in breeding programmes. The present study was undertaken to assess correlation coefficients among ten quantitative traits in rice genotypes. Grain yield per plant exhibited a strong positive correlation with number of productive tillers (r = 0.46), spikelet fertility (r = 0.40), and number of total tillers (r = 0.27), signifying their importance in yield improvement. On the contrary, days to 50% flowering showed a significant negative correlation with yield (r = -0.39), indicating that early flowering contributes positively to productivity. Panicle weight was positively associated with number of filled grains (r = 0.36), whereas test weight exhibited weak and non-significant correlations with most traits. These findings suggest that selection for productive tillers, total tillers, and spikelet fertility would be effective in breeding for higher yield potential in rice.

Keywords: Rice, correlation, productive tillers, spikelet fertility and yield

Introduction
Rice (*Oryza sativa* L.) is a vital staple crop globally, serving as the primary source of calories for more than half of the world's population. In India, it plays a pivotal role in ensuring food and nutritional security, occupying around 44 million hectares and making a substantial contribution to the agricultural GDP. Enhancing rice productivity remains a critical breeding goal, particularly in the face of climate change, shrinking cultivable land, and increasing population pressure. Grain yield in rice is a complex polygenic trait influenced by various morphological and physiological components, including tiller number, panicle structure, spikelet fertility, and grain filling. Due to its multifactorial nature and strong environmental dependency, direct selection for yield often proves less effective. Consequently, indirect selection through correlated traits provides a more dependable approach.

Correlation analysis helps elucidate the relationships among yield and its component traits, guiding breeders toward characteristics that can be targeted for genetic improvement. Positive correlations suggest traits that can be enhanced together, while negative correlations highlight potential compromises. The present study aims to examine the interrelationships among yield and yield-contributing traits in diverse rice genotypes and to identify the most influential parameters that can be efficiently used as selection indices in rice breeding programmes.

Materials and Methods
Experimental Material
A total of 9 cytoplasmic male sterile (CMS) lines of Wild Abortive source and 63 elite lines obtained from Crop Improvement Section (Hybrid Rice Section), ICAR-Indian Rice Research Institute, Hyderabad was utilized for study of correlation.

Traits Evaluated
Data were recorded on ten yield and yield-attributing traits:
1. Days to 50% flowering (DFF)
2. Plant height (PH, cm)

3. Panicle length (PL, cm)
4. Panicle weight (PW, g)
5. Number of total tillers (NTT)
6. Number of productive tillers (NPT)
7. Number of filled grains per panicle (NFG)
8. Spikelet fertility (SF,%)
9. Test weight (TW, g)
10. Grain yield per plant (YLD, g)

Statistical Analysis
Correlation coefficients were calculated using Pearson's method at the phenotypic level. The correlation matrix was visualized in the form of an ellipse plot, where the shape and colour intensity indicate the strength and direction of relationships. Positive correlations appear in teal, while negative correlations are represented in brown.

Results and Discussion
Grain yield per plant (YLD) showed positive and significant correlation with number of productive tillers (r = 0.46), spikelet fertility (r = 0.40), and number of total tillers (r = 0.27). These results confirm that plants producing more fertile and productive tillers contribute directly to yield enhancement. Days to 50% flowering (DFF) exhibited a negative correlation with grain yield (r = -0.39) and number of total tillers (r = -0.26). This suggests that early flowering genotypes tend to be more productive, likely due to efficient resource allocation and reduced risk of terminal stress. Panicle weight (PW) was positively correlated with number of filled grains (NFG, r = 0.36), indicating that panicle weight is largely a function of grain filling efficiency. Panicle length (PL) showed a moderate positive correlation with plant height (PH, r = 0.47). A strong positive correlation between NTT and NPT (r = 0.69) was observed, showing that higher tiller number contributes to greater productive tiller output. However, yield is primarily determined by productive tillers rather than total tillers, emphasizing the importance of tiller effectiveness. Test weight (TW) exhibited weak and non-significant correlations with most characters including yield, implying that grain weight is relatively independent of vegetative and reproductive growth. The details of correlation matrix was depicted in Fig.1

Breeding Implications
The results underline that productive tillers, total tillers, and spikelet fertility are the most critical traits influencing yield. Breeding programmes should prioritize these traits while selecting superior genotypes. The negative relationship between DFF and yield further indicates that earliness should be exploited for developing high-yielding varieties suitable for multiple environments.
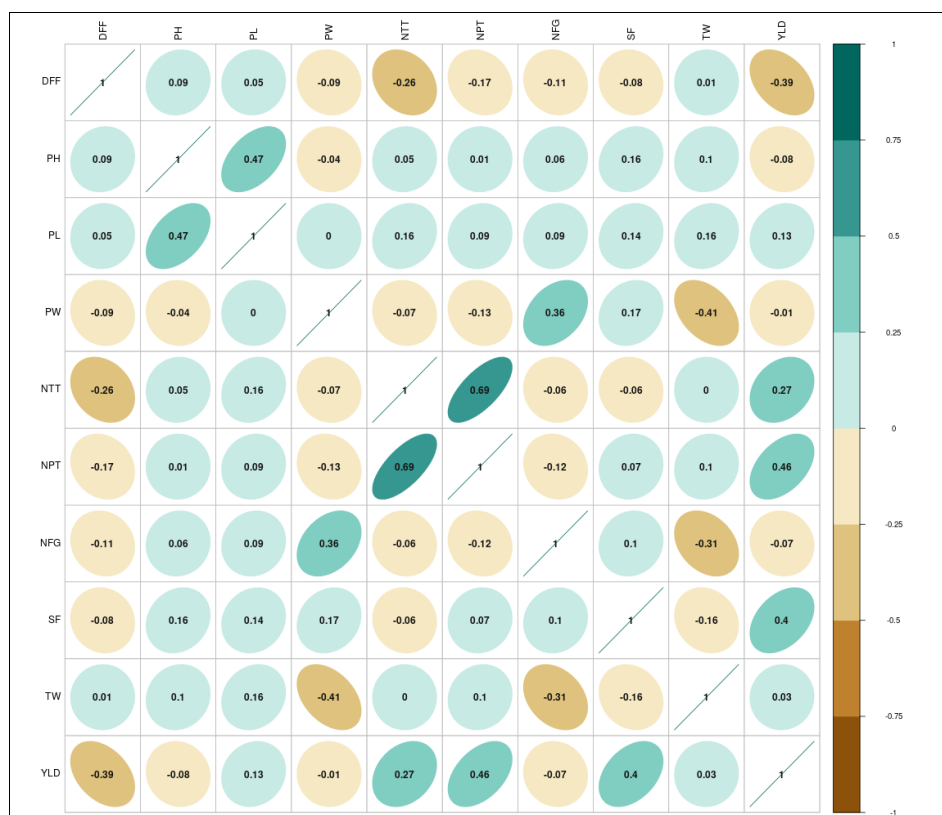

Fig 1: Correlation matrix of yield & yield contributing characters in rice genotypes

Conclusion
The present study demonstrated that grain yield in rice is significantly influenced by number of productive tillers, total tillers, and spikelet fertility, which should be considered as major selection criteria in breeding programmes. Early flowering genotypes showed better yield performance, highlighting the importance of earliness in rice improvement. Panicle weight and filled grain number also contributed positively, whereas test weight had little impact on yield.

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