# ASSOCIATION OF VARIOUS MORPHOLOGICAL TRAITS WITH YIELD IN RICE (*ORYZA SATIVA* L.)

## (Review)

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***ABSTRACT:*** *In this review, association of various morphological traits with yield, highest genetic variability, significant correlation among the genotypes for all traits in rice was found. Highest genetic variability is observed in spikelets per plant, panicle length, plant height, days to heading and days to maturity. Significant correlation with yield is also noticed for Panicle length. Seeds per panicle and seed weight per panicle showed significant positive correlation with grain yield. The highest variability is observed in panicle length and flag leaf area, tillers per plant and plant height. All the seed traits also showed significant variation amongst the genotypes. The derived information would be useful to select potentially breeding lines for future rice improvement program.*

### INTRODUCTION

In Pakistan rice is an important cash crop of the country. It belongs to the poaceae (gramineae) family. . Rice holds particularly important position in agriculture and national economy of Pakistan. Pakistan is the world's 4th largest rice producer after China, India and Indonesia [1]. Rice rank is as second amongst the staple food grain crop in Pakistan and it has been major source of foreign exchange earning in recent years. Rice account 2.7% of the value added in agriculture and 0.6% GDP. . At 744.7 million tones the resulting 2014 global production forecast would be slightly (0.2 percent) lower than the 2013 level of both plantings and yields by unfavorable weather conditions [2]. Export of rice from Pakistan decreased from us $2.18 billion in 2009-10 to us $ 1.92 billion in 2013-14 thus showing decline of 19 % [3]. Rice production has increased to 25,286 thousand tons in 2013-14 as compared to 5,536 thousand tons in 2012-13 showing an increase of 22.8% and decline of export 19% [4].Genetic variance among the plant materials is an important tool to the plant breeders for good Selection of breeding lines of the assorted parents for their potential use in a rice breeding program for the Improvement of the rice Production .Parents identified on the basis of divergence for any breeding program would be very useful for future rice improvement, more promising. Arunachalam *et al*. [5] Rice grain yield is a quantitative polygenic character and highly influenced by environment. Extent and significance of association of yield with yield components should be considered, while determining the selection criteria of germplasm on the basis of available genetic variation Habib *et al*. [6] Thousands rice cultivars have been evolved through selection from the cultivated material many centuries ago, which are well adapted to the local environments. Many of those ricecultivars having good quality characteristics and higher yield potential under biotic and abiotic stress environments. Since the dawn of civilization, thousands of locally adapted genotypes of aromatic rice have evolved through human selection. Sing *et al.* [7]The positive-Correlation with number of filled spikelet's per panicle, number of effective tiller per hill and 1000 grain weight, and negative association for number of unfilled spikelet per panicle, panicle length and non-significant association for plant height and number of ineffective tillers per hill. Path analysis showed positive direct effect for number of effective tillers per hill, plant height, panicle length .number of filled spikelet per panicle, 1000 grain weight and had negative direct effect for number of ineffective tiller per hill on grain yield per plant. Rahmane *et al.* [8] Ekka *et al.* [9] Bhadru *et al*. [10] Grains per panicle had high correlation coefficient with grain yield. The present study revealed that for increasing rice yield genotype should possess more number of panicles, grains per panicle, tillers per plant, high spikelet fertility and large panicle size. Seyoum *et al.* [11] Highly significant difference between the most of the character except for unfilled grain percentage per panicle. Grain yield and yield kg per hectare showed highest value of genotypic and phenotypic coefficient of variation. Panicle length and number of grains per panicle. The present study showed that there was high genetic variability among the genotypes, which shows that it could be select traits for increase the yield. Idris *et al.* [12] Number of grains per panicle, flag leaf area, number of productive tiller was significantly correlated with grain yield. Days to maturity and other yield component had positive correlation with grain yield except days to heading. Grain yield could improve if selection is done on the base of biological yield component, number of productive tillers per plant and flag leaf area. Wattoo *et al.* [13] Strong genetic correlation paddy yield was observed with number of grains per panicle, 1000 grain weight and days to maturity. The experiment revealed that genotype had more number of grains per panicle and 1000 grain weight produced more paddy yield , whereas that genotype had more spent long duration to reach maturity. Regression analysis showed that paddy yield had significant positive correlation with 1000- grain weight and number of grains per panicle. Hence, result showed for any breeding is to be planned for higher yield in which grains per panicle, 1000-grain weight and days to maturity are important. Akhtar *et al.* [14] Number of filled grains per panicle, total number of spikelet per panicle, panicle length and the panicle number per plant had the significantly correlated with grain yield. Path coefficient analysis result showed that panicle length had the highest positive direct effect on grain yield. Panicle length, number of filled grain per panicle and number of panicles per plant had linearly correlated with grain yield. Therefore these traits could be used in the selection for grain yield in rice. Bagheri

*et al*. [15] The number of productive tiller per plant had positive association of grain yield per plant. For the improvement of yield can select these traits. Path coefficient analysis showed that number of productive tillers per plant and panicle length had positive correlation with yield. Number of productive tillers per plant, among these characters had both positive association and high direct effect. For the improvement of yield and its components could be select this character. Babu *et al.* [16] Sing *et al*. [17] The plant height has a positive correlation with grain yield and negative correlation with empty grain. The regression showed important trait related to grain yield were total number of grain. Path analysis result showed that plant height and empty grain were the most important component of grain yield and they had direct effect on grain yield. Mirhoseini *et al.* [18] Grain yield was significantly positively correlated with number of tillers per plant, plant height and number of filled grains per panicle. Results suggesting the trait, number of filled grains per panicle as the selection criteria for the grain yield in rice. Atif *et al.* [19] Bagheri *et al.* [20] Highest significant positive association of number of grains per panicle, total number of productive tillers per plant, harvest index, kernel L/B ratio, milling percentage and panicle length with grain yield per plant. In path coefficient analysis, number of grains per panicle and total number of productive tillers per plant showed the highest positive direct effect towards increasing grain yield so these traits should be consider as the main yield components. Result suggesting the traits, numbers of grain per panicle and total number of productive tillers as effective selection. Nagaraju *et al.* [21] Plant height, and spikelet per plant, panicle length, days to maturity and days to heading with highest genetic variation. Positive correlation of panicle length, seeds per panicle and seed weight per panicle was noticed with grain yield. Plant height, tillers per plant, panicle length and lag leaf area exhibited highest variability. Twenty selected genotypes were further evaluated for the seed traits using Vernier caliper. All the traits as expected exhibited the significant variation among genotypes. Traits, seed length and seed width showed maximum variation (88%) with respect to the other seed traits. Ashfaq *et al.* [22] Positive correlation of traits; panicles per plant and filled grains per panicle with grain yield while negative association of unfilled grains per panicle with grain yield. Results from this experiment suggested that traits, the panicles per plant and filled grains per panicle could be use as selection criteria for grain yield improvement in segregating population in rice. Kiani *et al.* [23] Pratap *et al.* [24] Grain yield was found to be significantly correlated with plant height, panicle length, flag leaf area and total number of grains per panicle at genotypic level. Plant height had a positive correlation with number of tillers per plant at genotypic level. So these result suggested that such traits could be used for better parental selection strategy. Khan *et al.* [25] Hassan *et al.* [26] Path analysis revealed direct positive effect of filled grains per panicle and days to 50 % maturity on total grain yield per hectare while number of grains per panicle processed indirect positive effect on grain yield per hectare. Negative indirect effect on grain yield per hectare was processed by number of filled grains per panicle through the number of tillers per plant and number of panicles per meter square respectively. Ahmad *et al.* [27] Development of high yielding varieties requires the knowledge of existing genetic variability. Rice breeders are interested in developing varieties with improved yield and other desirable agronomic characters. Genetic variability for agronomic traits is the key component of breeding programs for broadening the gene pool of rice. Plant breeders commonly select for yield components which indirectly increase yield. Genetic parameters such as genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) are useful in detecting the amount of variability present in the germplasm. Idris *et al.* [28] Genetic divergence among the genotypes play an important role in selection of parents having wider variability for different traits. Nayak *et al.* [29] Crop improvements depend upon the magnitude of genetic variability present in the base population. The expected improvement in yield components primarily depends on the nature and magnitude of heritable total variation. Selection based on a single character may not always be effective while it is impractical for a researcher to consider a large number of component characters simultaneously in a particular selection procedure. Correlation analysis between yield and its components provides useful information for right choice of characters in the selection programme. Soni *et al.* [30] The positive significant association of grain yield with number of affective tillers, spikelet fertility, panicles, and thousand grain weight at both genotypic and phenotypic level. Hassan *et al.* [31]Imran *et al.* [32] Number of tillers per plant and plant height showed highest phenotypic coefficient of variation. For plant height, number of tillers per plant and 1000 grain weight high heritability was also observed. Negative association of grain yield with unfilled grains per panicle was also revealed while high positive association/correlation with number of tillers per plant, panicle length, number of filled grains per panicle and 1000 grain weight. So number of tillers per plant, panicle length, number of filled grains per panicle and 1000 grain weight could be the index traits to improve total grain yield. Osman *et al.* [33] Experiment showed the result of heritably and genetic advance as percent of mean and genotypic and phenotypic coefficient of variation among the accession. The data was record leaf width, number of effective tillers, filled grain per panicle, and total number of grains per panicle and grain yield per plant. Plant height, number of filled grains per panicle, days to maturity and test weight showed positive correlation at genotypic and phenotypic level. Singh *et al.* [34] Grain yield exhibited significantly positive correlation with the number of tillers per plant, panicle weight and number of grains per panicle. Therefore, the results suggest that these traits can be used for grain yield selection. Akinwale *et al.* [35] Lakshmi *et al.* [36] Plant height, number of tillers / plant, number of productive tillers / plant, panicle length, filled grains per panicle had significant positive association with grain yield. Filled grains /panicle, plant height, panicle length, number of tillers / plant and days to 50% flowering and they contributed primarily to yield and could be relied upon for selection of genotypes to improve genetic yield potential of rice. Selvaraj *et al.* [37] Correlation analysis indicated highly positive significant association for grain yield with all other parameters such as

plant height, number of tillers per plant, panicle length, panicle weight, and 1000-grain weight, number of grains per panicle and spikelet fertility. So selection on the basis of these characters will help breeders to achieve more paddy yield in rice. Shabir *et al.* [38]

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