CHARACTER ASSOCIATION STUDY OF YIELD CONTRIBUTING TRAITS IN RICE (ORYZA SATIVA L.)
(Review)

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ABSTRACT: *Paddy yield is a complex quantitative trait that is controlled by many genes which interact with the environment and is the product of many factors called yield components. Parental selection on their yield basis is not an appropriate selection strategy. Most of the authors found character association in rice indicating yield associated positively with the plant height, number of tillers per plant, number of seeds per panicle and panicle length. Hence, one should have the knowledge about the relationship between yield and its components to establish the strategy to increase paddy yield.*

INTRODUCTION

Rice (Oryza sativa L.) belongs to poaceae (gramineae) family, is a cereal crop that is grown as a cash crop in Pakistan. It holds an extremely 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 is one of the world's most important food crop with a total production around 600 million ton occupying 11% of the world's total arable land. Pakistan produced 9.8 million tons (6.5 million tons, milled basis) in 2104 [2]. Rice possessed 22.79% of agricultural value addition. The average rice production is 6 million tons together with the rest of south Asia. The country is supplying about 30% of the world's paddy rice output. Most of the rice crop is grown in fertile collar tract of Punjab and fertile regions of Sindh [3]. Among the most famous cultivars grown in Pakistan, Basmati (super) is best known for its flavor and quality. Rice is grown on an area of 2789.2 thousand hectares with a production of 6798.1 thousand tons during the year 2013-2014 in Pakistan. Present status of area under rice has been reduced up to 30% over last year [4]. Present rice production is not sufficient as compared to developed countries in the world. For development of new high yielding varieties, one requires the knowledge of character association of the traits that ultimately counts to yield. Plant breeders commonly perform selection for yield components which directly as well as indirectly contributes towards the yield increment. Mirhoseini *et al.* [5] identified that the grain yield has a positive and significant correlation with plant height and negative correlation with empty grain. Atif and Khalid [6] also identified that grain yield was significantly positively correlated with number of tillers per plant, plant height and number of filled grains per panicle. Nagaraju *et al.* [7] revealed highest significant positive association of number of grains per panicle, total number of productive tillers per plant, harvest index and panicle length with grain yield per plant. Chandra Mohan singh [8] found Grain yield showed positive and significant correlation with plant height and panicle length. Osman *et al.* [9] found 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. Idris *et al.* [10] found that in the selection of best genotype for yield and yield components, heritability estimate would be the most useful to predict the efficiency of the selection because it helps to determine the effect of environment on the genotypic expression and reliability of the character. Ashfaq *et al.* [11] observed Positive correlation of panicle length, seeds per panicle and seed weight per panicle with grain yield. Kiani and Nematzadeb [12] examined the association between yield and yield components and identified significant 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.

Bhadru *et al.* [13] found that plant height, number filled grains per panicle and days to 50 percent flowering had positive and significant association with yield. Seyed [14] concluded that grains per panicle, days to maturity, number of productive tillers per plant, days to flowering, plant height had positive and significant correlation with the grain yield. Immanuel *et al.* [15] revealed that parameters like plant height, number of tillers per plant, number of productive tillers per plant, panicle length, filled grains per panicle and test weight showed significant positive association with grain yield. Akhtar *et al.* [16] suggested the traits number of grains per panicle, 1000 grain weight and days to maturity as important in selection strategies aimed for higher paddy yield because these traits processed a strong genetic correlation for the grain yield in rice. Akinwale *et al.* [17] studied correlation analysis in rice and suggested that Grain yield was significantly and positively correlated with the number of tillers per plant, panicle weight and number of grains per panicle. Hence, they concluded that above mentioned traits can be used as a selection criterion in plant breeding projects for improvement of rice grain yield.

Yadav *et al.* [18] found that grain yield was significantly and positively associated with harvest index, number of tillers per hill, number of panicle per plant, panicle length, number of spikelet's per panicle and test weight at both genotypic and phenotypic levels. Ahmad *et al.* [19] studied correlation on sixteen rice genotypes. They reported that grain yield per plant was positively correlated with average panicle weight harvest index. Hairmasis *et al.* [20] conducted correlation analysis on nine advanced rice breeding lines and revealed direct effect of number of effective tillers per hill, number of filled grains per panicle and spikelet fertility on the grain

yield, while plant height possessed negative effect on the grain yield and maturity, number of spikelets per panicle and 1000-grain weight showed negligible effects on rice grain yield. Chakraborty and Chakraborty [21] found that sterility percentage, effective branch tiller per hill and panicle length had positive correlation with grain yield. Watto *et al.* [22] found that grain yield was significantly correlated with its component characters, number of effective tillers per plant, number of grains per panicle and flag leaf area. A positive correlation of yield with days to 50% flowering, plant height, number of grains per panicle, number of spikelets per panicle and spikelet fertility was also identified by Nandan et al. [23]. Sabesan *et al.* [24] identified that Grain yield per plant shows positive significant association with plant height and productive tillers per plant. Khan *et al.* [25] indicated that at genotypic level plant height shows positive and significant correlation with all the morphological/agronomic traits. 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.

Biometrical studies conducted by Vange [26] also described positive correlation with flag leaf area, number of tillers, number of panicle, panicle weight, panicle length, number of branches per panicle, number of seeds per panicle and seed weight per panicle, grain length and 1000 seed weight. Petchiammal and Kumar [27] performed association analysis and reported that panicle length, spikelet fertility and days to 50% flowering showed positive correlation with the yield. Agahi *et al.* [28] found that grain yield was significantly correlated with days to heading, total tillers, number of effective tillers, days to maturity, number of grains per panicle, flag leaf length, flag leaf width and plant height. Ahmad Mustafa and Yassir Elsheikh [29] found highest phenotypic correlation between grain yield and number of filled grains per panicle, number of panicles per meter square and 1000 grain weight. Zahid *et al.* [30] found highest positive direct effect of number of grains per panicle on grain yield and 1000 grain weight in basmati rice. Agbo and Obi [31] conducted a study and reported that number of tillers per plant and percentage of fertile spikelets had the strongest genotypic correlations with yield. Sivakumar and Bapu [32] determined the nature and magnitude of association between grain yield and its component characters. Number of tillers per plant, grains per panicle and 100-grain weight exhibited positive correlation with grain yield at both phenotypic as well as genotypic levels. Madhavilatha *et al.* [33] noted that the yield was found to be positively associated with number of effective tillers per plant, number of grains per panicle and 1000-grain weight. Among these, number of effective tillers per plant was noticed to exert high direct effects on grain yield. Zafar *et al.* [34] reported that days to heading had positive correlation with maturity and grain length. Plant height showed positive and significant correlation with the panicle length.

Chaturvedi *et al.* [35] found that the grain yield (t/ha) was positively and significantly correlated with number of filled spikelets. Saha *et al.* [36] concluded that short seedling and plant height along with heavy grains had appreciable contribution towards yield. Surek *et al.* [37] found that the grain yield was significantly correlated with its component characters like the number of effective tillers per meter square, biological yield, harvest index and the number of filled grains per panicle. Saif *et al.* [38] revealed that plant height had significant correlations at genotypic level with all other traits except grain yield per plant. Genotypic correlation between plant height and number of tillers per plant was positive and significant and at phenotypic level plant height had non-significant association with all other characters. Prasad *et al.* [39] studied yield components and found that effective tillers per plant, fertile grains per panicle and 1000 grains weight showed high positive correlation with grain yield while plant height exhibited negative correlation with grain yield. Nayak *et al.* [40] revealed that the grain yield per plant had positive correlation with the plant height, panicle number per plant, panicle length, total number of spikelets per panicle and total number of grains per panicle.

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