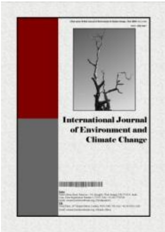

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Studies on Correlation and Path Coefficient Analysis of Yield and Yield Attributing Characters in Rice Landraces (*Oryza sativa* L.)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

In order to characterise the correlation and path analysis for yield and yield attributing traits for 66 genotypes including 4 checks in Augmented Block Design replicated thrice during Kharif, 2021, the present investigation was conducted at the Agricultural College, Aswaraopet, Bhadradri, Telangana. The most positive and significant correlation between important traits and grain yield per plant was found to be between the number of panicles per plant and the number of filled grains per panicle indicating yield can be improved through improvement of these traits. The features number of panicles per plant and number of filled grains per panicle had reported the strongest positive direct effect on grain yield per plant, and may be considered as excellent selection criteria for yield improvement, according to path coefficient analysis.

Keywords: Correlation; path coefficient analysis; landrace; rice.

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1. INTRODUCTION

India's main food crop is rice (*Oryza sativa* L.). It belongs to the Oryzoideae subfamily of the Gramineae. *Oryza sativa* and Oryza glaberrima are two of the 23 species in the genus, according to D. Chatterjee [1], 21 of which are wild. In India, rice is referred to as "Prana," which means "breath of life." 700 million tonnes of rice are produced annually on 158 million hectares of land worldwide. 114 of the 193 countries in the world's population grow it. But more than 90% of the world's rice is produced and consumed in Asia. More than half of the world's rice-growing acreage and 56% of its rice production are in China and India [2]. With an area, production, and productivity of 43.80 million ha, 118.88 million tonnes, and 2650 Kg ha-1, respectively, India is one of the world's top producers of rice. Nearly all of the states in India, including Telangana, Andhra Pradesh, Bihar, Uttar Pradesh, Maharashtra, and West Bengal, cultivate rice. Out of these, West Bengal and Uttar Pradesh generate the most rice. The production and productivity of rice in Telangana State, however, is 60.50 million tonnes and 3550 kg ha-1 on an area of 1.8 million ha. With an increasing area of 55.50 lakh acres in kharif and 54.30 lakh acres in rabi, Telangana is gradually becoming known as the "Rice Bowl of India".

Given that grain yield depends on various component characters, the knowledge of correlation among yield, yield components and quality traits, in addition to identification of direct and indirect effects of the yield and quality traits on grain yield would help in effective yield improvement [3]. The present investigation was undertaken in this context to elucidate information on character associations and path coefficients in the rice genotypes to identify effective selection criteria for grain yield and quality improvement of rice genotypes.

2. MATERIALS AND METHODS

The material used in the present investigation comprised of 70 genotypes which included 66 rice landraces and 04 Standard check varieties (Chittimutyalu, DRR Dhan 45, BPT5204 and Zincorice). The experiment was carried out during *kharif*, 2021, at Agricultural College, Aswaraopet, which is situated at an altitude of 64 m above mean sea level at 18° 80' N latitude and 7° 55' E longitudes in the Northern Zone of Telangana State. The experimental material was planted in an augmented block design, Standard check varieties were repliacated 3 times. Each replication consisted of three rows of 1 m in length with a spacing of 20 cm between the rows and 15 cm between the plants. All required precautions were taken to ensure a uniform plant population in each treatment per replication. Five plants were selected at random and observations were recorded from each replication. The characters studied were Days to 50% flowering, Days to maturity, Plant height (cm), Panicle length (cm), Number of panicles per plant, Number of filled grains per panicle, Grain length (mm), Grain width (mm), 1000 grain weight (g), Kernel length (mm), Kernel breadth (mm), Grain iron content (ppm), Grain zinc content (ppm) and Grain yield per plant (g). Relevant data were collected and subjected to statistical analysis by employing the methods of correlation coefficient and Path analysis by Dewey and Lu [4].

3. RESULTS AND DISCUSSION

Phenotypic selection is influenced by several biotic and abiotic factors, and the selection is always deceptive. Therefore, every crop development programme will benefit from selection based on the set of qualities that significantly correlate with grain yield.

The degree and direction of association between diverse features, which is the key to the selection process to develop high-yielding cultivars, will be shown by correlation studies on various yield and yield attributing traits. The fundamental information about the direct and indirect effects of various independent factors on the final dependent variable, grain yield, is provided by path coefficient analysis.

The correlation coefficients between yield and yield components, including plant height, panicle length, number of panicles per plant, number of filled grains per panicle, grain length, grain width, 1000 grain weight, kernel length, kernel breadth, grain iron content, and grain zinc content, were evaluated and the results have been presented in Table 1.

Positive and significant associations were noticed for panicle length, number of panicles per plant, number of filled grains per panicle. The positive but non-significant association was observed with days to maturity, grain length, grain width, 1000 grain weight, kernel length, kernel breadth, grain iron content, grain zinc content and showed a negative non significant correlation with days to 50%

Table 1. Correlation coefficients of yield and yield attributing traits in rice genotypes

Character	DFF	DM	PH	PL	NPP	NFG	GL	GW	TGW	KL	KB	FC	ZC	GYP
DFF	1.000	0.5649***	-0.1162	-0.1162	0.0632	0.2170	-0.2189	-0.2288	0.0055	-0.0723	-0.1289	0.2519*	0.2372*	-0.0549
DM		1.000	-0.3267**	0.0212	0.0673	0.1383	0.0639	-0.2411*	0.0864	0.0252	-0.0417	0.2340	0.2916*	0.1750
PH			1.000	0.1545	-0.1065	0.1214	-0.1337	0.1146	0.0620	-0.0264	0.0515	-0.2530*	-0.1680	-0.1755
PL				1.000	0.2396 *	0.2306	0.0547	0.2411 *	-0.0546	0.2525 *	0.0692	-0.0633	0.0424	0.3118 **
NPP					1.000	0.6061***	-0.0263	0.1582	-0.0210	0.1047	-0.0089	0.2008	0.1570	0.7991 ***
NFP						1.000	-0.0688	0.1255	0.0403	0.1013	0.1898	0.0830	0.3180**	0.5121 ***
GL							1.000	0.5569 ***	0.0861	0.7323 ***	0.0941	0.0780	-0.0658	0.0712
GW								1.000	0.0756	0.6173 ***	0.3923 ***	0.0334	-0.0257	0.1846
TGW									1.000	0.1109	0.3037*	0.0569	0.0771	0.0461
KL										1.000	0.1802	0.1724	-0.0112	0.1323
KB											1.000	0.0694	0.1815	0.0776
FC												1.000	0.6378 ***	0.0946
ZC													1.000	0.0609

** Significance at p = 0.01 **Significance at p = 0.05*

DFF- Days to 50% flowering, DM- Days to maturity, PH- Plant height, PL- Panicle length, NPP- Number of panicles per plant, NFP- Number of filled grains per panicle, GL- Grain length, GW- Grain width, TGW- 1000 grain weight, KL- Kernel length, KB- Kernel breadth, FC- Fe(iron) content, ZC- Zn(zinc) content, GYP- Grain yield per plant

Table. 2 Path coefficients of yield and quality traits in rice

CHARACTER	DFF	DM	PH	PL	NPP	NFG	GL	GW	TGW	KL	KB	FC	ZC	GYP
DFF	-0.2121	-0.1198	0.0247	0.0193	-0.0134	-0.0460	0.0464	0.0485	-0.0012	0.0153	0.0274	-0.0534	-0.0503	-0.0550
DM	0.1301	0.2302	-0.0752	0.0049	0.0155	0.0318	0.0147	-0.0555	0.0199	0.0058	-0.0096	0.0539	0.0671	0.1751
PH	0.0117	0.0328	-0.1005	-0.0155	0.0107	-0.0122	0.0134	-0.0115	-0.0062	0.0027	-0.0052	0.0254	0.0169	-0.1755
PL	-0.0092	0.0022	0.0157	0.1018	0.0244	0.0235	0.0056	0.0246	-0.0056	0.0257	0.0071	-0.0065	0.0043	0.3118
NPP	0.0465	0.0495	-0.0783	0.1762	0.7353	0.4457	-0.0193	0.1164	-0.0155	0.0771	-0.0066	0.1477	0.1155	0.7991
NFP	0.0133	0.0085	0.0074	0.0141	0.0372	0.0613	-0.0042	0.0077	0.0025	0.0062	0.0116	0.0051	0.0195	0.5121
GL	-0.0026	0.0008	-0.0016	0.0006	-0.0003	-0.0008	0.0118	0.0066	0.0010	0.0087	0.0011	0.0009	-0.0008	0.0712
GW	-0.0151	-0.0159	0.0076	0.0159	0.0104	0.0083	0.0367	0.0659	0.0050	0.0407	0.0259	0.0022	-0.0017	0.1846
TGW	0.0003	0.0041	0.0030	-0.0026	-0.0010	0.0019	0.0041	0.0036	0.0480	0.0053	0.0146	0.0027	0.0037	0.0462
KL	0.0031	-0.0011	0.0011	-0.0110	-0.0045	-0.0044	-0.0318	-0.0268	-0.0048	-0.0434	-0.0078	-0.0075	0.0005	0.1323
KB	-0.0028	-0.0009	0.0011	0.0015	-0.0002	0.0042	0.0021	0.0086	0.0067	0.0040	0.0220	0.0015	0.0040	0.0777
FC	-0.0226	-0.0210	0.0227	0.0057	-0.0180	-0.0075	-0.0070	-0.0030	-0.0051	-0.0155	-0.0062	-0.0899	-0.0573	0.0947
ZN	0.0046	0.0057	-0.0033	0.0008	0.0031	0.0062	-0.0013	-0.0005	0.0015	-0.0002	0.0036	0.0125	0.0196	0.1410

Residual effect = 0.5236. DFF- Days to 50% flowering, DM- Days to maturity, PH- Plant height, PL- Panicle length, NPP- Number of panicles per plant, NFP- Number of filled grains per panicle, GL- Grain length, GW- Grain width, TGW- 1000 grain weight, KL- Kernel length, KB- Kernel breadth, FC- Fe(iron) content, ZC- Zn(zinc) content, GYP- Grain yield per plant flowering and plant height [5,6]. The findings revealed that late flowering types may have more chance of vegetative growth, increasing source and sink relationship paving way for more number of grains and yield.

Positive and significant associations were observed for days to maturity with days to 50% flowering, zinc content and non significant positive correlation with the panicle length, number of panicles per plant [7], number of filled grains per panicle, grain length, 1000 grain weight, kernel length, grain iron content, grain yield per plant. It recorded a significant negative association with the plant height, grain width and non significant negative association with the kernel breadth.

Positive and significant associations were observed for days to maturity with days to fifty percent flowering ,iron content and zinc content. While non significant positive correlation with the panicle length, number of panicles per plant, number of filled grains per panicle [8], grain length, 1000 grain weight, kernel length, grain iron content, grain yield per plant. Days to maturity recorded significant negative association with the plant height, grain width and non significant negative association with the kernel breadth.

Plant height revealed that there was a non significant positive correlation with panicle length [9], number of filled grains per panicle, grain width, 1000 grain weight, kernel breadth.While significant negative association with days to maturity, grain iron content [10] and non significant negative association with the plant height, number of panicles per plant, grain length, kernel length , grain zinc content [11] and grain yield per plant [5,6].

Panicle length was significantly and positively correlated with number of panicles per plant [12], grain width, kernel length, grain yield per plant [13]and non significant positive association with the number of filled grains per panicle, grain length, kernel breadth and grain zinc content [14]. The concentrations of days to 50% flowering, 1000 grain weight, grain iron content have a non-significant negative correlation.

Panicle length, Number of filled grains per panicle, grain yield per plant had a strong positive connection with the number of panicles per plant showing that it is one of the important selection attributes for yield increase. The trait recorded that there was a non significant positive correlation with days to 50% flowering, days to maturity, grain width, kernel length, grain iron content and grain zinc content. Plant height, grain length, 1000 grain weight and kernel breadth have negative non-significant association with number of panicles per plant. The results were in conformity with Patel et al. [15], Pandey et al. [16], Seneega et al. [17], Islam et al*.* [18], Prasannakumari et al*.* [19], Parimala et al*.* [20] and Sudeepti et al*.* [21] for grain yield per plant.

Filled grains per panicle were significantly and positively correlated with number of panicles per plant, grain zinc content, grain yield per plant [15]. positive non significant association with days to 50% flowering, days to maturity, plant height, panicle length, grain width, 1000 grain weight, kernel length, kernel breadth and grain iron content and non significant negative correlation with the grain length. Selection based on the number of filled grains per panicle improves yield.

Grain length shows a positive significant correlation with grain width and kernel length and also exhibits a positive non significant association with days to maturity, panicle length, 1000 grain weight, kernel breadth, grain iron content and grain yield per plant. It recorded non significant negative correlation with the days to 50% flowering, plant height, number of panicles per plant, number of filled grains per panicle and grain zinc content. These results are in line with the earlier reports of Ekka et al. [3], Islam et al. [18].

Positive significant associations were observed for panicle length, grain length, kernel length, kernel breadth with grain width and positive non significant associations with the plant height, number of panicles per plant, number of filled grains per panicle, 1000 grain weight, grain iron content and grain yield per plant. The trait also shows a negative significant association with days to maturity and a negative non significant association with the days to 50% flowering and grain zinc content. These results are in line with the earlier reports of Ekka et al. [3], Mallimar et al. [22] and Islam et al. [18].

1000 grain weight revealed a significant positive correlation with kernel breadth and non significant positive correlation with days to 50% flowering, days to maturity, plant height, number of filled grains per panicle, grain length, grain width, kernel length, grain zinc content, grain iron content and grain yield per plant. This trait had a negative non significant association with panicle length and the number of panicles per plant [23]. As a result, simple selection of this attribute could be able to improve yield.

Positive significant correlations were noticed for panicle length, grain length, grain width with kernel length and positive non significant correlation with the days to maturity, number of panicles per plant, number of filled grains per panicle, 1000 grain weight, kernel breadth, grain iron content and grain yield per plant. The trait also reveals a negative non significant correlation with the days to 50% flowering, plant height and grain zinc content. These results are in line with the earlier reports of Ekka et al.[3], Islam et al. [18] and Prasannakumari et al. [19].

Kernel breadth exhibits a positive significant correlation with grain width, 1000 grain weight and positive non significant correlation with plant height, panicle length, number of filled grains per panicle, grain length, kernel length, grain iron content, grain zinc content and grain yield per plant. This trait had a negative non significant correlation with the days to 50% flowering, days to maturity and number of panicles per plant.These results are in line with the earlier reports of Ekka et al. [3], Islam et al. [18] and Prasannakumari et al. [19].

Grain iron concentration has a significant positive correlation (r=0.248) with days to 50% flowering and grain zinc content and also exhibits a non-significant positive connection (0.165) with days to maturity, number of panicles per plant, number of filled grains per panicle, grain length, grain width, 1000 grain weight, kernel length, Kernel breadth and grain yield per plant. This trait also shows a negative significant correlation with the plant height and a negative non significant correlation with the panicle length. Oliveira et al. [24], Mallimar et al. [22] and Raza et al. [25] all found a positive association between iron and zinc in their studies.

Grain zinc concentration has a significant positive correlation with days to 50% flowering, days to maturity, number of filled grains per panicle and grain iron content and also recorded a non-significant positive connection with panicle length, number of panicles per plant, 1000 grain weight, kernel breadth, grain yield per plant and number of filled grains per panicle. This trait reveals a negative non significant correlation with the plant height, grain length, grain width and kernel length. For iron, the results were consistent with Oliveira et al. [24], Mallimar et al. [22], and Raza et al. [25], and for yield, they were consistent with Singh et al. [12].

3.1 Path Coefficient Analysis

It is generally recognised that simple correlation does not reflect the underlying relationship between qualities and yield, nor does it explain the relationship between causes and effects between the numerous yield parameters and, ultimately, the yield. By separating the correlation coefficients into direct and indirect effects, the path analysis technique gives insight into the true impact of independent factors on yield.

For the yield and yield component traits, path coefficient analysis estimates have been presented in Table 2 and Fig. 1. From the path analysis it was observed that, the number of panicles per plant reported a high direct positive effect on grain yield per plant (0.7353) and the correlation between the two traits is positive and significant (0.7991). It expressed positive indirect effects through days to 50% flowering (0.0465), days to maturity (0.0495), panicle length (0.1762), number of filled grains per panicle (0.4457), grain width (0.1164), kernel length (0.0771), grain iron content (0.1477), grain zinc content (0.1155) and negative indirect effects through plant height (-0.0783), grain length (-0.0193), 1000 grain weight (-0.0155) and kernel breadth (-0.0066). The results were in agreement with the findings of Edukondalu et al.[26], Archana et al. [27] and Rachana et al. [28].

The trait, panicle length was noticed as the second most important character with a direct positive effect on grain yield per plant (0.1018) and the correlation between the two traits is positive and significant (0.3118). It expressed positive indirect effects through days to maturity (0.0022), plant height (0.0157), number of panicles per plant (0.0244), number of filled grains per panicle (0.0235), grain length (0.0056), grain width (0.0246), kernel length (0.0257), kernel breadth (0.0071), grain zinc content (0.0043) and negative indirect effects through days to 50% flowering (-0.0092), 1000 grain weight (-0.0056) and grain iron content (-0.0065). The results were in agreement with the findings of Islam et al.[18] .

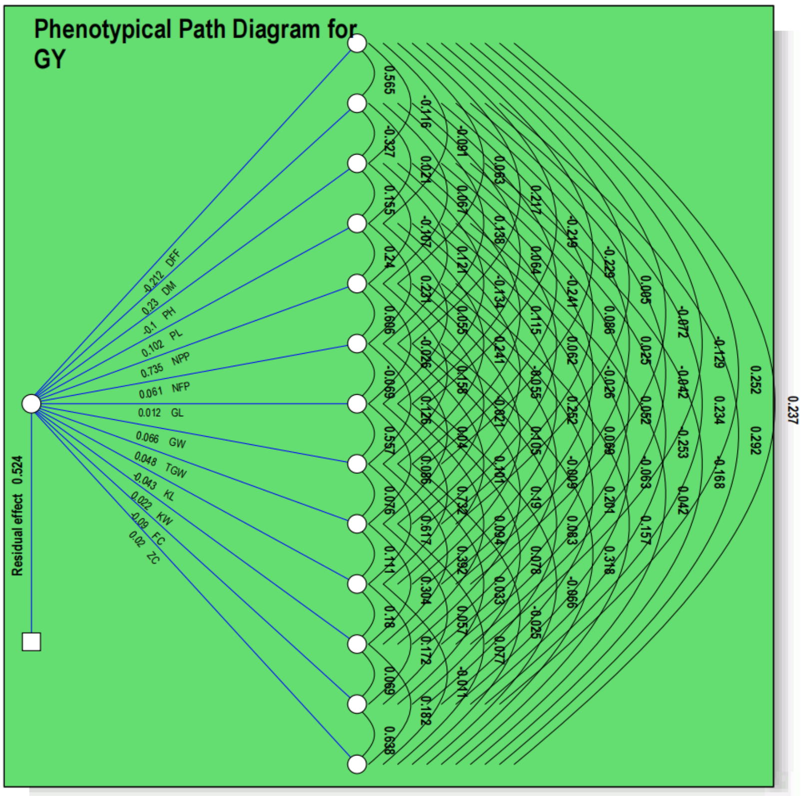

Fig. 1. Phenotypic correlation coefficients among different traits in rice

Days to maturity show a high direct positive effect on grain yield per plant (0.2302) and the correlation between the two traits is positive but non significant (0.1751) due to positive indirect effects through days to 50% flowering (0.1301), panicle length (0.0049), number of panicles per plant (0.0155), number of filled grains per panicle (0.0318), grain length (0.0147), 1000 grain weight (0.0199) kernel length (0.0153), grain iron content (0.0539), grain zinc content (0.0671) and a negative indirect effect through plant height (-0.0752), grain width (-0.0555), and kernel breadth (-0.0096). The results were in agreement with the findings of Immanuel et al. [8] and Babu et al. [29].

Grain width reported a direct positive effect on grain yield per plant (0.0659) and the correlation between the two traits is positive and non significant(0.1846) due to positive indirect effects through plant height (0.0076), panicle length (0.0159), number of panicles per plant (0.0104), number of filled grains per panicle (0.0083), grain length (0.0367), 1000 grain weight (0.0050), kernel length (0.0407, kernel breadth (0.0259), grain iron content (0.0022) and negative indirect effects through days to 50% flowering (-0.0151), days to maturity (-0.0159) and grain zinc content (-0.0017). The results were in agreement with the findings of Ekka et al. [3], Mallimar et al. [22] and Patel et al. [15].

Number of filled grains per panicle reported a direct positive effect on grain yield per plant (0.0613) and the correlation between the two traits is positive and significant (0.5121). It expressed positive indirect effects through days to 50% flowering (0.0133), days to maturity (0.0085), plant height (0.0074), panicle length (0.0141), number of panicles per plant (0.0372), grain width (0.0077), 1000 grain weight (0.0025), kernel length (0.0062), kernel breadth (0.0116), grain iron content (0.0051), grain zinc content (0.0195) and negative indirect effect through grain length (-0.0042). The results were in agreement with the findings of Khare et al. [30], Ratna et al. [5], Bhati et al. [31], Babaeian and Bagheri [13] and Prasannakumari et al. [19].

1000 grain weight reported a direct positive effect on grain yield per plant (0.0480) and the correlation between the two traits is positive and non significant (0.0462) due to positive indirect effects through days to 50% flowering (0.0003), days to maturity (0.0041), plant height (0.0030), number of filled grains per panicle (0.0019), grain length (0.0041), grain width (0.0036), kernel length (0.0053), kernel breadth (0.0146), grain iron content (0.0027), grain zinc content (0.0037) and negative indirect effects through panicle length (-0.0026) and number of panicles per plant (-0.0010). The results were in agreement with the findings of Mallimar et al. [22], Nayak et al.[32], Babaeian and Bagheri [13], Kishore et al. [33], Shivani et al. [14], Islam et al. [18] and Parimala et al. [20].

Kernel breadth reported a direct positive effect on grain yield per plant (0.0220) and the correlation between the two traits is positive and non significant (0.0777) due to positive indirect effects through plant height (0.0011), panicle length (0.0015), number of filled grains per panicle (0.0042), grain length (0.0021), grain width (0.0086), 1000 grain weight (0.0067), kernel length (0.0040), grain iron content (0.0015), grain zinc content (0.0040) and negative indirect effects through days to 50% flowering (-0.0028), days to maturity (-0.0009) and number of panicles per plant (-0.0002). The results were in agreement with the findings of Ekka et al. [3] and Prasannakumari et al. [19].

Grain zinc content shows a direct positive effect on grain yield per plant (0.0196) and the correlation between the two traits is positive and non significant (0.1410) due to positive indirect effects through days to 50% flowering (0.0046), days to maturity (0.0057), panicle length (0.0008), number of panicles per plant (0.0031), number of filled grains per panicle (0.0062), 1000 grain weight (0.0015), kernel breadth (0.0036), grain iron content (0.0125) and negative indirect effects through plant height (-0.0033), grain length (-0.0013), grain width (-0.0005) and kernel length (-0.0002). The results were in agreement with the findings of Bekele et al. [34] and Shivani et al. [14].

Grain length reported a direct positive effect on grain yield per plant (0.0118) and the correlation between the two traits is positive but non significant (0.0712) due to positive indirect effects through days to maturity (0.0008), panicle length (0.0006), grain width (0.0066), 1000 grain weight (0.0010), kernel length (0.0087), kernel breadth (0.0011), grain iron content (0.0009), and negative indirect effects through days to 50% flowering (-0.0026), plant height (-0.0016), number of panicles per plant (-0.0003), number of filled grains per panicle (-0.0008) and grain zinc content (-0.0008). The results were in agreement with the findings of Ekka et al. [3], Mallimar et al. [22] and Patel et al. [15].

Grain iron content shows a direct negative effect on grain yield per plant (-0.0899) and the correlation between the two traits is positive and non significant(0.0947) due to positive indirect effects through plant height (0.0011), panicle length (0.0015), and negative indirect effects through days to 50% flowering (-0.0226), days to maturity (-0.0210), number of panicles per plant (-0.0180), number of filled grains per panicle (-0.0075), grain length (-0.0070), grain width (-0.0030), 1000 grain weight (-0.0051), kernel length (-0.0155), kernel breadth (-0.0062) and grain zinc content (-0.0573). The results were in agreement with the findings of Bekele et al. [34] and Singh et al. [12].

Kernel length reported a direct negative effect on grain yield per plant (-0.0434) and the correlation between the two traits is positive and non significant(0.1323) due to positive indirect effects through days to 50% flowering (0.0031), plant height (0.0011), grain zinc content (0.0005) and negative indirect effects through days to maturity (-0.0011), panicle length (-0.0110), number of panicles per plant (-0.0045), number of filled grains per panicle (-0.0044), grain length (-0.0318), grain width (-0.0268), 1000 grain weight (-0.0048), kernel breadth (-0.0078) and grain iron content (-0.0075). The results were in agreement with the findings of Ekka et al. [3] and Prasannakumari et al. [19].

Plant height shows a direct negative effect on grain yield per plant (-0.1005) and the correlation between the two traits is negative and non significant(-0.1755) due to negative indirect effects through panicle length (-0.0155), number of filled grains per panicle (-0.0122), grain width (-0.0115), 1000 grain weight (-0.0062), kernel breadth (-0.0052) and positive indirect effects through days to 50% flowering (0.0177), days to maturity (0.0328), number of panicles per plant (0.0107), grain length (0.0134), kernel length (0.0027), grain iron content (0.0254) and grain zinc content (0.0169). The results were in agreement with the findings of Islam et al. [18].

Days to 50% flowering reported a direct negative effect on grain yield per plant (-0.2121) and the correlation between the two traits is negative and non significant(-0.0550) due to the indirect negative effect through days to days to maturity (-0.1198), number of panicles per plant (-0.0134), number of filled grains per panicle (-0.0460), 1000 grain weight (-0.0012), grain iron content (-0.0534), grain zinc content (-0.0503) and a positive indirect effect through plant height (0.0247), panicle length (0.0193), grain width (0.0485), grain length (0.0464), kernel length (0.0153) and kernel breadth (0.0274). The results were in agreement with the findings of Babu et al. [29] and Kalyan et al. [35].

4. CONCLUSION

Due to a significant and positive association with yield, number of panicles per plant, the number of filled grains per panicle, and panicle length are considered as a major character while selecting the genotypes for yield improvement. Direct positive association towards grain yield was contributed by the traits number of panicles per plant, the number of filled grains per panicle indicating the importance of these traits as selection criteria for enhancing the yield potential and nutritional quality.

FUTURE SCOPE

The features that were beneficial for improving yield were determined through investigations on correlation and path coefficient analysis. The relationships between these traits also became quite obvious, and these relationships can be used in rice breeding programmes in the future to increase grain yield without affecting other traits like crop length and plant architecture. In order to improve yield effectively, the data can also be employed as a selection method.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Chatterjee D. Botany of the wild and cultivated rices. Nature. 1947;160(4059): 234-7.
2. Patra BC. Collection and characterization of rice genetic resources from Keonjhar district of Orissa. Oryza. 2000;34:324-326.
3. Ekka RE, Sarawgi AK, Kanwar RR. Correlation and path analysis in traditional rice accessions of Chhattisgarh. Journal of Rice Research. 2011;4(1):11-18.
4. Dewey DR, Lu K. A correlation and path-coefficient analysis of components of crested wheatgrass seed production 1. Agronomy Journal. 1959;51(9):515-8.
5. Ratna M, Begum S, Husna A, Dey SR, Hossain MS. Correlation and path coefficients analyses in basmati rice. Bangladesh Journal of Agricultural Research. 2015;40(1):153-61.
6. Rahman MA, Hossain MS, Chowdhury IF, Matin MA, Mehraj H. Variability study of advanced fine rice with correlation, path co-efficient analysis of yield and yield contributing characters. International Journal of Applied Sciences and Biotechnology. 2014;2(3):364-70.
7. Devi KR, Chandra BS, Lingaiah N, Hari Y, Venkanna V. Analysis of variability, correlation and path coefficient studies for yield and quality traits in rice (*Oryza sativa* L.). Agricultural Science Digest-A Research Journal. 2017;37(1):1-9.
8. Immanuel SC, Pothiraj N, Thiyagarajan K, Bharathi M, Rabindran R. Genetic parameters of variability, correlation and path coefficient studies for grain yield and other yield attributes among rice blast disease resistant genotypes of rice (*Oryza sativa* L.). African Journal of Biotechnology. 2011;10(17):3322-34.
9. Umarani E, Radhika K, Padma V, Rao SL. Agro-morphological characterization of rice (*Oryza sativa* L.) landraces based on DUS descriptors. Int J Pure App Biosci. 2017;5(4):466-75.
10. Gangashetty PI, Salimath PM, Hanamaratti NG. Association analysis in genetically diverse non-basmati local aromatic genotypes of rice (*Oryza sativa* L.). Molecular Plant Breeding. 2013;4.
11. Dore V, Koti RV, Math KK. Response of zinc application on growth, zinc content and grain yield of rice genotypes and correlation between zinc content and yield attributes of rice genotypes. Indian Journal of Agricultural Research. 2018;52(6):625-30.
12. Singh A, Manjri SD, Kumar G, Dubey V, Rampreet KN, Dwivedi DK. Path coefficient analysis studies in Iron and Zinc

containing rice varieties. Journal of Pharmacognosy and Phytochemistry. 2018;7(2):3729-32.

13. Babaeian-Jelodar N, Bagheri N. Correlation and Path Coefficient Analysis in F_2 Generation of Rice Genotypes Derived from Crosses between Tarom-Jelodar and 229R Cultivars. Journal of Crop Breeding. 2018;9(24):152-7.
14. Shivani D, Cheralu C, Neeraja CN, Shankar VG. Grain zinc and iron association studies in swarna X type 3 ril population of rice. International Journal of Current Microbiology and Applied Sciences. 2018;7(5):708-714.
15. Patel JR, Patel DK, Prajapati KN, Soni NV, Patel A. Correlation and Path Coefficient Analysis in Rainfall Upland Rice (*Oryza sativa* L.). Environment & Ecology. 2017;35(2):789-94.
16. Pandey S, Doss DD, Shashidhar HE. Correlation and path analysis of yield determinants and micronutrient content in rice (*Oryza sativa* L.). Journal of Pharmacognosy and Phytochemistry. 2018;7(1):2723-8.
17. Seneega TA, 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):512-7.
18. Mahbub MM, Rahman MM, Hossain MS, Mahmud F, Kabir MM. Genetic variability, correlation and path analysis for yield and yield components in soybean. American-Eurasian Journal of Agricultural & Environmental Sciences. 2015;15(2):231-6.
19. Prasannakumari M, Akilan M, Kalaiselvan S, Subramanian A, Janaki P, Jeyaprakash P. Studies on genetic parameters, correlation and path analysis for yield attributes and Iron content in a backcross population of rice [*Oryza sativa* (L.)]. Electronic Journal of Plant Breeding. 2020;11(03):881-6.
20. Parimala K, Raju CS, Prasad AH, Kumar SS, Reddy SN. Studies on genetic parameters, correlation and path analysis in rice (*Oryza sativa* L.). Journal of Pharmacognosy and Phytochemistry. 2020;9(1):414-7.
21. Sudeepthi K, Srinivas T, Kumar BR, DPB J, Umar SN. Genetic variability, character association and path analysis for anaerobic germination traits in rice (*Oryza sativa* L.). Journal of Pharmacognosy and Phytochemistry. 2020;9(1):553-6.
22. Mallimar M, Surendra P, Hundekar R, Jogi M, Lakkangoudar MC. Correlation studies for micronutrients, yield and yield components in F3 population of rice (*Oryza Sativa* L.). Res Environ Life Sci. 2016;9(9):1140-2.
23. Hasan MJ, Kulsum MU, Akter A, Masuduzzaman AS, Ramesha MS. Genetic variability and character association for agronomic traits in hybrid rice (*Oryza sativa* L.). Bangladesh Journal of Plant Breeding and Genetics. 2011;24(1):45-51.
24. Garcia-Oliveira AL, Tan L, Fu Y, Sun C. Genetic identification of quantitative trait loci for contents of mineral nutrients in rice grain. Journal of Integrative Plant Biology. 2009;51(1):84-92.
25. Raza Q, Saher H, Shahzadi F, Riaz A, Bibi T, Sabar M. Genetic diversity in traditional genotypes for grain iron, zinc and beta-carotene contents reveale potential for breeding micronutrient dense rice. Journal of Experimental Biology and Agricultural Sciences. 2019;7(2):194-203.
26. Edukondalu B, Reddy VR, Rani TS, Kumari CA, Soundharya B. Studies on variability, heritability, correlation and path analysis for yield, yield attributes in rice (*Oryza sativa* L.). International Journal of Current Microbiology and Applied Sciences. 2017;6(10):2369-76.
27. Archana RS, Sudha Rani M, Vishnu Vardhan KM, Fareeda G. Genetic diversity studies among rice (*Oryza sativa* L.) genotypes for grain yield, yield components and nutritional traits in rice. Int J Chem Studies. 2018;6:134-7.
28. Bagudam R, Eswari KB, Badri J, Rao PR. Correlation and path analysis for yield and its component traits in NPT core set of rice (*Oryza sativa* L.). Int. J. Curr. Microbiol. App. Sci. 2018;7(9):97-108.
29. Babu VR, Shreya K, Dangi KS, Usharani G, Nagesh P. Genetic variability studies for qualitative and quantitative traits in popular rice (*Oryza sativa* L.) hybrids of India. International Journal of Scientific and Research Publications. 2012;2(6):1-5.
30. Khare R, Singh AK, Eram S, Singh PK. Genetic variability, association and diversity analysis in upland Rice (*Oryza sativa* L). SAARC Journal of Agriculture. 2014;12(2):40-51.

31. Bhati M, Babu GS, Rajput AS. Genetic variability, correlation and path coefficient for grain yield and quantitative traits of elite rice (*Oryza sativa* L.) genotypes at Uttar Pradesh. Electronic Journal of Plant Breeding. 2015;6(2):586-91.
32. Mishra SS, Behera PK, Kumar V, Lenka SK, Panda D. Physiological characterization and allelic diversity of selected drought tolerant traditional rice (*Oryza sativa* L.) landraces of Koraput, India. Physiology and Molecular Biology of Plants. 2018;24(6):1035-46.
33. Nayak R, Singh VK, Singh AK, Singh PK. Genetic variability, character association and path analysis of rice genotypes. Annals of Plant and Soil Research. 2016;18(2):161-4.
34. Bekele BD, Rakhi S, Naveen GK, Kundur PJ, Shashidhar HE. Estimation of genetic variability and correlation studies for grain zinc concentrations and yield related traits in selected rice (*Oryza sativa* L.) genotypes. Asian Journal of Experimental Biological Sciences. 2013;4(3):345-51.
35. Kalyan B, Radha Krishna KV, Rao LVS. Path coefficient analysis for yield and yield contributing traits in rice (*Oryza sativa* L.) genotypes. International Journal of Current Microbiology and Applied Sciences. 2017;6(7):2680-2687.

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