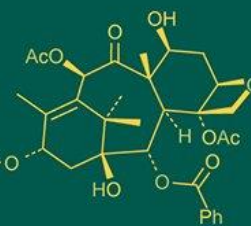
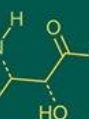
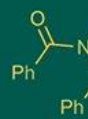


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Biradar SC
M.Sc. Agri., Department of
Genetics and Plant breeding,
College of Agriculture, Dr.
Balasaheb Sawant Konkan Krishi
Vidyapeeth, Dapoli, Ratnagiri,
Maharashtra, India

Waghmode BD
Associate Director of Research and
Rice Specialist, Regional
Agricultural Research Station,
Karjat, Raigad, Maharashtra,
India

Gawai MP
Jr. Rice Breeder, Regional
Agricultural Research Station,
Karjat, Dapoli, Maharashtra, India

Keluskar MH
Jr. Plant Physiologist, Regional
Agricultural Research Station,
Karjat, Raigad, Maharashtra,
India

Kunkerkar RL
Head Department of Agricultural
Botany, College of Agriculture, Dr.
Balasaheb Sawant Konkan Krishi
Vidyapeeth, Dapoli, Ratnagiri,
Maharashtra, India

Rakesh KR
M.Sc. Agri., Department of
Genetics and Plant breeding,
College of Agriculture, Dr.
Balasaheb Sawant Konkan Krishi
Vidyapeeth, Dapoli, Ratnagiri,
Maharashtra, India

Nagarajan S
M.Sc. Agri., Department of
Genetics and Plant breeding,
College of Agriculture, Dr.
Balasaheb Sawant Konkan Krishi
Vidyapeeth, Dapoli, Ratnagiri,
Maharashtra, India

Madane AA
Jr. Research Fellow, Regional
Agricultural Research Station,
Karjat, Raigad, Maharashtra,
India

Corresponding Author:

Biradar SC
M.Sc. Agri., Department of
Genetics and Plant breeding,
College of Agriculture, Dr.
Balasaheb Sawant Konkan Krishi
Vidyapeeth, Dapoli, Ratnagiri,
Maharashtra, India

Correlation and path coefficient analysis study in rice (*Oryza sativa* L.) restorer lines

Biradar SC, Waghmode BD, Gawai MP, Keluskar MH, Kunkerkar RL, Rakesh KR, Nagarajan S and Madane AA

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Abstract

The present investigation was conducted to assess correlation and perform path analysis in forty-four rice (*Oryza sativa* L.) genotypes, which were evaluated using a Randomized Block Design with two replications at RARS, Karjat, during *Kharif* 2025. The correlation studies revealed that grain yield per plant exhibited a significant positive association with harvest index, straw yield per plant, productive tillers per plant, glume opening angle, panicle length, no. of filled grains per panicle, test weight, flag leaf length and filament length at both phenotypic and genotypic levels. Indicating that these characters are very important for yield improvement and can be effectively utilised in formulating indirect selection schemes. Path coefficient analysis revealed that harvest index had the highest positive direct effect followed by straw yield per plant, filament length, pollen load and glume opening angle at both phenotypic and genotypic levels on grain yield per plant, indicating that selection for these characters is likely to bring about an overall improvement in single plant yield directly.

Keywords: Correlation, grain yield per plant, path coefficient analysis, rice

Introduction

Rice (*Oryza sativa* L.) is one of the most significant staple food crops in the world, providing sustenance to billions of people and playing an essential role in ensuring food security. In 2025-2026, the world rice production was 545.73 million tons. India ranked first in production, with a total production of 154.02 million tons from an area of 52.8 million hectares with an average yield of 4.37 t/ha, feeding the mouths of more than 75% of the population (USDA FAS, 2026) [25]. Rice occupies a position of considerable importance in Maharashtra, ranking as the second major crop cultivated in the state. It is grown across approximately 15.25 lakh hectares, yielding an annual production of 52.03 lakh tonnes, with the state recording an average productivity of 3.30 t/ha. Within Maharashtra, the Konkan region stands out as the principal rice-cultivating belt, accounting for nearly 3.31 lakh hectares under rice cultivation and contributing 14.20 lakh tonnes of rough rice production, at an average productivity of 4.28 t/ha. Notably, although Konkan represents 21.73% of the state's total area under rice, it disproportionately contributes 32.14% of Maharashtra's overall rough rice production, underscoring the region's relatively higher productivity and agronomic significance (CES GoM, 2025) [5]. To meet the food security of the growing population, the exigency for rice is anticipated to increase by 40% by 2030 (Khush *et al.*, 2005) [15]. Rice hybrids show a yield advantage of about 15-20% over the best available inbred varieties grown commercially (Virmani, 1996) [26] and large-scale adoption of hybrid rice cultivation is one of the feasible options to address the food security challenges faced by India (Pranathi *et al.*, 2016) [21]. Producing F₁ seeds needs crossing male sterile and restorer lines. Successful hybrid rice requires good restorers, reliable CMS lines, usable heterosis and economical seed production.

Correlation can be described as the mutual relationship between two variables (Karl Pearson, 1905) [13]. Correlation coefficient is a statistical tool that shows the strength and direction of the relationship between two or more variables.

Correlation coefficient analysis is helpful in understanding the relationships between different plant traits and identifying the key components that can be targeted for selection to achieve genetic improvement in yield. Selections based on the results of correlation coefficient analysis may not produce the expected outcome, it is necessary to include path coefficient analysis for estimation of degree of association insight into cause and effect relationship between different pairs of character (Prasanna *et al.*, 2020) ^[22]. Path analysis helps to study the direct and indirect effects of the different traits on yield, the dependent variable. The nature of effect like direct or indirect effect of yield and its characteristics can be explained through path coefficient analysis (Baye *et al.*, 2020) ^[3]. Correlation in combination with path analysis would give a better yield.

Materials and Methods

The research was carried out at Regional Agricultural Research Station, Karjat, Dist. Raigad (MH) during Kharif 2025 season. Forty restorer lines along with four checks (KJTRHR 01, KJTRHR 02, KJTRHR 03 and KJTRHR 04 are male parents of Sahyadri, Sahyadri 02, Sahyadri 03 and Sahyadri 04) were grown in Randomized Block Design (RBD) with two replications and spacing of 20 cm × 15 cm. The standard agronomical package of practices was followed to raise the good experimental crop. Information on floral traits and grain yield and yield contributing traits have all been recorded as part of the data gathering process. These data were gathered from five randomly selected healthy plants per entry within each replication viz., filament length (mm), anther length (mm), pollen load (pollens/liter), pollen fertility (%), glume opening angle (°), days to 50 percent flowering, flag leaf length (cm), plant height (cm), panicle length (cm), productive tillers per plant, no. of filled grains per panicle, spikelet fertility (%), straw yield per plant (g), harvest index (%), test weight (g), grain yield per plant (g).

Statistical Analysis

Genotypic and phenotypic correlation coefficients were calculated following Johnson *et al.* (1955) ^[12] to determine the degree of association between grain yield per plant and its component traits.

Path coefficient analysis was carried out as per the method of Dewey and Lu (1959) ^[7] to partition correlation coefficients into direct and indirect effects, considering grain yield per plant as the dependent variable. The residual effect was computed to account for unexplained variation. For interpretation, the scale suggested by Lenka and Mishra (1973) ^[17] was followed:

Negligible: 0.00-0.09

Low: 0.10-0.19

Moderate: 0.20-0.29

High: 0.30-0.99

Very High: >1.00

Results and Discussion

Significant differences between the genotypes for all variables under investigation have been identified through analysis of variance, suggesting that the material under study has a significant amount of genetic diversity. Correlation analysis is considered a useful strategy that can be applied in breeding programmes. It provides a broad

understanding of how traits are related to each other and helps in pointing out the component of character that should be selected in order to bring about genetic improvement on grain yield. The interrelationship between the traits could be extracted through the correlation analysis and those traits which are directly correlated with grain yield per plant can be taken for direct selection (Table 1).

According to the results obtained, most of the traits showed genotypic correlation coefficients that were higher in value than their corresponding phenotypic correlation coefficients. This indicates that there exists a strong genetic association among the traits. However, it also suggests that considerable interaction between the environment and genotypes has affected the phenotypic values, thereby reducing the strength of phenotypic correlation.

Correlation analysis

Genotypic Correlation Coefficient

The current investigation revealed the grain yield per plant had a positive and significant relationship with harvest index (0.8913), straw yield per plant (0.7046), productive tillers per plant (0.617), glume opening angle (0.6089), panicle length (0.5531), no. of filled grains per panicle (0.5264), test weight (0.3646), flag leaf length (0.3538) and filament length (0.3132). The similar result of positive and significant association between grain yield per plant and glume opening angle was reported by Bornare *et al.* (2014) ^[4]. Hossain *et al.* (2020) ^[11] reported that grain yield per plant had a positive association with spikelet fertility. Grain yield per plant had a positive and significant relationship with flag leaf length, straw yield per plant and harvest index, as reported by Kirtan *et al.* (2022) ^[16]. Grain yield per plant had a positive and significant relationship with productive tillers per plant, as recorded by Niharika *et al.* (2022) ^[19].

Filament length had a positive and significant relationship with anther length (0.7518), test weight (0.3641) and grain yield per plant (0.3132). Anther length had a positive and significant association with filament length (0.7518). Pollen fertility (0.5506) and spikelet fertility (0.3012) showed a positive and significant association with pollen load. Pollen fertility had a positive and significant relationship with pollen load (0.5506). Glume opening angle had a positive and significant association with harvest index (0.6448), grain yield per plant (0.6089), panicle length (0.6055), productive tillers per plant (0.4564) and flag leaf length (0.4155). The traits no. of filled grains per panicle (0.3887) and straw yield per plant (0.3) showed a positive and significant association with days to 50 percent flowering. In contrast, the trait exhibits significant and negative correlation with flag leaf length (-0.3004). Flag leaf length had a positive and significant relationship with test weight (0.5358), panicle length (0.5065), glume opening angle (0.4155), harvest index (0.4053) and grain yield per plant (0.3538) also exhibits significant and negative correlation with days to 50 percent flowering (-0.3004). Plant height had a positive and significant association with straw yield per plant (0.5574), panicle length (0.368) and no. of filled grains per panicle (0.3157). The traits glume opening angle (0.6055), grain yield per plant (0.5531), harvest index (0.5223), flag leaf length (0.5065), plant height (0.368) productive tillers per plant (0.3667) and straw yield per plant (0.3379) showed a positive and significant association with panicle length.

Productive tillers per plant had a positive and significant relationship with grain yield per plant (0.617), harvest index (0.5385), straw yield per plant (0.4598), glume opening angle (0.4564) and panicle length (0.3667). No. of filled grains per panicle had a positive and significant association with straw yield per plant (0.5378), grain yield per plant (0.5264), days to 50 percent flowering (0.3887), harvest index (0.3256) and plant height (0.3157). In contrast, the trait exhibits significant and negative correlation with test weight (-0.3602). The trait pollen load (0.3012) showed a positive and significant association with spikelet fertility. Straw yield per plant had a positive and significant relationship with grain yield per plant (0.7046), plant height (0.5574), no. of filled grains per panicle (0.5378), productive tillers per plant (0.4598), panicle length (0.3379) harvest index (0.316) and days to 50 percent flowering (0.3). Harvest index had a positive and significant association with grain yield per plant (0.8913), glume opening angle (0.6448), productive tillers per plant (0.5385), panicle length (0.5223), test weight (0.4439), flag leaf length (0.4053), no. of filled grains per panicle (0.3256) and straw yield per plant (0.316). The traits flag leaf length (0.5358), harvest index (0.4439), grain yield per plant (0.3646) and filament length (0.3641) showed a positive and significant association with test weight. In contrast, the trait exhibits significant and negative correlation with no. of filled grains per panicle (-0.3602).

Phenotypic Correlation Coefficient

Total grain yield per plant had a positive and significant relationship with harvest index (0.8571), straw yield per plant (0.7063), productive tillers per plant (0.5398), no. of filled grains per panicle (0.4953), glume opening angle (0.495), panicle length (0.4924), test weight (0.3604), flag leaf length (0.3312) and filament length (0.2818). Additionally, there is a positive but non-significant correlation with plant height (0.2079), pollen load (0.204), pollen fertility (0.192), spikelet fertility (0.1884), anther length (0.1169) and days to 50 percent flowering (0.1024). Similar results were observed, wherein total grain yield per plant had a positive and significant relationship with test weight, panicle length and productive tillers per plant, as reported by Kavya *et al.* (2023) ^[14]; with harvest index, straw yield per plant, number of filled grains per panicle and test weight, as reported by Saran *et al.* (2023) ^[23]; with panicle length, number of filled grains per panicle and test weight, as reported by Maneesha *et al.* (2024) ^[18]; with harvest index and number of filled grains per panicle, as reported by Babu *et al.* (2024) ^[2]; flag leaf length, productive tillers per plant and number of filled grains per panicle, as reported by Patel *et al.* (2025) ^[20]; and with straw yield per plant, number of filled grains per panicle, harvest index and productive tillers per plant, as reported by Ananda *et al.* (2025) ^[1]. Such associations suggest that improving these traits could indirectly contribute to higher grain yield. Filament length had a positive and significant relationship with anther length (0.6888), test weight (0.3162), total grain yield per plant (0.2818), harvest index (0.2703) and panicle length (0.2338). Anther length had a positive and significant association with filament length (0.6888), plant height (0.2747) and panicle length (0.2231). The traits pollen fertility (0.5249), spikelet fertility (0.27) and straw yield per plant (0.2336) showed a positive and significant association with pollen load. Pollen fertility had a positive and

significant relationship with pollen load (0.5249), test weight (0.2545) and harvest index (0.2422). Glume opening angle had a positive and significant association with harvest index (0.5385), total grain yield per plant (0.495), panicle length (0.4584), productive tillers per plant (0.4045), flag leaf length (0.336) and spikelet fertility (0.2375). The traits no. of filled grains per panicle (0.3738) and straw yield per plant (0.2379) showed a positive and significant association with days to 50 percent flowering. Flag leaf length had a positive and significant relationship with test weight (0.5127), panicle length (0.4286), harvest index (0.3851), glume opening angle (0.336) and total grain yield per plant (0.3312). Plant height had a positive and significant association with straw yield per plant (0.4829), panicle length (0.3176), no. of filled grains per panicle (0.3128) and anther length (0.2747). The traits total grain yield per plant (0.4924), harvest index (0.4688), glume opening angle (0.4584), flag leaf length (0.4286), plant height (0.3176), productive tillers per plant (0.2878), straw yield per plant (0.2854), filament length (0.2338) and anther length (0.2231) showed a positive and significant association with panicle length. Productive tillers per plant had a positive and significant relationship with total grain yield per plant (0.5398), harvest index (0.4637), glume opening angle (0.4045), straw yield per plant (0.3985) and panicle length (0.2878). No. of filled grains per panicle had a positive and significant association with total grain yield per plant (0.4953), straw yield per plant (0.4762), days to 50 percent flowering (0.3738), plant height (0.3128) and harvest index (0.3108). The traits pollen load (0.27), glume opening angle (0.2375) and test weight (0.2141) showed a positive and significant association with spikelet fertility. Straw yield per plant had a positive and significant relationship with total grain yield per plant (0.7063), plant height (0.4829), no. of filled grains per panicle (0.4762), productive tillers per plant (0.3985), panicle length (0.2854), harvest index (0.2559) days to 50 percent flowering (0.2379) and pollen load (0.2336). Harvest index had a positive and significant association with total grain yield per plant (0.8571), glume opening angle (0.5385), panicle length (0.4688), productive tillers per plant (0.4637), test weight (0.4297), flag leaf length (0.3851), no. of filled grains per panicle (0.3108), filament length (0.2703) straw yield per plant (0.2559) and pollen fertility (0.2422). The traits flag leaf length (0.5127), harvest index (0.4297), total grain yield per plant (0.3604), filament length (0.3162), pollen fertility (0.2545) and spikelet fertility (0.2141) showed a positive and significant association with test weight.

Path coefficient analysis

Genotypic Path Coefficient Analysis

The path analysis separates the effect on grain yield into direct and indirect effect (Table 2). The direct effect influences the yield directly, while indirect effect enhances yield through some other traits. At genotypic level a positive direct effect on grain yield per plant was through harvest index (0.61078), straw yield per plant (0.33744), no. of filled grains per panicle (0.18513), filament length (0.18138), pollen load (0.10368), productive tillers per plant (0.15594), test weight (0.06676) and glume opening angle (0.06809). A negative direct effect on grain yield per plant was through anther length (-0.10557), pollen fertility (-0.15222), days to 50 percent flowering (-0.0493), flag leaf length (-0.00209), plant height (-0.02248), spikelet fertility

(-0.10169). The similar kinds of result were obtained by Hossain *et al.* (2016) ^[10], Niharika *et al.* (2022) ^[19], Kirtan *et al.* (2022) ^[16], Maneesha *et al.* (2024) ^[18], Singh *et al.* (2025) ^[24], Dabhi *et al.* (2025) ^[6], and Gaurav *et al.* (2026) ^[8].

Overall, the findings revealed that harvest index, straw yield per plant, no. of filled grains per panicle, filament length, pollen load, productive tillers per plant exerted the prominent positive direct effects on grain yield per plant at the genotypic level. Therefore, these traits emerge as key selection criteria for enhancing grain yield in rice breeding programmes. Fig. no. 2 demonstrates the genotypic path diagram for grain yield per plant, highlighting the direct and indirect effects of contributing traits.

Phenotypic Path Coefficient Analysis

A positive direct effect on grain yield per plant was through harvest index (0.7247), straw yield per plant (0.53814),

anther length (0.03416), days to 50 percent flowering (0.02772), glume opening angle (0.01882), flag leaf length (0.01665), pollen load (0.01364), spikelet fertility (0.01005), filament length (0.00882). A negative direct effect on grain yield per plant was through pollen fertility (-0.01199), plant height (-0.03885), panicle length (-0.00189), productive tillers per plant (-0.0156), no. of filled grains per panicle (-0.0046), test weight (-0.04499). The similar kinds of result were obtained by Hossain *et al.* (2020) ^[11], Kavaya *et al.* (2023) ^[14], Maneesha *et al.* (2024) ^[18], Ananda *et al.* (2025) ^[1] and Singh *et al.* (2025) ^[24].

Overall, harvest index and straw yield per plant emerged as the most influential traits directly contributing to yield, while other traits largely contributed through indirect effects. Fig. no. 4 illustrates the phenotypic path diagram for grain yield per plant, depicting the direct and indirect effects of various contributing traits.

Table 1: Correlation coefficient among different floral and yield traits

Traits	FL	AL	PLD	PF	GOA	DFP	FLL	PH	PL	PT	Nfg	SF	SY	HI	TW	GY
FL	P 1	0.688**	-0.014	0.1503	0.1776	-0.0394	0.1556	0.1208	0.2338 *	0.0299	-0.0015	0.0093	0.1309	0.2703 *	0.3162**	0.2818**
	G 1	0.7518**	0.0433	0.2023	0.1476	-0.0295	0.1789	0.147	0.2679	-0.0237	0.0025	0.018	0.154	0.2934	0.3641 *	0.3132 *
AL	P	1	-0.0337	-0.1823	0.0446	-0.0206	0.114	0.2747**	0.2231 *	-0.0972	0.0206	-0.1283	0.0189	0.113	0.1851	0.1169
	G	1	-0.0271	-0.1828	0.0375	-0.0205	0.1185	0.2762	0.2447	-0.1228	0.0208	-0.1309	0.025	0.1186	0.1884	0.1254
PLD	P		1	0.5249**	0.1446	-0.0379	0.1186	0.1378	0.0977	0.1475	0.0488	0.27 *	0.2336 *	0.1137	0.1883	0.204
	G		1	0.5506**	0.2151	-0.0287	0.1157	0.1538	0.0847	0.1967	0.0591	0.3012*	0.2693	0.1194	0.1941	0.2241
PF	P			1	0.1105	-0.0307	-0.0772	-0.2133*	-0.0365	0.1921	-0.0549	0.0358	0.059	0.2422 *	0.2545 *	0.192
	G			1	0.1448	-0.0461	-0.0806	-0.2198	-0.038	0.2548	-0.0687	0.0256	0.0666	0.2546	0.2618	0.2009
GOA	P				1	-0.1268	0.336 **	0.1786	0.4584**	0.4045**	0.1877	0.2375 *	0.1835	0.5385**	0.1345	0.495 **
	G				1	-0.1433	0.4155**	0.2124	0.6055**	0.4564**	0.2024	0.2901	0.2351	0.6448**	0.1631	0.6089**
DFP	P					1	-0.2805**	0.0972	-0.0032	0.1718	0.3738**	-0.2195*	0.2379 *	-0.0598	-0.1918	0.1024
	G					1	-0.3004*	0.0991	-0.0102	0.2504	0.3887**	-0.2213	0.3 *	-0.0365	-0.2118	0.1393
FLL	P						1	0.0894	0.4286**	0.0796	-0.06	0.1126	0.1046	0.3851**	0.5127**	0.3312**
	G						1	0.0925	0.5065**	0.0711	-0.0585	0.1281	0.1166	0.4053**	0.5358 *	0.3538 *
PH	P							1	0.3176**	-0.0424	0.3128**	-0.1237	0.4829**	-0.0472	-0.0283	0.2079
	G							1	0.368 *	-0.0294	0.3157 *	-0.1363	0.5574**	-0.049	-0.0299	0.2292
PL	P								1	0.2878**	0.2079	-0.1273	0.2854**	0.4688**	0.1579	0.4924**
	G								1	0.3667 *	0.2397	-0.1533	0.3379 *	0.5223**	0.1588	0.5531**
PT	P									1	0.0191	0.19	0.3985**	0.4637**	0.1861	0.5398**
	G									1	0.0304	0.2333	0.4598**	0.5385**	0.209	0.617 **
Nfg	P										1	0.0331	0.4762**	0.3108**	-0.3556**	0.4953**
	G										1	0.0364	0.5378**	0.3256 *	-0.3602*	0.5264**
SF	P											1	0.0854	0.1944	0.2141 *	0.1884
	G											1	0.1167	0.1952	0.2141	0.2041
SY	P												1	0.2559*	0.1448	0.7063**
	G												1	0.316 *	0.1402	0.7046**
HI	P													1	0.4297**	0.8571**
	G													1	0.4439**	0.8913**
TW	P														1	0.3604**
	G														1	0.3646 *
GY	P															1
	G															1

*Significant at 5 percent, **Significant at 1 percent

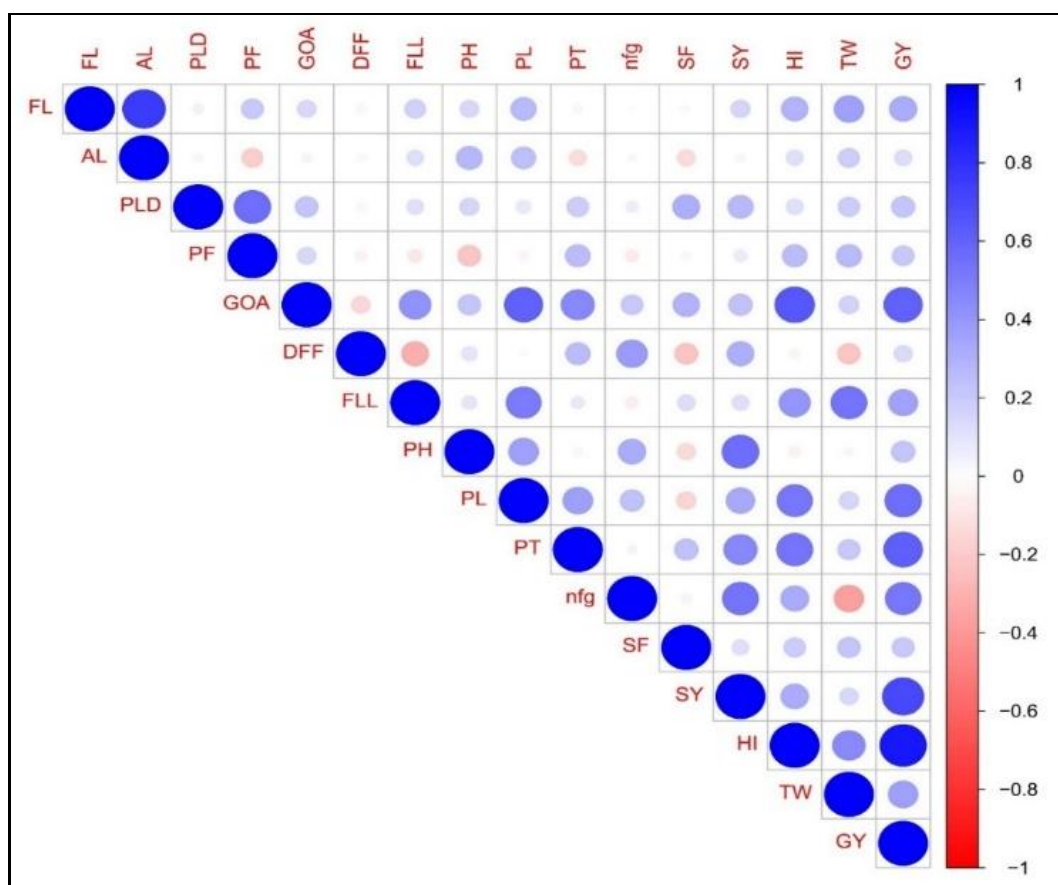
Note: P = Phenotypic Correlation, G = Genotypic Correlation, FL = Filament Length (mm), AL = Anther Length (mm), PLD = Pollen Load (pollens/liter), PF = Pollen Fertility (%), GOA = Glume Opening Angle (°), DFP = Days to 50 percent Flowering, FLL = Flag Leaf Length (cm), PH = Plant Height (cm), PL = Panicle Length (cm), PT = Productive Tillers per plant, Nfg = No. of filled grains per panicle, SF = Spikelet Fertility (%), SY = Straw Yield per plant (g), HI = Harvest Index (%), TW = Test Weight (g), GY = Grain Yield per plant (g).

Table 2: Path analysis among different floral and yield traits

Traits		FL	AL	PLD	PF	GOA	DFF	FLL	PH	PL	PT	Nfg	SF	SY	HI	TW	GY
FL	P	0.00882	0.02353	-0.00019	-0.0018	0.00334	-0.00109	0.00259	-0.00469	-0.00044	-0.00047	0.00001	0.00009	0.07044	0.19589	-0.01423	0.2818 **
	G	0.18138	-0.07936	0.00448	-0.0308	0.01005	0.00145	-0.00037	-0.00331	-0.02074	-0.00369	0.00045	-0.00184	0.05196	0.17922	0.02431	0.3132 *
AL	P	0.00608	0.03416	-0.00046	0.00219	0.00084	-0.00057	0.0019	-0.01067	-0.00042	0.00152	-0.0001	-0.00129	0.01017	0.08189	-0.00833	0.1169
	G	0.13636	-0.10557	-0.00281	0.02783	0.00255	0.00101	-0.00025	-0.00621	-0.01894	-0.01914	0.00385	0.01331	0.00842	0.07243	0.01258	0.1254
PLD	P	-0.00012	-0.00115	0.01364	-0.0063	0.00272	-0.00105	0.00197	-0.00535	-0.00018	-0.0023	-0.00022	0.00271	0.12571	0.0824	-0.00847	0.204
	G	0.00784	0.00286	0.10368	-0.08382	0.01465	0.00141	-0.00024	-0.00346	-0.00656	0.03067	0.01094	-0.03063	0.09088	0.07295	0.01296	0.2241
PF	P	0.00133	-0.00623	0.00716	-0.01199	0.00208	-0.00085	-0.00129	0.00829	0.00007	-0.003	0.00025	0.00036	0.03175	0.17552	-0.01145	0.192
	G	0.0367	0.0193	0.05709	-0.15222	0.00986	0.00227	0.00017	0.00494	0.00294	0.03974	-0.01272	-0.00261	0.02246	0.15551	0.01748	0.2009
GOA	P	0.00157	0.00152	0.00197	-0.00133	0.01882	-0.00351	0.0056	-0.00694	-0.00087	-0.00631	-0.00086	0.00239	0.09875	0.39025	-0.00605	0.495 **
	G	0.02677	-0.00395	0.0223	-0.02204	0.06809	0.00706	-0.00087	-0.00478	-0.04686	0.07118	0.03746	-0.0295	0.07933	0.3938	0.01089	0.6089 **
DFF	P	-0.00035	-0.0007	-0.00052	0.00037	-0.00239	0.02772	-0.00467	-0.00378	0.00001	-0.00268	-0.00172	-0.00221	0.12802	-0.04334	0.00863	0.1024
	G	-0.00535	0.00216	-0.00297	0.00702	-0.00976	-0.0493	0.00063	-0.00223	0.00079	0.03905	0.07195	0.02251	0.10123	-0.02229	-0.01414	0.1393
FLL	P	0.00137	0.00389	0.00162	0.00093	0.00632	-0.00777	0.01665	-0.00347	-0.00081	-0.00124	0.00028	0.00113	0.05629	0.27908	-0.02307	0.3312 **
	G	0.03245	-0.01251	0.012	0.01227	0.02829	0.01481	-0.00209	-0.00208	-0.03919	0.01108	-0.01082	-0.01302	0.03935	0.24756	0.03577	0.3538 *
PH	P	0.00107	0.00938	0.00188	0.00256	0.00336	0.00269	0.00149	-0.03885	-0.0006	0.00066	-0.00144	-0.00124	0.25987	-0.03421	0.00127	0.2079
	G	0.02667	-0.02916	0.01595	0.03345	0.01446	-0.00489	-0.00019	-0.02248	-0.02848	-0.00459	0.05846	0.01386	0.18807	-0.02995	-0.002	0.2292
PL	P	0.00206	0.00762	0.00133	0.00044	0.00863	-0.00009	0.00714	-0.01234	-0.00189	-0.00449	-0.00096	-0.00128	0.15359	0.33974	-0.0071	0.4924 **
	G	0.0486	-0.02584	0.00878	0.00578	0.04123	0.0005	-0.00106	-0.00828	-0.07739	0.05719	0.04438	0.01559	0.11403	0.31899	0.0106	0.5531 **
PT	P	0.00026	-0.00332	0.00201	-0.0023	0.00761	0.00476	0.00133	0.00165	-0.00054	-0.0156	-0.00009	0.00191	0.21445	0.33605	-0.00837	0.5398 **
	G	-0.0043	0.01296	0.02039	-0.03879	0.03108	-0.01235	-0.00015	0.00066	-0.02838	0.15594	0.00563	-0.02373	0.15517	0.32892	0.01395	0.617 **
Nfg	P	-0.00001	0.0007	0.00067	0.00066	0.00353	0.01036	-0.001	-0.01215	-0.00039	-0.0003	-0.0046	0.00033	0.25626	0.22524	0.016	0.4953 **
	G	0.00044	-0.00219	0.00612	0.01046	0.01378	-0.01916	0.00012	-0.0071	-0.01855	0.00474	0.18513	-0.0037	0.18148	0.19887	-0.02404	0.5264 **
SF	P	0.00008	-0.00438	0.00368	-0.00043	0.00447	-0.00608	0.00188	0.00481	0.00024	-0.00296	-0.00015	0.01005	0.04596	0.14088	-0.00963	0.1884
	G	0.00327	0.01381	0.03123	-0.0039	0.01975	0.01091	-0.00027	0.00307	0.01186	0.03638	0.00673	-0.10169	0.03939	0.11925	0.01429	0.2041
SY	P	0.00115	0.00065	0.00319	-0.00071	0.00345	0.00659	0.00174	-0.01876	-0.00054	-0.00622	-0.00219	0.00086	0.53814	0.18545	-0.00652	0.7063 **
	G	0.02793	-0.00263	0.02792	-0.01013	0.01601	-0.01479	-0.00024	-0.01253	-0.02615	0.07171	0.09957	-0.01187	0.33744	0.19303	0.00936	0.7046 **
HI	P	0.00238	0.00386	0.00155	-0.00291	0.01014	-0.00166	0.00641	0.00183	-0.00089	-0.00723	-0.00143	0.00195	0.13771	0.7247	-0.01933	0.8571 **
	G	0.05322	-0.01252	0.01238	-0.03876	0.0439	0.0018	-0.00085	0.0011	-0.04042	0.08398	0.06028	-0.01985	0.10664	0.61078	0.02963	0.8913 **
TW	P	0.00279	0.00632	0.00257	-0.00305	0.00253	-0.00532	0.00854	0.0011	-0.0003	-0.0029	0.00164	0.00215	0.07792	0.31141	-0.04499	0.3604 **
	G	0.06604	-0.01989	0.02013	-0.03985	0.0111	0.01044	-0.00112	0.00067	-0.01229	0.03259	-0.06668	-0.02177	0.04729	0.27111	0.06676	0.3646 *

*Significant at 5 percent, **Significant at 1 percent (Phenotypic Residual effect = 0.817%), (Genotypic Residual effect = 0.00155%)

Note: P = Phenotypic Correlation, G = Genotypic Correlation, FL = Filament Length (mm), AL = Anther Length (mm), PLD = Pollen Load (pollens/liter), PF = Pollen Fertility (%), GOA = Glume Opening Angle (°), DFF = Days to 50 percent Flowering, FLL = Flag Leaf Length (cm), PH = Plant Height (cm), PL = Panicle Length (cm), PT = Productive Tillers per plant, Nfg = No. of filled grains per panicle, SF = Spikelet Fertility (%), SY = Straw Yield per plant (g), HI = Harvest Index (%), TW = Test Weight (g), GY = Grain Yield per plant (g).

**Fig 1:** Shaded correlation matrix of genotypic correlation

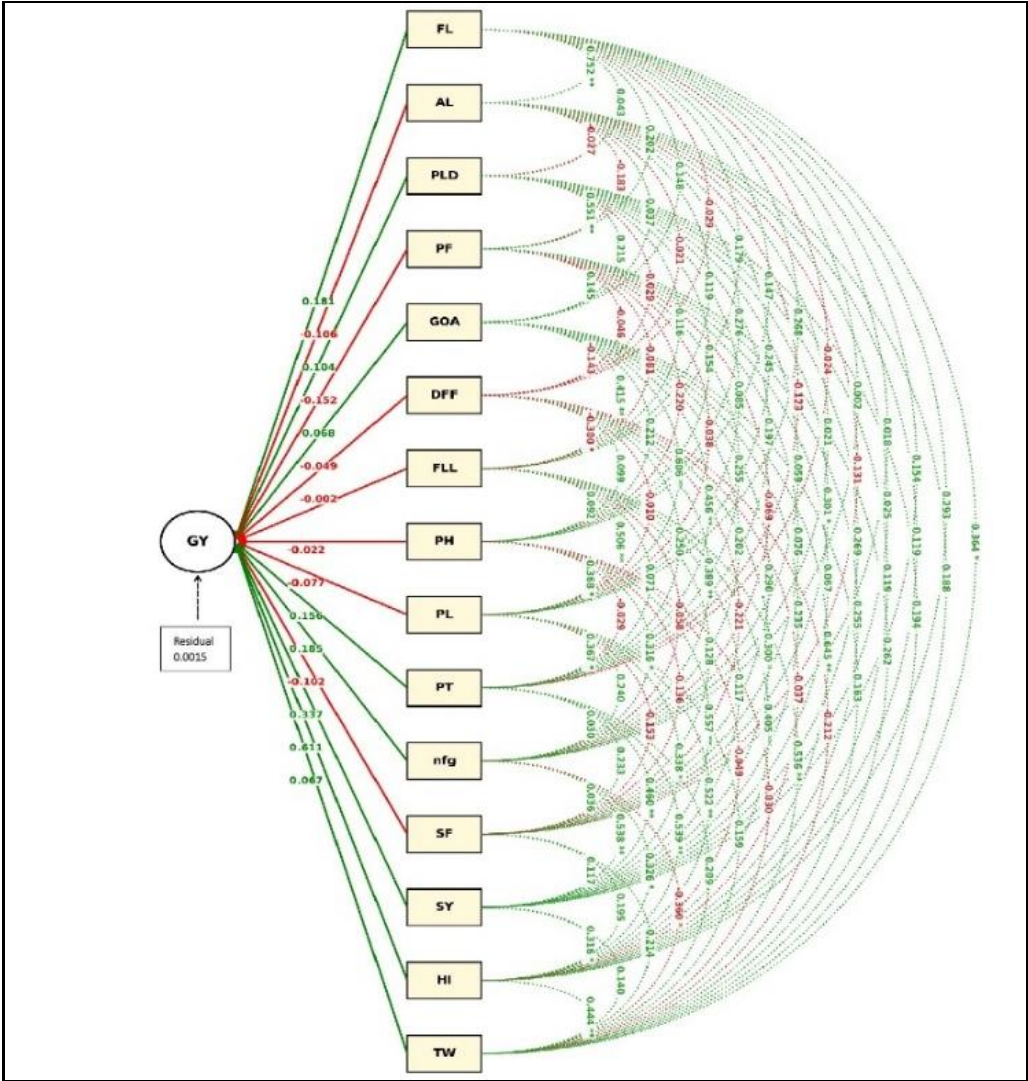


Fig 2: Genotypic path diagram for grain yield per plant

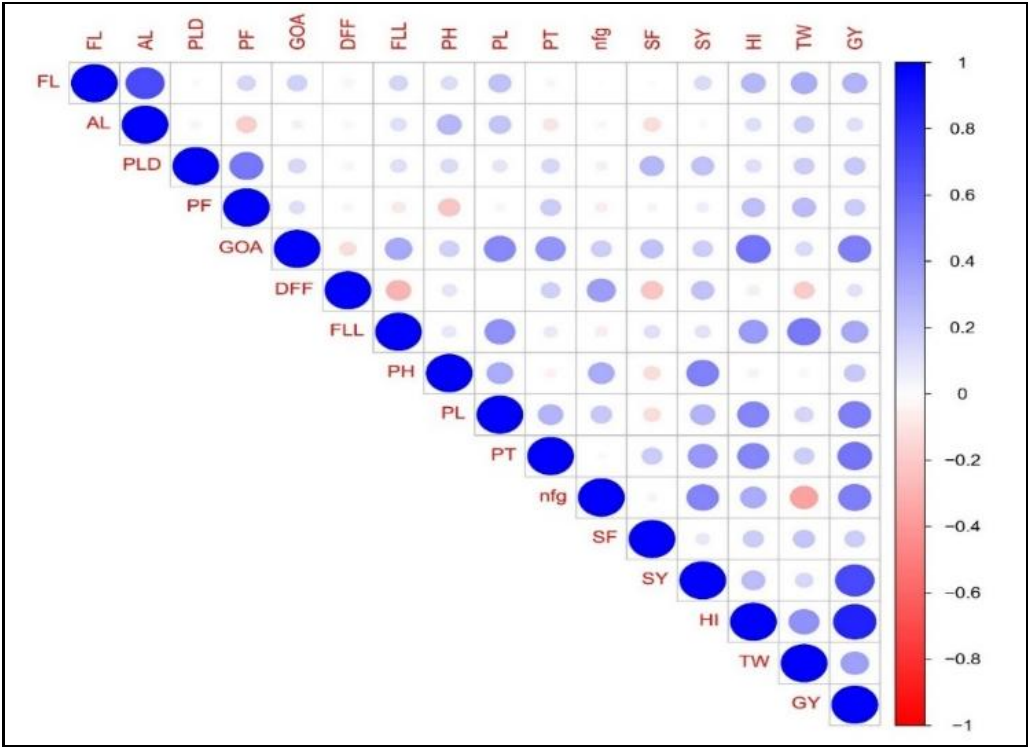


Fig 3: Shaded correlation matrix of phenotypic correlation

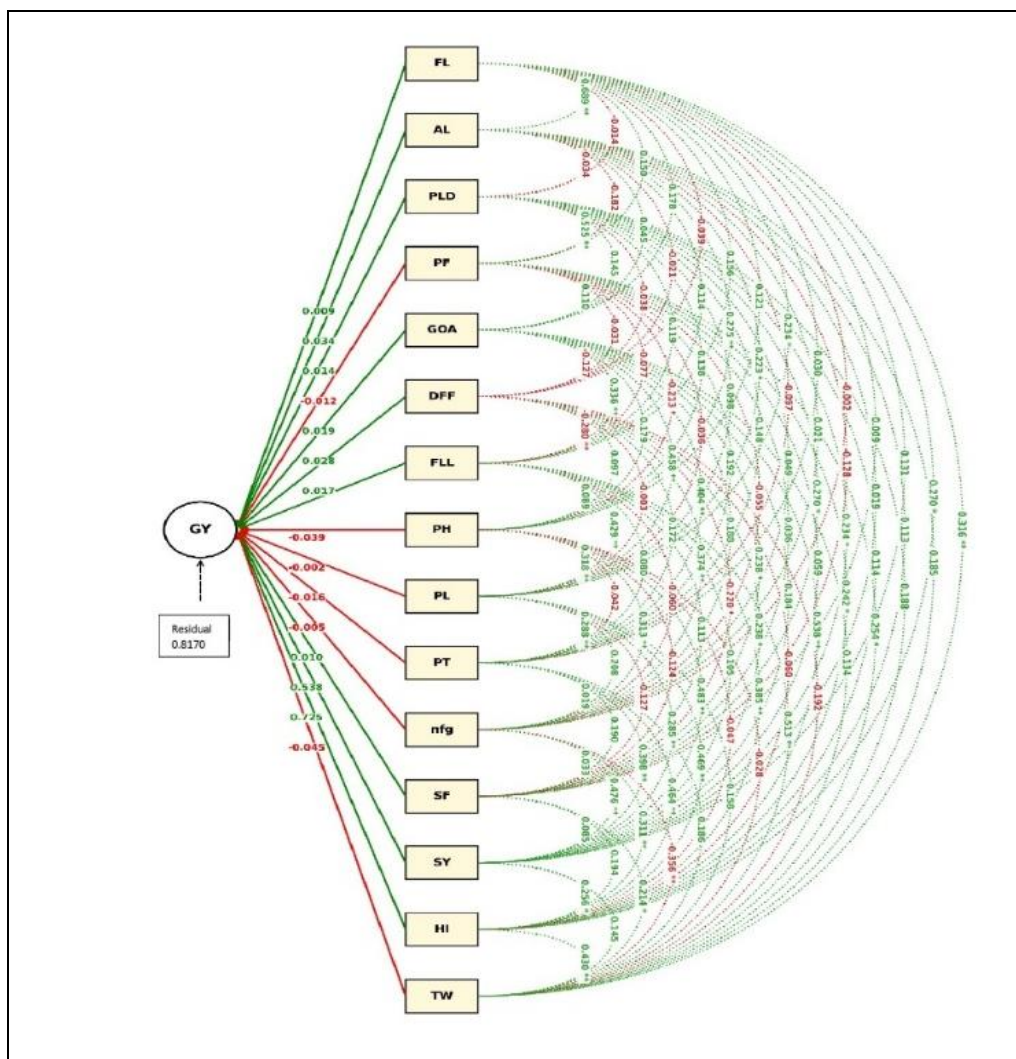


Fig 4: Phenotypic path diagram for grain yield per plant

Conclusion

Analysis on correlation and path coefficient analysis revealed the importance of selection with regard to harvest index, straw yield per plant, productive tillers per plant, glume opening angle, panicle length, filled grains per panicle, test weight, flag leaf length and filament length exhibited significant positive genotypic correlation and would enhance yield. The path analysis studies showed harvest index, straw yield per plant, filament length, pollen load and glume opening angle expressing positive direct effect and significant association with grain yield per plant.

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