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Studies on Correlation and Path Coefficient Analysis of Yield and Yield Attributing Traits in Semi Dry System of Rice (*Oryza sativa* L.)

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ABSTRACT: The present investigation was carried out at Rice Research Center, ARI, Rajendranagar, Hyderabad, Telangana, India. The experiment was laid out in Augmented Block Design to study the correlation and path analysis for yield and yield attributing traits of 84 germplasm lines including four standard checks were planted in 4 blocks randomly and each block comprised of 21 germplasm lines in semi dry system during Kharif, 2021. The correlation studies revealed that the highest positive significant association with grain yield per plant was exhibited by Total biomass followed by Root biomass, 1000-grain weight, Kernel length, Spikelet fertility and Milling % which indicated that all these characters were important for yield improvement. Path coefficient analysis has revealed that Total biomass has exhibited the highest positive direct effect on grain yield per plant followed by Amylose content, 1000-grain weight and Milling % indicating that the selection for these characters was likely to bring about an overall improvement in grain yield per plant directly.

Keywords: Correlation, Path coefficient, Germplasm lines, Semi dry system of Rice.

INTRODUCTION

Rice (*Oryza sativa* L.) is among the three most important grain crops in the world and it has a major contribution to fulfill the food needs across the globe. In order to meet the demand of increasing population, globally the production of rice has to be increased to 880 MT by 2025. However, conventional rice production system, which involves raising of nursery seedlings followed by transplanting of those seedlings in puddled flooded soil, requires a lot of water, energy and labour resources. Flooded rice fields are also a source of methane emission- a potent greenhouse gas. In this scenario, farmers around the world have been shifted towards water and labour-saving direct seeding of rice. Direct seeding also reduces methane emission (Nawaz *et al.*, 2019). There are several constraints associated with shift from PTR to DSR, such as high weed infestation, evolution of weedy rice, increase in soil borne pathogens (nematodes), lodging, incidence of blast, brown leaf spot *etc*. Furthermore, semi dry DSR could effectively use the early-season monsoon in areas with limited moisture.

The efficiency of selection for yield mainly depends on the direction and magnitude of association between yield and its component characters and also among themselves. Character association provides information on the nature and extent of association between pairs of metric traits and helps in selection for the improvement of the character. Correlation gives only the relation between two variables whereas path coefficient analysis allows separation of the direct effect and their indirect effects through other attributes by partitioning the correlations (Wright, 1921).

MATERIAL AND METHODS

A. Materials

The experimental material for the present study comprised of 84 germplasm lines and 4 checks which were maintained at Rice Research Center, ARI, Rajendranagar, Hyderabad. The experiment was laid out in Augmented Block Design with purpose of evaluating and doing statistical analysis of large number of population, 84 germplasm lines including four standard checks (JGL 11118, SN 1026, Tellahamsa and MTU 1121) which were planted in 4 blocks randomly and each block comprised of 21 germplasm lines planted in three rows. Each genotype was grown in three rows, each row comprising 15 hills with a row spacing of 25 cm and plant to plant spacing of 10 cm. The characters studied were seedling vigour based on plant height, seedling vigour based on leaf number, days to 50% flowering, number of productive tillers per plant, plant height (cm), panicle length (cm), number of filled grains per panicle, spikelet fertility (%), culm strength (gram/stem), stem diameter (mm), root biomass / plant (g), total biomass / plant (g), 1000-grain weight (g), grain yield per plant (g), kernel length (mm), kernel L/B ratio, hulling (%), Milling (%), head Rice Recovery (%), amylose content (%). Recording of observations was carried out on randomly selected competitive plants of each entry.

B. Statistical Analysis

The statistical analysis was carried out using INDOSTAT software. Correlation coefficients were calculated using the formulae suggested by Falconer (1964). Path coefficient analysis was done according to (Wright, 1921 and Dewey and Lu, 1959) to estimate the direct and
indirect effects at the genotypic and phenotypic levels.

RESULTS AND DISCUSSION

The correlation coefficients among yield and yield attributing traits i.e., seedling vigour based on plant height, seedling vigour based on leaf number, days to 50% flowering, number of productive tillers per plant, plant height (cm), panicle length (cm), number of filled grains per panicle, spikelet fertility (%), culm strength (gram/stem), stem diameter (mm), root biomass / plant (g), total biomass / plant (g), 1000-grain weight (g), grain yield per plant (g), kernel length (mm), kernel L/B ratio, hulling (%), milling (%), head Rice Recovery (%), amylose content (%)were assessed and the results have been presented in Table 1, Fig. 1.

The correlation studies revealed that the grain yield per plant had significant and positive association with spikelet fertility, root biomass, total biomass, 1000-grain weight, kernel length and milling % which indicated that all these characters were important for yield improvement.

Similar kind of association was revealed by Latha *et al*. (2003) for 1000-grain weight, Rao and Shrivastav (1999) for spikelet fertility, Marekar and Siddiqui (1997) for kernel length.

The study of phenotypic correlation studies showed that selection of plants with higher spikelet fertility, root biomass, total biomass, 1000-grain weight, kernel length and milling % would result in improvement of yield.

Interrelationships among yield attributing traits revealed that seedling vigour based on plant height has exhibited significant positive correlation with seedling vigour based on leaf number, plant height. It has also shown significant negative correlation with days to 50% flowering, culm strength, amylose content. seedling vigour based on leaf number has exhibited significant positive correlation with seedling vigour based on plant height, plant height, kernel length. It has also shown significant negative correlation with days to 50% flowering, amylose content. Days to 50% flowering has exhibited significant positive correlation with culm strength. It has also shown significant negative correlation with seedling vigour based on plant height, seedling vigour based on leaf number, spikelet fertility, kernel length, milling %. Similar results were reported by Ramesh Babu (1999), Nayak *et al*. (2001) for kernel length. Number of productive tillers per plant has exhibited significant positive correlation with root biomass, total biomass, kernel L/B ratio. It has also shown significant negative correlation with number of filled grains per panicle, culm strength. Plant height has exhibited significant positive correlation with seedling vigour based on plant height, seedling vigour based on leaf number, panicle length, stem diameter, total biomass. It has also shown significant negative correlation with kernel L/B ratio, hulling %. Similar results were reported by Kavitha and Sree Rama Reddi (2001), Tara satyavathi *et al*. (2001), Latha et al. (2003) for panicle length. Panicle length has exhibited significant positive correlation with plant height, 1000-grain weight, kernel length. Similar results were reported by Latha *et al*. (2003) for plant height, Latha *et al*. (2003) for 1000-grain weight, Reddy *et al*. (1997), Ramesh Babu (1999) for kernel length. Number of filled grains per panicle has exhibited significant positive correlation with head Rice Recovery and significant negative correlation with number of productive tillers per plant, 1000-grain weight, kernel length. Similar results were reported by Nayak *et al*. (2001) for 1000-grain weight, Ramesh Babu (1999), Nayak *et al*. (2001) for kernel length. Spikelet fertility has exhibited significant positive correlation with milling %, head Rice Recovery, grain yield per plant. It has also shown significant negative correlation with days to 50% flowering, culm strength. Similar results were reported by Kumar *et al.* (1998), Rao and Shrivastav (1999) for grain yield per plant. Culm strength has exhibited significant positive correlation with days to 50% flowering. It has also shown significant negative correlation with seedling vigour based on plant height, number of productive tillers per plant, spikelet fertility, hulling %.

Table 1: Correlation matrix of yield and yield attributing traits in rice.

	S(PH)	S(LN)	DFF	NPT	PH	PL	NFG	SF	CS	SD	RB	TB	TW	KL	LB	HP	MP	HRR	AC	GY
S(PH)	**1.0000**	0.6207 **	-0.2833 **	0.0658	0.4488 **	0.0677	-0.1263	-0.0644	-0.2413 *	0.0586	0.0549	0.1043	0.1645	0.1388	-0.1306	-0.0001	-0.1135	-0.1822	-0.2640 *	-0.1657
S(PL)		**1.0000**	-0.2811 **	0.1156	0.2927 **	0.0706	-0.1015	-0.0130	-0.1237	-0.0078	0.0584	0.1132	0.1666	0.2142 *	-0.1613	-0.0635	-0.0584	-0.1719	-0.2537 *	-0.0601
DFF			**1.0000**	-0.0985	-0.0804	-0.1235	0.0252	-0.3507 **	0.2528 *	-0.0455	0.0788	-0.0059	-0.1953	-0.3024 **	-0.1766	-0.1480	-0.3251 **	-0.0458	0.1350	-0.0791
NPT				**1.0000**	-0.1951	-0.1634	-0.2180 *	0.1714	-0.3546 **	0.0191	0.2434 *	0.3977 **	-0.1199	0.0239	0.3211 **	0.0460	0.0791	-0.0319	0.0015	0.1914
PH					**1.0000**	0.5205 **	0.0418	-0.1170	0.0440	0.2198 *	0.0541	0.2476 *	0.1527	0.1283	-0.2325 *	-0.2889 **	-0.1371	-0.1919	-0.1631	-0.1141
PL						**1.0000**	-0.0589	0.0502	0.1979	0.0591	-0.0200	0.1225	0.3870 **	0.4792 **	0.0607	-0.1578	0.0066	-0.0392	-0.0679	0.0627
NFG							**1.0000**	0.0981	0.1884	0.0827	-0.0817	-0.0490	-0.5394 **	-0.4294 **	0.0565	-0.0342	0.0664	0.2137 *	0.1691	-0.1084
SF								**1.0000**	-0.2893 **	-0.0424	-0.0431	0.0905	0.1329	0.1957	0.2015	-0.0205	0.3444 **	0.2193 *	-0.0238	0.2763**
CS									**1.0000**	0.1167	0.1531	0.0893	0.1402	0.0539	-0.0868	-0.2465 *	-0.1142	-0.1349	-0.1024	0.0417
SD										**1.0000**	0.2267 *	0.2623 *	0.1115	0.1647	-0.0409	-0.1232	-0.0509	0.0147	0.1155	0.1001
RB											**1.0000**	0.8265 **	0.1061	0.1713	0.0826	-0.1480	-0.0337	-0.0466	-0.1445	0.3239**
TB												**1.0000**	0.1444	0.2287 *	0.0901	-0.2585 *	0.0382	-0.0205	-0.1524	0.5028**
TW													**1.0000**	0.7740 **	-0.1455	-0.0760	0.1203	-0.1165	-0.1201	0.3016**
KL														**1.0000**	0.2478 *	-0.2281 *	0.0455	0.0711	-0.0158	0.2943**
LB															**1.0000**	0.0380	0.1164	0.4311 **	0.2375 *	0.0749
HP																**1.0000**	0.4645 **	-0.0555	0.0298	-0.0959
MP																	**1.0000**	0.2807 **	-0.1468	0.2462*
HRR																		**1.0000**	0.4542 **	0.1837
AC																			**1.0000**	0.1074

* Significant at 5 per cent level; ** Significant at 1 per cent level

SV(PH): Seedling vigour based on plant height, SV(LN): Seedling vigour based on leaf number, DFF: Days to 50% flowering, NPT: Number of productive tillers per plant, PH: Plant height, PL: Panicle length, NFG: Number of filled grains per panicle, SF: Spikelet fertility (%), CS: Culm strength, SD: Stem diameter, RB: Root biomass / plant, TB: Total biomass / plant, TW: 1000-grain weight, GY: Grain yield per plant, KL: Kernel length, LB: Kernel L/B ratio, HP: Hulling (%), MP: Milling (%), HRR: Head Rice Recovery (%), AC: Amylose content (%).

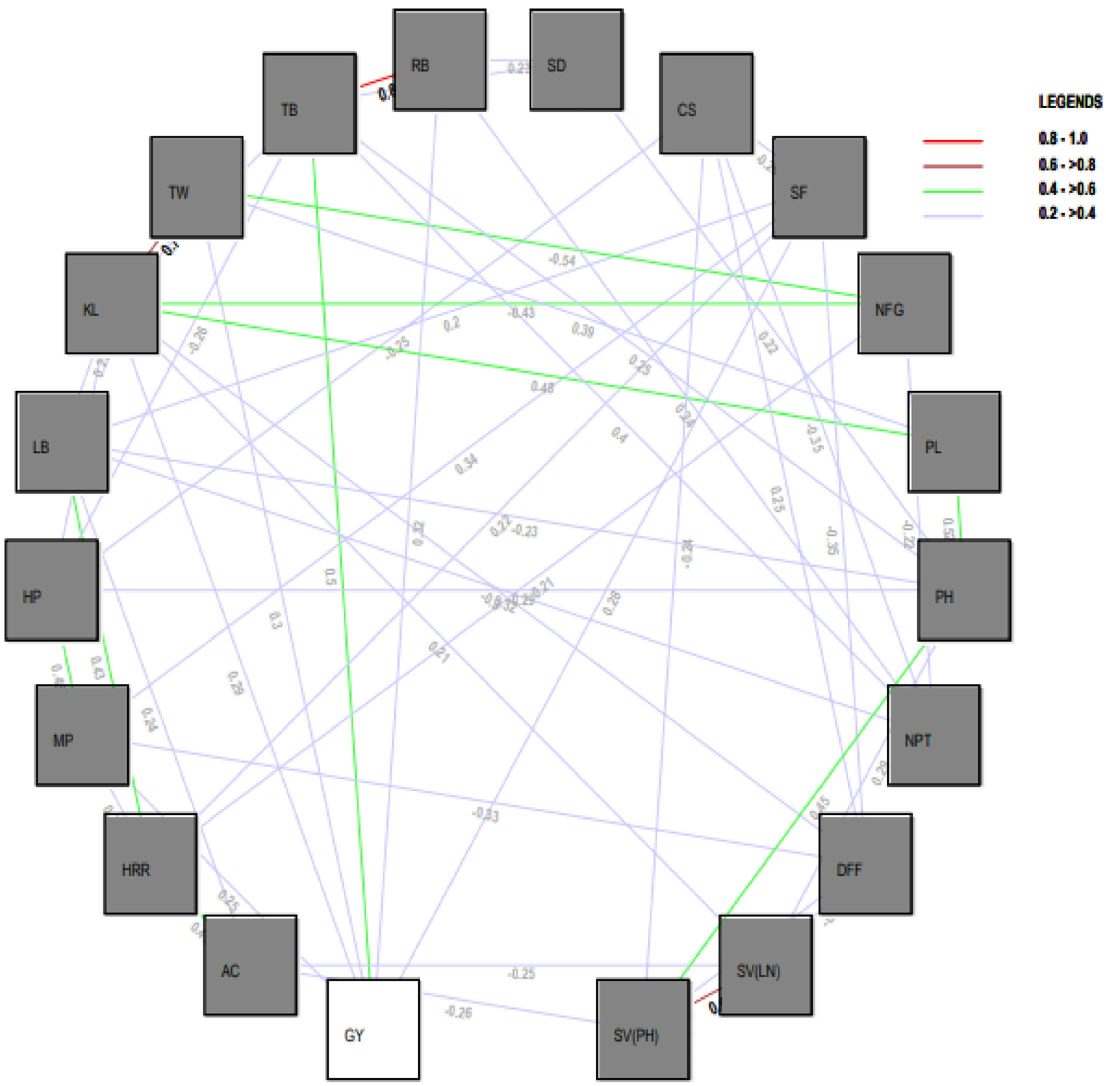

Fig. 1. Phenotypic correlation coefficients among different traits in rice.

Stem diameter has exhibited significant positive correlation with plant height, root biomass, total biomass. Root biomass / plant has exhibited significant positive correlation with number of productive tillers per plant, stem diameter, total biomass, grain yield per plant. Total biomass / plant has exhibited significant positive correlation with number of productive tillers per plant, plant height, stem diameter, root biomass, kernel length, grain yield per plant. It has also shown significant negative correlation with hulling %. 1000-grain weight has exhibited significant positive correlation with panicle length, kernel length, grain yield per plant. It has also shown significant negative correlation with number of filled grains per panicle. Similar results were reported by Tara Satyavathi *et al.* (2001), Latha *et al.* (2003) for grain yield per plant, Satish *et al.* (2003) for number of filled grains per panicle.

Kernel length has exhibited significant positive correlation with seedling vigour based on leaf number, panicle length, total biomass, 1000-grain weight, kernel L/B ratio, grain yield per plant. It has also shown significant negative correlation with days to 50% flowering, number of filled grains per panicle, hulling %. Similar results were reported by Marekar and Siddiqui (1997) for grain yield per plant, Nayak *et al.* (2001) for 1000-grain weight, Asha Christopher (1999), Nayak *et al.* (2001) for kernel L/B ratio. Kernel L/B ratio has exhibited significant positive correlation with number of productive tillers per plant, kernel length, head Rice Recovery, amylose content. It has also shown significant negative correlation with plant height.

Hulling % has exhibited significant positive correlation with milling %. It has also shown significant negative correlation with plant height, culm strength, total biomass, kernel length. Similar results were reported by Prem *et al*. (2010) for milling %. Milling % has exhibited significant positive correlation with spikelet fertility, hulling %, head Rice Recovery, grain yield per plant. It has also shown significant negative correlation with days to 50% flowering. Head Rice Recovery has exhibited significant positive correlation with number of filled grains per panicle, spikelet fertility, kernel L/B ratio, milling %, amylose content. Amylose content has exhibited significant positive correlation with kernel L/B ratio, head Rice Recovery. It has also shown significant negative correlation with seedling vigour based on plant height, seedling vigour based on leaf number.

Path coefficient analysis estimates for yield and yield attributing traits, have been presented in Table 2, Fig. 2. The studies revealed that seedling vigour based on plant height had exhibited negligible direct phenotypic negative effect on grain yield per plant. The trait contributed negative non-significant correlation with grain yield. However, the contribution of seedling vigour based on plant height on grain yield per plant through other traits were negligible in both positive and negative direction. Seedling vigour based on leaf number had exhibited negligible direct phenotypic positive effect on grain yield per plant. The trait contributed negative non-significant correlation with grain yield. However, the contribution of seedling vigour based on leaf number on grain yield per plant through other traits were negligible in both positive and negative direction. Days to 50% flowering had exhibited negligible direct phenotypic negative effect on grain yield per plant. The trait contributed negative non-significant correlation with grain yield. However, the contribution of days to 50% flowering on grain yield per plant through other traits were negligible in both positive and negative direction. Similar results were reported by Kavitha and Sree Rama Reddi (2001), Nayak *et al.* (2001) for negative direct effect of days to 50% flowering on grain yield per plant. Number of productive tillers per plant had exhibited low direct phenotypic negative effect on grain yield per plant. The trait contributed positive non-significant correlation with grain yield. However, the contribution of number of productive tillers per plant on grain yield per plant through other traits were negligible in both positive and negative direction. Similar results were reported by Kavitha and Sree Rama Reddi (2001), Janardhanam *et al.* (2001) for negative direct effect of number of productive tillers per plant on grain yield per plant. Plant height had exhibited high direct phenotypic negative effect on grain yield per plant. The trait contributed negative non-significant correlation with grain yield. It has shown negative indirect effects on yield through seedling vigour based on plant height, panicle length. Similar results were reported by Gupta *et al*. (1998), Valarmathi and Leenakumary (1998), Nayak *et al*. (2004) for negative direct effect of plant height on grain yield per plant. Panicle length had exhibited negligible direct phenotypic positive effect on grain yield per plant. The trait contributed positive non-significant correlation with grain yield. However, the contribution of panicle length on grain yield per plant through other traits were negligible in both positive and negative direction. Similar results were reported by Bala (2001), Chakraborty (2001), Kavitha and Sree Rama Reddi (2001), Tara Satyavathi *et al*. (2001), Nayak *et al*. (2004), Raju *et al.* (2004) for positive direct effect of panicle length on grain yield per plant. Number of filled grains per panicle had exhibited negligible direct phenotypic negative effect on grain yield per plant. The trait contributed negative non-significant correlation with grain yield. However, the contribution of number of filled grains per panicle on grain yield per plant through other traits were negligible in both positive and negative direction. Spikelet fertility had exhibited negligible direct phenotypic positive effect on grain yield per plant. The trait contributed positive significant correlation with grain yield. However, the contribution of spikelet fertility on grain yield per plant through other traits were negligible in both positive and negative direction. Similar results were reported by Kumar *et al*. (1998), Latha *et al*. (2003) for positive direct effect of spikelet fertility on grain yield per plant. Culm strength had exhibited negligible direct phenotypic positive effect on grain yield per plant. The trait contributed positive non-significant correlation with grain yield. However, the contribution of culm strength on grain yield per plant through other traits were negligible in both positive and negative direction. Stem diameter had exhibited negligible direct phenotypic negative effect on grain yield per plant. The trait contributed positive non-significant correlation with grain yield. However, the contribution of stem diameter on grain yield per plant through other traits were negligible in both positive and negative direction. Root biomass / plant had exhibited high direct phenotypic negative effect on grain yield per plant. The trait contributed positive significant correlation with grain yield. It has shown negative indirect effects on yield through total biomass / plant. Total biomass / plant had exhibited high direct phenotypic positive effect on grain yield per plant. The trait contributed positive significant correlation with grain yield. It has shown positive indirect effects on yield through seedling vigour based on leaf number, number of productive tillers per plant, plant height, panicle length, stem diameter, root biomass / plant, 1000-grain weight, kernel length and negative indirect effects on yield through hulling %, amylose content. 1000-grain weight had exhibited low direct phenotypic positive effect on grain yield per plant. The trait contributed positive significant correlation with grain yield. It has shown positive indirect effects on yield through kernel length.

Table 2: Path matrix of yield and yield attributing traits in rice.

	S(PH)	S(LN)	DFF	NPT	PH	PL	NFG	SF	CS	SD	RB	TB	TW	KL	LB	HP	MP	HRR	AC	GY
S(PH)	**-0.0673**	-0.0418	0.0191	-0.0044	-0.0302	-0.0046	0.0085	0.0043	0.0162	-0.0039	-0.0037	-0.0070	-0.0111	-0.0093	0.0088	0.0000	0.0076	0.0123	0.0178	-0.1657
S(PL)	0.0102	**0.0164**	-0.0046	0.0019	0.0048	0.0012	-0.0017	-0.0002	-0.0020	-0.0001	0.0010	0.0019	0.0027	0.0035	-0.0027	-0.0010	-0.0010	-0.0028	-0.0042	-0.0601
DFF	0.0093	0.0092	**-0.0328**	0.0032	0.0026	0.0041	-0.0008	0.0115	-0.0083	0.0015	-0.0026	0.0002	0.0064	0.0099	0.0058	0.0049	0.0107	0.0015	-0.0044	-0.0791
NPT	-0.0097	-0.0170	0.0145	**-0.1474**	0.0288	0.0241	0.0321	-0.0253	0.0523	-0.0028	-0.0359	-0.0586	0.0177	-0.0035	-0.0473	-0.0068	-0.0117	0.0047	-0.0002	0.1914
PH	-0.1482	-0.0966	0.0265	0.0644	**-0.3301**	-0.1718	-0.0138	0.0386	-0.0145	-0.0726	-0.0178	-0.0817	-0.0504	-0.0424	0.0768	0.0954	0.0453	0.0633	0.0538	-0.1141
PL	0.0016	0.0017	-0.0029	-0.0039	0.0124	**0.0238**	-0.0014	0.0012	0.0047	0.0014	-0.0005	0.0029	0.0092	0.0114	0.0014	-0.0038	0.0002	-0.0009	-0.0016	0.0627
NFG	0.0107	0.0086	-0.0021	0.0185	-0.0035	0.0050	**-0.0849**	-0.0083	-0.0160	-0.0070	0.0069	0.0042	0.0458	0.0364	-0.0048	0.0029	-0.0056	-0.0181	-0.0144	-0.1084
SF	-0.0059	-0.0012	-0.0324	0.0158	-0.0108	0.0046	0.0091	**0.0923**	-0.0267	-0.0039	-0.0040	0.0083	0.0123	0.0181	0.0186	-0.0019	0.0318	0.0202	-0.0022	0.2763**
CS	-0.0018	-0.0009	0.0019	-0.0026	0.0003	0.0015	0.0014	-0.0021	**0.0073**	0.0009	0.0011	0.0007	0.0010	0.0004	-0.0006	-0.0018	-0.0008	-0.0010	-0.0008	0.0417
SD	-0.0012	0.0002	0.0009	-0.0004	-0.0045	-0.0012	-0.0017	0.0009	-0.0024	**-0.0206**	-0.0047	-0.0054	-0.0023	-0.0034	0.0008	0.0025	0.0010	-0.0003	-0.0024	0.1001
RB	-0.0208	-0.0221	-0.0299	-0.0923	-0.0205	0.0076	0.0310	0.0164	-0.0581	-0.0860	**-0.3792**	-0.3134	-0.0402	-0.0649	-0.0313	0.0561	0.0128	0.0177	0.0548	0.3239**
TB	0.0985	0.1069	-0.0056	0.3758	0.2340	0.1158	-0.0463	0.0855	0.0844	0.2479	0.7810	**0.9450**	0.1365	0.2161	0.0851	-0.2443	0.0361	-0.0194	-0.1440	0.5028**
TW	0.0290	0.0294	-0.0344	-0.0211	0.0269	0.0682	-0.0951	0.0234	0.0247	0.0197	0.0187	0.0255	**0.1762**	0.1364	-0.0257	-0.0134	0.0212	-0.0205	-0.0212	0.3016**
KL	-0.0022	-0.0033	0.0047	-0.0004	-0.0020	-0.0074	0.0067	-0.0030	-0.0008	-0.0026	-0.0027	-0.0036	-0.0120	**-0.0155**	-0.0039	0.0035	-0.0007	-0.0011	0.0002	0.2943**
LB	0.0105	0.0130	0.0142	-0.0258	0.0187	-0.0049	-0.0045	-0.0162	0.0070	0.0033	-0.0066	-0.0072	0.0117	-0.0199	**-0.0803**	-0.0030	-0.0093	-0.0346	-0.0191	0.0749
HP	0.0000	0.0044	0.0103	-0.0032	0.0200	0.0109	0.0024	0.0014	0.0171	0.0085	0.0103	0.0179	0.0053	0.0158	-0.0026	**-0.0693**	-0.0322	0.0038	-0.0021	-0.0959
MP	-0.0192	-0.0099	-0.0549	0.0134	-0.0231	0.0011	0.0112	0.0581	-0.0193	-0.0086	-0.0057	0.0064	0.0203	0.0077	0.0196	0.0784	**0.1688**	0.0474	-0.0248	0.2462*
HRR	-0.0025	-0.0023	-0.0006	-0.0004	-0.0026	-0.0005	0.0029	0.0030	-0.0018	0.0002	-0.0006	-0.0003	-0.0016	0.0010	0.0059	-0.0008	0.0038	**0.0136**	0.0062	0.1837
AC	-0.0569	-0.0547	0.0291	0.0003	-0.0352	-0.0146	0.0365	-0.0051	-0.0221	0.0249	-0.0312	-0.0329	-0.0259	-0.0034	0.0512	0.0064	-0.0317	0.0980	**0.2157**	0.1074

*** Significant at 5 per cent level; ** Significant at 1 per cent level**

Phenotypic Residual effect = 0.6889, Bold values are direct effects

SV(PH): Seedling vigour based on plant height, **SV(LN):** Seedling vigour based on leaf number, **DFF:** Days to 50% flowering, **NPT:** Number of productive tillers per plant, **PH:** Plant height, **PL:** Panicle length, **NFG:** Number of filled grains per panicle, **SF:** Spikelet fertility (%), **CS:** Culm strength, **SD:** Stem diameter, **RB:** Root biomass / plant, **TB:** Total biomass / plant, **TW:** 1000-grain weight, **GY:** Grain yield per plant, **KL:** Kernel length, **LB:** Kernel L/B ratio, **HP:** Hulling (%), **MP:** Milling (%), **HRR:** Head Rice Recovery (%), **AC:** Amylose content (%).

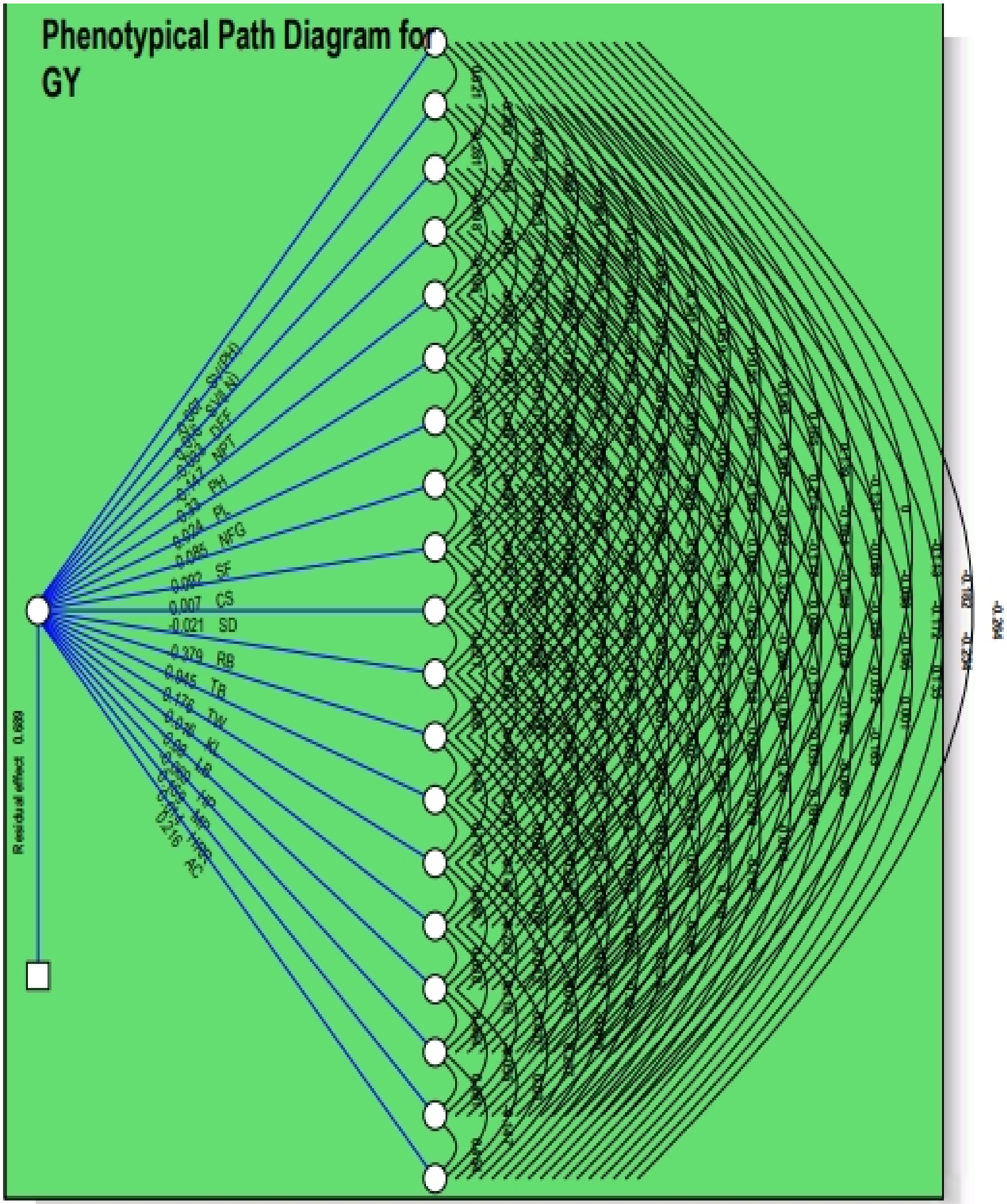

Fig. 2. Phenotypical Path Diagram for Grain yield per plant.

Similar results were reported by Nayak *et al*. (2001), Tara satyavathi *et al.* (2001), Satish *et al*. (2003), Latha *et al*. (2003), Nayak *et al*. (2004) for positive direct effect of 1000-grain weight on grain yield per plant.

Kernel length had exhibited negligible direct phenotypic negative effect on grain yield per plant. The trait contributed positive significant correlation with grain yield. However, the contribution of Kernel length on grain yield per plant through other traits were negligible in both positive and negative direction. Similar results were reported by Panduranga Rao *et al*. (1986), Ganesan *et al*. (1997), Vivekanandan and Giridharan (1998) for negative direct effect of kernel length on grain yield per plant. Kernel L/B ratio had exhibited negligible direct phenotypic negative effect on grain yield per plant. The trait contributed positive non-significant correlation with grain yield. However, the contribution of kernel L/B ratio on grain yield per plant through other traits were negligible in both positive and negative direction. Hulling % had exhibited negligible direct phenotypic negative effect on grain yield per plant. The trait contributed negative non-significant correlation with grain yield. However, the contribution of hulling % on grain yield per plant through other traits were negligible in both positive and negative direction. Milling % had exhibited low direct phenotypic positive effect on grain yield per plant. The trait contributed positive significant correlation with grain yield. However, the contribution of milling % on grain yield per plant through other traits were negligible in both positive and negative direction. Head Rice Recovery had exhibited negligible direct phenotypic positive effect on grain yield per plant. The trait contributed positive non-significant correlation with grain yield. However, the contribution of head Rice Recovery on grain yield per plant through other traits were negligible in both positive and negative direction. Similar results were reported by Ekka *et al*. (2011) and Edukondalu *et al*. (2017) for positive direct effect of head rice recovery percentage on grain yield per plant. Amylose content had exhibited moderate direct phenotypic positive effect on grain yield per plant. The trait contributed positive non-significant correlation with grain yield. However, the contribution of amylose content on grain yield per plant through other traits were negligible in both positive and negative direction. Similar results were reported by Saxena and Suman (2017) for positive direct effect of amylose content on grain yield per plant.

Residual effect was 0.6889 for phenotypic path coefficient analysis, high value of residual effect could be due to the influence of other traits which were not included in this study. The association of different component characters among themselves and with yield is quite important for devising an efficient selection criterion for yield. The total correlation between yield and component characters may be some times misleading, as it might be an over-estimate or under-estimate because of its association with othercharacters. Hence, indirect selection by correlated response may not be sometimes fruitful, when many characters are affecting a given character, splitting the total correlation into direct and indirect effects of cause as devised by Wright (1921) would give more meaningful interpretation to the cause of association between the dependent variable like yield and independent variables like yield components. This kind of information will be helpful in formulating the selection criteria, indicating the selection for these characters is likely to bring about on overall improvement in single plant yield directly.

Path coefficient analysis revealed that total biomass has exhibited the highest positive direct effect on grain yield per plant followed by amylose content, 1000-grain weight and milling % indicating that the selection for these characters was likely to bring about an overall improvement in grain yield per plant directly. Therefore, it is suggested that preference should be given to these characters in the selection programme to isolate superior lines with genetic potentiality for higher yield in rice genotypes.

CONCLUSION

Through the studies of correlation and path coefficient analysis it can be concluded that the traits like total biomass, 1000-grain weight, kernel length and milling % exhibited a highly significant correlation values. Further, the same traits exhibited a higher values of direct effects on grain yield per plant during Path analysis also, indicating the importance of these traits should be given in selection criteria for enhancing the yield potential.

FUTURE SCOPE

The desirable traits for yield improvement and the assosiations among them were identified through the studies of correlation and path coefficient analysis which can be exploited in further breeding programmes to develop elite genotypes with high yield potential.

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