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ASSOCIATION STUDIES FOR YIELD COMPONENTS AND DORMANCY RELATED TRAITS IN RICE (*Oryza sativa* L.)

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ABSTRACT

One hundred and nineteen recombinant inbred lines along with parents BPT 2231 and MTU 1001 were studied to determine the association between yield, yield components and dormancy related traits. The results revealed that total soluble sugars and free amino acids manifested positive and significant relationship with germination (%) at 5 days and 10 days after harvesting. Grain yield per plant exhibited significant & positive relationship with test weight while its association with total soluble sugars is significant and negative. The studies of path analysis revealed maximum direct effect for germination (%) at 10 days after harvesting followed by test weight.

Key words : *Grain yield, dormancy traits, correlation and path coefficient*

Rice is the most consumed cereal grain in the world. It is a staple food crop for more than half of the world's human population. Yield enhancement is the major breeding objective in rice breeding programmes. One of the important agronomic problem in rice production in humid climates is pre-harvest sprouting. Pre-harvest sprouting is germination in the inflorescence after maturation of the crop, when moist conditions prevail or untimely rains occur. Resistance to pre-harvest sprouting is correlated with the level of dormancy in dry and mature seeds (1). Information on correlation co-efficient between grain yield and its component characters is essential for yield improvement since grain yield is a complex entity and is highly influenced by several component characters. Studies on path co-efficient analysis also provide useful information regarding the direct and indirect effects of different yield component characters on grain yield. Hence, the present study was under taken with an objective to determine the association between grain yield with yield components and dormancy related traits.

MATERIALS AND METHODS

The experiment was carried out with 119 $F_{6:7}$ Recombinant Inbred Lines obtained from a cross combination of BPT 2231/MTU 1001. The experiment was conducted at Agricultural College Farm, Bapatla during *kharif* 2018-19 in a simple lattice design with two replications. One month old seedlings were transplanted in thoroughly puddled main field. Each experimental unit consisted of 2.4 m^2 and the spacing adopted was 20 cm between rows and 15 cm between plants. Recommended management practices were followed for raising the crop. Observations on yield and yield attributing traits were recorded on five randomly selected plants of each genotype in every replication for 6 characters *viz.,* days to 50% flowering, number of ear bearing tillers, plant height, panicle length, test weight and grain yield per plant. The germination (%) at 5 days and 10 days after harvesting was assessed in 4 replications by following the procedure delineated by (2). The physiological parameters *viz.,* free amino acids concentration and total soluble sugars in seeds for two replications were estimated by using Ninhydrin method as suggested by (3) and Anthrone method as described by (4) respectively. Correlation coefficient was worked out by using the formulae suggested by (5). Path coefficient analysis as suggested by (6) and elaborated by (7) was used to calculate the direct and indirect contribution of various traits under study.

RESULTS AND DISCUSSION

The aim of correlation studies is primarily to know the suitability of various characters for indirect selection because any particular trait may bring about change in other associated characters. The results of character association studies between grain yield, yield components and dormancy related traits were presented in Table-1. The trait test weight manifested positive and significant association with grain yield per plant at phenotypic and genotypic level (0.1381 and 0.1595) indicating that genotypes with bolder grain recorded high grain yield. The results are in accordance with the findings reported by (8). Total soluble sugars manifested negative and significant relationship with grain yield (0.2006 and 0.2476) both at phenotypic and genotypic level.

The characters *viz.,* days to 50% flowering, plant height and panicle length exhibited positive relationship with grain yield per plant and these results are in accordance with the findings of (9). Studies on inter character associations for yield components and dormancy related traits revealed that plant height manifested significant positive relationship with panicle length (0.4751 and 0.6475) and test weight (0.3517 and 0.3611) suggesting that the genotypes with longer panicle possessed bold grain which ultimately resulted in positive

Table-1 : Estimates of correlation coefficients for yield components and dormancy related traits in rice (*Oryza sativa* L.)

Characters		DFF	EBT	PH	PL	TW	Germination (%) at 5DAH	Germination (%) at 10DAH	FAA	TSS	GY/P
DFF	P	1.0000	0.0341	0.0413	-0.1108	-0.1108	-0.1016	-0.1789*	0.0158	-0.0992	0.0407
	G	1.0000	0.0332	0.0425	-0.1480	-0.1117	-0.1016	-0.1817*	0.0158	- 0.1009	0.0573
EBT	P		1.0000	-0.0923	-0.1324*	-0.1163	0.0426	0.0355	0.0750	0.0982	-0.0214
	G		1.0000	-0.0948	-0.2089*	-0.1252	0.0524	0.0329	0.0766	0.0997	-0.0113
PH	P			1.0000	0.4751**	0.3517**	-0.1485*	-0.0968	0.0407	-0.0781	0.0963
	G			1.0000	0.6475**	0.3611**	-0.1536*	-0.1009	0.0437	-0.0777	0.1210
PL	P				1.0000	0.2992**	0.0461	0.0660	0.0930	-0.0214	0.0727
	G				1.0000	0.4108**	0.0603	0.0962	0.1306	-0.0141	0.1077
TW	P					1.0000	-0.1173	-0.1205	-0.0769	-0.0762	0.1381*
	G					1.0000	-0.1180	-0.1236	-0.0777	- 0.0765	0.1595*
Germination (%) at 5DAH	P						1.0000	0.6894**	0.1382*	0.2185**	-0.0902
	G						1.0000	0.7079**	0.1407*	0.2198**	-0.1157
Germination (%) at 10DAH	P							1.0000	0.1318*	0.2395**	-0.0243
	G							1.0000	0.1342*	0.2434**	-0.0310
FAA	P								1.0000	0.1803*	-0.0304
	G								1.0000	0.1810*	-0.0277
TSS	P									1.0000	-0.2006**
	G									1.0000	-0.2476**
GY/P	P										1.0000
	G										1.0000

*,** Significant at 5% and 1% levels, respectively

Note : DFF = Days to 50% flowering (No.); EBT = Number of ear bearing tillers/plant; PH = Plant height (cm); PL : Panicle length (cm); TW = Test weight (g), DAH = Days after harvesting; FAA = Free amino acids (mg/100g); TSS = Total soluble sugars (mg/100g), GY/P = Grain yield per plant (g); P = Phenotypic; G = Genotypic.

Table-2 : Direct and indirect effects of yield components and dormancy related traits in rice (*Oryza sativa* L.)

Characters		DFF	EBT	PH	PL	TW	Germination (%) at 5DAH	Germination (%) at 10DAH	FAA	TSS
DFF	P	**0.0466**	0.0016	0.0019	-0.0052	-0.0052	-0.0047	-0.0084	0.0007	-0.0046
	G	**0.0664**	0.0022	0.0028	-0.0098	-0.0074	-0.0067	-0.0121	0.0010	-0.0067
EBT	P	0.0005	**0.0162**	-0.0015	-0.0021	-0.0019	0.0007	0.0006	0.0012	0.0016
	G	0.0014	**0.0410**	-0.0039	-0.0086	-0.0051	0.0021	0.0013	0.0031	0.0041
PH	P	0.0009	-0.0019	**0.0208**	0.0099	0.0073	-0.0031	-0.0020	0.0008	-0.0016
	G	0.0006	-0.0013	**0.0134**	0.0086	0.0048	-0.0021	-0.0013	0.0006	-0.0010
PL	P	-0.0029	-0.0035	0.0125	**0.0264**	0.0079	0.0012	0.0017	0.0025	-0.0006
	G	-0.0078	-0.0111	0.0343	**0.0530**	0.0218	0.0032	0.0051	0.0069	-0.0007
TW	P	-0.0130	-0.0136	0.0412	0.0350	**0.1171**	-0.0137	-0.0141	-0.0090	-0.0089
	G	-0.0144	-0.0162	0.0467	0.0531	**0.1293**	-0.0153	-0.0160	-0.0101	-0.0099
Germination (%) at 5DAH	P	0.0116	-0.0049	0.0171	-0.0052	0.0135	**-0.1147**	-0.0791	-0.0158	- 0.0250
	G	0.0164	-0.0085	0.0248	-0.0097	0.0190	**-0.1615**	-0.1143	-0.0227	-0.0355
Germination (%) at 10DAH	P	-0.0219	0.0043	-0.0118	0.0081	-0.0148	0.0845	**0.1226**	0.0162	0.0294
	G	-0.0296	0.0054	-0.0164	0.0157	-0.0201	0.1152	**0.1627**	0.0218	0.0396
FAA	P	0.0001	0.0006	0.0003	0.0007	-0.0006	0.0010	0.0010	**0.0076**	0.0014
	G	0.0002	0.0011	0.0007	0.0020	-0.0012	0.0021	0.0020	**0.0150**	0.0027
TSS	P	0.0191	-0.0190	0.0151	0.0042	0.0147	-0.0421	-0.0462	-0.0347	**-0.1928**
	G	0.0242	-0.0239	0.0186	0.0034	0.0184	-0.0528	-0.0584	-0.0435	**-0.2401**
GY/P	P	0.0411	-0.0203	0.0956	0.0717	0.1380	-0.0908	-0.0239	-0.0306	-0.2012
	G	0.0573	-0.0113	0.1210	0.1077	0.1595	-0.1157	-0.0310	-0.0277	-0.2476
Partial R^2	P	0.0019	-0.0003	0.0020	0.0019	0.0162	0.0104	-0.0029	-0.0002	0.0388
	G	0.0038	-0.0005	0.0016	0.0057	0.0206	0.0187	-0.0050	-0.0004	0.0595

Note : DFF = Days to 50% flowering (No.); EBT = Number of ear bearing tillers/plant; PH = Plant height (cm); PL = Panicle length (cm); TW = Test weight (g); DAH = Days after harvesting; FAA = Free amino acids (mg/100g); TSS = Total soluble sugars (mg/100g); GY/P = Grain yield per plant (g); P = Phenotypic; G = Genotypic.

and significant association of test weight with grain yield/plant. Similar findings also observed by (8). Likewise, total soluble sugars and free amino acids showed significant and positive association with germination percentage at 5 days and 10 days after harvesting suggesting that the presence of total soluble sugars and free amino acids in the endosperm will enhance coleoptile elongation or germination of genotypes which is in accordance with the findings reported by (10). Significant and negative association was observed between ear bearing tillers per plant and panicle length (0.1324 and 0.2089) indicating that the genotypes with more number of tillers had small panicles which might be the reason for negative association of ear bearing tillers with grain yield/plant. Significant and negative relationship was observed between plant height and germination (%) at 5 days after harvesting (0.1485 and 0.1536) and days to 50% flowering and germination (%) at 10 days after harvesting (0.1789 and 0.1817).

The correlation coefficients observed among yield and dormancy related traits may sometimes be misleading since it may be over or under estimate because of its association with other characters. Hence, the correlation coefficient needs to be split into direct and indirect effects using path coefficient analysis (Table-2) for critical evaluation. Thus, the correlation and path analysis in combination can give a better insight into cause and effect relationship between different pairs of characters. The results of path analysis revealed high direct effects for test weight, germination (%) at 10 days after harvesting, days to 50% flowering and panicle length. Among these, germination (%) at 10 days after harvesting manifested maximum positive direct effect (0.122 and 0.1627) followed by test weight (0.1171 and 0.1293) and days to 50% flowering (0.0466 and 0.0664). Test weight, days to 50% flowering, plant height and panicle length also exhibited positive correlation coefficient indicating the true relationship and selection through these traits will be effective for improvement of grain yield per plant. These findings are in agreement with the results reported by (11).

CONCLUSION

Results of the present investigation conducted on character association and path co-efficient analysis revealed the importance of test weight as selection criteria for effective yield improvement. The traits, total soluble sugar significantly associated with germination percentage at 5 days after harvesting, 10 days after harvesting and free amino acids there by it is inversely related with the level of dormancy.

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