



E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; 9(3): 867-869
Received: 28-03-2020
Accepted: 30-04-2020

D.B.K.V Mani

M.Sc. Scholar, Department of genetic and plant breeding, Agricultural college, Bapatla, Andhra Pradesh, India.

B Krishna Veni

Scientist, Department of genetic and plant breeding, Agricultural research station, Bapatla, Andhra Pradesh, India.

V Roja

Assistant Professor, Department of biotechnology, Agricultural College, Bapatla, Andhra Pradesh, India.

S.N Umar

Assistant Professor, Department of statistics and computer application, Agricultural College, Bapatla, Andhra Pradesh, India.

Corresponding Author:**D.B.K.V Mani**

M.Sc. Scholar, Department of genetic and plant breeding, Agricultural college, Bapatla, Andhra Pradesh, India.

Association studies for yield components and dormancy related traits in rice (*Oryza sativa* L.)

D.B.K.V Mani, B Krishna Veni, V Roja and S.N Umar

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.

Keywords: Grain yield, Dormancy traits, Correlation and Path coefficient

Introduction

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 (Seshu and Sorrells, 1986) [12]. 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.

Material 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 m² 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 Wan *et al.* (1997) [14]. 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 Moore and Stein (1948) [7] and Anthrone method as described by Hedge and Hofreiter (1962) [5] respectively. Correlation coefficient was worked out by using the formulae suggested by Falconer (1964) [4]. Path coefficient analysis as suggested by Wright (1921) [15] and elaborated by Dewey and Lu (1959) [3] 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 & 0.1595) indicating that genotypes with bolder grain recorded high grain yield. The results are in accordance with the findings reported by Pandey *et al.* (2018) [8]. Total soluble sugars manifested negative and significant relationship with grain yield (0.2006 & 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 Kishore *et al.* (2018) [16], Rajesh *et al.* (2017) [9] and Kumari *et al.* (2019) [6]. 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 & 0.6475) and test weight (0.3517 & 0.3611) suggesting that the genotypes with longer panicle possessed bold grain which ultimately resulted in positive & significant association of test weight with grain yield/plant. Similar findings also observed by Ramesh *et al.* (2018) [10] and Pandey *et al.* (2018) [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 Chaitanya *et al.* (2017) [2]. Significant and negative association was observed between ear bearing tillers per plant and panicle length (0.1324 & 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 & germination (%) at 5 days after harvesting (0.1485 & 0.1536) and days to 50% flowering & germination (%) at 10 days after harvesting (0.1789 & 0.1817).

The correlation co-efficients 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 & 0.1627) followed by test weight (0.1171 & 0.1293) and days to 50% flowering (0.0466 & 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 Sivasankar *et al.* (2018) [13], Reddy *et al.* (2018) [11] and Abebe *et al.* (2019) [1].

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

Characters		DFE	EBT	PH	PL	TW	Germination (%) at 5DAH	Germination (%) at 10DAH	FAA	TSS	GY/P
DFE	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% level, ** Significant at 1% level

DFE: 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		DFE	EBT	PH	PL	TW	Germination (%) at 5DAH	Germination (%) at 10DAH	FAA	TSS
DFE	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

DFE: 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

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.

References

- Abebe T, Alamerew S, Tulu L. Traits association and path coefficient analysis of yield and related traits in rainfed lowland rice (*Oryza sativa* L.) genotypes in north western Ethiopia, *African Journal of Plant Science J.* 2019; 13:1-8.
- Chaitanya M.S, Krishna Veni B, Mohammed L.A, Rani M.G, Lalitha K.J. Association studies for physiological parameters and early vigour traits under anaerobic condition in rice (*Oryza sativa* L.), *Journal of Rice Research J.* 2018; 10:24-28.
- Dewey D.R, Lu K.H. A correlation and path coefficient analysis of components of crested wheat grass seed production, *Agronomy Journal J.* 1959; 51:515-518.
- Falconer D.S. *An Introduction to Quantitative Genetics, Second edition*, Oliver and Boyd, Edinburgh, 1964, 312-324.
- Hedge J.E, Hofreiter B.T. In: Carbohydrate Chemistry 17 (Eds Whistler R.L and Be Miller J.N) Academic press, New York, 1962.
- Kumari N, Kumar R, Kumar A. Genetic variability and association of traits in mutant lines of rice (*Oryza sativa* L.) for submergence tolerance, *Current Journal of Applied Science and Technology.* 2019, 1-7.
- Moore S, Stein W.H. In: Methods in Enzymology (Eds. Colowick, S. P and Kaplan, N. D) Academic Press, New York J. 1948; 3:468.
- Pandey V.K, Kar S. Association analysis of native rice (*Oryza sativa* L.) of Bastar, *Electronic Journal of Plant Breeding J.* 2018; 9:199-212.
- Rajesh K, Prakash N, Kumar V. Analysis of morpho-physiological traits for rice improvement under submergence condition, *Indian Journal of Ecology J.* 2017; 44:86-89.
- Ramesh Ch, Raju Ch.D, Raju S, Varma N.R.G. Character association and path coefficient analysis for grain yield and yield components of parents and hybrids in rice (*Oryza sativa* L.), *International Journal of Current Microbiology and Applied Sciences J.* 2018; 7:2692-2699.
- Reddy B.S, Rani M.G. Evaluation of near Isogenic lines (NILs) of rice for major abiotic stresses of coastal areas, *Electronic Journal of Plant Breeding J.* 2018; 9:808-814.
- Seshu D.V, M.E Sorrells. Genetic studies on seed in rice, *In Rice Genetics*, IRRI, Manila, Philippines, 1986, 369-382.
- Sivasankar R, Suresh B.G, Ashish S, Sudheer T.R. Correlation and path coefficient analysis in elite germplasm of rice (*Oryza sativa* L.), *International Journal of Current microbiology and applied sciences J.* 2018; 7:3454-3459.
- Wan J, Nakazaki T, Kanaura K, Ikehashi H. Identification of marker loci for seed dormancy in rice (*Oryza sativa* L.), *Crop Science J.* 1997; 37:1759-1763.
- Wright S. Correlation and causation, *Journal of agricultural research J.* 1921; 20: 557-585.
- Kishore C, Kumar A, Pal A.K, Kumar V, Prasad B.D, Kumar A. Character association and path analysis for yield components in traditional rice (*Oryza sativa* L.) genotypes, *International Journal of current microbiology and applied sciences J.* 2018; 7:283-291.