International Journal of Agriculture Sciences
ISSN: 0975-3710&E-ISSN: 0975-9107, Volume 10, Issue 6, 2018, pp.-5418-5420.
Available online at http://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000217

Research Article

GENETIC VARIABILITY, CHARACTER ASSOCIATION AND PATH COEFFICIENT ANALYSIS OF HYBRID RICE IN SOUTH EASTERN GHAT ZONE OF ODISHA

SIAL PARSHURAM[1*], MOHANTY MIHIR RANJAN[2], RESHMI RAJ K.R.[3], PRADHAN KEDARESWAR[4] AND JAGADEV PREMNARAYAN[5]

[1]High Altitude Research Station, Pottangi, Koraput, Orissa University of Agriculture and Technology, Bhubaneswar, 751003, Odisha
[2]Regional Research and Technology Transfer Sub Station, Jeypore, Koraput, Orissa University of Agriculture and Technology, Bhubaneswar, 751003, Odisha
[3]Department of Plant Breeding and Genetics, College of Agriculture, Orissa University of Agriculture and Technology, Bhubaneswar, 751003, Odisha
[4]Regional Research and Technology Transfer Station, Semiliguda, Koraput, Orissa University of Agriculture and Technology, Bhubaneswar, 751003, Odisha
[5]Directorate of Research, Orissa University of Agriculture and Technology, Bhubaneswar, 751003, Odisha
*Corresponding Author: Email-parsuramsial@gmail.com

Received: March 14, 2018; Revised: March 19, 2018; Accepted: March 20, 2018; Published: March 30, 2018

Abstract- Field experiment was carried out during *Kharif,* 2011, 2012 and 2013 in the South Eastern Ghat Zone at the research farm of Regional Research and Technology Transfer Sub Station (OUAT), Jeypore, Odisha, India to evaluate the performance of 17 rice hybrids in randomized block design with three replications. It was revealed from the results that genotypic coefficient of variation (GCV) and phenotypic coefficient variation (PCV) were high for number of spikelets per plant followed by number of tillers per hill , grain yield (q/ha) and plot yield which reflects the least effect of environmental factors on expression of these traits. High heritability along with high genetic advance was registered for number of spikelets per plant followed by grain yield (q/ha), plot yield and number of tillers per hill suggesting predominance of additive gene action in expression of these traits. Grain yield exhibited significant positive correlations with days to initial flowering, days to 50% flowering, plant height, panicle length and number of spikelets per panicle at both genotypic and phenotypic levels. This indicates the relative utility of all these traits for selection with respect to grain yield. Path coefficient analysis revealed that number of spikelets per panicle had highest positive direct effect on grain yield, followed by no of tillers per hill and days to initial flowering This may indicate that the direct selection for number of spikelets per panicle and days to initial flowering would likely be effective in increasing grain yield

Keywords- Hybrid rice, genetic variability, yield improvement, character association, path coefficient analysis

Citation: Sial Parshuram, *et al*., (2018) Genetic Variability, Character Association and Path Coefficient Analysis of Hybrid Rice in South Eastern Ghat Zone of Odisha. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 10, Issue 6, pp.-5418-5420.

Academic Editor / Reviewer: Dr Alok Kumar Yadav

Introduction

Rice (*Oryza sativa* L.) is one of the staple cereal crops feeding more than half of the world population. In view of the growing population, the basic objective of the plant breeders would always be towards yield improvement in staple food crops. Hybrid rice technology has proved to be one of the most feasible and readily adoptable approaches to break the yield barrier, as the yield superiority of about 15-20 per cent over the best of the improved or High Yielding Varieties. China ranks first in Hybrid rice production in terms of area and production i.e. about 55 per cent of total rice area and 66 per cent of the total rice output is through hybrid rice. High magnitude of variability in a population provides the opportunity for selection to evolve a variety having desirable characters [16]. Most of the characters of interest to breeders are complex and are the result of the interaction of a number of components. Understanding of the presence of existing genetic variability, relationship between yield and its components is of paramount importance for making the best use of these relationships in selection. Path coefficient analysis discerns correlation into direct and indirect effects. In the present study, an attempt was made to understand presence of existing genetic variability, the association and path analysis of component characters for grain yield in popular rice hybrids in South Eastern Ghat zone of Odisha.

Materials and Methods

The present experiment was carried out at Regional Research and Technology Transfer Sub Station (OUAT), Jeypore, Odisha, India, situated at 18°51'55"N latitude and of 82°34'23"E longitude and altitude of 659m above mean sea level. A total of seventeen hybrids and four check varieties constitute the experimental materials [Table-1]. The experiment was laid out in a Randomized Block Design (RBD) with three replications. Twenty-five days old seedlings were transplanted 20cm apart between rows and 15cm within the row. All necessary precautions were taken to maintain uniform plant population in each treatment per replication. Recommended packages and practices were followed. Observations on days to initial flowering, days to 50% flowering, plant height (cm), panicle length (cm), tillers per hill, spikelets per panicle, plot yield (Kg) and grain yield (qtls/ha) were recorded and the data was subjected to statistical analysis. The analysis of variance (ANOVA) for RBD was estimated according to [8]. Estimates of GCV and PCV were done as per [14] whereas heritability in broad sense for yield and its components were worked out by using formula suggested by [5]. Genetic advance (GA) was calculated by the method suggested by [7]. Path coefficient analysis was done using the method suggested by [4]. Analysis of variance revealed significant differences among the genotypes for all the characters. A wide range of variability was exhibited by most of the traits under study. The results [Table-1] revealed that genotypic coefficient of variation (GCV) and

phenotypic coefficient variation (PCV) were high for number of spikelets per plant (21.89% and 23.47%) followed by number of tillers per hill (13.43% and 16.11%), grain yield q/ha (13.27% and 14.11%) and plot yield (13.26 % and 14.10%) which reflects the least effect of environmental factors on expression of these traits.

Table-1 *Statistical and genetic variability parameters for yield and morphological traits in hybrid rice*.

Characters	Statistical and Genetic Parameters									
	Range	Mean	Heritability %	GCV	PCV	GA	GA as % Mean	SE (m)	CD (0.05)	CV %
Days to Initial Flowering	81 - 105	98	93.3	5.95	5.75	11.21	11.44	0.875	2.509	1.545
Days to 50% Flowering	87 - 112	105	93.4	5.63	5.44	11.33	10.83	0.872	2.502	1.444
Plant Height (cm)	80.20 – 108.33	96.82	69.3	7.60	6.33	10.50	10.85	2.356	6.760	4.216
Panicle Length (cm)	19.07 – 26.00	23.31	75.9	6.86	5.98	2.50	10.73	0.453	1.300	3.367
No of tillers per hill	09 - 16	11	69.5	16.11	13.43	2.64	23.07	0.587	1.685	8.890
No of spikelet per panicle	126 - 265	181	87.0	23.47	21.89	76.09	42.06	8.842	25.365	8.465
Plot Yield (Kg)	6.347 – 11.230	8.877	88.4	14.10	13.26	2.28	25.68	0.246	0.706	4.799
Grain Yield (qtl/ha)	48.10 – 85.10	67.25	88.4	14.11	13.27	17.28	25.70	1.863	5.345	4.798

The same type of finding was reported earlier by [2,13,15] etc. High heritability along with high genetic advance was registered for number of spikelets per plant (87% and 42.06%) followed by grain yield q/ha (88.4% and 25.70%), plot yield(88.4 % and 25.68%) and number of tillers per hill (69.5% and 23.07%) suggesting predominance of additive gene action in expression of these traits. A combination of high value of heritability and genetic advance helps the breeders in arriving at more reliable conclusion in formulating the selection procedure. [Table-2 and 3] show the estimates of genotypic and phenotypic correlation coefficients of all the characters studied. The genotypic correlations in general were higher than the corresponding phenotypic correlations. This is due to the modified effect of environment on character association at the genetic level. Grain yield exhibited significant positive correlations with days to initial flowering, days to 50 flowering, plant height, panicle length and number of spikelets per panicle at both genotypic and phenotypic levels. This indicates the relative utility of all these traits for selection with respect to grain yield. The observed positive correlation of grain yield with various traits was supported by earlier workers *viz.*, [6,10,[9] for number of spikelets per panicle; [12] for panicle length; [1] for plant height; [9] and [10] for days to 50% flowering.

Table-2 *Phenotypic Correlation Coefficients for morphological traits in hybrid rice.*

Characters	Days to Initial Flowering	Days to 50% Flowering	Plant Height (cm)	Panicle Length (cm)	No. of Tillers per Hill	No. of Spikelets per panicle	Plot yield (Kg)	Grain yield (qtl/ha)
Days to Initial Flowering								
Days to 50% Flowering	0.892**							
Plant Height (cm)	0.202^{NS}	0.262*						
Panicle Length (cm)	0.562**	0.333**	0.390**					
No. of Tillers per Hill	0.162^{NS}	0.345**	0.122^{NS}	-0.256*				
No. of Spikelets per panicle	0.443**	0.434**	0.415**	0.349**	-0.077^{NS}			
Plot yield (Kg)	0.729**	0.651**	0.291*	0.596**	0.049^{NS}	0.395**		
Grain yield (qtl/ha)	0.729**	0.650**	0.291*	0.596**	0.049^{NS}	0.396**	1.000**	

Table-3 *Genotypic Correlation Coefficients for morphological traits in hybrid rice.*

Characters	Days to Initial Flowering	Days to 50% Flowering	Plant Height (cm)	Panicle Length (cm)	No of Tillers per Hill	No of Spikelets per panicle	Plot yield (Kg)	Grain yield (qtls/ha)
Days to Initial Flowering								
Days to 50% Flowering	0.918**							
Plant Height (cm)	0.273*	0.350**						
Panicle Length (cm)	0.677**	0.403**	0.314*					
No of Tillers per Hill	0.204^{NS}	0.422**	0.235^{NS}	-0.221^{NS}				
No of Spikelets per panicle	0.497**	0.510**	0.590**	0.487**	-0.087^{NS}			
Plot yield (Kg)	0.840**	0.746**	0.359**	0.700**	0.073^{NS}	0.463**		
Grain yield (qtls/ha)	0.840**	0.746**	0.359**	0.700**	0.072^{NS}	0.465**	1.000**	

Table-4 *Environmental Correlation Coefficients for morphological traits.*

Characters	Days to Initial Flowering	Days to 50% Flowering	Plant Height (cm)	Panicle Length (cm)	No. of Tillers per Hill	No. of Spikelets per panicle	Plot yield (Kg)	Grain yield (qtl/ha)
Days to Initial Flowering								
Days to 50% Flowering	0.530**							
Plant Height (cm)	-0.122^{NS}	-0.137^{NS}						
Panicle Length (cm)	-0.061^{NS}	-0.050^{NS}	0.599**					
No. of Tillers per Hill	-0.018^{NS}	0.038^{NS}	-0.133^{NS}	-0.355**				
No. of Spikelets per panicle	-0.058^{NS}	-0.278*	-0.215^{NS}	-0.264*	-0.050^{NS}			
Plot yield (Kg)	-0.385**	-0.314*	0.051^{NS}	0.133^{NS}	-0.039^{NS}	-0.095^{NS}		
Grain yield (qtl/ha)	-0.384**	-0.315*	0.051^{NS}	0.133^{NS}	-0.042^{NS}	-0.095^{NS}	1.000**	

Table-5 *Genotypic path coefficients showing direct and indirect effects of different characters on grain yield per plant.*

Characters	Days to Initial Flowering	Days to 50% Flowering	Plant Height (cm)	Panicle Length (cm)	No. of Tillers per Hill	No. of Spikelets per panicle	Plot yield (Kg)	Grain yield (qtl/ha)
Days to Initial Flowering	**0.00008**	-0.00252	-0.00039	-0.00038	0.00027	0.00158	0.84112	0.840**
Days to 50% Flowering	0.00007	**-0.00275**	-0.00050	-0.00022	0.00055	0.00162	0.74714	0.746**
Plant Height (cm)	0.00002	-0.00096	**-0.00143**	-0.00017	0.00031	0.00188	0.35972	0.359**
Panicle Length (cm)	0.00005	-0.00111	-0.00045	**-0.00056**	-0.00029	0.00155	0.70124	0.700**
No. of Tillers per Hill	0.00002	-0.00116	-0.00034	0.00012	**0.00131**	-0.00028	0.07262	0.072^{NS}
No. of Spikelets per panicle	0.00004	-0.00140	-0.00085	-0.00027	-0.00011	**0.00319**	0.46403	0.465**
Plot yield (Kg)	0.00007	-0.00205	-0.00051	-0.00039	0.00009	0.00148	**1.00132**	1.000**

In the present study path coefficient analysis has been conducted taking grain yield as dependent variables. Path coefficient analysis revealed that number of spikelets per panicle had highest positive direct effect on grain yield, followed by no of tillers per hill and days to initial flowering [Table-5]. The correlation analysis revealed positive association of grain yield with number of spikelets per panicle and days to initial flowering. This may indicate that the direct selection for number of spikelets per panicle and days to initial flowering would likely be effective in increasing grain yield.

Conclusions

Results of the present investigation on correlation and path analysis indicated a scope for improvement of grain yield through selection. The importance of number of spikelets per panicle and days to initial flowering as selection criteria for effective yield improvement. The study also indicated the need for balanced selection in light of negative association of number of tillers per hill with number of spikelet per panicle and panicle length in crop yield improvement programmes.

Application of research: This research will be helpful for improvement of hybrid rice in Odisha.

Research Category: Genetic variability

Abbreviations:
GCV: Genotypic coefficient of variation
PCV: Phenotypic coefficient variation

Acknowledgement / Funding: Author thankful to Orissa University of Agriculture and Technology, Bhubaneswar, 751003, Odisha. We are thankful to the district administration of Koraput for this support. Author thankful to Agricultural Technology Management Agency, Koraput for financial support.

***Research Guide or Chairperson of research: Dr Parshuram Sial**
University: Orissa University of Agriculture and Technology, Bhubaneswar, 751003, Odisha
Research project name or number: All India Coordinated Rice Improvement Project, Jeypore, Koraput, Odisha

Author Contributions: All author equally contributed

Author statement: All authors read, reviewed, agree and approved the final manuscript

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

References

[1] Basavaraja P., Rudraradhya M. and Kulkarni R. S. (1997) *Mysore J. Agric. Sci.,* 31, 1-6.
[2] Chaubey P.K. and Singh R. (1994) *Madras Agric. J.,* 81(9), 468-470
[3] Comstock R.E. and Rabinson H.F. (1952) Genetic parameters, their estimation and significance. In: proceed. On 6th International Grassland Congress. pp. 284 -291.
[4] Dewey J.R and Lu K.H. (1959) *Agronomy Journal*, 51, 515-518.
[5] Hanson C.H., Robinson H.F. and Comstock R.E. (1956) *Agron. J.,* 48, 268-272.
[6] Ismail C. and Alvarez M. (1986) *Cultiva.s Tropicl.,*8, 3-11.
[7] Johnson H.W., Robinson H.F. and Comstock R.E. (1955) *Agron J.,* 47(7), 314 -318.
[8] Panse V.G. and Sukhatme P.V. (1989) Statistical Methods for Agricultural Workers. Indian Council of Agricultural Research, New Delhi, India.
[9] Rajeshwari S. and Nadarajan N. (2004) *Agric. Sci. Dig*., 24,280-282.
[10] Rao S.S. and Shrivastava M.N. (1999) *Oryza,* 36, 13 - 15.
[11] Ruth Elizabeth Ekka, Sarawgi A.K. and Raja R. Kanwar (2011) *Journal of Rice Research,* 4 (1 & 2).
[12] Sharma R.K. and Dubey S. D. (1997) *Oryza,* 34, 8-12.
[13] Shobha Rani N., Rama Prasad A.S., Prasad G.S.V., Bhaskar Reddy P. and Krishnaveni B. (2001) *Indian J. Pt. Genetic Resources*, 14, 206- 209
[14] Singh R.K. and Chaudhary B.D. (1995) Biometrical methods in quantitative genetic analysis. Kalyani Publishers New Delhi 1995, pp. 215-218.
[15] Sweta R.N. and Singh S.K. (2010) *World Journal of Agricultural Sciences,* 6 (2), 201-206.
[16] Ravindra Babu V., Shreya K., Kuldeep Singh Dangi, Usharani G. and Siva Shankar A. (2012) *International Journal of Scientific and Research Publications*, 2, 3.