



Variability, Character Association and Path coefficient Analysis for Physiological traits in Rice (*Oryza Sativa* L.)

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ABSTRACT

Rice is an extensively consumed cereal crop, which serves as a major source of carbohydrate in human diet. The knowledge on the variability, character association and path analysis of physiological traits is of great importance in formulating efficient selection criteria for improvement of yield. Seven rice varieties viz, Samba mahsuri, Polasa prabha, Jagtial samba, Nellore mahsuri, Indra, Vijetha and Prabhat were crossed in diallel mating design (without reciprocals). Five physiological characters viz., chlorophyll content, specific leaf weight, harvest index, biological yield and flag leaf nitrogen content along with yield was assessed in 21F. Analysis of variance revealed significant differences among the genotypes for all the traits. Heritability in broad sense was found high for all the characters except chlorophyll content and harvest index. High genetic advance along with high heritability were found for biological yield and Grain yield /plant indicating presence of additive gene action for controlling these traits and selection for the improvement of these characters might be rewarding. Correlation studies indicated that the biological yield and flag leaf Nitrogen content upon which emphasis may given during selection. biological yield and flag leaf nitrogen content showed positive correlation with grain yield along with positive direct effects might be considered in developing breeding strategy for yield improvement.

Key words :Character association, Grain yield, Path coefficient analysis.

Rice is the staple food for half of the world's population and occupies almost one-fifth of the total land area covered under cereals. Plants are thought have evolved numerous strategies for coping with limited water available ility including changes in phenological, developmental and physiological traits (Araus *et al.* 2002) The scope of crop improvement depends on the conserved use of genetic variability, heritability, genetic advance and relationship between yield and its contributing characters in a given crop species is of paramount importance for the success of any plan breeding programme. Character association derived by correlation coefficient, forms the basis for electing the desirable plant, aiding in evaluation of relative influence of various components characters on yield. Path coefficient analysis discerns correlation into direct and indirect effects. The present investigation was undertaken to establish the relationship between component characters to grain yield.

MATERIAL AND METHODS

Seven rice varieties viz, Samba mahsuri, Polasa prabha, Jagtial samba, Nellore mahsuri,

Indra, Vijetha and Prabhat were crossed in diallel mating design (without reciprocals) during *rabi* 2006 and *kharif* 2007 seasons. These parents were selected based on their attributes for grain quality, cooking quality, reaction to pests and diseases and high yield. The parental line Samba mahsuri possessed excellent cooking quality. Polasa Prabha, Jagtial samba and Nellore mahsuri have got good grain quality. Indra is having biotic and abiotic stress tolerance like Brown Plant Hopper (BPH) and salinity. Vijetha and Prabhat are high yielding varieties. These varieties showed great diversity for morphological and physiological traits. The twenty one F_1 s and seven parents were grown at the experimental farm of Andhra Pradesh Rice Research Institute and Regional Agricultural Research station, Maruteru in a randomized block design (RBD) with three replications having 3m row length and 20 x 15 cm spacing. Each replication comprised of one row of parent and three rows of F_1 s. Recommended agronomic practices were followed. Mean values on physiological traits viz., chlorophyll content (mg/g), specific leaf weight (g/m^2), harvest index (%), biological yield (%), flag leaf nitrogen content (%) and grain yield per plant (g) was analyzed.

Correlation coefficients were computed (Weber and Moorty, 1952). Path coefficient analysis involving the direct and indirect effects of different components traits on yield were estimated (Wright, 1921). Using SPRI (Doshi, 1991).

RESULTS AND DISCUSSION

All the physiological characters showed highly significant variation among the genotypes (Table 1). The phenotypic variation was higher than the correlation genotypic variance for all the characters and showed moderate to low phenotypic and genotypic coefficient of the relatively low environmental variance due to low difference between phenotypic variance and genotypic variance were observed for all the characters under study which indicated the expression of the genes controlling these characters are not markedly influenced by the environmental conditions.

The differences between phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) of these traits are also very low. Specific leaf weight, harvest index, Biological yield, Flag leaf N content and grain yield per plant showed difference between phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) of 0.07, 1.77, 1.37, 0.2 and 0.68 respectively, which also reveals that the influence of the environment on the expression of these traits is very little. So, the expression of these traits are mainly due to the genetic constituents of the populations and the effect of environment is not so effective in case of expression

of these traits. Relatively high environmental variance and high difference between PCV and GCV for the traits of chlorophyll content (3.67) which indicate that the character is largely influenced by the environmental conditions rather than the genetic constituents of the population.

Heritability in broad sense (Table 2) was found high for all the characters except chlorophyll content (64.70) and harvest index (60.90). High genetic advance along with high heritability were found for biological yield (22.13 and 80.50 respectively) and Grain yield /plant (24.47 and 90.00 respectively) indicating presence of additive gene action for controlling these traits and selection for the improvement of these characters might be rewarding (Rahman *et al.*, 2012). The remaining characters *viz.* chlorophyll content, harvest index and flag leaf Nitrogen content showed that they are controlled by non additive gene action and in this case heterosis breeding might be used rather than selection for the improvement of these traits.

Correlation and Path Analysis:

Yield is a complex product being influenced by several inter dependable quantitative characters. Thus developing a breeding protocol for yield improvement may not be effective unless the other yield components influencing it directly or indirectly are taken into consideration. When selection pressure is exercised for improvement of any character highly associated with yield, it simultaneously affects a number of other correlated characters. Hence knowledge regarding

Table 1. Analysis of variance for physiological traits.

Source	df	Chlorophyll Content (mg/g)	Specific leaf weight (g/m ²)	Harvest Index (%)	Biological Yield (g)	Flag leaf N content(%)	Grain yield per plant (g)
1	2	3	4	5	6	7	8
Replications	2	1.21	0.003	0.85	6.77	0.01*	0.99
Genotypes	27	41.12**	0.55**	31.36**	164.53**	0.13**	37.38**
Parents	6	61.25**	0.66**	12.25	14.16*	0.02**	10.61**
Hybrids	20	32.25**	0.55**	38.10-**	144.33**	0.15**	28.89**
Parents vs hybrids	1	97.96**	0.04**	11.07	1470.64**	0.42**	367.69**
Error	54	6.34	0.003	5.54	12.304	0.001	1.34**
CV %		12.9072	1.0842	5.0408	5.8976	2.3276	4.1794

Table 2. Mean, Coefficient of variation, Heritability and Genetic Advance for physiological traits.

S.No	Character	Mean	Coefficient of variation (%)		Heritability (Broad Sense) %	Genetic Value (k=206)	Genetic Advance as % of mean
1	2	3	Genotypic 4	Phenotypic 5	6	7	8
1	Chlorophyll Content (mg/g)	19.48	17.49	21.07	64.70	5.65	28.99
2	Specific Leaf Weight (g/m ²)	5.15	8.30	8.37	98.30	0.87	16.96
3	Harvest Index (%)	46.68	6.29	8.06	60.90	4.71	10.10
4	Biological yield (g)	59.48	11.98	13.35	80.50	13.16	22.13
5	Flag leaf N content (%)	1.61	12.84	13.04	96.80	0.42	26.02
6	Grain yield/plant (g)	27.68	12.52	13.20	90.00	6.77	24.47

Table 3. Estimates of Simple correlation coefficients of physiological characters and yield for F₁ crosses.

Character	Chlorophyll Content (mg/g)	Specific leaf weight (g/m ²)	Harvest Index (%)	Biological Yield (g)	Flag leaf N content (%)	Grain Yield/Plant (g)
1	2	3	4	5	6	7
Chlorophyll Content (mg/g)	1.0000	0.1526 (0.2160)	0.2062 (0.3640)	0.1807 (0.2217)	0.0510 (0.0629)	0.2937 (0.3791)
Specific Leaf Weight		1.0000	0.0936 (0.1081)	-0.0684 (-0.0694)	-0.1380 (-0.1430)	-0.1380 (-0.0197)
harvest Index			1.0000	0.2853** (-0.1270)	0.2516* (0.3272)	0.3327* (0.3748)
Biological Yield				1.0000	0.5813** (0.6671)	0.8054* (0.8710)
Flag Leaf Nitrogen Content					1.0000	0.7387* (0.7998)
Grain Yield/ Plant						1.0000

* significant at 5 % level ** significant at 1% level
(fig in parenthesis are genotypic correlation coefficients)

association of character with yield and among themselves provides guideline to the plant breeder for making improvement through selection and provides a clear understanding about the contribution in respect of establishing the association by genetic and non genetic factors.

Correlation analysis among yield and its contributing characters (Table 3) revealed that the genotypic correlation coefficients in most cases were higher than their phenotypic correlation coefficients indicating the association is largely due

to genetic reason. Significant positive genotypic and phenotypic correlation was found between biological yield and harvest index, flag leaf N content and harvest indeed, and biological yield and flag leaf N content. Grain yield showed significant correlation with harvest index Shashidhar *et al* 2005, Biological yield and flag leaf Nitrogen content upon which emphasis may given during selection.

Path coefficient analysis (Table 4) showed that biological yield had the maximum direct effect (0.9015), on grain yield followed by harvest index

Table 4. Path coefficient analysis showing direct and indirect effects for physiological traits.

Character	Chlorophyll Content (mg/g)	Specific leaf weight (g/m ²)	Harvest Index (%)	Biological Yield (g)	Flag leaf N content(%)	Grain Yield/Plant
1	2	3	4	5	6	7
Chlorophyll Content (mg/g)	0.0048	0.0010	0.0017	0.0011	0.0003	0.2937
Specific Leaf Weight (g/m ²)	-0.0007	-0.0033	-0.0004	0.0002	0.0005	0.1380
harvest Index (%)	0.1725	0.0512	0.4740	-0.0602	0.1551	0.3327*
Biological Yield (g)	0.1999	-0.0626	0.1145	0.9015	0.6014	0.8054*
Flag Leaf Nitrogen Content (%)	0.0027	-0.0061	0.0139	0.0284	0.0426	0.7387*

RESIDUAL EFFECT = 0.0352

(0.4740), flag leaf Nitrogen content (0.0426) and chlorophyll content (0.0048). Specific leaf weight shoed direct negative effect (-0.0033) on yield. Though specific leaf weight shoed negative direct effect on yield its correlation with grain yield was positive. Harvest index (Rahman *et al.*, 2012 and Surek and Beser 2003) , biological yield and flag leaf nitrogen content showed positive correlation with grain yield along with positive direct effects might be considered in developing breeding strategy for yield improvement.

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(Received on 27.12.2012 and revised on 10.07.2013)