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Assessment of Character Contribution to the Divergence for Some Rice Varieties

M.R. Zaman, D.N.R. Paul, M.S. Kabir, M.A.A. Mahbub and [1]M.A.A. Bhuiya
Bangladesh Rice Research Institute, Gazipur, Bangladesh
[1]Patuakhali Science and Technology University, Patuakhali, Bangladesh

Abstract: Fifteen modern rice varieties were grown in Aman seasons of 2002 and 2003. On the basis of data on days to 50% flowering, 1000-grain weight, plant height, flag leaf area, yield, field grain per panicle, tiller number per hill and flag leaf angle in the lower portion, characters like days to 50% flowering and 1000-grain weight made the largest contribution to the total divergence. After excluding less contributory characters to the total divergence and Mahalanabis D^2 values were calculated, then identified the most three distant and closest pairs. From the distance matrix tables of Mahalanabis D^2 analysis, (BR10, BRRI dhan30) was found as the closest pair and (BR5, BRRI dhan33) was found most distant pair. It was estimated that among the Aman varieties, yield, tiller number per hill, filled grains per panicle were the less contributing characters towards the total divergence. Breeding for the improvement of those characters, therefore, have the little possibility. However, there is a scope to improve days to flowering using those varieties.

Key words: Divergence, character contribution, days to 50% flowering, 1000-grain weight, Aman rice varieties

INTRODUCTION

Rice is the staple food for the people of Bangladesh. In the country, about 43% Aman rice area is covered by the modern varieties[1]. Bangladesh Rice Research Institute has developed 18 Aman modern varieties[2] but few have been popular among the farmers. To get the adequate production from the favorable environment, it is important to know the variability among the varieties, characters contribution towards the variability and scope of improvement of different characters.

Genetic diversity is one of the important tools to quantify genetic variability in both cross and self-pollinated crops[3,4]. Precise information on the nature and degree of genetic divergence of the parents is the prerequisite of variety development program. The quantification of genetic diversity through biometrical procedures has made it possible to choose genetically diverge parents for successfully hybridization programme[5,6]. Moreover, evaluation of genetic diversity is important to know the source of genes for a particular trait with in the available germplasm[7]. It is the common view of the researchers that the more diversity of parents, the greater chances of obtaining high heterotic F_1s and broad spectrum of variability in segregating generations. But if we go for particular character improvement, it is important to know the contribution of that character to the total divergence and or diversity between the involving in hybridization. The results of diversity analysis often influenced by the number of characters and the nature of characters considered for analysis. Further Multivariate analysis is an important tool for assessing the degree of divergence and relative contribution of different characters to total divergence[8-11]. Miah *et al.* [12]also suggested that the multivariate analysis is an important tool to identify genetically diverse parents. Studies on character contribution to the total divergence in rice are scarce in Bangladesh. Therefore, present study was undertaken to estimate the contribution of different characters to the total divergence and estimated the pair wise distance for each case to identify the right pair for using in hybridization program.

MATERIALS AND METHODS

The experiment was conducted in the Aman seasons of 2002 and 2003 with 15 Modern Rice Varieties (MVs) following RCB design with three replications. All of these varieties were developed by the Bangladesh Rice Research Institute. The plot size was 18 m^2 with planting spacing of 20x20 cm. Standard crop management practices were followed to raise a good crop. From each plot 6 m^2 was identified during maximum tillering stage for grain yield and remaining 12 m^2 area were used for taking other necessary data including destructive samples. Observation were recorded from 10 randomly selected plants of each plot on plant height (cm), number of panicles per hill, filled grains per panicle and 1000-grain

Corresponding Author: Md. Rokonuzzaman, Scientific Officer, Bangladesh Rice Research Institute, Gazipur 1701, Bangladesh

weight (g), flag leaf angle (°) and flag leaf area (cm). Flag leaf area (cm) were calculated from middle most and longest tiller, at the time of flowering just after the complete emergence of the panicle satured crop was harvested and grain yield (t/ha) was calculated at 14% moisture content.

Mahalanabis D^2 determines the distance between any two varieties based on common characters measured on each variety. Contribution of each character towards divergence was calculated taking under consideration of all combinations. Each character was ranked on the basis of the different value for each combination and thus rank-1 was given for the highest value for each combination. Contribution of a character towards divergence was calculated in percentage with how many times that particular character ranked as 1 out of total number of combinations[13].

To classify the BRRI developed Aman varieties, at first eight characters were considered and their contributions towards divergence were assessed. The characters showing the null or almost null contribution were excluded one by one and reassessed the contribution. In such way character contribution assessment were done with 8, 7 and 6 characters separately. For all the cases Mahalanabis D^2 values were calculated and identified distant and closer pairs.

RESULTS AND DISCUSSION

Growth duration of a variety is important character, which is determined by days to 50% flowering or heading time. Table 1 and 2 indicated that among the tested varieties, BR5, BR22 and BR23 required more time to reach in heading state because of days lengthy and lowest observation for days to 50% flowering was found in BRRI dhan33, followed by BRRI dhan39 for both year.

Plant height is also another important growth character. Table 1 and 2 showed that the highest plant height was observed for BR25 and the lowest plant height was observed for BR3. Flag leaf area with its angle is the most important growth character in which maximum photosynthesis is occurred. Results showed that, BR25 had bigger flag leaf area although its angle was higher. It was observed that BR10, BR22 and BRRI dhan32 performed the better yield with good combination of flag leaf area and angle, i.e., with large leaf area with low leaf angle. It might be due to the higher light penetration was occurred in erect leaf. The poorest combination of flag leaf area and angle i.e. small leaf area with high leaf angle was observed in BRRI dhan38, followed by BRRI dhan34 and BR5. These varieties are aromatic rice varieties. Among the varieties, BRRI dhan32 produced the highest grain yield, which followed by BRRI dhan31 and BRRI dhan39 produced the lowest grain yield followed by BRRI dhan33 and BRRI dhan37. It might be due to the higher % filled grain, tiller number and flag leaf area with lower angle were produced by BRRI dhan32 and BRRI dhan31. 1000-grain weight was higher in BR23 and lower in BRRI dhan34.

Table 3 showed the lowest and the highest D^2 values for pairs of varieties for different number of character combinations. Based on D^2 values, (BR10, BRRI dhan30) was found as the closest pair where D^2 values were 27.3 and 15.6 for 2002 and 2003, respectively and it was followed by (BRRI dhan33, BRRI dhan39) pair. It might be due to have more or less similar characters like days to 50% flowering, 1000-grain weight and plant height. Accordingly, based on the D^2 values, (BR5, BRRI dhan33) was the most distant pair for both of the years. It was observed that BR5 needed more heading time, plant height is higher but 1000-grain weight is low. On the other hand BRRI dhan33 needed less heading time and had less plant height but 1000-grain weight is larger.

Firstly percent contribution was assessed with all 8 characters and we found that the percent filled grain per panicle and flag leaf angle were showed null contribution towards the divergence for both years then flag leaf angle was excluded and assessed with of characters 7 characters percent filled grain per panicle also showed null contribution (Table 4). Finally assessed with 6 characters and found that in all the cases days to 50% flowering exhibited major contributions towards the divergence and followed by 1000-grain weight and plant height. For the year 2002 days to 50% flowering contributed 62.9-67.6% and 1000-grain weight contributed 26.7-31.4% of the total divergence and for the year 2003 it becomes 60.0-68.7% and 18.1-22.8%, respectively (Table 4). Among the tested varieties, it was also observed that, grain yield, tiller number per hill and filled grain gram per panicle were the less contributions characters to the total divergence. So, breeding for the improvement of those characters there fore, have the tiller possibility those tested varieties. So Breeding for the improvement of those characters, therefore, have the little possibility with these aman varieties.

Many authors found the similar results. Maurya and Singh[14] found that maturity time and plant height contributed most to the divergence in rice. Kotaiah *et al.*[15] also found that days to 50% heading and 100-grain weight were the main contributors to the total divergence in long duration rice genotypes. Again Reddey *et al.*[16] found that the genotypes were distributed differentiated mainly by days to 50%

Table 1: Mean performances of 15 Aman rice varieties for eight different characters during 2002

Varieties	Days to 50% flowering	1000-grain weight (g)	Plant height (cm)	Filled grains/ panicle (%)	Tiller No. per hill	Flag leaf angle (°)	Flag leaf area (cm^2)	Grain yield (t/ha)
BR3	115.33	27.03	93.80	65.80	7.37	15.58	31.90	4.12
BR5	120.33	11.46	131.75	51.58	9.33	21.38	33.60	3.95
BR10	119.67	21.85	115.74	77.29	7.17	11.63	47.67	3.97
BR11	116.00	21.52	110.42	51.31	9.00	16.00	42.02	3.54
BR22	120.33	19.77	137.58	68.92	9.10	13.33	40.69	3.92
BR23	120.00	25.26	131.21	61.13	6.17	13.50	48.21	4.42
BR25	108.00	20.22	153.77	71.48	6.67	19.75	50.15	4.41
BRRI dhan30	119.33	20.97	116.07	75.37	8.37	13.73	36.94	4.12
BRRI dhan31	112.00	24.55	119.20	58.15	6.87	16.83	47.21	4.97
BRRI dhan32	104.00	21.16	129.58	72.22	9.17	10.88	46.00	5.48
BRRI dhan33	94.33	23.68	103.49	66.10	5.17	8.42	37.73	2.49
BRRI dhan34	108.00	10.21	138.93	47.41	9.60	20.10	31.75	3.13
BRRI dhan37	112.00	15.34	135.28	62.29	9.30	26.08	34.21	2.92
BRRI dhan38	111.33	18.12	128.28	59.03	11.07	22.90	26.26	3.34
BRRI dhan39	98.33	23.29	104.36	74.77	7.03	12.67	38.60	2.17
SE (±)	0.21	0.70	2.04	3.17	0.57	1.71	1.42	0.17
LSD (5%)	0.60	1.03	5.90	9.19	1.65	4.95	4.11	0.49

Table 2: Mean performances of 15 Aman rice varieties for eight different characters during 2003

Varieties	Days to 50% flowering	1000-grain weight (g)	Plant height (cm)	Filled grains/ panicle (%)	Tiller No. per hill	Flag leaf angle (°)	Flag leaf area (cm^2)	Grain yield (t/ha)
BR3	111.67	25.61	101.56	68.12	6.88	14.96	30.62	4.53
BR5	120.67	11.67	131.71	70.50	7.79	20.52	32.25	4.35
BR10	121.00	22.03	110.12	71.58	6.79	11.16	45.77	4.37
BR11	117.33	21.37	107.95	72.83	5.63	15.36	40.34	3.89
BR22	120.00	20.01	121.48	75.80	7.67	12.80	39.06	4.31
BR23	120.33	25.46	122.77	70.74	6.67	12.96	46.28	4.33
BR25	105.67	17.80	149.85	73.41	6.88	18.96	48.14	4.32
BRRI dhan30	119.33	21.20	109.90	75.85	5.67	13.18	35.46	4.04
BRRI dhan31	110.33	24.51	110.89	69.86	6.92	16.16	45.32	4.87
BRRI dhan32	102.33	21.03	119.51	77.03	7.63	10.44	44.16	5.37
BRRI dhan33	96.33	22.95	92.60	70.36	5.04	8.08	36.22	2.74
BRRI dhan34	105.67	10.01	126.08	66.79	6.29	19.30	30.48	3.44
BRRI dhan37	111.33	15.37	126.58	69.65	5.08	25.04	32.84	3.21
BRRI dhan38	112.33	18.54	117.22	70.18	8.94	21.98	25.21	3.67
BRRI dhan39	99.33	23.22	95.66	69.94	7.58	12.16	37.06	2.39
SE (±)	0.60	0.12	1.63	2.18	0.90	1.64	1.36	0.79
LSD (5%)	1.75	0.34	4.72	6.32	2.60	4.75	3.95	1.54

Table 3: Estimated closest and distant pairs on the basis of Mahalanabis D^2 value for six characters combinations

Years	Closest pair	D^2 value	Distant pair	D^2 value
2002	BR10 and BRRI dhan30	27.3	BR5 and BRRI dhan33	6923
	BRRI dhan33 and BRRI dhan39	50.2	BR22 and BRRI dhan33	5998
	BR22 and BRRI dhan30	74.6	BR3 and BRRI dhan34	5041
2003	BR10 and BRRI dhan30	15.6	BR5 and BRRI dhan33	7965
	BRRI dhan33 and BRRI dhan39	22.0	BR3 and BRRI dhan34	7331
	BR22 and BRRI dhan30	47.5	BRRI dhan31 and BRRI dhan34	6601

Table 4: Estimated contribution (%) of different characters to divergence in BRRI released Aman rice varieties

Years	No. of characters	Days to 50% flowering	1000-grain weight (g)	Plant height (cm)	Grain yield (t/ha)	Flag leaf area (cm^2)	Tiller per hill	Filled grain/ panicle (%)	Flag leaf angle (°)
2002	8	67.6	25.8	3.8	0.9	0.9	0.9	0.0	0.0
	7	62.9	29.5	2.9	2.6	0.9	0.9	0.0	-
	6	66.7	26.7	4.7	0.9	0.9	0.0	-	-
2003	8	67.6	18.1	2.8	2.8	1.9	6.7	0.0	0.0
	7	60.0	22.8	5.7	2.9	1.9	6.7	0.0	-
	6	68.7	22.8	2.9	3.8	0.9	0.9	-	-

flowering. On the other hand Kumari and Rangsamy[17] found grain yield and plant height the major contributors to the divergence for some early rice genotypes. Further Morais *et al.*[18] found that variation in plant height; days to flowering and grain weight explain the majority of genetic divergence in irrigated rice. De *et al.*[19] also found that 100-grain weight and grain/panicle making the greater contributions to D^2 values. Pendey *et al.*[20] found that the character contributing most to total divergence were days to 50% flowering, plant height, primary branches per

panicle and 100-seed weight (27.9, 24.7, 16.4 and 10.4, respectively). These results agree with the findings of this experiment.

It may be concluded that the character days to 50% flowering exhibited the largest contribution to total divergence followed by 1000-grain weight and plant height in BRRI developed aman varieties. Thus, there have a great scope to improve days to 50% flowering, 1000-grain weight and plant height using those varieties.

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