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Selection of Parents Through Genetic Divergence in Rice (*Oryza sativa* L.)

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ABSTRACT

Forty eight diverse genotypes of rice were evaluated for the selection of parents using Mahalanobis' D^2 statistic for the improvement of yield and quality. The genotypes were grouped into fifteen clusters. The maximum inter-cluster distance (1855.88) was recorded between Cluster XIV and XV and minimum inter-cluster distance (47.74) was recorded between Cluster III and V. The genetic diversity was not related to geographic diversity. The characters *viz.,* plant height, panicle length, days to 50 per cent flowering, 1000-grain weight were mainly responsible for genetic divergence. Based on divergence studies, the genotypes Velluthachera and Heera in addition to popular and locally adopted varieties could be considered for getting the transgressive segregants for high yield and quality.

Key words : Genetic Divergence, Rice, Quality, Yield.

The more diverse the parents, the greater are the chances of obtaining higher amount of heterotic expression in F_1's and broad spectrum of variability in segregating generations. Bhatt (1970), demonstrated the usefulness of D^2 statistic for choosing parents of diverse origin. Therefore, an attempt has been made to ascertain the nature and magnitude of genetic diversity to identify suitable donors having wide genetic divergence to develop suitable varieties for yield and quality in rice.

MATERIAL AND METHODS

A field experiment was conducted at S.V. Agricultural College, wetland farm, Tirupati during the *Kharif,* 2006-07 to estimate genetic diversity among forty eight rice genotypes using a randomized block design with three replications. Thirty days old seedling were transplanted at the rate of one seedling per hill with an inter and intra - row spacing of 20 x 15 cm. Recommended package of practices were followed to raise the crop. Observations were recorded on 14 quantitative and qualitative characters viz., days to 50% flowering, days to maturity, number of effective tillers per plant, plant height, panicle length, number of grains per panicle, 1000-grain weight, harvest index, kernel length, kernel breadth, kernel length breadth ratio^{-1}, kernel length after cooking, kernel elongation ratio and grain yield per plant. The data were subjected to analysis of variance and then Mahalanobis' D^2 (1936) statistic to measure genetic divergence. The grouping of genotypes into various clusters was done by Tocher's method (Rao, 1952).

RESULTS AND DISCUSSION

The analysis of variance showed significant differences between genotypes for each character studied. Based on relative magnitude and D^2 estimates, forty eight genotypes were grouped into fifteen clusters (Table 1) which indicated the presence of large amount of diversity in the population. The maximum number of genotypes were included in cluster I (25 genotypes) followed by cluster II (8 genotypes) and cluster VI (3 genotypes), where as cluster III to V and from VII to XV contained single genotype each. The clustering pattern of genotypes revealed that the clustering did not follow any particular patterning with respect to the origin. Similar pattern was also observed by Vanaja *et al.* (2003) and Sarawgi and Rita Bisne (2007) in rice. Hence, the present study also revealed that geographical diversity is not necessarily related to genetic diversity. This may be attributed to genetic drift and selection in different environments which might cause greater genetic diversity than geographical distance, as suggested by Murty and Arunachalam (1966).

The intra - and inter - cluster divergence among the material studied was of varying magnitude (Table 2). The maximum inter - cluster distance was observed between cluster XIV and XV (1855.88), followed by cluster XI and XV (1308.99), whereas minimum inter - cluster D^2 value (47.74) has been found between cluster III and V, suggesting close relationship between these clusters. A wide range of variation was also observed in cluster means for all the characters studied (Table 3). Cluster V

Table 1. Cluster composition of 48 rice genotypes of rice

Cluster	No. of Genotypes	Name of the Genotypes
I	25	MTU 7029, MTU 2067, MTU 2077, MTU 1031, ADT 43, JGL 384, Pooja, MTU 1071, MTU 1081, RGL 2537, BPT 4358, IET 8585, Lunisree, MTU 1064, MTU 4870, MTU 1032, Triguna, NLR 145, PR-103, MTU 5249, MTU 1061, BPT 2270, MTU 1001, MTU 1010 and TKM 6
II	8	Sasyasree, MTU 9993, Salivahana, MSS, TN 1, MTU 1006, Lalanakanda and Vasundhara
III	1	PR-106
IV	1	BPT 5204
V	1	JGL 1798
VI	3	N 22, Plutikambani and Mahsuri
VII	1	Dular
VIII	1	BPT 1235
IX	1	ARC 6650
X	1	Bhadraj
XI	1	Suduhonerawala
XII	1	IR-64
XIII	1	CRMR-1523
XIV	1	Velluthachera
XV	1	Heera

recorded minimum values for kernel length and 1000-grain weight, Cluster XII recorded maximum values for kernel L/B ratio and kernel length after cooking. Highest mean grain yield per plant was recorded by Cluster X. Plant height (33.51%) contributed maximum to the diversity followed by panicle length (19.33%), days to 50% flowering (16.13%) and 1000-grain weight (11.17%) (Table 4). To realize much variability and high heterotic effect, Parents should be selected from two clusters having wider inter cluster distance. Mishra *et al.* (2003) and Chaturvedi and Maurya (2005). Hence, in the present investigation, the genotypes Velluthachera and Heera, which are having maximum genetic divergence with desired mean values for important yield and quality traits could be utilized to exploit in the breeding programme for improvement of yield and quality. However, crossing of these genotypes with diverse local and popular cultivars may also give potential transegregants with high yield and better quality.

Table 3. Cluster means for fourteen characters in rice

Cluster No.	Days to 50% flowering	Days to maturity	Number of effective tillers per plant	Plant height (cm)	Panicle length (cm)	Number of grains per panicle	Harvest index (%)	Kernel length (mm)	Kernel breadth B (mm)	Kernel L L/B	Kernel length after cooking	Kernel elongation ratio	1000-grain weight	Grain yield per plant (g)
I	106.76	133.25	8.10	106.53	23.03	179.51	49.14	5.85	2.19	2.72	8.45	1.45	20.60	20.10
II	85.54	112.50	7.61	109.89	24.87	146.29	50.21	6.23	2.27	2.80	8.75	1.41	20.53	15.62
III	94.67	132.00	6.60	104.53	19.55	128.00	36.05	7.12	2.05	3.48	9.20	1.29	14.95	17.34
IV	118.33	146.67	9.67	94.07	19.12	161.00	58.11	6.18	1.82	3.43	8.50	1.37	14.80	21.50
V	97.00	131.33	7.67	102.03	19.79	138.27	36.42	5.23	1.89	2.77	8.10	1.55	14.34	15.67
VI	85.22	116.67	8.42	124.60	18.70	128.44	40.16	5.47	2.24	2.47	8.44	1.54	18.37	15.19
VII	97.67	126.67	8.27	120.73	22.87	162.67	54.79	6.24	2.37	2.63	8.93	1.43	29.12	25.85
VIII	97.00	125.67	6.70	87.47	18.38	90.40	46.44	7.22	2.22	3.25	9.27	1.28	25.75	16.83
IX	118.00	144.33	5.57	96.60	17.88	199.77	36.66	5.98	2.46	2.45	7.57	1.26	16.25	17.00
X	92.67	116.67	9.07	147.80	24.43	242.13	55.36	5.71	2.61	2.19	8.33	1.46	25.75	26.49
XI	94.00	116.00	7.27	152.73	30.42	138.73	45.54	5.85	2.55	2.30	8.57	1.46	26.82	18.48
XII	121.00	147.00	6.03	93.87	24.87	113.37	44.24	7.93	2.11	3.78	9.60	1.21	22.31	15.95
XIII	113.67	143.33	7.53	152.40	22.25	208.33	44.59	5.92	2.85	2.08	8.77	1.48	21.72	19.18
XIV	108.00	138.33	7.47	170.93	29.31	138.20	53.72	6.72	2.59	2.60	8.73	1.30	22.69	21.55
XV	51.00	84.67	8.60	81.20	17.27	86.93	45.23	6.15	2.54	2.42	9.07	1.47	17.73	12.02

Table 2. Inter- and intra-cluster (diagonal) average of D^2 values of the clusters in rice.

Cluster Number	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV
I	85.37 (9.24)	153.76 (12.40)	146.41 (12.10)	147.41 (12.14)	138.29 (11.76)	194.60 (13.95)	129.50 (11.38)	196.84 (14.03)	192.93 (13.89)	259.53 (16.11)	450.28 (21.22)	154.75 (12.44)	284.25 (16.86)	623.00 (24.96)	631.51 (25.13)
II		84.27 (9.18)	171.61 (13.10)	313.64 (17.11)	194.60 (13.95)	167.70 (12.95)	158.25 (12.58)	224.10 (14.97)	364.04 (19.08)	230.43 (15.18)	359.10 (18.95)	251.85 (15.87)	381.42 (19.53)	639.07 (25.28)	424.77 (20.61)
III			0.00 (0.00)	97.81 (9.89)	47.74 (6.91)	124.99 (11.18)	266.66 (16.33)	100.20 (10.01)	129.73 (11.39)	420.25 (20.50)	698.54 (26.43)	170.56 (13.06)	430.14 (20.74)	898.80 (29.98)	367.48 (19.17)
IV				0.00 (0.00)	77.61 (8.81)	257.92 (16.06)	327.97 (18.11)	173.44 (13.17)	69.55 (8.34)	541.95 (23.28)	879.12 (29.65)	178.48 (13.36)	479.17 (21.89)	1013.14 (31.83)	624.50 (24.99)
V					0.00 (0.00)	122.10 (11.05)	313.99 (17.72)	155.25 (12.46)	88.73 (9.42)	453.69 (21.30)	738.20 (27.17)	239.63 (15.48)	463.97 (21.54)	972.81 (31.19)	394.81 (19.87)
VI						125.44 (11.20)	239.32 (15.47)	248.69 (15.77)	273.57 (16.54)	269.61 (16.42)	512.11 (22.63)	357.58 (18.91)	335.98 (18.33)	726.84 (26.96)	472.24 (20.67)
VII							0.00 (0.00)	251.53 (15.86)	403.20 (20.08)	98.01 (9.90)	254.40 (15.95)	224.40 (14.98)	208.22 (14.43)	424.36 (20.60)	737.12 (27.15)
VIII								0.00 (0.00)	198.81 (14.10)	533.14 (23.09)	825.41 (28.73)	152.27 (12.34)	625.00 (25.00)	1146.49 (33.86)	335.98 (18.33)
IX									0.00 (0.00)	606.63 (24.63)	926.59 (30.44)	225.60 (15.02)	489.29 (22.12)	1064.71 (32.63)	668.73 (25.86)
X										0.00 (0.00)	94.28 (9.71)	443.10 (21.05)	122.98 (11.09)	208.22 (14.43)	954.81 (30.90)
XI											0.00 (0.00)	583.22 (24.15)	219.33 (14.81)	124.54 (11.16)	1308.99 (36.18)
XII												0.00 (0.00)	403.20 (20.08)	752.95 (27.44)	788.48 (28.08)
XIII													0.00 (0.00)	157.00 (12.53)	1271.63 (35.66)
XIV														0.00 (0.00)	1855.88 (43.08)
XV															0.00 (0.00)

Table 4. Relative contribution of fourteen characters to genetic diversity in rice

Character	Times ranked first	Contribution (%)
Days to 50% flowering	182	16.13
Days to maturity	65	5.76
Number of effective tillers per plant	12	1.06
Plant height	378	33.51
Panicle length	218	19.33
Number of grains per panicle	60	5.32
Harvest index	4	0.35
Kernel length	35	3.10
Kernel breadth	2	0.18
Kernel L/B ratio	0	0.00
Kernel length after cooking	19	1.68
Kernel elongation ratio	0	0.00
1000-grain weight	126	11.17
Grain yield per plant	27	2.39

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