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Genetic divergence for yield and its contributing traits in some rice genotypes (*Oryza sativa* L.) grown in Zn-deficient soil

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ABSTRACT

Assessment of genetic divergence using Mahalanobis D^2 statistics was carried out among 46 rice genotypes including high yielding local and advanced breeding lines grown in Zn-deficient soil. The genotypes were grouped into seven clusters. Cluster I had the highest number of genotypes (Twenty one) followed by Cluster II (Nineteen) and Cluster V with two genotypes. Other cluster were found to be monogenotypic. Cluster IV showed highest inter-cluster distance from Cluster VI which was immediately followed by Cluster III and Cluster VII. Highest intra-cluster distance was observed in Cluster V and lowest in Cluster I. The desirable yield and its contributing traits were distributed mainly in Cluster III followed by Cluster VII and Cluster I. The genotypes within Cluster III, VII and I may be used as parents in hybridization programme to develop high yielding line ideal for Zn-deficient soil.

Key words: Multivariete analysis, D^2 value, Inter and intra cluster distance, Zn-deficient soil.

Present research effort was directed to selection of rice genotypes to be used as parents in combination breeding to develop lines potential in Zn deficient soil prevalent in terai zone of West Bengal. The importance of Zn in rice productivity had been convincingly demonstrated (Castro 1977, Sakel *et al.* 1981, Maharana *et al.*, 1993). Estimation of the nature and magnitude of genetic diversity in the population may provide effective guidance for achieving the objectives by selection of ideal genotypes in mating programme.

MATERIALS AND METHODS

Forty six rice genotypes were considered in the divergence study. Out of forty six genotypes, thirty eight genotypes were collected from Uttar Banga Krishi Viswavidyalaya, Pundibari, Coochbehar and most of them are high yielding lines except Chapalu, Chakadumra, Nipun Punde, Nipun Pumpso which are of indegenous types collected from Terai zone and North Eastern region. Other AVT lines were collected from Directorate of Rice Research Institute, Hyderabad.

These lines were grown in the U.B.K.V. University Farm Coochbehar following randomized block design with three replication in Aman season of 2002. The seedling were transplanted at a spacing of 20 cm between rows and 15 cm within lines. The recommended agronomic package of practices were followed except application of Zn in the soil. The status of Zn in the experimental plot was in average of 1.53 ppm and may be considered as Zn-deficient soil.

The observations were recorded from ten randomly chosen plants from each replication for the eight characters as follows : (1) plant height (cm), (ii) number of effective tillers per plant (iii) floret fertility percentage (iv) number of seeds per panicle (v) Harvest index (vi) Test weight (g), (vii) yield per plant (g), (viii) Maturity. Analysis of variance with D^2 statistics was carried out from the recorded data on eight character following Mahalanobis D^2 statistics (Mahalanabis, 1936). The genotypes were grouped into different classes using Tocher's Method (Rao, 1952).

RESULTS AND DISCUSSION

Varietal differences were significant for yield and its contributing traits. The forty six genotypes were grouped into seven clusters on the basis of D^2 values (Table 1). Cluster I had the highest number of genotypes (twenty one) followed by Cluster II (Nineteen), Cluster V with two genotypes and single genotype in each of the other clusters. Maximum inter-cluster distance was observed between Cluster IV and Cluster VI (230.58) followed by between Cluster III and Cluster VII (205.70) indicating the presence of high genetic divergence between these clusters (Table 2). Minimum inter-cluster

Table 1 Distribution of 46 genotypes into distinct clusters on the basis of D^2 statistics

Cluster number	Total number of genotype	Name of genotypes
I	21	IET 9315, IR 50, IET 4049, Nipun Punde, DNR 381, PNR 519, Bikash, IET 9947, IET 10384, Bhupen, IET 13250, AVT-IEH-1908, AVT-IEH-1901, AVT-IEH-1903, MW-10, AVT-2105, Basmati 385, IR-64, IET 4786, KGR 19, Ajaya
II	19	AVT-IEU-2104, IET 8786, IET 1804, IET 8286, AVT-IEU-2110, IET 1812, AVT-IEH-1904, AVT-IEU-2106, Farashi, IR-61608-2B, Banna, IET 1809, AVT-IEH-1906, AVT-IEH-1905, AVT-IEU-2102, IET 1708, Chapalu, Chakadumra, IET 1707
III	1	IET 13544
IV	1	Nipun Pumpso
V	2	CR-237-1-B, MW-10-1
VI	1	IET-13783
VII	1	IRAT-144

Table 2. Average intra (diagonal) and inter cluster distance [Sqrt (D^2) values]

Cluster	I	II	III	IV	V	VI	VII
I	54.99						
II	101.82	64.49					
III	95.06	128.78	0.00				
IV	159.21	88.85	190.46	0.00			
V	95.31	113.95	132.87	166.46	68.29		
VI	98.61	171.30	139.98	230.58	125.83	0.00	
VII	128.40	152.92	205.70	182.56	132.69	142.72	0.00

Table 3. Cluster means for eight characters of rice

Cluster	Characters							
	Plant height (cm)	Number of effective tillers per plant	Fertility (%)	Number of seeds per panicle	Harvest index	Test weight (g)	Yield per plant (g)	Maturity (number of days)
I	95.41	13.74	75.78	124.81	0.45	21.27	20.73	119.64
II	127.10	11.79	73.70	113.98	0.40	23.01	17.79	114.94
III	98.74	20.38	87.67	151.91	0.57	15.35	26.80	112.67
IV	152.90	9.72	66.08	95.57	0.36	26.17	14.64	125.00
V	94.03	8.48	55.43	77.25	0.30	19.76	11.05	95.42
VI	65.58	18.05	73.29	65.93	0.38	21.92	16.62	125.83
VII	91.21	18.05	79.04	120.01	0.43	30.75	19.33	114.17

distance was recorded between Cluster I and Cluster III (95.06) which was closely followed by Cluster I and Cluster V (95.31) and also between Cluster I and Cluster VI (98.61) indicating presence of least genetic difference between the genotypes present within these clusters respectively. Maximum intra cluster divergence was recorded within Cluster V (68.23) with two genotypes and minimum in single genotypic classes like Cluster III, IV, VI and VII respectively. Large number of desirable traits like effective tillers per plant, floret fertility, number of seeds per panicle, harvest index, yield per plant, early maturity were found in cluster III. Cluster VII was found to be superior for test weight. The genotypes present in these cluster may be used for selection or breeding lines suitable for Zn deficient soil. Selection on the basis of floret fertility and harvest index may provide desirable line in Zn-deficient soil (Gholipper *et al.,* 1998, Balan *et al.,* 1999). Ramadass and Krishnasamy (1992) used floret fertility percentage, grain yield to select tolerant genotypes to Zn deficiency. Mating among genotypes from widely divergent clusters may provide heterotic combinations with respect to high yield potentiality in Zn deficient soil (Kandhola and Panwar, 1999).

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