Indian J. Genet., 68(4): 453-455 (2008)

Short Communication

Genetic variability studies in physico chemical and cooking characteristics of land races of rice grown in Nilgiris

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(Received: December 2007; Revised: August 2008; Accepted: October 2008)

Improvement of rice grain quality in order to meet the requirements of rice market and raised living standards is one of the important objectives of present day rice breeding. Due to the introduction of high yielding varieties and absence of conservation and improvement programmes, most of the land races possesing desirable quality attributes have gone out of cultivation (genetic erosion). Some tribal people still cultivate these land races in small areas, primarily for their personal consumption. To achieve superiority in terms of quality, the 'immense wealth' of indigenous land races may be included in the breeding programmes. Hence, an attempt was made to study the variability in grain physico-chemical and cooking quality traits of different land races collected from hilly areas of Gudalur, the Nilgiris, Tamil Nadu.

The experimental materials consisted of thirteen land races *viz*., Maranel, Kuttivilayan, Puludisamba, Wayanadan, H_4, Adukkan, Thondhi, Vali, Karuvalli, Chinthamani, Mannuvilayan, Kothandan and Kodavilayan collected from tribal farmers in the hilly areas of Gudalur, the Nilgiris, Tamil Nadu. Improved white Ponni was included as check. The land races were utilised for recording grain and cooking quality characters *viz.,* milling per cent, kernel length (L), kernel breadth (B), LB ratio, kernel size, kernel shape, kernel length after cooking, kernel breadth after cooking, linear elongation ratio, breadthwise expansion ratio, alkali spreading value, gel consistency, amylose content, water uptake and volume expansion. Cleaned rough rice dried to 12 per cent moisture content were shelled in satake rice mill and polished for finding out milling out turn. Vernier caliper was used for measurement of grain length and breadth. The length of milled rice and length/breadth (L/B) ratio were used to determine grain size and shape. Standard procedures were followed for recording cooking qualities [1], amylose content [2], alkali spreading value (AVS) [3], gel consistency [4], water uptake and volume expansion. The mean of three replications was used for carrying out the variability analysis [5].

Mean values of land races for various grain physico chemical and cooking characters are presented in Table 1. Milling out turn is the measure of rough rice performance during milling. In the present study, milling out turn ranged from 60 to 77 per cent. Mannuvilayan recorded the highest milling out turn. The appearance of the processed kernel is extremely important for judging the quality of rice. Among the genotypes studied, Maranel, Puludhisamba, Wayanadan, Thondhi, Mannuvilayan, Kothandan, Vali, kodavilayan, were medium in size and shape where as Adukkan, Kuttivilayan, Karuvalli, Chinthamani and H_4 were medium bold.

High mean values for linear elongation ratio coupled with low mean values for breadthwise expansion ratio result in longer cooked rice grains, giving a good appearance [6]. These characters were favourably combined in Adukkan, Kuttivilayan, Mannuvilayan and H_4. Gelatinisation temperature is calculated based on alkali spreading score (ASS). Most of the indica types are intermediate to high ASV types [7], which is a desirable trait. All the land races included in the study exhibited high ASS (low GT) except Adukkan and Mannuvilayan, which had intermediate ASV (Intermediate GT). Gel consistency determines the softness or hardness of cooked rice. Soft and medium GC types are generally preferred. In the present study, all the genotypes invariably possessed soft gel consistency. Amylose content is considered as a prime determinant of cooking quality along with gelatinisation temperature (ASV) and gel consistency in rice. High amylose content rice shows high volume expansion (not necessarily elongation) and high degree of flakiness.

Table 1. Mean values for various quality characters in land races

Genotype	Milling (%)	Kernel length (mm)	Kernel breadth (mm)	Kernel length/ breadth	Linear elonga-tion ratio	Breadth-wise expansion ratio	Amylose content (%)	Gel consistency	ASV	VE	Water uptake (ml)	Grain size	Grain shape	Total
Maranel	69.25	6.30	3.05	2.14	1.54	1.13	29.25	90.50	2	5.00	3.27	M	M	28
Kuttivilayan	67.90	5.90	3.00	1.98	1.75	1.23	30.80	107.50	2	5.00	4.50	M	B	30
H_4	68.00	5.85	2.85	2.05	1.70	1.14	26.25	78.50	7	3.20	3.36	M	B	26
Puludhi Samba	68.05	5.85	2.60	2.25	1.39	1.22	21.45	102.50	2	2.70	2.18	M	M	23
Wayanadan	67.80	5.85	2.70	2.14	1.44	1.08	30.30	79.00	2	5.00	3.67	M	M	27
Adukkan	68.00	5.60	2.80	2.01	1.87	1.13	21.80	76.30	5	5.00	4.71	M	B	31
Thondhi	68.75	5.85	2.65	2.20	1.51	1.38	21.60	71.30	2	4.00	2.93	M	M	26
Karuvalli	60.01	6.10	3.00	2.01	1.36	1.05	27.15	96.25	2	4.10	3.07	M	B	25
Chinthamani	70.00	5.54	2.75	1.98	1.49	1.06	30.85	66.25	2	4.40	3.71	M	B	26
Mannuvilayan	77.00	5.80	2.70	2.16	1.70	1.16	20.50	71.00	5	5.00	4.12	M	M	33
Kothandan	70.30	5.65	2.50	2.26	1.57	1.21	19.80	60.10	2	6.00	4.31	M	M	29
Vali	66.80	6.25	2.85	2.53	1.42	1.08	20.25	76.30	2	4.00	2.80	M	M	28
Kodavilayan	65.80	5.65	2.65	2.13	1.47	1.09	25.95	97.25	2	5.00	4.93	M	M	27
Improved white Ponni (Check)	71.00	5.47	1.93	2.83	1.84	1.25	28.00	70.00	2	2.87	2.09	M	S	

M = Medium, B = Bold, S = Slender. ASV = Alkali Spreading Value; VE = Volume expansion

The grains cook dry and become hard upon cooling. In contrast, low amylose content rice cooks moist and sticky. Intermediate amylose rice are preferred in most rice growing areas of the world as it cooks fluffy and remains soft on cooling [8]. In this study, genotypes such as Adukkan, Thondhi, Mannuvilayan, Kothandan, Vali and Puludhi Samba were found to have intermediate amylose content. Kothandan recorded highest mean values for volume expansion and water uptake followed by the Adukkan, Kuttivilayan, Mannuvilayan and Kodavilayan. This high volume expansion is associated with high or intermediate amylose content [9]. Among different landraces, Mannuvilayan, Adukkan and Kuttivilayan recorded highest score by exhibiting desirable quality traits (Table 1). Hence, these land races can be utilised in breeding programmes to develop good quality genotypes suitable for cultivation in the Nilgris.

The co-efficient of variability, heritability and genetic advance as per cent of mean for various quality traits are presented in (Table 2). In the present study, the highest GCV (Genotypic co-efficient of variability) was observed for volume expansion (24.29) followed by water uptake (20.50) and alkali spreading value (20.12). High GCV for volume expansion, water uptake and alkali spreading value has been reported earlier [10]. Moderate to high variability observed for the traits such as cooked kernel length (19.05), amylose content (18.42) and gel consistency (17.81) indicate better scope for genetic improvement in these characters. The closeness between GCV and PCV for the characters like milling per cent, cooked kernel length, amylose content, gel consistency, alkali spreading value, volume expansion and water uptake indicate minimal influence of the environment on expression of these characters. Apart from showing high to moderate GCV, the traits such as volume expansion (98.49), water uptake (94.15), alkali spreading value (95.12), amylose content (98.65), gel consistency (97.67) and cooked kernel length (97.66) also exhibited high heritability. The genetic advance as per cent of mean was high for volume expansion (49.67), alkali spreading value (39.45), water uptake (39.62), amylose content (37.70), gel consistency (36.26) and moderate for kernel length after cooking (18.43) [10]. Heritability estimates considered along with genetic advance will be more helpful in predicting the gain under selection. High heritability coupled with moderate to high genetic advance and high genotypic co-efficient of variation in traits such as volume expansion, alkali spreading value, water uptake, amylose content, gel consistency and kernel length after cooking indicate the predominance of additive gene action for these traits. Hence selection based on these traits will be highly rewarding.

Table 2. Genetic parameters for grain physico chemical characters of land races

Characters	GCV (%)	PCV (%)	Herita-bility (%)	Genetic advance as % of mean
Milling (%)	3.33	3.66	83.10	6.26
Kernel length	3.97	4.43	80.38	7.33
Kernel breadth	5.70	6.36	80.83	10.51
Kernel length/breadth	5.59	8.55	42.66	7.51
Linear elongation ratio	9.55	10.12	89.07	18.58
Amylose content (%)	18.42	18.55	98.65	37.70
Gel consistency	17.81	18.02	97.67	36.26
Alkali spreading value	20.12	20.62	95.12	39.45
Volume expansion	24.29	24.48	98.49	49.67
Water uptake	20.50	23.15	94.18	39.62

GCV: Genetic coefficient of variation; PCV: Phenotypic coefficient of variation

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