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Research Notes

Genetic parameter studies on quality traits in rice

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Grain quality has always been an important consideration in rice variety selection and development. The physico-chemical characteristics of rice grains are important indicators of grain quality. The consumer mainly prefers good quality rice. The cooking quality is a complex character which is very much influenced by physico-chemical characteristics of rice grain. (Tomar and Nanda, 1981; Hussain *et al.*, 1987). The knowledge of variability and heritability of different quality characters will help the breeder in choosing the parents for hybridization programme. In the development of improved breeding lines having superior quality, the correlation between the grain quality characters is useful in the choice of parents, screening and selection procedures. Hence the present experiment was undertaken to study the different genetic parameters and correlation of quality characters of promising cultures / varieties/ hybrids of rice.

Fifty five rice cultures / varieties/hybrids were analyzed for quality parameters at Rice Quality Laboratory, Department of Rice, Centre for Plant Breeding and Genetics, TNAU, Coimbatore during 2004. The grains of fifty five cultures /varieties were utilized for recording fourteen quality characteristics *viz.*, hulling, milling, head rice recovery, kernal length, kernel breadth, after cooking linear elongation ratio, volume expansion, gelatinization temperature, gel consistency and amylose content. The quality characters were estimated

Table 1. Variability and heritability parameters for physiochemical quality traits of rice.

Characters	Mean	Range	GCV	PCV	h^2	Genetic advance as per cent of mean
Hulling percentage (%)	72.22	55.9-86.9	10.15	10.36	95.90	36.23
Milling percentage (%)	63.26	37.3-88.0	18.15	18.29	98.47	37.11
Head rice recovery (%)	43.52	27.5-61.2	21.18	21.46	97.40	43.06
Kernel length (mm)	5.58	4.0-7.0	11.17	11.37	96.45	22.60
Kernel breadth (mm)	2.12	1.7-4.0	15.73	15.90	97.80	32.04
L/B ratio	2.67	1.52-3.10	16.22	16.37	98.24	33.14
Kernal length after cooking (mm)	8.22	6.0-11.0	12.39	12.70	95.14	24.89
Kernal breadth after cooking (mm)	2.58	2.0-3.6	12.93	13.29	94.71	25.93
Linear elongation ratio	1.53	1.18-1.88	9.70	10.22	90.11	18.97
Breadth wise elongation ratio	1.22	0.37-1.58	16.90	17.20	96.58	34.22
Volume expansion	4.43	2.5-6.2	20.46	20.79	96.92	41.51
Alkali spreading value	3.53	2.0-7.0	27.34	29.38	86.60	52.41
Gel consistency (mm)	79.19	30-170	45.86	46.02	99.31	94.16
Amylose content (%)	24.10	13.4-27.2	12.65	12.81	97.49	25.73

GCV - Genotypic co-efficient of variance
PCV - Phenotypic co-efficient of variance
h^2 - Heritability

as per the standard evaluation system in rice. Alkali spreading value was estimated following the method of Little *et al.* (1986), gel consistency was analyzed based on the method described by Cagampang *et al.* (1973) and amylose content by Juliano (1971). The genetic parameters were calculated according to Burton (1952) and heritability by Lush (1940). Genetic advance was calculated according to Johnson *et al.* (1955).

The genotypic and phenotypic coefficients of variation (Table l) among different quality traits revealed that high GCV and PCV values were observed for head rice recovery, volume expansion, alkali spreading value, gel consistency and medium values for milling out turn, kernel length, kernel breadth, L/B ratio, kernel length after cooking, kernel breadth after cooking, breadthwise elongation ratio and amylose content. A similar result for L/B ratio was already reported (Sarkar *et al.*, 2007). Heritability values were high for all the characters. Heritability alone will not able to give successful results in improving specific traits unless there is a higher genetic gain which is attributed to additive gene action. High genetic advance as per cent of mean was observed for head rice recovery, kernel length, kernel breadth, L/B ratio, kernel length / breadth after cooking, breadth wise elongation ratio, volume expansion, alkali spreading value and amylose content. Presence of high heritability values along with high genetic advance indicated the predominance

Table 2. Genotypic correlation coefficients among physio-chemical and cooking quality traits in rice.

Characters	Hulling %	Milling %	Head rice recovery (%)	Kernel length (mm)	Kernel breadth (mm)	L/B ratio	Kernel length after cooking (mm)	Kernel breadth after cooking (mm)	Linear elongation ratio	Breadth wise elongation ratio	Volume expansion	Alkali spreading value	Gel consis-tency	Amylose content %
Hulling %	1.00	0.055	0.175	0.037	0.047	-0.032	-0.038	0.079	-0.138	0.022	-0.105	-0.042	-0.087	0.035
Milling %		1.00	0.622**	0.09	-0.028	0.077	0.266	-0.058	0.051	0.025	0.104	-0.004	-0.196	-0.066
Head rice recovery (%)			1.00	0.237	-0.083	0.203	0.198	0.22	0.086	0.195	-0.144	0.24	-0.182	-0.119
Kernel length (mm)				1.00	0.051	0.643**	0.586**	0.313*	-0.30*	0.117	-0.153	0.38**	-0.068	0.309*
Kernel breadth (mm)					1.00	-0.682**	0.008	0.283*	-0.071	-0.44**	-0.068	0.005	0.270*	-0.023
L/B ratio						1.00	0.397**	-0.05	-0.167	0.386**	-0.155	0.274**	-0.206	0.257
Kernal length after cooking (mm)							1.00	0.143	0.185	0.082	0.096	0.243	0.032	0.317*
Kernal breadth after cooking (mm)								1.00	-0.137	0.522**	0.093	0.396**	0.211	0.013
Linear elongation ratio									1.00	-0.144	0.025	0.141	0.005	0.017
Breadth wise elongation ratio										1.00	0.228	0.322*	0.101	-0.026
Volume expansion											1.00	-0.304*	0.174	0.047
Alkali spreading value												1.00	0.1	-0.163
Gel consistency (mm)													1.00	-0.118
Amylose content (%)														1.00

* Significant at P = 0.05; ** Significant at P = 0.01

of additive gene action in the inheritance of these characters. This is in accordance with earlier findings (Nayak *et al.,* 2003). High heritability with high genetic advance and high GCV and PCV were observed for the head rice recovery, volume expansion, alkali spreading value and gel consistency. This indicated that the parents should be selected for hybridization programme based on the above characters. High heritability with moderate to high genetic advance and GCV and PVC were observed for all the quality characters except linear elongation ratio.

Correlation analysis revealed that milling out turn exhibited a highly significant positive correlation with head rice recovery. Kernel length showed highly signilicant positive correlation with length/breadth ratio (Table 2). Different workers have reported similar results (Chauhan, 1987; Khatun *et al.,* 2003). On the other hand, kernel breadth showed highly significant but negative association with length / breadth ratio (Sood and Siddiq, 1980). Results showed that there was negative correlation between amylose content and gel consistency, amylose content and gelatinization temperature (Table 2). The results are in agreement with earlier findings (Tang, 1989). The highly significant negative correlation between amylose content and gel consistency indicated that simultaneous improvement of these two quality traits could be made with the selection, of either one but not both of them. Positive association was observed between gel consistency and gelatinization temperature (Khatun, 2003). Highly significant positive association was exhibited between kernel breadth after cooking and breadth wise elongation ratio. Positive but non-significant association was observed between breadth wise elongation ratio and volume expansion (Table 2).

Kernel length showed highly significant positive association with L/B ratio, kernel length after cooking, gelatinization temperature, amylose content and significant positive association with kernel breadth after cooking (Table 2). While significant negative association with linear elongation ratio, the L/B ratio had highly significant positive association with kernel length after cooking, breadth wise elongation ratio and gelatinization temperature. Kernel length after cooking showed significant and positive association with kernel length, L/B ratio and amylose content. The character breadth wise elongation ratio had highly positive association with L/B ratio, kernel breadth after cooking while highly negative associating with kernel breadth. Gelatinization temperature showed significant positive association with kernel length, L/B ratio, kernel breadth after cooking, breadth wise elongation ratio, while negative significant association with volume expansion. Gel consistency showed significant positive association with kernel breadth. Amylose content had positive significant association with kernel length and kernel length after cooking.

Based on the strong and positive correlation between all possible pairs of 14 quality characters, it was concluded that the characters such as kernel length, length / breadth ratio, kernel length after cooking, breadth wise elongation ratio, gelatinization temperature, amylose content and kernel breadth could be used as selection indices for the improvement in grain quality characters of rice.

The present study revealed that, for physico-chemical and cooking quality improvement, the parents might be selected for hybridization programme by taking appropriate quality characters particularly head rice recovery, kernel length, length / breadth ratio, kernel length after cooking, breadth wise elongation

ratio, volume expansion, gelatinization temperature, amylase content and gel consistency and followed by multiple selection criteria which would help in quick realization of better selection for quality rice.

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