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Cooking quality and physico-chemical characteristics analysis for drought tolerant hybrids in rice

V. Karpagam [1]*, S. Jebaraj [2] and S. Rajeswari [3]

[1]Department of Plant Breeding and Genetics, Vanavarayar Institute of Agriculture,Pollachi- 642103, Tamil Nadu, India.
[2]Department of Plant Breeding and Genetics, Agricultural College and Research Institute, Madurai- 625104, Tamil Nadu, India.
[3]Centre for Plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore – 641003, Tamil Nadu, India.
*Corresponding author's E-mail: priyatnau2007@yahoo.co.in

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ABSTRACT

Rice is a food crop of world-wide importance and forms the foundation of the diet of over 3 billion people, constituting over half of the World's population. The best performing five hybrids with respect to the single plant yield and their parents were analysed for cooking quality and physico-chemical characteristics. The cross combination, ADT 43 x Anna (R) 4 with the high milling per cent of 50 had medium slender grains with KLAC of 9.55 mm. The LER is also less than 2.00 (0.58), with intermediate gelatinization temperature and amylose content. It had desirable feature of soft gel consistency.

Key words: Quality, gelatinization, amylose and gel consistency

Rice is a food crop of world-wide importance and forms the foundation of the diet of over 3 billion people, constituting over half of the world's population (Cantral and Ravees, 2002). Quality is a complex phenomenon governed by physio-chemical properties of starch. Quality desired in rice vary from one geographical region to another and consumer demand certain varieties and favors specific quality traits of milled rice for home cooking (Juliano *et al*., 1964; Azenz and Shafi, 1966). It is worthy of note that all the newly introduced hybrid varieties showed very low values for grain elongation. Linear elongation of rice on cooking is one of the major characteristics of good rice (Sood and Sadiq, 1979., Oko *et al*., 2012). In pure lines, all the individual kernels are more or less uniform with respect to different grain quality characteristics. In hybrids, seed borne on F_1 plants which are intermediate to the parents and uniform in shape but different in cooking quality characteristics. This affects the quality of cooked rice. The physical characters like kernel length, breadth and L/B ratio contribute to appearance of brown and cooked rice.

These are important traits determining the market value and consumer preference. Amylose content, gelatinization temperature and gel consistency are very important in determining the cooking and eating quality of rice (Khush *et al.*, 1979). V irmani and Zaman (1998) have suggested that parental lines with desirable grain quality could give hybrids with improved quality. In the present investigation, there were hybrids which showed better performance over their parents with desirable kernel length and shape.

The present study was therefore aimed at to identify high yielding cross combinations with acceptable grain and cooking quality parameters. The best performing five hybrids based on mean performance for grain yield, along with its parents were analyzed for physical and cooking quality characters.

MATERIALS AND METHODS

The best performing five hybrids with respect to the single plant yield *viz.*, ADT 43 x Anna (R) 4, ADT 43 x PMK (R) 3, ADT (R) 49 x Chandikar, BPT 5204 x Chinnar 20 and CO (R) 50 x PMK (R) 3 and their parents were analysed for cooking quality and physico-chemical characteristics.

RESULTS AND DISCUSSION

The physical and cooking quality characters of five superior hybrids selected based on mean performance of single plant yield and drought

related traits and their parents are presented in the Table 1. Rice Technical Working Group (RTGW, 1997) recommended ≥ 75 per cent hulling percent, ≥ 65.1 percent for milled rice and 48 per cent for head rice recovery. Milling recovery is one of the important criteria of rice quality especially from the stand point of marketing. The cross, ADT 43 x PMK (R) 3 had the highest hulling per cent than the parents. Milling recovery depends on grain shape and appearance, which has direct effect on the percentage of hulling, milling and head rice recovery. The crosses *viz.*, ADT 43 x Anna (R) 4, ADT 43 x PMK (R) 3 had the highest values of hulling, milling and head rice recovery percentage.

Table 1. Mean performance of parents and hybrids for grain quality characters

S. No	Genotypes	H %	M %	HRR	KL	KB	L/B	KLAC	LER	KBAC	GT	AC	GC
1	Anna (R) 4	71.00	51.00	40.00	6.90	2.15	3.21	11.10	0.63	3.46	7.00	24.08	57.00
2	Chandikar	73.00	45.00	36.00	7.05	2.25	3.16	11.80	0.60	3.77	7.00	25.33	68.00
3	Chinnar 20	67.00	62.50	43.50	5.55	2.80	1.98	11.15	0.50	5.63	6.00	23.22	55.50
4	PMK (R) 3	76.50	65.00	49.00	6.00	2.80	2.14	10.75	0.56	5.02	6.50	25.31	80.50
5	ADT 43	76.00	65.50	46.00	5.50	1.75	3.17	9.35	0.59	2.98	2.60	21.08	92.00
6	ADT (R) 49	69.50	64.00	58.00	5.60	2.40	2.33	9.45	0.59	4.05	2.00	21.15	88.50
7	BPT 5204	58.50	51.00	45.50	5.35	1.75	3.06	9.10	0.59	2.98	2.00	21.22	66.50
8	CO (R) 50	62.50	52.00	48.50	5.60	1.80	3.11	10.35	0.54	3.33	2.50	22.00	71.50
9	ADT 43 x Anna (R) 4	75.00	70.00	50.00	5.50	1.75	3.14	9.55	0.58	3.04	3.60	21.47	71.00
10	ADT 43 x PMK (R) 3	81.50	60.00	52.00	5.80	2.25	2.58	9.50	0.61	3.69	2.70	19.63	78.50
11	ADT 49 x Chandikar	77.50	57.00	52.50	5.80	2.35	2.47	9.05	0.64	3.67	1.00	17.66	55.50
12	BPT 5204x Chinnar 20	72.50	58.50	41.50	5.38	1.73	3.14	9.35	0.58	3.01	1.00	18.68	91.50
13	CO (R) 50 x PMK (R) 3	72.50	53.00	41.00	5.49	2.05	2.66	10.30	0.54	3.85	3.50	21.12	78.00

H% - Hulling percentage, M% - Milling percentage, HRR - Head rice recovery, KL – Kernel length, KB – Kernel breadth, L/B – Length bredth ratio, KLAC – Kernel length after cooking, LER – Linear elongation ratio, KBAC - Kernel breadth after cooking, GT – Gelatinization temperature, AC - Amylose content and GC- Gel consistency

The appearance of milled rice is important to the consumer, which in turn makes it important to the producer and the miller. Thus grain size and shape are the first criteria for rice quality. The breeders consider these characters developing new varieties for release of commercial production (Adair *et al.*, 1966). In general, medium to long

grains are preferred in the Indian subcontinent while the country is also replete with hundreds of short grain domestic types and long grain basmati types. The latter commanding the highest premium in both domestic and International markets.

In the present study, the cross combinations *viz.,* ADT 43 x Anna (R) 4, BPT 5204 x Chinnar 20 categorized under the medium slender and short slender respectively. The genotypes ADT 43 x PMK (R) 3 and ADT (R) 49 x Chandikar categorized under medium size and shape grains. Cooking quality parameters like kernel length and breadth after cooking, linear elongation ratio and breadth wise expansion ratio are important regarding consumer preference. Rice with more expansion and less breadth wise ratio is preferred. Kernel length after cooking was higher in CO (R) 50 x PMK (R) 3, ADT 43 x Anna (R) 4 and ADT 43 x PMK (R) 3.

Rice with high gelatinization temperature requires more water and time to cook than rice with low or intermediate gelatinization temperature. There seems to be distinct preference for rice with intermediate gelatinization temperature. (Khush *et al.,* 1979). In the present study, two cross combinations *viz.* ADT 43 x Anna (R) 4 and CO (R) 50 x PMK (R) 3 had the intermediate gelatinization temperature. The crosses, ADT (R) 49 x Chandikar and BPT 5204 x Chinnar 20 were categorized under low intermediate gelatinization temperature.

Gel consistency determines the softness or hardness of the cooked rice. The varieties having the same amylose content can be differentiated for their tenderness of cooked rice by the gel consistency test (Cagampang *et al*., 1973). In the present study, most of the hybrids expressed soft gel consistency except ADT (R) 49 x Chandikar which expressed medium consistency. A similar result of soft gel consistency was reported for varieties and hybrids in rice (Asish *et al.,* 2006).

High amylose varieties cook dry, flaky, fluffy and have volume expansion but become hard after cooking intermediate amylose rice cook fluffy and remain soft on cooking whereas, low amylose varieties cook sticky. In the study, all cross combinations exhibited intermediate amylose content.

The cross combination, ADT 43 x Anna (R) 4 with the high milling per cent of 50 had medium slender grains with KLAC of 9.55 mm. The LER is also less than 2.00 (0.58), with intermediate gelatinization temperature and amylose content. It had desirable feature of soft gel consistency.

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