

Physicochemical Properties and Cooking Characteristics of Some Cultures of Rice

By

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ABSTRACT

Sixteen promising cultures of rice were assessed for physical properties, chemical composition and cooking qualities. Culture 7711 proves to be the best with fine grain, high protein and amylose levels. It also takes less cooking time and shows higher water uptake and swelling number.

INTRODUCTION

The important and desirable characteristics of rice are its physical geometry, cooking quality, and nutritive value. Number of methods like starch iodine blue test for white milled rice, gelatinization and pasting characteristics, amylose content etc., have been evolved for judging the quality of rice. In addition to the above, physical properties of rice are considered important in evaluating the quality of rice. However, no single test has been accepted as a sole criterion for judging the quality of rice (Chakrabarthy, *et al.* 1972).

In this paper the studies made on the physicochemical properties and cooking characteristics of sixteen promising cultures of rice from the Tamil Nadu Agricultural University are reported.

MATERIALS AND METHODS

Sixteen promising rice cultures namely RP-4-2, RP-4-14, RP-5-3,

RP-126-5, RP-176-4, IET-1136, IET-2222, IET-2588, IET 2593, 7711, RPC-IB-31, RPC-IB-35, RPC-176-2, BC-11-6-3, CR-12-178 and Bhavani were taken for the present study. These cultures were stored for nine months, dehusked and used for investigations.

Grain dimensions, and hundred grains weight were determined. Bulk density was estimated as weight per litre of rice. Total protein was determined using Microkjeldahl apparatus (Jackson, 1962). The carbohydrate content was estimated using Nelson's Somogyi (Somogyi, 1952) reagents. The amylose content was estimated colorimetrically. Cooking characteristics were determined by taking 10 g of rice in a beaker and cooking in a boiling water bath after adding excess water. Cooking was adjudged as 'complete' when no white spots appeared between two glass slides on pressing the cooked grain. After cooking, the excess water in the beaker

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was transferred to a dish, evaporated to dryness and solids lost in the gruel was estimated. The water uptake was determined on the basis of water absorbed by 100 g of rice during cooking. Swelling number was calculated as the ratio of volume of swollen grain after cooking to that of the original grain. Cooking time was noted for all the varieties after completion of cooking. All the cooked samples were tested organoleptically for colour, appearance, texture, stickiness, flavour, aroma and taste.

RESULTS AND DISCUSSION

Physical Characteristics: The physical characteristics of the cultures

are given in Table 1. The weight of 100 grains varied from 1.43 to 2.22 g. in the cultures studied. IET cultures in general had higher grain weight. The bulk density did not vary considerably among the cultures except for culture IET 2588, which recorded the lowest bulk density value of 718 g/l. The difference in grain dimension among the cultures was not appreciable. The RP cultures, BC-11-6-3 and Bhavani were found to possess L/B values of more than 3.00 while that of others ranged from 2.00 to 2.98. The swelling number in IET varieties and BC-11-6-3 was comparatively low, because of coarse nature of grains. Other fine-grained varieties have higher

TABLE 1. Physical characteristics of different rice cultures

Cultures	Wt. of 100 kernels (g)	Bulk density g/l	Length (L) mm.	Breadth (B) mm.	Thickness (T) mm.	L/B Value
RP-4-2	1.6652	838.5	6.42	2.08	1.62	3.09
RP-4-14	1.6350	806.0	6.32	1.85	1.59	3.42
RP-5-3	1.4328	782.0	6.51	1.76	1.52	3.70
RP-126-5	1.8478	807.5	6.31	2.10	1.65	3.01
RP-176-4	1.7408	792.0	6.37	2.09	1.62	3.05
IET 1136	2.1432	816.0	6.32	2.50	1.90	2.53
IET 2222	1.9216	814.0	6.50	2.18	1.70	2.98
IET 2588	2.2228	718.0	5.70	2.82	2.00	2.02
IET 2593	2.1450	803.0	6.36	2.40	1.77	2.65
7711	1.9100	803.0	6.11	2.34	1.77	2.61
RPC-IB-31	1.6458	816.0	6.00	2.19	1.76	2.74
RPC-IB-35	1.5100	800.0	5.79	2.04	1.51	2.84
RPC-176-2	1.8798	810.0	6.28	2.50	1.80	2.51
CR-12-178	1.6156	808.0	6.00	2.07	1.70	2.90
BC-11-6-3	2.1590	800.0	7.00	2.10	1.68	3.33
Bhavani	1.5780	808.0	6.42	2.00	1.58	3.21

swelling number. There is much variation in water uptake number also among the cultures (Table 2). The culture 7711 recorded the minimum cooking time of 30 min. higher water uptake number of 460 and high

swelling number. For other cultures the cooking time ranged from 35 to 38 min. The percentage of solids lost in the gruel was high in RP-4-2 and IET 2222 and it was lowest in RP-5-3 and Bhavani.

TABLE 2. Cooking characteristics and chemical composition of different cultures

Cultures	Swelling number	Water uptake number	Cooking time (minutes)	Solids lost in gruel %	Amylose %	Carbohydrate %	Protein %
RP-4-2	6.4	370	35	4.07	23.6	78.0	9.39
RP-4-14	5.8	321	38	3.97	25.6	80.0	8.50
RP-5-3	6.1	380	35	4.43	27.6	82.0	8.63
RP-126-5	6.0	350	36	2.80	24.8	79.3	9.18
RP-176-4	6.0	340	36	3.08	26.8	81.6	8.71
IET-1136	5.0	328	36	3.60	24.8	77.5	7.95
IET-2222	4.16	280	36	4.12	26.0	80.7	9.16
IET-2588	5.0	272	38	2.94	20.8	79.4	9.52
IET-2593	6.5	350	35	3.03	26.4	80.3	8.02
7711	6.5	460	30	3.26	25.6	80.1	10.84
RPC-IB-31	6.0	382	38	3.20	26.4	80.9	8.98
RPC-IB-35	6.5	320	35	2.75	26.0	76.8	9.85
RPC-176-2	6.1	390	38	3.14	23.0	78.5	8.62
CR-12-178	6.2	362	37	3.80	26.0	79.3	9.15
BC-11-6-3	4.16	280	37	3.00	17.6	79.9	8.52
Bhavani	5.6	278	35	2.26	25.6	76.3	9.35

Chemical Composition: The chemical composition of the cultures are indicated in Table 2. The amylose content of the cultures ranged from 17.6 to 27.6 per cent. BC-11-6-3 and IET 2588 varieties had comparatively lower amylose content of 17.6 and 20.8 per cent respectively. In general, cultures with high amylose content possessed higher swelling number. The carbohydrate which

constitutes the bulk of the endosperm was found to be in the range of 76.3 (Bhavani) to 82.0 per cent (RP-5-3) of the grain.

The protein level varied from 7.95 (IET 1156) to 10.84 per cent (7711). The high protein level might influence the cooking time (Table 2) and water uptake number (Juliano *et al.*, 1965). However, there is no such relationship

of these factors for IET varieties. This is presumably due to colloidal properties of protein in the grains.

Cooking Quality: The results of the cooking test are given in Table 2. In general, the swelling number and water uptake number were more in cultures with high amylose content and less in cultures like IET 2588 and BC-11-6-3 with low amylose content. This agrees well with the results of Rao *et al.* (1952) who observed a positive correlation between the swelling number and amylose content in rice. It is very difficult to arrive at an optimum quality of rice, due to variation in preference. In India the consumer prefers a long and slender variety with relatively firm texture and high degree of gelatiness. The cultures with superior cooking qualities as tested organoleptically had high amylose content which were flaky. In addition, the cooked rice of these cultures gave relatively firm texture. On contrary, low amylose rice cultures were sticky and mushy. The results confirm to the findings of Chakrabarthy *et al.* (1972). The degree of swelling indicates the degree of 'oldness'. The

culture 7711, proves to be of superior type. This culture is of fine grain nature; takes less cooking time with higher water uptake and swelling number. Above all, the carbohydrate content is fairly good with high amylose. The protein level is also found to be higher in this culture.

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