Cooking Characteristics, Eating Quality, and Preference of Some Rice Varieties Grown Experimentally in Puerto Rico[1]

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ABSTRACT

A 10–12 member tasting panel appraised cooked samples of 26 rice varieties as to appearance, cohesion, tenderness, and flavor; and judged 25 of those varieties for eating quality using a +2, −2 (acceptable — not acceptable) scale. All samples had good cooking characteristics. The eating quality of IR-8 and Chontalpa 59 was questionable. An additional test showed preference for Sunbonnet and Starbonnet. Bluebelle was very close to the significant level of preference. The commercial sample came close to a significant level of preference over Chontalpa 59.

INTRODUCTION

Efforts are being made to establish a rice industry in Puerto Rico. Several varieties have been imported and field tested. Chemical and physical measurements give an indication of the cooking characteristics and eating quality of rice varieties (3), but it is the cooking and tasting alone which provide most reliable information on characteristics and quality. Cooking the rice samples by a standardized procedure and submitting them to a sensory evaluation by a trained panel is a sound procedure to ascertain cooking characteristics and eating quality. Batcher et al. (1) described a standard cooking procedure for the evaluation of the cooking and eating quality of rice. Batcher et al. (2) also reported on the cooking quality of 26 rice varieties, four of which were included in this study. Quality evaluation of foreign and domestic rices was done by Simpson et al. (5), but they did not name the varieties studied.

MATERIALS AND METHODS

Single rice samples from experimental plots during the years 1973 and 1974 were milled after they were dried to 12 to 14% moisture. Milling was done under controlled conditions, using the standard equipment for rice milling tests specified by the USDA (6). The samples were graded according to U.S. standards, placed in well protected sample bottles, and stored in a dry cool place until used. Only US No. 1 grade samples were used for the evaluation studies.

Name _____   Date _____

Product _____

Palatability Characteristics of Cooked Rice
Sample No._____

Scale	Appearance	Cohesion	Tenderness	Flavor
5	Whole smooth grains	Well separated	Hard centers	No off flavors
4	Fuzzy edges	Partially separated	Firm and chewy	Perceptible off flavors
3	Sloughing	Sticky or slightly clumped	Tender and firm	Slightly strong off flavors
2	Indistinct broken grains	Very sticky, clumped	Soft	Moderately strong off flavors
1	Disintegrated	Pasty	Mushy	Very strong off flavors

FIG. 1. — Tasting ballot used for the evaluation of cooking characteristics.

TABLE 1.—*Appearance of cooked samples of 26 rice varieties*

Variety	Score (average)	Description
Sinaloa A68-1C	4.8	Whole smooth grains
Sinaloa A68-8C	4.8	Whole smooth grains
Chontalpa 437	4.7	Whole smooth grains
Vista 96-28-2	4.6	Whole smooth grains
Colusa	4.6	Whole smooth grains
Caloro	4.5	Whole smooth grains
Chontalpa 59	4.5	Whole smooth grains
Juma 13	4.4	Grains with fuzzy edges
IR-8	4.4	Grains with fuzzy edges
Girona	4.4	Grains with fuzzy edges
Brazos	4.4	Grains with fuzzy edges
Chontalpa 16	4.4	Grains with fuzzy edges
Sinaloa A68-19C	4.3	Grains with fuzzy edges
Balilla	4.3	Grains with fuzzy edges
Venus	4.2	Grains with fuzzy edges
Dosel	4.2	Grains with fuzzy edges
Bluebelle	4.2	Grains with fuzzy edges
Bahía	4.2	Grains with fuzzy edges
Starbonnet	4.2	Grains with fuzzy edges
Sunbonnet	4.2	Grains with fuzzy edges
Juma 18	4.2	Grains with fuzzy edges
Amposta	4.1	Grains with fuzzy edges
Galaxia	4.1	Grains with fuzzy edges
Juma 1	4.1	Grains with fuzzy edges
Bluebonnet 50	4.1	Grains with fuzzy edges
Nano × Sollana	4.0	Grains with fuzzy edges

The samples were cooked by the oven method (1). To 400 ml of boiling distilled water in a covered porcelain bowl, 4 g of table salt and 200 g of the rice sample were added. The bowl was placed immediately in a preheated oven at 350° F for 28 min, after which the lid was removed and the sample cooked for 5 additional min. This procedure was followed with all samples irrespective of grain size.

To determine the cooking characteristics, the cooked samples were judged by 10 to 12 members of a trained tasting panel who were asked to score their judgments on a ballot similar to the one used by Simpson

TABLE 2. — *Cohesion of cooked samples of 26 rice varieties*

Variety	Score (average)	Description
Chontalpa 59	4.9	Well separated grains
Nano × Sollana	4.6	Well separated grains
Chontalpa 437	4.4	Partially separated
IR-8	4.3	Partially separated
Sinaloa A68-8C	4.3	Partially separated
Juma 18	4.1	Partially separated
Starbonnet	4.0	Partially separated
Venus	3.9	Partially separated
Sinaloa A68-1C	3.8	Partially separated
Bluebonnet-50	3.8	Partially separated
Bluebelle	3.8	Partially separated
Chontalpa 16	3.8	Partially separated
Sinaloa A68-19C	3.8	Partially separated
Vista 96-28-2	3.8	Partially separated
Juma 13	3.7	Partially separated
Sunbonnet	3.6	Partially separated
Galaxia	3.6	Partially separated
Girona	3.6	Partially separated
Bahía	3.4	Sticky or slightly clumped
Brazos	3.3	Sticky or slightly clumped
Dosel	3.2	Sticky or slightly clumped
Colusa	3.2	Sticky or slightly clumped
Balilla	3.1	Sticky or slightly clumped
Caloro	3.0	Sticky or slightly clumped
Juma 1	2.9	Sticky or slightly clumped
Amposta	2.9	Sticky or slightly clumped

et al. (5), with the scale reduced to 5 points (fig. 1). Only one sample was presented at each tasting session.

To ascertain the eating quality, the samples were evaluated by the same trained panel using Kramer's +2, −2 (acceptable-not acceptable) scale (4). All samples were cooked as described above with the addition of 25 ml of vegetable oil to the boiling water. Again only one sample was appraised at each tasting session.

To compare an experimental sample with a commercial sample, both

samples were cooked simultaneously by the method previously described, including the addition of vegetable oil. They were presented, coded, simultaneously to the panelists. Tasters were asked to consider the overall characteristics and to indicate which one they preferred. The test was replicated two or three times. The results were analyzed for significance by the chi-square test.

TABLE 3. — *Tenderness of 26 rice varietes after cooking*

Variety	Score (average)	Description
Juma 18	4.8	Hard centers
Galaxia	4.4	Firm and chewy
Chontalpa 59	4.4	Firm and chewy
Nano × Sollana	4.2	Firm and chewy
Sunbonnet	4.2	Firm and chewy
Chontalpa 437	4.0	Firm and chewy
Bahía	3.9	Firm and chewy
Bluebelle	3.9	Firm and chewy
Sinaloa A68-19C	3.9	Firm and chewy
Starbonnet	3.9	Firm and chewy
Colusa	3.9	Firm and chewy
IR-8	3.9	Firm and chewy
Girona	3.9	Firm and chewy
Brazos	3.9	Firm and chewy
Chontalpa 16	3.8	Firm and chewy
Venus	3.8	Firm and chewy
Vista 96-28-2	3.6	Firm and chewy
Balilla	3.6	Firm and chewy
Sinaloa A68-8C	3.6	Firm and chewy
Juma 1	3.5	Between firm and chewy and tender and firm
Bluebonnet 50	3.5	Between firm and chewy and tender and firm
Dosel	3.3	Tender and firm
Juma 13	3.3	Tender and firm
Sinaloa A68-1C	3.3	Tender and firm
Amposta	2.5	Between tender and firm and soft
Caloro	2.3	Soft

RESULTS AND DISCUSSION

Four cooking characteristics were evaluated in this study: appearance, cohesion, tenderness, and flavor. The scores and descriptions of the characteristics of each variety are presented in tables 1, 2, 3, and 4, respectively.

Table 1 gives the panel score and descriptive terms for appearance of the 26 varieties. All samples had good appearance. The lowest score (4.0) corresponds to grains with fuzzy edges. In judging appearance the

tasters were asked to consider only the physical condition of the grains, disregarding color, since only white or slightly creamy samples were submitted for evaluation.

As indicated in table 2, Chontalpa 59 (long-grain) and Nano × Sollana (medium-grain) varieties cooked with well-separated grains. Juma I, a long-grain variety cooked with sticky or slightly clumped grains. None of the cooked samples was found to be very clumped or pasty. The scores for Bluebonnet 50, Sunbonnet, Caloro, and Colusa

TABLE 4. — *Flavor of cooked samples of 26 rice varieties*

Variety	Score (average)	Description
Bluebonnet 50	5.0	No off flavors
Balilla	5.0	No off flavors
Starbonnet	5.0	No off flavors
Chontalpa 437	5.0	No off flavors
Brazos	4.9	No off flavors
Chontalpa 16	4.9	No off flavors
Chontalpa 59	4.9	No off flavors
Juma 13	4.9	No off flavors
Sinaloa A68-8C	4.9	No off flavors
Galaxia	4.9	No off flavors
Girona	4.9	No off flavors
Caloro	4.8	No off flavors
Venus	4.8	No off flavors
IR-8	4.8	No off flavors
Nano × Sollana	4.8	No off flavors
Sunbonnet	4.7	No off flavors
Sinaloa A68-1C	4.7	No off flavors
Colusa	4.7	No off flavors
Sinaloa A68-19C	4.7	No off flavors
Dosel	4.7	No off flavors
Juma 18	4.6	No off flavors
Juma 1	4.6	No off flavors
Amposta	4.5	No off flavors
Bahía	4.5	No off flavors
Bluebelle	4.5	No off flavors
Vista 96-28-2	4.1	Perceptible off flavors

were similar to the ones reported by Batcher et al. (2) for these varieties. The general trend, where cooked long-grain varieties are more loose and flaky than short- or medium-grain ones, was observed.

Table 3 includes the score and corresponding descriptive tests for tenderness.

The great majority of the samples were found to be firm and chewy, indicating that they were slightly under the optimum doneness. Juma-18 had hard centers, while Caloro was soft; none was pasty. A shift toward the upper end of the scale is observed. This may be due to the

volume of water used. Batcher et al. used 250 ml of water per 100 g of long-grain rice and 200 ml per 100 g of medium or short-grain varieties. In this test all samples were cooked in 200 ml of water per 100 g of rice, irrespective of grain size.

All samples, as indicated in table 4, were found to have no off flavors, with the exception of Vista 96-28-2, which had a score of 4.1, denoting perceptible off flavors. The judges described the off flavor as a stale or strawlike flavor. Since these samples had been stored for about two years, off flavor development could have taken place. Possibly,

TABLE 5. —*Eating quality of 25 rice varieties*

Variety	Score (average)	Description
Galaxia	1.4	Acceptable
Sunbonnet	1.3	Acceptable
Starbonnet	1.3	Acceptable
Venus	1.2	Acceptable
Chontalpa 437	1.2	Acceptable
Bluebelle	1.1	Acceptable
Bluebonnet 50	1.1	Acceptable
Juma 1	1.1	Acceptable
Sinaloa A68-1C	1.0	Acceptable
Sinaloa A68-19C	1.0	Acceptable
Juma 13	1.0	Acceptable
Sinaloa A68-8C	1.0	Acceptable
Dosel	1.0	Acceptable
Bahía	1.0	Acceptable
Amposta	1.0	Acceptable
Brazos	1.0	Acceptable
Nano × Sollana	1.0	Acceptable
Colusa	1.0	Acceptable
Chontalpa 16	.9	Acceptable
Vista 96-28-2	.9	Acceptable
Girona	.8	Acceptable
Juma 18	.8	Acceptable
Caloro	.6	Acceptable
IR-8	.4	Questionable
Chontalpa 59	.3	Questionable

Vista 96-28-2 had no off flavor when fresh. All samples showed good keeping quality.

The results of the eating quality tests of 25 rice varieties are presented in table 5. The scores range was from 0.3 to 1.4. Only two samples, IR-8 and Chontalpa 59, were rated questionable in quality; all other samples were found acceptable. Why these samples scored lower than the others is not known. Rice samples were cooked with vegetable oil and salt because Puerto Ricans boil rice with water to which lard, vegetable oil, or other shortening is added. Hence, for rice to be judged

for eating quality for the Puerto Rican market, samples were cooked according to local custom.

The same 25 experimental samples that were appraised for eating quality were compared individually for preference with a commercial rice sample (Colusa variety) of a trade brand known to have very good consumer acceptance. Sunbonnet ($\chi^2 = 9.0909$) and Starbonnet ($\chi^2 = 7.3142$) were highly prefered. Bluebelle ($\chi^2 = 3.3684$) came very close to a significant level of preference. The commercial sample ($\chi^2 = 3.6818$) approached the significant level of preference over Chontalpa 59. No significant preference could be established between the rest of the samples and the commercial one.

RESUMEN

Un panel de 10 a 12 catadores debidamente entrenados evaluó muestras de 26 variedades de arroz cocidas en horno por un método estándar, con respecto a las siguientes características: apariencia, cohesión, blandura y sabor. El mismo panel examinó 25 variedades para determinar la calidad al degustarlas, usando una escala (+2, −2) (aceptable-no aceptable). Se realizaron pruebas de preferencia entre 25 muestras experimentales y una muestra comercial de una marca de reconocida aceptación por los consumidores. Todas las muestras tenían buenas propiedades de cocción. La calidad de las variedades IR-8 y Chontalpa 59 resultó ser dudosa. La preferencia por las variedades Sunbonnet y Starbonnet excedió a la comercial en forma altamente siginificativa. Bluebelle estuvo muy cerca de ser preferida significativamente y la variedad comercial estuvo muy cerca de ser significativamente preferida a la variedad Chontalpa 59.

LITERATURE CITED

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