Culinary characteristics of new selections of sweet potato[1]

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ABSTRACT

Thirteen new sweet potato selections differing in sweetness were tested for suitability when mashed, baked, or fried as chips or french fries. They were rated by two trained investigators and in the case of mashing, by a trained taste panel. The sweet potatoes were of high quality for most uses. However, non-sweet selections were more suitable for frying than for baking. Mashing of boiled sweet potatoes enhances appearance and texture. Among non-sweet sweet potatoes, SPV 70 was rated highly, SPV 65 intermediate, and SPV 52 as the poorest of the group. Specific sweet potato selections were often found more useful for one purpose than for another.

INTRODUCTION

Sweet potatoes are associated in the mind with sweetness, and thus are frequently cooked in dishes which express or enhance this characteristic. But sweet foods seldom become staple foods. The sweetness of the sweet potato may be one factor limiting its wider usage.[3]

Recently, non-sweet sweet potatoes have been found.[4] In these sweet potatoes the initial concentration of all sugars is low. On cooking, starch is not converted to maltose, as in the case of normal sweet potatoes. The basis for non-conversion is the absence of or low activity of beta amylase, the enzyme responsible for hydrolysis of starch in cooking.[5] Non-sweet sweet potatoes are defined here as staple type sweet potatoes. In addition, intermediate levels of sweetness may occur. These can be distinguished as substaple types. Staple and substaple varieties do not tire the palate and thus are similar in the diet to potatoes, rice, and other tropical roots and tubers.

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[3]Tsou, S. C. S. and R. L. Villareal, 1982. Resistance to eating sweet potato. Pp. 37–44. *In*: R. L. Villareal and T. D. Griggs (Eds). Sweet Potato. Proc. First Intl. Symp.

[4]Martin, F. W. and S. Deshpande, 1985. Sugars and starches in a non-sweet sweet potato compared to conventional cultivars. *J. Agric. Univ. P. R.* 69: 401–06.

[5]Hammett, H. L. and B. F. Barrentine, 1961. Some effects of baking on the carbohydrate content of sweet potatoes. Proc. Am. Soc. Hort. Sci. 78: 421–26.

The purpose of this study was to cook some new sweet potato selections of various sweetnesses in different ways, to observe quality characteristics, and to relate the cooked product quality to the sugar content of the selection.

MATERIALS AND METHODS

The new selections used are listed in table 1 and subsequent tables with numbers assigned. The selections were rated for their external characteristics by techniques developed by Ruberté and Martin.[6] The selections were tested by boiling and mashing, baking, and frying, and were evaluated on scales devised for each test. Most evaluations were made by two experienced people, the first author and his assistant. Rating scales ranked the poorest to the best from 1 to 5, but some characteristics judged neutral were described and not ranked. For each cooking method a final or summary rating was given. All scores, including that from boiling without mashing,[7] are gathered in the final table as an overall judgment of versatility and value.

Some of the sweet potato selections were rated boiled and mashed by a trained taste panel. Boiling followed by mashing is one of the easiest techniques for preparing sweet potatoes and results in a product almost always acceptable. Boiled, mashed samples were rated on a scale of 1 to 5 under normal light for appearance and under red light for flavor, sweetness, and texture (mouthfeel). Overall acceptability was then rated. The results were analyzed for variance or were presented in tabular form.

RESULTS

The new selections are rated and compared with respect to external and internal characteristics in table 1. External and internal color are described but are not rated because we considered them neutral in terms of value. From an external standpoint, shape is very important, but convenience and uniformity are its most important components.

Attractiveness can best be judged by experience and indeed is somewhat subjective. On the other hand, internal characteristics are somewhat easier to rate. The final rating was made independent of the previous scores.

The most attractive of the selections were SPV 46, SPV 44, and SPV 63. In spite of a lower score, SPV 60 was also given a high final rating. The least attractive selection, SPV 65, was nevertheless acceptable.

[6]Ruberté, R. M. and F. W. Martin, 1983. Laboratory evaluations of sweet potato for quality characteristics. Pp. 119–25. *In* F. W. Martin (Ed) Breeding New Sweet Potatoes for the Tropics. Proc. Am. Soc. Hort. Sci., Trop. Region 27(B).

[7]Martin, F. W. and I. Beauchamp de Caloni, 1986. Sensory analysis of boiled new sweet potato cultivars. *J. Agric. Univ. P. R.* (In press.)

TABLE 1.—*Ratings of before cooking characteristics of new sweet potato selections*[1]

Selection	Uniformity of form	External attractiveness	Color[2]	External score	Absence latex	Absence oxidation	Uniformity	Internal attractiveness	Internal color	Final rating
SPV 46 (Bonara)	4.5	4.5	Lt. orange	9	4	4	5	5	Orange	4
SPV 66 (Cremm)	4	4	Beige	8	5	4	5	5	Cream	3
SPV 63 (Francia)	4	4	Beige	8	5	4	5	5	Cream	4
SPV 60 (Limonette)	4	3	Beige	7	4	4	5	4.5	Cream	4.5
SPV 70 (Margarita)	3	3.5	Purple	6.5	5	4	5	4	White	3.5
SPV 65 (Mojave)	3	3.5	Purple	6.5	3	2	4	3	Cream	3.5
SPV 52 (Ninety-nine)	4	3	White	8	4	4	5	4	White	4
SPV 44 (Papota)	5	4	Beige	9	3	4	5	5	White	4
SPV 64 (Sneaky)	3	3	White	6	4	5	4	4	White	3.5
SPV 43 (Sunny)	4	4	Orange	8	4	4	4	4.5	Orange	4
SPV 71 (Tapató)	3	3.5	Purple	6.5	2	2	4	1	Yellow	3.5
SPV 55 (Toquecita)	4	4	Beige	8	3	4	5	4.5	White	3
SPV 56 (Viola)	4	3.5	Purple	7.5	4	4	4	4	Cream	4

[1]Scales used for this table: Uniformity of shape. 1 = least uniform, 5 = completely uniform. External attractiveness. 1 = least attractive, 5 = most attractive. Absence of latex. 1 = much latex, 5 = no latex. Absence of oxidation. 1 = much oxidation, 5 = no oxidation. Uniformity of color. 1 = mottled, 5 = uniform. Internal attractiveness. 1 = least attractive, 5 = most attractive. Rating. 1 = poorest, 5 = best.

[2]External color is influenced by the color of the peel and the flesh color, which often shows through the peel.

TABLE 2.—*Characteristics of 13 sweet, staple, or sub-staple sweet potatoes on boiling and mashing*[1]

Selection	Carotene color	Appearance	Sweetness	Texture	Rating
SPV 46 (Bonara)	4	4	4	3	4.5
SPV 66 (Cremm)	2	4	2	2	4
SPV 63 (Francia)	1	3.5	2	2.5	5
SPV 60 (Limonette)	1	2	2	3	3.5
SPV 70 (Margarita)	1	4	1	2	5
SPV 65 (Mojave)	1	3	1	2	4.5
SPV 52 (Ninety-nine)	1	2.5	2	2	4.5
SPV 44 (Papota)	1	4	3	2	4.5
SPV 64 (Sneaky)	1	4	2	3	4
SPV 43 (Sunny)	5	5	4	3	4
SPV 71 (Tapató)	3	4	2	2	4
SPV 55 (Toquecita)	1	3	3.5	2	5
SPV 56 (Viola)	1	2	2	2.5	4

[1]Scales used for this table: Carotene color. 1 = white, 3 = yellow, 5 = orange. Appearance. 1 = poorest, 5 = best. Sweetness. 1 = not sweet, 5 = very sweet. Texture. 1 = dry, 5 = moist. Rating. 1 = poorest, 5 = best.

All of the selections were rated acceptable or better after boiling and mashing (table 2). Mashing improves the appearance and texture and appears to increase sweetness. Several selections were outstanding, including the high-quality non-sweet SPV 70 (Margarita).

The trained taste panel evaluated 9 of the 13 selections (table 3). All selections were acceptable in appearance (between "like" and "neither like or dislike"). The highest scored were SPV 71, 63, 56, 55, and 44 and the lowest SPV 52. Significant differences were observed between SPV

TABLE 3.—*Evaluation of 9 sweet potato selections when mashed, by a trained panel*

	Mean values				
Selection	Appearance	Texture	Flavor	Sweetness	Overall acceptability
SPV 46	3.70 bcd	3.00 b	2.70 c	3.80 abc	3.30 b
SPV 63	4.27 abc	3.36 ab	3.64 ab	3.27 abc	4.18 a
SPV 60	3.69 bcd	3.38 ab	3.69 ab	4.08 a	3.91 ab
SPV 52	3.27 d	1.91 c	1.73 d	1.82 d	2.18 c
SPV 44	4.00 bcd	3.40 ab	3.20 bc	3.60 abc	3.70 ab
SPV 43	3.55 cd	3.27 ab	3.54 abc	3.18 bc	3.82 ab
SPV 71	4.60 a	3.60 ab	3.70 ab	3.00 c	4.10 ab
SPV 55	4.23 abc	3.69 ab	3.62 ab	3.23 bc	3.92 ab
SPV 56	4.50 ab	4.08 a	4.31 a	4.00 ab	4.46 a

[1]5-point scale: Appearance. 1 = do not like, 5 = like very much. Flavor. 1 = poor, 5 = excellent. Sweetness. 1 = not sweet, 5 = very sweet. Texture. 1 = poor, 5 = excellent. Overall acceptability. 1 = do not like, 5 = like very much.

[2]Means in columns followed by one or more letters in common do not differ significantly at the 5% probability level.

52 and SPV 55, 56, 63, and 71. SPV 71 was significantly different from SPV 46, 60, and 43. Significant difference was observed between SPV 56 and SPV 43.

Flavor of mashed sweet potatoes was rated between "very good" and "good" on all cultivars except for SPV 46 and SPV 52, which were rated "fair" and "poor," respectively. SPV 52 was significantly different from all other samples; SPV 46 was significantly different from SPV 55, 56, 60, 63, and 71. The highest rated in flavor were SPV 56, 71, 60, 63, and 55.

Highly significant difference in sweetness was observed between mashed sweet potato from SPV 52 and all others studied. Selection SPV 60 was the highest scored in sweetness and was significantly different from samples SPV 55, 71, and 43.

Regarding texture all samples were rated acceptable (between "very good" and "good"), except SPV 52 ("poor"). Significant difference were observed between SPV 52 and all other samples evaluated. The highest scored were SPV 56, 55, 71, and 44. Selection SPV 56 was significantly different from SPV 44 at the 5% level.

In relation to overall acceptability, all selections were found acceptable except SPV 52. There was a highly significant difference between this and all other samples evaluated. The samples with highest acceptability were those of SPV 56, 63, 71, 55, and 60, followed by SPV 43 and 44.

The new sweet potatoes often did not bake well (table 4). During baking some became too dry and hard. Sweetness did not increase appreciably. Selection SPV 55, one of the sweetest of the group, is an exception and was found to be very good baked. The least sweet selections, SPV 52 and 65, were the worst when baked.

On the other hand, the new selections are particularly useful for frying (table 5). A particular selection does not necessarily serve equally well for two fried products, chips and french fries. Whereas the former must be crisp, the latter should not be limp or hard, but firm. Thus, the best selections as chips were the most crisp. Selection SPV 70 was clearly the best, followed closely by SPV 52 and 63. All yielded good chips. Since the quality of fries varied, the best was SPV 60, an exceptionally fine selection for several purposes.

Table 6 shows the final scores, which consist of the sums of 6 ratings. Highest total scores were received by SPV 63, 70, 55, and 56. The lowest score was obtained by SPV 52.

DISCUSSION

Because preferences vary, it is desirable to rate preferences with trained panels whenever possible. But panels are expensive, and therefore experienced scientific and technical staff may have to make judg-

TABLE 4.—*Characteristics of 13 sweet, staple, or sub-staple sweet potatoes on baking*[1]

Selection	Carotene color	Grayness	Greenness	Appearance	Softness	Texture	Sweetness	Fiber	Rating
SPV 46	4	1	1	4	2	3	4	1	3
SPV 66	3	2	1	3	2	1.5	1.5	1	3
SPV 63	2.5	1.5	1.5	3	2	2	1.5	1	3
SPV 60	2.5	1	1.5	3	2	1	1	1.5	2
SPV 70	1	1	1	3.5	2	3	1	1	4
SPV 65	2	3	2	2.5	1	1	1	1	2
SPV 52	1	2	1	3	1	1	1	1	2
SPV 44	1	1.5	1	3	1.5	1	2	1	3
SPV 64	1	2	1	3	2	2	1.5	1	3
SPV 43	5	1	1	4.5	2	3	4	1	3.5
SPV 71	3	2	1	3	3	3	1	1	2.5
SPV 55	1	1.5	1.5	3.5	3	1.5	2.5	1	4
SPV 56	1	1	1	3.5	3	3.0	2	1	3.5

[1]Scales used for this table: Carotene color. 1 = white, 3 = yellow, 5 = orange. Grayness. 1 = white, 5 = gray. Greenness. 1 = white, 4 = greenish. Appearance. 1 = poorest, 5 = best. Softness. 1 = hard, 5 = very soft. Texture. 1 = dry, 5 = moist. Sweetness. 1 = not sweet, 5 = very sweet. Fiber. 1 = none, 5 = much. Rating. 1 = poorest, 5 = best.

TABLE 5.—*Characteristics of 13 sweet, staple or sub-staple sweet potatoes on frying as chips and as French fries*[1]

Selection	Carotene color	Sweetness	Taste	Attractiveness	Crispness	Rating	Attractiveness	Firmness	Lack of sweetness	Flavor	Rating
SPV 46	Orange	3	4	4	3	3.5	3	3	1	2	2.5
SPV 66	Yellow	1.5	3	3	2	3	3	3	4	3	3.5
SPV 63	Yellow	1.5	3.8	5	2.5	4.5	4.5	1.5	3	4	3.5
SPV 60	White	1.5	3.5	3	4	4	5	3	4	4	5
SPV 70	White	1	3	4	4	3	4.5	2	5	4	3
SPV 65	Dark cream	1	4	4	4	4	4.5	3	4.5	4	4
SPV 52	White	2	4	4	2	4	4	4	4	4	4
SPV 44	White	1.5	4	4	4	4	4	2	2	3	3
SPV 64	White and brown	1	3	3	3	3.5	4	4	4	4	4
SPV 43	Orange	3	3.5	4	4	4	4.5	3	4.5	4	4
SPV 71	Yellow	1	4	4	3	4	4	3	4	4	4
SPV 55	White	2	4	4	2	4	4	4	4	4	4
SPV 56	White	1.5	4	3	4	4	4	3	5	4	4

[1]Scales used for this table: Sweetness. 1 = not sweet, 3 = sweet. Taste. 1 = poorest, 5 = best. Attractiveness. 1 = least, 5 = most. Crispness. 1 = none, 5 = very crisp. Firmness. 1 = limp, 5 = rigid. Lack of sweetness. 1 = sweet, 5 = not sweet. Ratings. 1 = poorest, 5 = best.

TABLE 6.—*Summary ratings of 13 sweet potatoe selections*

Selection	Ratings						
	Before cooking	Boiling[1]	Mashing	Baking	Chips	Fries	Final score[2]
SPV 44	4.0	3.8	4.5	3.0	3.5	2.5	21.3
SPV 66	3.0	3.0	4.0	3.0	3.0	3.5	19.5
SPV 63	4.0	3.5	5.0	4.0	4.5	3.0	24.0
SPV 60	4.5	3.1	3.5	2.0	4.0	5.0	22.1
SPV 70	3.5	3.7	5.0	4.0	4.0	3.0	23.2
SPV 65	3.5	2.7	4.5	2.0	4.0	4.0	20.7
SPV 52	4.0	1.9	4.5	2.0	4.0	3.0	19.4
SPV 44	4.5	3.9	4.5	3.0	4.0	3.0	22.9
SPV 64	3.5	3.4	4.0	3.0	3.5	4.0	21.4
SPV 43	4.0	3.4	4.0	3.5	3.5	3.0	21.0
SPV 71	3.5	4.2	4.0	2.5	4.0	4.0	22.2
SPV 55	3.0	3.3	5.0	4.0	4.0	4.0	23.3
SPV 56	4.0	3.5	4.0	3.5	4.0	4.0	23.0

[1]Boiling was rated in a previous test.[7]

[2]Final score: Determined by addition of all ratings.

ments. In the current experiments the judgment of mashed sweet potatoes by the trained panel was fairly consistent with the judgment of the investigators.

High quality in several characteristics is necessary for a really great sweet potato, and yet some sweet potatoes can be very good for some purposes and not for others. The non-sweet selection SPV 52 is poor boiled, but better mashed. Selection SPV 70, is non-sweet, similar to mashed Irish potatoes, and very good baked. SPV 60 is an excellent selection for french fries, whereas SPV 63 is best for fried chips.

Among the selections are several that will be released as cultivars for Puerto Rico and the Caribbean. Excellent quality features are necessary in a new cultivar, but other characteristics (yield, resistance) are also necessary.

RESUMEN

Características culinarias de nuevas selecciones de batata

Trece nuevas selecciones de batata se evaluaron para calidad al hervir y majar, hornear y freír en rodajas o en tiras. Las selecciones las evaluaron dos investigadores entrenados o, en el caso de las majadas, un grupo de catadores. Las batatas resultaron de alta calidad y apropiadas para la mayoría de los propósitos. Las selecciones pobres en dulzura, sin embargo, eran más apropiadas para freír que para hornear. Al majar la batata se mejora su apariencia y su textura. De las selecciones no dulces, la SPV 70 (Margarita) fue de calidad superior; la SPV 70 entre extremos, y la SPV 52 la peor del grupo. Las selecciones de batatas frecuentemente resultaron adecuadas para un propósito, pero no para otros.