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IDENTIFICATION OF QUALITY CHARACTERISTICS OF SWEET POTATO
USED AS A STAPLE FOOD IN THE CARIBBEAN

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The potential of the sweet potato in the tropics is an everyday staple. A chief limitation to achieving this potential is lack of quality. The quality features of the sweet potato at the table are attractiveness, softness, mouthfeel, fiber, and flavor. Quality in appearance is having a uniform color, and the absence of gray and greenish tints, and of cracks and erosion. Quality in mouthfeel is an intermediate sensation, neither too moist nor too dry and choking. Quality in flavor is complex. It involves lack of strong flavors, blandness, and a low amount of sweetness. Observations and experimental data are mustedered to demonstrate these characteristics.

The sweet potato would appear to have a great future as a staple food crop in the tropics. Already 7th among world crops (FAO, 1978), the sweet potato is the only one of the roots and tubers that can be planted or harvested any day of the year. As compared to most tropical roots and tubers, the season of production is short. The principle edible product is not used for replanting. All residues of the crop are suitable as animal food. Furthermore, the sweet potato is widely adapted.

Nevertheless, except for Papua New Guinea, the sweet potato is probably not a dietary staple anywhere. Why is this? I believe it is a question of quality. After wide experience with sweet potato, and perhaps a thousand or more taste tests, I do not believe that I have found a sweet potato that tastes as good as a yam or a potato.

We are in the process of breeding new sweet potato varieties for the tropics. In order to do so we need clear

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concepts of what constitutes quality. Quality is something of an integration of all those individually defined characteristics that can be judged as desirable. While the objective measurement of such characteristics may require years of development, nevertheless, some definitions of quality are needed now. It is my intention here to call to your attention quality characteristics of staple type sweet potatoes, and what we know about them.

A considerable amount of thought as well as experimental study has gone into the task of defining sweet potato quality in the United States. In the South, quality is considered to include an intense orange color, a moist feel in the mouth (mouthfeel), and a very sweet taste (S101 Technical Committee, 1980). Quality is also influenced by as yet undefined but recognizable flavor attributes. These characteristics are related to consumer preferences within the area where these sweet potatoes are grown and marketed. People who are not familiar with such sweet potatoes find them to have an oily or a carrot-like flavor. In addition, many persons prefer a different, somewhat drier mouthfeel, that appears to be more satisfying psychologically. The orange, moist, sweet type of sweet potato appears to be useful as a dessert type vegetable, used for special purposes and special occasions, and is not appealing for everyday use as a staple.

The popularity of Cuban "boniatos" (native sweet potatoes, usually white to light yellow before cooking) demonstrates that there are other valid standards for sweet potato quality (Rodríguez, 1970). Experience in the eastern Caribbean points to such varieties as the preferred, popular, and likely to be used daily (Baynes, 1972). Our own studies of preference in Puerto Rico revealed two poles of preference, one for the orange, moist, sweet, and the other for the white, dry, non-sweet. These regional preferences must be considered in breeding sweet potatoes for Latin America and the Caribbean.

I shall describe the principal table quality characteristics as they appear to me. Without a doubt the first characteristic is appearance. Appearance depends to a great extent on color.

A good sweet potato should be attractive in color before and after cooking. Color may vary, but should be uniform and free of minor discolorations or irregularities before cooking. Excess latex, which exudes on peeling and slicing, and polyphenolic oxidation, giving rise to grayish or brownish spots, detract from appearance. Discoloration after cutting is a function of the interaction of several different enzymes and

several different polyphenols, and may be inhibited by naturally occurring ascorbic acid. The system is greatly influenced by temperatures, storage, and processing conditions (Arthur and McLemore, 1956). In cooked sweet potatoes common color defects are gray, khaki green, irregular purple spots, marbelling, and blotchy appearance. Some of the blotchy gray color occurs after boiling when the cooked pieces are exposed to the air. This and uniform gray color that appears on cooking otherwise white sweet potatoes have not been fully explained. Greenish colors, in our work, appear to be associated with epoxy derivatives of carotenoids, particularly of the precursors of Beta-carotene.

Minor characteristics associated with appearance are cracking, usually radial, and erosion of the cooked piece. Erosion may be severe in excessively soft sweet potatoes.

Sweet potatoes that are attractive, according to the above standards, are rare in the Caribbean. Among thousands of seedlings, about 10 per cent, can be expected to have an acceptable appearance, but less than one per cent approach the optimum.

Softness of the cooked sweet potato is a characteristic that is influenced by cooking time. A good sweet potato should be coherent, yet soft. It should not erode during boiling. A few sweet potatoes erode excessively and prolonged cooking will break them down entirely. A few sweet potatoes harden with cooking and are so dry that they are difficult to eat. Most sweet potatoes are adequate with respect to softness and 2.5 cm slices can be cooked to softness in 20 minutes.

Sweet potatoes differ in the way they feel in the mouth. Some feel moist while others feel dry. A dry but not extremely dry mouthfeel appears to be very satisfying to the palate. When sweet potatoes are extremely dry, they may cause a disagreeable, choking sensation. Mouthfeel is not related to the moisture content of the sweet potato but to properties of starchy fractions, and probably most closely to viscosity (Rao, et al., 1975). Mouthfeel has been found to be related to density. Storage roots that are more dense than normal also have a higher percentage of dry matter and a dryer mouthfeel.

All sweet potatoes contain fiber. The fiber should be fine and unobstrusive, not noticed by the eye or the palate. Excess fiber is seldom an important problem in tropical sweet

potatoes.

Although good flavor is hard to describe, it can be recognized. In West Africa, the preferred flavor is called yam-like, similar to the true yams, *Dioscorea* (IITA, 1981). In Puerto Rico, a good flavor is likely to be described as "rico". Good flavor includes absence of bitterness or "off" flavors, and broad attractiveness. In addition, good flavor probably includes blandness, which might be thought of as the absence of flavor. We have demonstrated this to be true in sweet potatoes, as mentioned later.

The flavor associated with intensive orange color is of considerable importance. In our studies with osmotic diffusion processing we have a product that is orange and yet with a mild flavor, which suggests that Betacarotene itself is not responsible for the oily or carrot-like flavor.

Flavor includes sweetness. A good flavor for a staple food is little or no sweetness (Villareal, 1982). This is an uncommon trait in sweet potatoes. For purpose of evaluation, sweetness should be considered separately from flavor because it can be judged independently. Sweetness changes during storage of the sweet potato and during cooking. During storage sweetness may increase or decrease. This is related to the relative velocity of three processes; the enzymatic breakdown of starch, the synthesis of sucrose, and the consumption of sugars during respiration (Edmond, 1971). On cooking, there is a rapid breakdown of starch and an increase in reducing sugars. This increase is now believed to be due chiefly to hydrolysis of starch, a non-enzymatic process (Picha, 1982).

Sweet potatoes with low sugar contents are rare. Nevertheless, there is a threshold to the sensation of sweetness, and we can expect that less sweet varieties can be developed.

We can think of high quality of the sweet potato as a characteristic limited by any one of its components. To be good a sweet potato must be good in all respects. Thus, it is not strange to say that we have not yet seen high quality sweet potatoes. But we have seen excellence in each component, and this leads us to believe that high quality can be developed.

Recently, we have developed a simple household technique that rapidly improves the eating quality of even the poorest sweet potatoes (Martin and Ruberté, 1982). Under controlled

conditions, much of the sugar, polyphenols, and other substances are removed by osmotic diffusion in water, leaving a product that after cooking is bland in flavor, attractive in appearance, moist to intermediate in mouthfeel, and versatile in uses. We believe that this is the way a staple type sweet potato should be.

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