SENSORY QUALITY OF MANGO FRUIT

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This is actually the second mango meeting held in Hawaii. In developing my talk I came across the Proceedings of the First Territorial Mango Forum held in July 1955 on Maui. Looking through the titles and abstracts of that proceedings, it struck me that although we know a lot more about mango now, not a lot has changed in terms of the types of problems faced as we try to develop a mango industry. Problems still persist with seed weevils, fruit flies, cultivar selection, and uncertainties about taste preferences.

An important aspect of consumer acceptance for any food is its sensory quality. By sensory quality, we mean those characteristics that are perceived by our senses of sight, smell, taste, touch and hearing. Translated to food, these characteristics include color and appearance, aroma, flavor, texture, and sometimes sound. Only if all of these characteristics meet consumer expectations will the product be accepted.

The mango is a rather unique fruit in that there is such a wide variation in sensory characteristics, depending on cultivar. The growing regions for this fruit are widely distributed throughout the world and consumer tastes have developed over long periods of time. If you have ever discussed consumer preferences for mango varieties with people in various parts of the world, you will learn that every region has "the best mangos in the world." I used to attribute this conclusion to regional pride, but I have come to conclude that everyone is right! People like the mangos they have become accustomed to. The explanation is that we come to prefer those things we are familiar with. Let me give you an example to illustrate this point. Many people who grew up eating canned peas prefer them to frozen peas even though frozen peas taste more like fresh peas. This point is a very important one for anyone intending to produce and market mangos in a given market. It is especially important if the market is one which has already been exposed to mangos, where consumers may already have developed a preference. We know that it is very difficult to change consumers' preferences. Ethnic preferences for mangos have not been documented, but are generally accepted as being real. It appears that this may be an area for some research. Regarding marketing mangos in our local market, it makes a difference whether you are marketing to the hotel industry, the tourist industry, markets focused on immigrants, or the supermarket.

There are really two facets to sensory quality. The first is this issue of consumer preference. What are the basic qualities that consumers want in a mango? This information can only be obtained from the marketplace. We need to survey the intended market to determine its preference; this cannot be done in a laboratory. For example, if we want to know if varietal preference differs by ethnic group, then we need to survey those ethnic groups. It is not likely that we can predict consumer acceptance in Minnesota by asking consumers in Hawaii what they like. There is not much published work relating to consumer preferences. About twenty years ago, a study was conducted by Mattern and Pennock (1971) in supermarkets in Puerto Rico to determine the market potential for improved varieties. They concluded that Puerto Rican consumers showed a strong preference for semi-ripe mangos and that coloration and fruit size were very important determinants of acceptance. Color was more important than size. In that study they were measuring purchases; consumers had not yet tasted the mangos. Continued purchases by those consumers is an important matter that would require additional study. Knight (1985), in Florida, in describing criteria for evaluating fruit characters in mango, stated that the North American preference is for a bright, highly-colored fruit with a red or purple blush. This is apparently also the case here in Hawaii. The same is probably not the case for consumer preferences in Asia and Southeast Asia, where different varieties are grown.

Beyond the issue of preference, we also need to know how other factors affect quality. You have heard many speakers here discussing a variety of treatments that may be used for insect and disease

control in mango. Invariably, you have heard about detrimental effects of these treatments on fruit quality. These effects are very important and are something we can measure in the laboratory in a more analytical way, either by chemical and physical methods or by a taste panel.

Appearance

Mangos vary in size and shape from round to oval, flat to full, symmetrical to asymmetrical, and beaked. Their skin color varies from green to yellow, to these colors with blushes of red or reddish purple. Flesh color ranges from a light yellow to vivid orange. Consumer preferences for color, size, and shape may vary from region to region. Appearance is the first impression the consumer gets from the fruit and can be a decisive factor in purchasing. Defects that may be present are thus important: bruising, scalding, scarring, and disease.

Aroma

Mangos are harvested at the physiologically mature, but unripe stage and require ripening to reach the optimum edible stage if eaten as a dessert fruit. Sometimes, however, green and unripened fruit are used for certain products. Full development of the aroma occurs during ripening. The compounds that contribute to the aroma and flavor of mango have been examined and many of them identified. However, none has been identified that has a typical mango aroma. Some of those considered important have coconut-like, peach-like and caramel aromas. However, the presence of many compounds seems to be necessary to achieve the mango aroma.

Lipid compounds appear to be linked with both color and aroma development during ripening. In a study by Gholap et al. (1971), oil extracted from mango pulp contained the following fatty acids: myristic, palmitic, palmitoleic, stearic, oleic, linoleic and linolenic acids. In later work, they found that the ratio between palmitic and palmitoleic acids was important in determining the intensity of mango aroma. If this ratio was >1, the aroma was mild, but if <1, the aroma was strong. The relationship appeared to hold for a number of varieties.

One of the aroma characters is a turpentine aroma found in certain varieties. Acceptance of this aroma is partly a matter of preference, but when it is excessive, it is usually considered undesirable. Certain varieties are more aromatic than others and some have a spicy character.

Taste / Flavor

The flavor characteristics of mango include the aroma components mentioned above. Much of what we attribute to "taste" is, in fact, aroma. To these characteristics are added the important taste components of acidity and sweetness which are perceived by the taste buds on the tongue.

Sweetness in mango is a function of the sugars present. The primary sugars are glucose, fructose, and sucrose, with sucrose predominating. The simple measure of sugars is percent total soluble solids (%TSS) in the flesh of the fruit. The %TSS increases during maturity and also after harvest, during ripening, when starch is converted to sugar in the fruit. However, if the fruit is allowed to ripen on the tree, the %TSS will actually decline. The %TSS of ripe mangos varies with variety, ranging from 14 to 24.

The other critical taste component is acidity which is imparted by organic acids, predominantly citric acid. Acidity is very high in young fruit and declines as the fruit approaches maturity. At maturity, the acidity can be as high as 3 percent titratable acidity or 0.5 to 1.0 percent in most of the Florida varieties. During the ripening process, the percent titratable acidity declines to as low as 0.1 to 0.2 percent.

It is the balance between the sugars and acids that provide the pleasant sweetness of mango. If this ratio between %TSS and percent titratable acidity is too low, the fruit will be too tart; if it is too high, the fruit will taste too sweet and bland.

Texture

Generally, smoothness, rather than fibrousness, is desirable in a mango. This characteristic is largely a function of the variety and can be a determining factor in acceptability. Knight discusses this characteristic in terms of the abundance of the fiber and its fineness or coarseness. He feels that the presence of abundant, but fine fiber is desirable to protect the fruit from damage during handling. A fiberless fruit may not be a good shipper. Juiciness is another sensory characteristic contributing to acceptability and is related to variety.

Factors Determining Sensory Characteristics

Any of these sensory characteristics may be a limiting factor in determining acceptability of a mango by the consumer. Variety is a major factor in determining these characteristics, but there are other factors as well.

The time of harvest, ripening conditions,

treatments, and storage and handling conditions can play a significant role in modifying the appearance, aroma, taste, and texture of this fruit.

We should also consider the quality characteristics that may be required for a processed product for these may be different than for a fresh, dessert fruit. These characteristics may vary depending on the type of processing that will occur, whether it will be heated, frozen, dried, etc.

The bottom line is a successful mango industry will depend on determining the wants of the marketplace and the selection and handling of fruit to meet those requirements.

References

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Q: What about the local preference for 'Haden' mangos? I hear people at this conference saying it is not such a good fruit.

A: We need to examine those established preferences and consider factors such as color, size, and fibrousness in choosing what to grow. It does not have to be 'Haden', but could be something like it, or something better. If you try to predict what consumers might like based on your personal preferences, you are on dangerous ground. You can learn a lot from evaluating what consumers find acceptable now, what they are buying. Certainly, 'Haden' seems to be quite well accepted in the local market. Consumer preference do change, however.

Q: What are the major varieties grown in Florida?

Dr. Davenport: Our two major ones are 'Tommy Atkins' and 'Keitt'. Nobody argues the fact that 'Tommy Atkins' is an inferior tasting and somewhat fibrous mango, but the people who buy mangos in the U.S. generally do not know the difference, even in Florida. They think it tastes great; they do not know there is something that tastes better. They see a beautifully colored fruit, and so by and large they demand 'Tommy Atkins'. We focused on these because 'Tommy Atkins' is attractive and easy to sell, and 'Keitt' is a later variety that extends our season into August. The 'Van Dyke' is another colorful mango being planted recently because people thought it was a good producer, but they are discovering that it only produces 50-75 percent of the yield of 'Tommy Atkins'. Production rather than quality was the factor that led to planting 'Van Dyke', but production is not an unimportant consideration. There used to be a 'Haden' industry in Florida, but it died because 'Haden' does not ship well.