

Future consumption will depend upon efforts to have quality products available.

Quality in relation to marketability of fresh fruits and vegetables

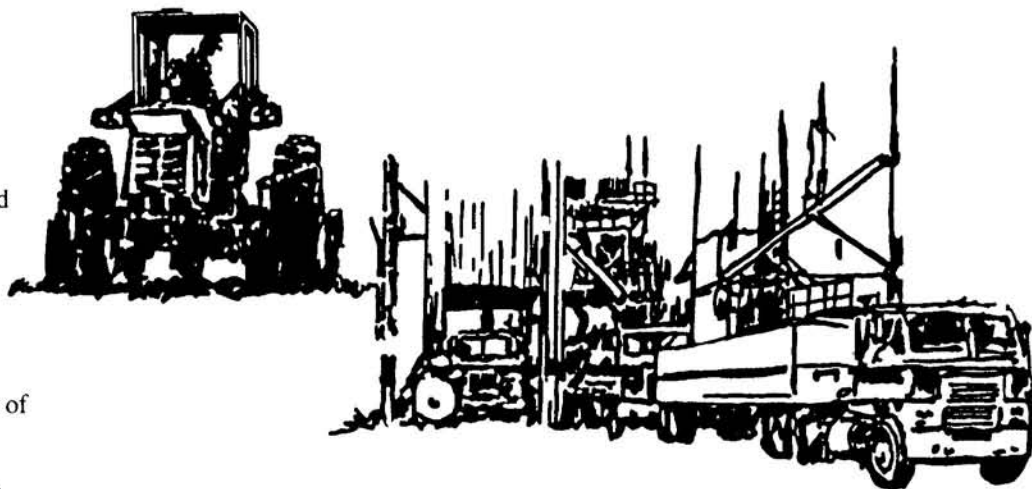
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Consumers' concerns about diet and nutrition, health and safety, quality and freshness, and cost aspects of food continue to result in shifts in food consumption patterns. Per capita consumption of fresh fruits and vegetables in the U.S. continues an upward trend. For example, between 1967 and 1982 per capita consumption of fresh fruits, melons and vegetables increased by 6.6%, 4.0% and 12.6%, respectively. Future consumption trade will depend upon continued efforts by producers and handlers to make available a year-round supply of good quality fresh horticultural crops to the consumers in both the domestic and export markets. Increasing concentrations of wholesale-retail buyers and increased importance of produce sections within retail distribution centers are resulting in demands for greater variety, larger volume and stricter quality control at shipping point.

In all marketing operations, highest attention should be given to quality maintenance between harvest and consumption. Quality, as the degree of excellence, is a combination of many attributes that give each commodity value in terms of human food.

Attributes in quality

- *Appearance quality factors:* size, shape, color, gloss, freedom from defects and decay, freshness.
- *Textural quality factors:* firmness, crispness, juiciness, mealiness, toughness.
- *Flavor quality factors:* sweetness, sourness (acidity), astringency, bitterness, aroma, and off-flavors.
- *Nutritional quality factors:* vitamins (A, B, C), minerals, dietary fiber, carbohydrates, proteins.
- *Safety factors:* levels of naturally occurring toxicants in certain crops,



contaminants (e.g., residues of agricultural chemicals, heavy metals), mycotoxine.

The relative importance of each quality component depends upon the commodity and its intended use (e.g., fresh or processed) and varies among producers, handlers, and consumers. To producers a given commodity must have high yield and good appearance, must be easy to harvest, and must withstand long-distance shipping to markets. Appearance quality, firmness, and shelf-life are important from the point of view of wholesale and retail marketers. Consumers judge quality of fresh fruits and vegetables on the basis of appearance (including "freshness") and firmness at the time of initial purchase. Subsequent purchases depend upon the consumer's satisfaction in terms of flavor (eating) quality of the product. Consumers are also concerned about the nutritional quality and safety of fresh fruits and vegetables.

Maturity vs quality

Maturity indices are important for deciding when to harvest each commodity or cultivar within a commodity. In most cases, currently-used maturity indices are based on a compromise between those that would ensure best eating quality to the consumer and those which provide the needed flexibility in marketing.

All fruits and mature fruit-vegetables, with a few exceptions (e.g., pears, avocados and bananas), reach their best eating quality when allowed to ripen on the tree or plant. However, most fruits are picked mature but unripe so that they can withstand long-distance shipping. This results in less than optimum quality to the consumer.

For most non-fruit and immature-fruit vegetables, the optimum eating quality is reached before full maturity. Delayed harvest results in lower quality and faster deterioration after harvest.

The ability to pick fresh fruits and vegetables near their peak flavor quality and make them available to consumers within hours of harvest is one of the major reasons for continued expansion of direct marketing operations (farmers markets, roadside stands, pick-your-own operations).

Quality standards

Grade standards have been developed to identify the degrees of quality in the various commodities and thereby aid in establishing their usability and value. Grade standards provide a common language for trading among growers, handlers, processors, and receivers at wholesale markets. The end aim is to bring consumers the quality of product they want, but this does not always happen.

Quality

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The U.S. standards for grades of fresh fruits and vegetables are voluntary except when their use is required by certain state and local regulations, industry marketing orders (federal or state), produce procurement agencies, or importers. Some states, such as California, have their own standards for quality of fresh horticultural crops. These are mandatory minimum standards to protect the reputation of the state producers and ensure a certain level of quality to the consumer.

The cost of inspection for enforcing the U.S. standards is paid by the person who requests it while the cost of enforcing state standards is paid by the state's taxpayers. Budget limitations, in recent years, have resulted in reductions in the number of inspectors who enforce the California state code. Consequently, there is a significant quantity of below-standard fresh fruits and vegetables that reaches the markets.

Many improvements are needed in federal and state quality standards. Following are some proposed changes which should be considered if they are not already under consideration:

1. Use of uniform grade nomenclature.
2. Including some of the flavor and nutritional quality factors in these standards which currently emphasize appearance quality for most commodities.
3. Increased use of more objective criteria for maturity and quality evaluation procedures.
4. Improved enforcement procedures.
5. Establishing a system for periodic review and update of all grade standards to reflect changes in cultivars and technology of grading and measurement of quality attributes.

Quality control

An effective quality control (Quality Control) system throughout the handling steps between harvest and retail display (Table 1) is essential to providing a consistently good quality supply of fresh fruits and vegetables. Quality Control procedures are essential to continued success in marketing via protection of the label's reputation and consistency of delivering good quality products to the consumers.

Quality Control personnel should devote full time and attention to their function and should have the authority to make needed changes in the handling operations when needed to obtain and maintain the quality needed. They should also be involved in training appropriate workers within their organizations on importance of quality attributes of each commodity and procedures for postharvest quality maintenance.

Currently, there are many attempts to automate separation of a given commodity into various grades and elimination of defective units. The availability of low-cost microcomputers and solid-state imaging systems have made computer-aided video inspection on the packing line a practical reality. Solid-state video camera or light reflectance systems can be used for detection of external defects, while x-ray or light transmittance systems can be used for detecting internal defects. Further developments of these systems to provide greater reliability and efficiency will be very helpful in quality control efforts.

Future needs in research

These are areas in which research must focus:

1. Working with horticultural plant breeders, continue efforts aimed at

development of new cultivars of fruits and vegetables that have better flavor and nutritional quality as well as good shipping ability.

2. Conduct consumer acceptance research to relate currently used maturity and quality indices to the final organoleptic acceptability by the consumer.

3. Evaluate state and federal grade standards and other quality control procedures used for fresh horticultural crops in relation to consumer demands.

4. Develop methods of improving the enforcement of current minimum maturity and quality standards to ensure better quality for the consumer.

5. Find alternative methods for disease and insect control to decrease the use of chemical fungicides and insecticides and improve safety of fresh fruits and vegetables.

6. Evaluate the marketing potential for new commodities, new varieties, and new ways of presenting fresh horticultural crops to consumers.

7. Expand the current extension programs in postharvest technology and marketing of horticultural crops to reach a larger percentage of handlers, receivers, marketers, and consumers with information about proper procedures for quality maintenance between harvest and consumption. □

TABLE 1—Quality Control Procedures

Operation	Procedures
Harvesting:	Check proper maturity and quality.
Preparation for Market:	Monitor effectiveness of the various steps (washing, sorting, waxing, sizing, fungicide treatment, etc.). Check culls to determine causes of cullage and sorting accuracy. Check shipping containers and other packing materials vs specifications. Check packed containers for compliance with grade, size and weight regulations.
Cooling:	Monitor product temperature at key points in the handling system, especially before and after cooling.
Transportation:	Check transit vehicles for cleanliness and cooling before loading, loading pattern, load immobilization, thermostat setting, and placement of recording thermometer.
Destination Markets:	Check quality and condition of the product and shipping container.