What is quality? Definitions of quality differ, especially among scientists, who define quality in reference to their field of interest. For example, plant breeders would define quality in reference to physical characteristics, yield, and disease resistance of plants. Human nutritionists would define quality in reference to chemical components of food, such as vitamins, mineral elements, carbohydrates, and proteins. Consumers would refer to sensory attributes in defining quality. However, quality cannot be defined adequately by referring only to these specific attributes. As stated by Kramer and Twigg (1), quality is the composite of those characteristics that differentiate individual items of a product and have significance in determining the degree of acceptability of the item to the buyer. Thus, those of us seeking to improve postharvest technology must refer to all of the above factors — chemical composition and physical, sensory and other attributes of horticultural crops — in defining quality.

Just what attributes should we measure to evaluate postharvest quality? A review of articles in our Society’s journal shows that factors that affect consumer choice, such as physical characteristics, appearance, and color, were examined commonly. Many people present data on soluble solids content, titratable acid content, and firmness. All of these can be measured readily, but the relationship between these objective measurements and subjective responses are not clearly understood for all products. Only a limited number of people make subjective analysis of sensory attributes such as taste, flavor, and texture, which affect consumer satisfaction. These sensory response factors are equally as important as other factors in assessing quality and should be given a comparable amount of attention. Ideally, a good subjective analysis should be made concurrently with objective analysis to substantiate the effectiveness of the objective analysis. I recognize that this is not always feasible, due to limitations on personnel, equipment, or facilities; thus, we need to select appropriate attributes for analysis, and undertake the analysis correctly.

What are the correct procedures for determining quality by sensory and objective methods? Examination of our journal indicates that methods of analysis differ widely and are changing continually as technology advances. I will briefly describe some of the significant changes that resulted with time and some of the problems associated with these changes.

Problems with subjective sensory evaluation

About 30 years ago, in 1948, evaluation of taste and/or flavor was based on the judgment of the scientist and his co-workers, and results were reported in terms chosen by the scientists. By 1958, hedonic scales were in use, but with untrained panelists, and by 1968, scientists used trained panelists for analysis. In the past year, of the 10 papers on sensory analysis, a few papers described the use of methods comparable to those practiced 30 years ago and only 3 papers described the use of trained panelists.

Sensory response is a complex subject, particularly when psychophysics and psychochemistry are considered. In recent years, a considerable number of papers have been published in various journals on psychophysical, psychochemical, and other factors that should be considered for effective sensory analysis. We horticulturists need to recognize the complexity of sensory response and develop analytical procedures on the basis of current knowledge. Refinement and improvement of sensory analysis is essential, particularly in studies in which the results of subjective studies are compared with results of technically advanced, highly refined objective analyses. In addition, we need to use current knowledge fully and agree on standard techniques for sensory analysis.

Problems with objective color evaluation

In 1948, 6 papers were published on the evaluation of color; 2 papers described the evaluation of color without any guide, 2 papers described the use of color guides such as the Maxwell disc and reported the values according to Munsell notation, and 2 papers reported color on the basis of spectrophotometric readings of plant pigment extracts. In 1958, papers were published on the use of color difference meters, which gave reflectance readings of either whole tissue or macerates. About 10 years ago, in 1967, a technique for measuring optical density of a whole fruit was described. This technique could be used to assess internal color and/or characteristics without destroying the fruit. In the past few years, the number of papers on color evaluation increased to an average of 16 per year, and methods of analysis differed widely. A few papers described evaluation of color solely on visual judgment without guide, which limits the reader’s appreciation for true color and color changes. A few papers failed to comment on the physical environment of analysis, which under noncontrolled condition can affect both visual judgment and objective readings. In a few papers, only instrument readings were presented to describe color. Instrument readings have no meaning as to color. Color is a complex subject and all instruments do not use the same principle to measure color. Thus, the problem of not understanding the relationship between instrument reading and color is compounded by the difficulty in understanding the relationship between readings obtained with diverse instruments. This problem is simplified or intensified, depending on one’s viewpoint, with development of highly sophisticated equipment, which unfortunately is available only in a few laboratories.

Problems with objective texture evaluation

Firmness probably was the first textural attribute to be evaluated, and a plunger-type pressure tester was developed for measuring the attribute objectively. About 20 years ago, in 1957, a technique of measuring resistance to compression of a whole fruit was described for determining firmness nondestructively. About 10 years ago, in 1967, the technique of measuring sonic vibrational properties of a fruit was described for determining firmness and other textural characteristics nondestructively. This and other nondestructive methods of determining textural quality have tremendous potential for use in both research studies and commercial application. In addition to these methods, other methods of measuring textural quality have been developed; however, in all these methods relating sensory response with the objective measurements is difficult. Advancements have been made in qualifying and quantifying textural attributes by analyzing the deformation curve of a tissue during compression; however, these studies generally have been limited to tissues that are homogeneous. We have the challenge of implementing this type of technique in studies where the sample material is heterogeneous and complex.

Summary

In summary, the selection of attribute and method of analysis must be made appropriately for effective quality evaluation. Procedures for analysis must be modified as technology advances to minimize variation and errors within and among studies. However, as changes and advancements are made, it is imperative that scientists understand the principles and are able to recognize the pitfalls of a technique. The authors who follow will elaborate on these points and give us guidance on use of improved methods for evaluating quality. Appreciation of these factors will be helpful in obtaining data that can be used effectively by other scientists and in using the study as a base for establishing improved techniques of grading fruits and vegetables.