

# How to Use a Color Chart

## Objectives:

1. Teach how fruit and vegetable color can be utilized as an indicator of quality and market value.
2. Provide resources for obtaining or making your own color chart.

## Key Concepts:

Fruits and vegetables exist in a wide range of colors, which may change as they mature. Color is used as a simple means of determining quality, maturity and market value. Farmers, postharvest handlers and traders may receive payment based in part on the color of their fruits and vegetables, depending on the intended market. Kitinoja (2012) cites examples of 10-15% increases in market value after sorting and packing tomatoes in India, chili peppers in West Africa and cucumbers in Lebanon. Sorting and packing by color and maturity may help extend produce shelf life by protecting a portion of the lot from early ripening. Ripe fruits can be packed separately and sold immediately, while less mature fruits can be packed and stored for a few days before taking them to the market.

Immature fruits and vegetables are typically green in color, due to a high concentration of chlorophyll, which is instrumental in photosynthesis and plant growth. As fruits and vegetables grow and mature, chlorophyll is degraded and other pigments increase in concentration. Water soluble pigments such as the phenolics impart colors from blue to purple and brown while fat soluble pigments such as the carotenoids are yellow, orange and red. Examples of color changes during maturation of various fruits and vegetables are illustrated (Kader and Cantwell 2010).



Photo credit: Adel Kader (bananas) and Marita Cantwell (tomatoes)

## The Background Material:

Measurement of color by eye is common, but quantification is enhanced and standardized if color is compared to some type of standard. Depending on the time of day, type of lighting available, tiredness of the observer, etc., an individual's evaluation of color may vary. For this reason, color charts have been developed by national, state and industry associations to improve evaluations that may otherwise be subjective and make them more objective. Use of color charts and uniform lighting environments allows for normalization of the measurements of different observers.

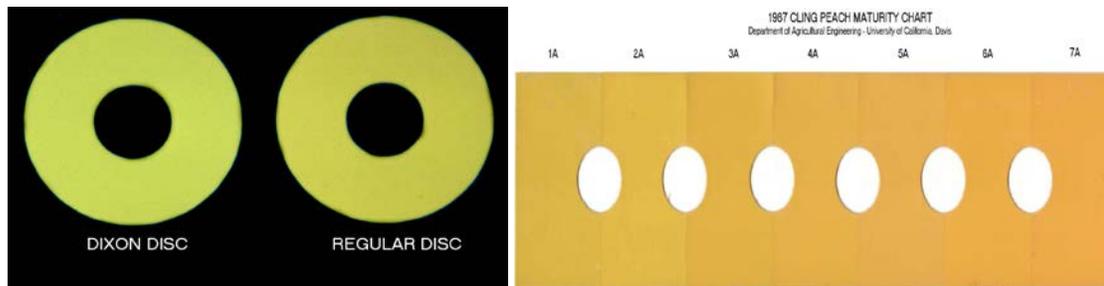
Resources providing sample color charts for fruits and vegetables include the United States Department of Agriculture's Fruit and Vegetable Programs Inspection Service (USDA, 2013) and the Postharvest Technology Research and Information Center at the University of California, Davis (Kader and Cantwell, 2010). Other potential resources include state inspection services, industry associations or individual postharvest handlers or processors.

## Materials Required:

The USDA sells plastic standards that may be used to determine the minimum color required for various fresh and processed fruits and vegetables. In some of these plastic standards, there is a hole provided for placing the commodity of interest up to the standard so that its color may be observed next to the standard color.

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See examples for different peach varieties (left) and color standards from 1A-7A (right) as examples below. In other standards there is no hole, but the plastic tile is placed next to the produce. The UC Davis resource is sold as both a CD and a paper binder containing a multitude of fruits and vegetables (arranged from A to Z), with scales determined based on either color or the presence of a defect. This resource has established a consistent method of scoring based on a 1-9 scale.



Another option used by many private companies and researchers is to create your own color chart. This may be done by first determining the range of colors you are interested in, or may expect to encounter in the fruit or vegetable of interest, and making those extremes the number '1' and '9' of your scale. Then sort the commodity into fairly equal intervals, based on the population you have, and assign these intervals numbers between 2 and 8 on the scale. Finally, take color photos of each point in the scale, copy and laminate these if possible and distribute them to all of the participants in your postharvest chain.

## How Learning Will Be Reinforced/Evaluated

Students should be allowed to practice using various commercially available color charts to measure color in a range of fruits and vegetables. A digital camera and printer should be available, and students should be asked to make their own color charts according to the procedure described above.

## Discussion questions

1. Why might it be financially beneficial to color sort fruits and vegetables?
2. Where can one obtain standardized color charts?
3. How would one create their own color chart?

## References

Kader, A.A. and M.I. Cantwell. 2010. Produce quality rating scales, 2<sup>nd</sup> edition. Postharvest Technology Research and Information Center, University of California, Davis.

Kitinoja, L. 2012. Color Charts. Postharvest Innovations Plan Series No. 4. Postharvest Innovations LLC <http://www.postharvestinnovations.com>

Postharvest Technology Center (UC Davis) <http://postharvest.ucdavis.edu>  
Small-scale postharvest handling practices: A manual for horticultural crops (Chapter 3)  
<http://ucce.ucdavis.edu/files/datastore/234-1450.pdf>

The Postharvest Education Foundation <http://www.postharvest.org>

USDA Marketing and Regulator Programs, Agriculture Marketing Service, Fruit & Vegetable Programs Inspection Division. [Equipment Catalog for Fresh and Processed Products Inspections](http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5103563)  
[www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5103563](http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5103563)Cached. Accessed on October 21, 2013.