POSTHARVEST TOOLS AND SUPPLIES KIT
Utilization, Calibration and Maintenance Manual

Dr. Lisa Kitinoja and Dr. Awad Hussein
University of California, Davis
February 2005

This publication is a guide to the proper use and care of the common tools used by commercial operators of packinghouses, cooling facilities, cold storages and transport services and those tools and supplies utilized by educational providers of training in postharvest technology. Each chapter will provide the details on how to operate, calibrate, clean and care for a specific tool or analytical supply used to measure postharvest characteristics of fruits or vegetables. These tools allow the users to measure important quality factors such as firmness and sweetness, which are related to maturity and market value, and pulp temperature or relative humidity of the storage environment, which are related to the predicted storage life of the produce.

Chapter 1: Digital temperature probe; measuring temperatures.
Chapter 2: Firmness or pressure t

Chapter 1: Digital temperature probe; measuring temperatures.

The FlashCheck Pocket Probe Digital Thermometer is a fast, accurate HACCP and quality assurance tool that allows you to quickly determine temperatures of foods throughout handling, preparation, and storage. You can check the pulp temperature of produce within 10 seconds by inserting the tip of the probe into the item. If you do not want to damage the produce, you can get an accurate reading of the internal temperature by holding the tip of the probe BETWEEN two items for 15 seconds.

The digital probe included in your Postharvest Tool Kit has a stainless steel reduced tip probe that provides a fast response time, a thermistor sensor at the tip of the probe with an accuracy of ± 1.8°F (1°C), and an operating range of -40°F to 302°F (-40°C to 150°C). A rugged ABS unibody structure with a molded steel collar probe construction braces against severe pull and push flex actions. It can be field calibrated, and is waterproof so it can be washed with soap and water for thorough cleaning and sanitization.

Details	
Temperature Range	-40°F to 302°F (-40°C to 150°C)
Accuracy	±1.8°F (20°F to + 165°F) ±1.0°C (-7°C to + 74°C)
Resolution	0.1°F (0.1°C)

to turn the adjustment potentiometer. It may be necessary to grind one slightly smaller than the size of the hole.

2) Mix thoroughly crushed ice in water (60% ice and 40% water) in a cup. You can use the thermometer to be calibrated to do this and it will cool the tip fast. Mix for 1 minute and let sit for 5 minutes.

3) Mix again with probe for 30 seconds. Insert Reference Thermometer, if available, and probe to be calibrated in water approximately 2" deep. Let sit for 5 minutes. The pocket clip on the Digital Probe Thermometer can be clipped over the rim of the cup to hold it in place, See Fig 1. Stir ice and water using probe(s), for 30 seconds. Note Reference Thermometer temperature reading.

4) Using the Flat Tip screwdriver adjust the temperature through the hole on the probe to

DeltaTRAK Technologies ‡9260 Isaac Street, Ste. D ‡Santee, CA 92071
Tel: 800-390-0804 ‡Fax: (619) 596-4829 ‡E-mail: techsupport@deltatrak.com

Chapter 2: Firmness or pressure tester; measuring firmness

Using a firmness tester

The degree of softness or crispiness can be estimated by squeezing produce, or by taking a bite. Objective measurements can be made with inexpensive penetrometers. The most common way to measure firmness is resistance to compression or puncture (pounds-force (lbf). The Effe-gi fruit penetrometer is a hand-held probe with a gauge for pounds-force.

To measure firmness, use fruit that are uniform in temperature, since warm fruit are usually softer than cold fruit. Use fruits that are uniform in size, since large fruit are usually softer than smaller fruit. Make two puncture tests per fruit on larger fruits, once on opposite cheeks, midway between stem and blossom ends. Remove a disc of skin (larger than the tip to be used) and choose the appropriate plunger tip (see below). Hold the fruit against a stationary, hard surface, and force the tip into to fruit at a slow, uniform speed (take 2 seconds) to the scribed line on the tip. Take the reading to the nearest 0.5 lb force.

Appropriate Effi -gi plunger tip sizes to use when measuring firmness in selected fruits:

1.5mm (1/16 inch)	Olive
3 mm (1/8 inch)	Cherry, grape, strawberry
8 mm (5/16 inch)	

HARVESTING - Fruit Testing Equipment

Penetrometer

Penetrometers are used by fruit growers world wide to help determine the harvest times for plums, navel oranges, nectarines, kiwifruit, peaches, and various other stone or pome fruit. The penetrometer included in your kit is made in Italy by Effegi and has been considered the standard penetrometer for fruit growers for decades.

The plunger of the unit is pressed against the fruit and measurements of the pressure can be seen on the gauge. Different varieties will have different rupture points. Can be used hand held or can be mounted on a drill press for additional accuracy.

Each unit comes with appropriate tips, a foam lined carrying case, test tube splash plate, a fruit peeler, a manual and recommended pressure test readings for specific fruits

reading of the penetrometer is the same the scale reading. Do this a few times to ensure the instrument is calibrated correctly.

Selecting the right fruit for testing is as important of making sure your penetrometer is properly calibrated:

Avoid testing undersized or oversized fruit;

Trees you take fruit from should be representative of the entire block's age and vigor;

Use ten or more fruit from many different trees; and

Take comparative readings from fruit that is the same temperature.

Once you've got your sample, measure firmness on each side of the fruit by using a peeler to remove the skin with a single, shallow cut. Avoid taking measurements in bruised areas. Place the fruit on a hard surface never take a measurement by holding the fruit. Push the plunger into the fruit up to the line on the probe, not the plate. Pushing the plunger at a consistent speed is important.

Because of the many variables involved in taking penetrometer readings by hand, it's best to have one well-trained person do the testing for consistency.

Source: http://www.findarticles.com/p/articles/mi_qa3824/is_199809/ai_n8818915

Chapter 3: Refractometer; measuring soluble solids or sugars

Sugars are the major so

Article: HOW TO USE A REFRACTOMETER TO TEST BRIX LEVELS
Brix is the measure of % sugar in a given sample. The instrument which is used to measure brix is called a refractometer.

Step 1
Expose the refractometer measuring surface by lifting the surface cover. Inspect the surface to ensure it is clean. If needed, clean the surface by spraying it with distilled water, and wiping it dry with a delicate cloth. Be careful not to scratch the measuring surface.

Step2
Carefully place a drop of the sample being measured onto the measuring surface. Use a rubber spatula or rod if possible (metal may scratch the prism surface and impair readings).

Spread the sample in a thin and even layer over the measuring surface. Replace the surface cover. Remove any trapped air bubbles from underneath the cover by gently pressing.

Step 3
Look through the eyepiece while holding the refractometer up to a light source.

Step 4

Chapter 4: Sling Psychrometer; measuring relative humidity

Relative humidity has a direct impact on produce quality because as RH% in the packinghouse, storage environment or during transport decreases, the rate of water loss increases. Knowing the RH of the environment in which produce is being handled can assist the postharvest handler to reduce water loss, which is weight loss of the product and decreases its quality (with symptoms of shriveling or wilting) and its quantity (the amount or weight available to sell).

Article: Sling Psychrometer

Relative humidity can be measured by an instrument called a hygrometer. The simplest hygrometer - a sling psychrometer - consists of two thermometers mounted together with a handle attached on a chain. One thermometer is ordinary. The other has a cloth wick over its bulb and is called a wet-bulb thermometer.

When a reading is to be taken, the wick is first dipped in distilled water and then the instrument is whirled around. During the whirling, the water evaporates from the wick, cooling the wet-bulb thermometer. Then the temperatures of both thermometers are read.

The wet-bulb thermometer cools to the lowest value possible in a few minutes. This value is known as the wet-bulb temperature. The drier the air the more the thermometer cools and hence, the lower the wet-bulb temperature.

If the surrounding air is dry, more moisture evaporates from the wick, cooling the wet bulb thermometer more so there is a greater difference between the temperatures of the two thermometers. If the surrounding air is holding as much moisture as possible - that is the relative humidity is 100% - there is no difference between the two temperatures. Meteorologists have worked out charts of these differences for each degree of temperature so that the observer can find relative humidity easily. A sample is shown below:

Partial Relative Humidity Chart for 30° C

Difference Between Dry Bulb and Wet Bulb Temperatures	Relative Humidity
None	100%
0.5°	96%
1.0°	93%
1.5°	89%
9.0°	44%
9.5°	42%
14.5°	19%
15.0°	17%
18.0°	5%

You can make a sling psychrometer by using two commercial thermometers. Wrap the bulb of one tightly with a piece of cloth. Attach the thermometers to a narrow, thin board

with wire or strong tape. Drill a hole in the top of the board and attach a wooden handle to the board with a short piece of chain.

Source: NASA website http://asdwww.larc.nasa.gov/SCOOL/psychrometer.html

Chapter 5: Chlorine test strips; measuring free chlorine in ppm (parts per million).

Measuring the chlorine level in wash water is an important part of assuring produce quality during postharvest handling. The wash water can easily spread disease from one unit of produce to another if the water is not kept clean and sanitized with chlorine bleach (hypochlorite). 100 to 150 ppm is the recommended level of chlorine in wash water that will provide adequate protection when the pH is 6.5

To use Cl Test Strips:
Dip a test strip into the water sample for 5 seconds. Wait 10 seconds and match with the closest color on the color chart found on the package

Chapter 6: pH test strips, measuring acidity or alkalinity

pH test strips provide a simple uncomplicated way of determining the degree of acidity/alkalinity of aqueous solutions. pH test strips can be used for measuring the acidity/alkalinity of washwater samples. If the wash water is found to be too alkaline, muratic acid should be added until the pH level reads 6.5

Simple to use:

Immerse strip and read results in 2 or 3 seconds

Chapter 7: Other useful tools and supplies

Scales

Measurements of produce weight at various points in the handling chain can help postharvest trainers demonstrate how different handling methods, packages, treatments, etc can affect weight loss. Digital scales (battery operated) can be carried to the field or market and used easily during demonstrations.

Calipers

Example: banana calipers used in the tropics to measure diameter of banana fingers to determine fruit grade.

- Quick and easy readings simply by pressing caliper button which squeezes against banana finger and gives diameter in inches.

- Scale: 7/8" to 2" by 1/32"

Sizing rings

Orange Sizing Rings

Used by growers and the USDA to determine sizing of packing house oranges. Each orange size has its own ring constructed of heavy duty poly plastic. Box and inch sizes are clearly marked on the rings. Each individual ring can be removed easily from it's holder to use independently. Six boxes sizes include: 48, 64, 80, 100, 125, & 163.

Ethylene absorbers

Ethylene Absorber Sachets, 9 Gram Sachets

Ryan Ethylene Sachets

The Ethylene Control pellets are sealed in a 5, 9 or 28 gram teabag size pouch. One sachet in an individual box will keep produce fresh and free of ethylene and reduces airborne spores from packing to end-user.

The material and ink on the packaging material is F.D.A. approved. This sachet when exposed to high humidity, will not bleed on your produce, but will allow ethylene gas thru to be oxidized.

The Ethylene Control Pellets are transformed naturally into an organic fertilizer (manganese dioxide).

Applications sachet s

- 5 gram sachets can be used in boxed produce up to 5 kg.
- 9 gram sachets can be used in boxed produce up to 14 kg.
- 28 gram sachets can be used to reduce ethylene gas and control odors in super market reach-in coolers and display cases

Ryan Ethylene Filters

A special honeycomb design allows better air

Harvesting bags

This is an example of a FISKARS® 2-in-1 Harvest Bag. It can be used as both a shoulder harvest bag or a waist harvest bag. The convenient, easy-to-adjust strap quickly changes to accommodate the desired location for use. It is 16" deep and 9" in diameter and can accommodate a wide variety of fruits and vegetables. You can also rinse vegetables right in the heavy

Chapter 8: Sources of postharvest measurement tools, equipment and supplies

QA Supplies
www.qasupplies.com

Cole Parmer
http://www.coleparmer.com/catalog/catalog_toc.asp?cat=1&view=all

iBuys.com Thermometers and Test Strips
PO BOX 117, Franklin, NJ 07416
973-209-4276 |sales@ibuys.com

FrostPro
http://frostpro.virtualfocus.com/catalog/productcatalog.html

USDA website
http://www.ams.usda.gov/fv/fpbdepot.htm