AUGUST 2021

Weigh Measure

The Ripe Mysterious AVOCADO

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The Ripe My
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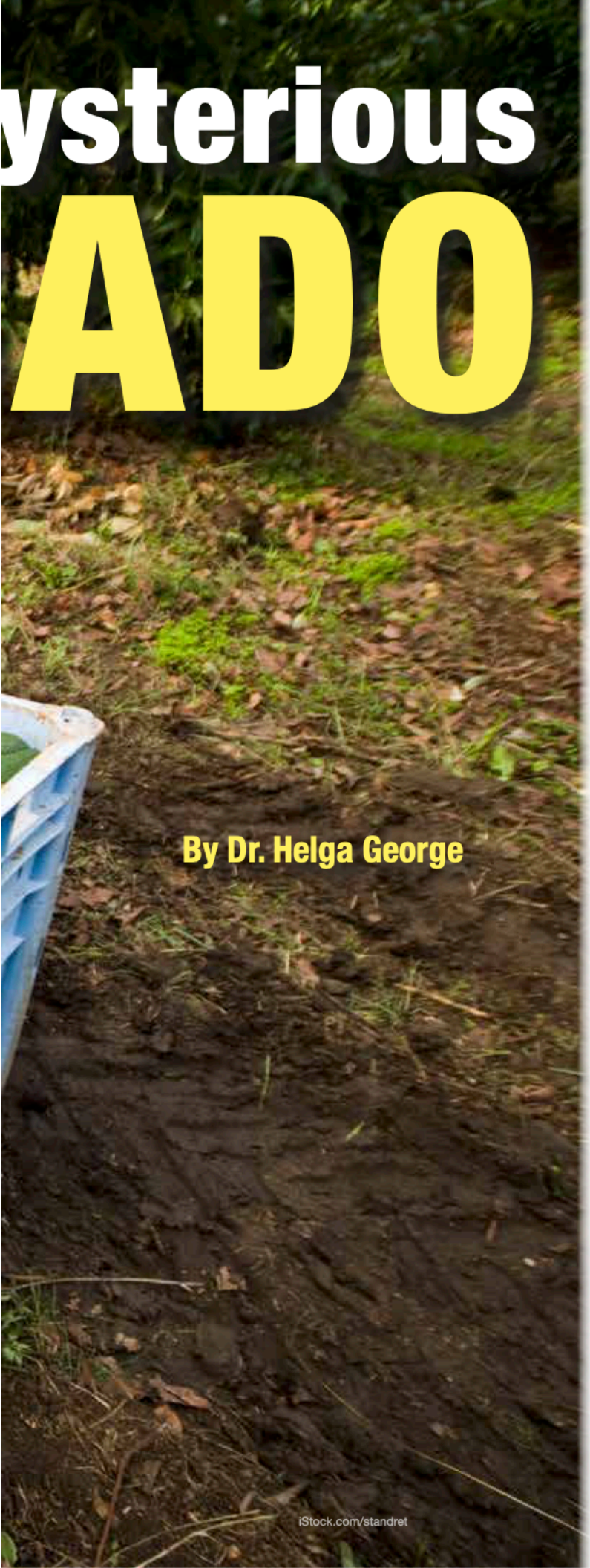
By Dr. Helga George



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Avocados have a storied history that most people are unaware of. As my new neighbor said when I told her I did research on avocados, "What's there to do with an avocado? You just eat it." These fruits are truly miracles of nature. Most people never think of the purpose of fruit. Their biological role is to be eaten by animals, which will disperse the seeds to new areas, so the plants can spread! To keep from being eaten prematurely, unripe avocados are full of foul-tasting compounds to keep animals at bay. The fruit detoxify themselves as they ripen, so they will be enticing to eat.

You might wonder what is large enough to eat an avocado. Scientists think that giant sloths that went extinct about 11,000 years ago originally ate them. "Giant" does not do justice to these sloths that were two stories high and weighed more than a UPS truck.

Avocados have been staple foods in Mexico and southern and central America since 500 BC. They were not always the highly honed and large fruit that we enjoy today. The Aztecs called them "testicle fruit." There are numerous avocado cultivars throughout the world. One of the most famous and the one favored on the West Coast is the Hass. All 10 million Hass trees throughout the world are derived from one tree – part of a grafting experiment conducted by a mailman – Rudolph Hass. He named the fruit after himself. Unfortunately, the original Hass tree met an untimely demise when it succumbed to root rot in 2002.

Avocados Mature Before They Ripen

Most fruits mature and ripen at the same time. However, avocados are not your typical fruit. They mature long before they ripen, and they don't start ripening until they have been picked or fall off the tree. Since the hard green unripe fruit look mostly the same whether they are mature or not, scientists had to figure out an easy way to determine maturity.

The oil content of the fruit is an indicator of its degree of maturity, and measurements of the amount of oil in the fruit used to be the standard way to determine maturity. However, a main chemical used in these tests (chloronapthalene) was found to be carcinogenic, so alternate ways of assessing maturity had to be developed.

Fortunately, scientists discovered that the percentage of water in an avocado decreases as the oil content increases. The dry weight of the fruit increases in parallel with the increase in oils. This led to the development of an easy method to determine the maturity of an avocado fruit that requires only a microwave, a petri dish, a coring device and an analytical scale.

How to Measure Dry Weight in Avocados

California

The state of California provides its method to measure the dry weight of avocados in Article 11 Avocados section 1408.3 of the *California Food and Agriculture Code of Regulations*. The number

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of avocados that need to be sampled is based on the number of avocados in section 1408.2.

1. You will need a coring device with an inside diameter of .833 inch. Use the corer to remove a core from the entire width of the fruit at its widest circumference. Discard the seed and remove the seed coat and skin. Cut the core piece in half.
2. Repeat for the number of fruit required.
3. If you have to wait to measure them, immediately put the samples in a sealed plastic bag.
4. Record the weight of a clean Petri dish. This is designated P.
5. Place the core samples on this Petri dish and record the weight, designated F.
6. Put the Petri dish with samples in a 1,000-watt microwave and dry the sample at 50% power for 40 minutes. Adjust the power down as necessary to keep the fruit from charring.
7. Remove the sample from the microwave and measure its weight.
8. Put the sample back in the microwave for five minutes and measure the weight again. If the weight is the same, record it as the dry weight.
9. If there is a difference in weight, repeat step eight until you obtain a constant weight.
10. Calculate the percentage of dry matter using this formula: D-P divided by F-P x 100 = _____% dry matter

The Adam Equipment CQT 202 is used in multiple industries and applications, such as figuring out the dry weight of Avocados.

There are a wide array of analytical scales that can be used to weigh avocado samples to determine their dry weight. Carlos de la Torre, a large-scale avocado grower in southern Florida, prefers to use a CQT 202 scale, one of Adam Equipment's line of Core® Portable Compact Balances. Mr. de la Torre considers it to be reliable and easy to use. This scale has a maximum weight of 200 g. Its lower limit of readability is 0.01 g, and its reproducibility is 0.02 g.

The CQT 202 scale is highly versatile and designed to handle field and laboratory conditions. The scale can be battery operated if you need to use it in the field. You can remove the stainless steel pan for quick cleaning, and the scale will alert you with an audible alarm if you exceed its capacity. Brian Thomas, Adam Equipment's marketing manager, said that he is constantly surprised by the variety of items that people weigh on this scale.

Florida

In contrast to California, the state of Florida does not require avocado growers to provide the dry weight of fruit at the time of sale.

Why Does the Dry Weight of an Avocado Matter?

What's the big deal about harvesting immature fruit? They will ripen and be edible. However, they don't taste anywhere near as good as ripe avocados that have fully matured. Therefore, the avocado industry does its best to keep immature fruit off the market.

In addition, the percentage of dry weight is critical information for the packinghouses that get shipments of fruit from many different producers. This means that they are likely to get fruit that vary in their age and dry weight percentage. This parameter is critical, especially at the beginning of the season.

Avocados at different stages of maturity ripen at different rates. This will complicate decisions on how to handle the fruits at the packinghouses. It is standard to cool the fruit before and while shipping them to their final destination. Different cooling temperatures are used depending on the state of maturity. Boxes or pallets that include avocados of different dry rates will present difficulties for retail stores that require consistently ripe fruit to offer for sale.

If the producers have not provided the dry weight of their fruit, the packinghouses have to determine it. There are minimum maturity standards available for many of the large numbers of varieties of avocados that are grown. For example, the legal standard in California is eight percent oil, which corresponds to 19.1 percent dry matter for Fuerte and 19.8 percent for Hass.

How to Store Avocadoes Based on Their Dry Weight

The Hass Avocado Board provides the range of temperatures used to store and ship Hass avocados that have different dry weights in its *Avocado Quality Manual*. Fruit that are stored at temperatures that are too cold can suffer from postharvest chilling injury, which causes the fruit to turn brown. However, if the dry matter is close to 30 percent, you can store them at 39 ºF. Late season fruit along with those from Mexico can be shipped as low as 38 ºF. The appropriate temperatures are shown below:

- Dry matter >26% – Store at 40 ºF
- Dry matter 23-26% – 42 ºF
- Dry matter <23% – 45 ºF

It should be noted that the dry matter is only one factor in the decision of how much to cool the avocados. The destination of the fruit should be considered, as well as whether the avocados are from early or late in the season.

Packinghouses typically ripen the fruit before it is shipped using rooms of 65-68 ºF with relative humidity of 90-95 percent. The dry

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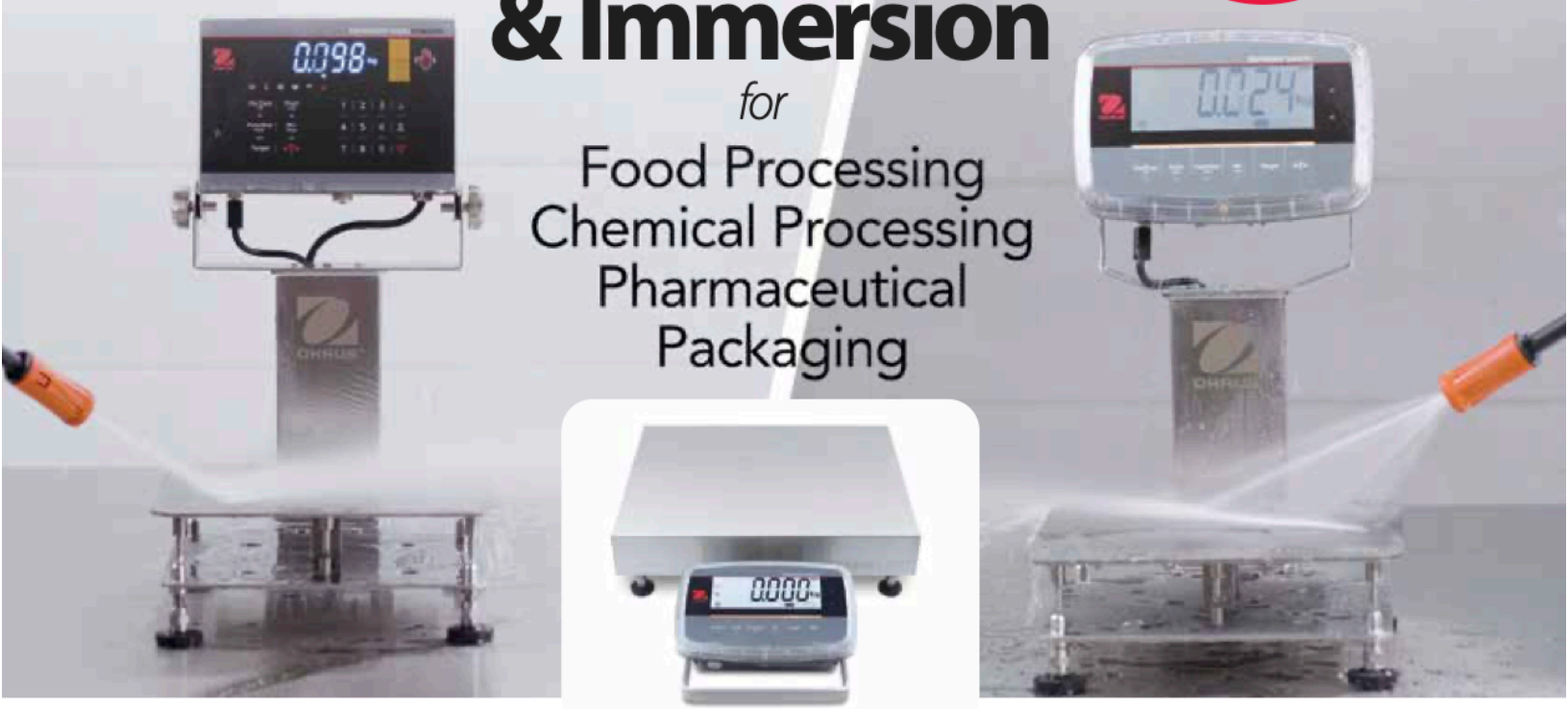

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The Ripe Mysterious Avocado

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weight also determines how long the fruit are stored in ripening rooms as shown below:

- Dry matter >26% 1 day
- Dry matter 23-26° 1-2 days
- Dry matter <23% 2-3 days

This process is to initiate ripening, but it should be stopped before the fruit become ripe.

How Packinghouses Determine the Weight of Avocados

California

Mission Produce, Inc., the world's largest avocado company located in Oxnard, California, provided the information that is the finely honed industry standard for Hass avocados. Packinghouses in California do not weigh avocados to determine their weight. Instead, the weight is determined by the number of avocados that fit in a standard carton called a "lug." This container holds approximately 25 pounds of avocados.

Different varieties of avocados vary in their taste. There is even a variety called Bacon that tastes like its name.

For example, very large avocados that weigh about 13.9 ounces will fill the lug when 28 of these sizable fruit are added. In contrast, if the avocados are small (about 3.7 ounces), it will take 84 of them to fill a lug. Therefore, the smaller the sizing number, the larger the avocado. Each lug will provide the same amount of pulp.

Here is the full range of sizes:

Count	Approximate Ounces
28	13.9
32	11.9
30	10.7
40	10.0
48	7.7
60	5.9
70	5.0
84	3.7

Florida

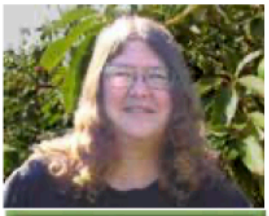
Unlike California, many different varieties of avocados are grown and sold commercially. Avocado packinghouses in Florida weigh the fruit from growers in containers that weigh about 1,000 pounds. This may sound perilous for the avocados. However, since the unripe fruit are extremely hard, they are not damaged during this process.

On to Guacamole

A lot of steps go into getting perfectly ripe avocados for you to purchase to make guacamole or eat raw. If you think that you do not like avocados, just try another variety. Different varieties of avocados vary in their taste. There is even a variety called Bacon that tastes like its name.

Ever since the US agreed to allow the importation of avocados from Mexico, the fruits have been available year round. Although US avocado growers advocated against this legislation, it worked out well for them in the end, since there is now a broad market for the fruit. Just think. There was once a time when you could walk into a supermarket and not find avocados for sale! Fortunately, these delectable and healthy fruits are now commonplace.

About the Author



Dr. Helga George is a scientific copywriter. She was entranced with plants and insects as a child and excited to learn that plants make chemicals to defend themselves. This led her to earn a BS in Agriculture from Cornell University and an MS in Plant Pathology from the University of Massachusetts, Amherst. After that, she returned to Cornell to obtain a doctorate in Plant Pathology where she was thrilled to conduct research on plant defense. She was a Visiting Student Scholar at the University of Arizona after her lab moved there. Helga was a Postdoctoral Fellow at the University of California Santa Barbara where she studied changes in avocados as they ripen and obtained her own USDA grant. A lack of funding in the sciences led her to become a fulltime writer in 2009 when she wrote hundreds of articles explaining science to laymen. Dr. George has a broad range of interests and has written on topics ranging from international relations to cybersecurity. She currently satiates her curiosity about science by writing copy for businesses to explain their products to their buyers. She can be reached at Helga@PlantsRule.com.