

Maturity and Dry Matter Testing

The Industry mandated standard for Hass avocados in terms of maturity was in 2009 updated from 21% to 23% Dry Matter (DM) at time of harvesting. This was based on consumer research showing that consumer acceptance of the quality of avocados declined from approximately 95% to 70% if the DM is below 23% and that up to 70% of consumers would choose 26% DM avocados over 22% DM avocados.

The new standard aims to assist growers and packhouses to achieve the best tasting avocados. The standard for Shepard avocados remains at 21% DM.

Avocados Australia has implemented a project to randomly sample avocados on a monthly basis from the wholesale market and test for DM percentage as a measure of maturity. The aim of this is to provide data to illustrate how the current level of maturity available to consumers' stacks up against consumer preferences as determined in the consumer testing.

Individual results are sent to each of the grower's whose fruit is tested in any one month. The aggregated results of these tests are also reported on the Avocados Australia website.

Deciding when to harvest for optimum quality

Given consumer's preferences for mature Shepard and Hass avocados it is particularly important for growers to be monitoring maturing closely in the lead up to harvest. Below is a guide on how to test DM at home.

The following article is based on the following reports/articles:

- The Avocado Agrilink Manual
- Hofman PJ, O'Farrell PJ (2004) The importance of correctly sampling avocado fruit for maturity testing. *Talking Avocados* 15, 22-24.
- Woolf A, Clark C, Terander E, Phetsomphou V, Hofshi R, Arpaia ML, Boreham D, Wong M, White A (2003) Measuring avocado maturity; ongoing developments. *Orchardist* 76, 40-45

The date when minimum harvest maturity is reached will vary from year to year and according to the location on your property, for each variety. For example, large fruit on the northern and eastern side of the tree, and fruit at the top and outside of the canopy usually mature first. Rootstocks may also have an influence.

Avocado fruit have a number of characteristics which help indicate when the fruit may be getting close to minimum maturity. Judging maturity on these characteristics is not reliable, but with the experience of comparing them with DM testing results, they can help indicate when to start testing. These characteristics include:

- More mature fruit can be larger, but this is not very reliable.
- Skin is dull and lustreless, with a powdery appearance, rather than shiny. The usefulness of this characteristic is variety dependent.
- Fruit stalk is yellow rather than green, and the lenticels may become brown and prominent.
- The seed coat is dark, dry and somewhat shrivelled, rather than pale whitish in colour.

The dates when the fruit have reached minimum maturity in previous seasons is also a useful indicator of when to start maturity testing. Once you think that your fruit may be approaching acceptable maturity, it is important to check by doing a ripening test and a DM test before picking.



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Ripening test

For a ripening test, select at least 10 avocados from trees scattered throughout the block that are representative of the fruit that may be ready for harvest. Sample fruit will show no sign of broken skin, insect stings or disease. Allow the fruit to ripen at room temperature, and examine and taste the fruit when ready to eat. Mature fruit usually ripen within 10 to 15 days without shrivelling, and will have good flavour.

Dry Matter Test

Percent DM is the easiest and relatively accurate maturity test for avocados. The % DM at which you harvest will depend on variety and the intended market. The Australian domestic market standard for Hass is now set at a minimum of 23%. This is based on an average DM over a sample of at least 10 fruit.

The DM test involves weighing a sample of flesh before and after drying. The test can be done at home using a household conventional oven, domestic food dehydrator or a microwave (although this can be less reliable because of the risk of burning the samples). Alternatively, some marketing cooperatives and packhouses offer this service for a fee. Here are the details of the various tests based on methods used by the Department of Agriculture, Fisheries and Forestry (DAFF) formally known as the Department of Employment, Economic Development and Innovation (DEEDI). The three components are sampling the fruit, holding the fruit before DM testing, and weighing and drying the sample. Poor practices in any of these components will result in inaccurate results.

1. Sample preparation

a. Using the grated flesh method

- Harvest at least 10 avocados, making sure that they represent the fruit (size, position on the tree, block etc.) that you intend to harvest.
- Place the fruit in a plastic bag and keep cool. Start the DM test within a few hours of harvest.
- Cut each fruit lengthwise into quarters (stem end to base). Remove the seed as well as any adhering seed coat.
- Select two diagonally opposite quarters from each fruit to provide a total sample of 20 quarters. Peel the 20 quarters.
- Shred the flesh of all 20 quarters using a kitchen grater. Ideally the shreds should be less than 1mm thick. This can be achieved using graters with five cutters per square centimetre.
- Thoroughly mix all of the shredded flesh together.

Or

b. Using the Hofshi Coring Machine (or a similar implement – for small quantities of fruit a hand held cork borer is adequate)

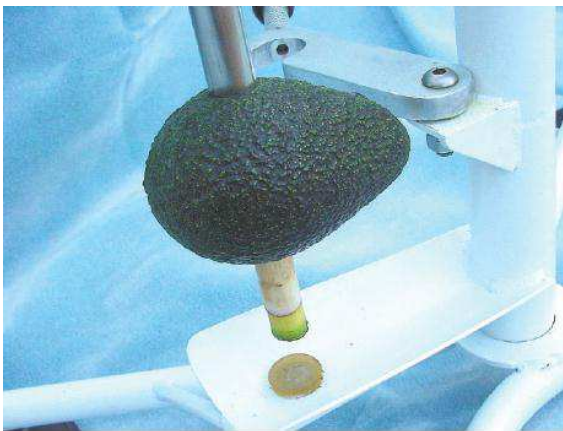
- Bore a 'plug' or core of flesh from the equator of the fruit as seen below. The Hofshi machine pushes a sharpened 15.9 mm metal tube completely through the equator of the fruit, yielding a core of tissue as seen in the below images. The two plugs of flesh generally weigh about 5g (depending on the fruit size).
- Remove the skin and seed coat from the flesh plugs.
- Cut each plug in half so that there are four pieces of flesh from each piece of fruit.



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The Hofshi Corer



Using the Hofshi machine to take an avocado core sample



A core sample of fruit taken by the Hofshi machine

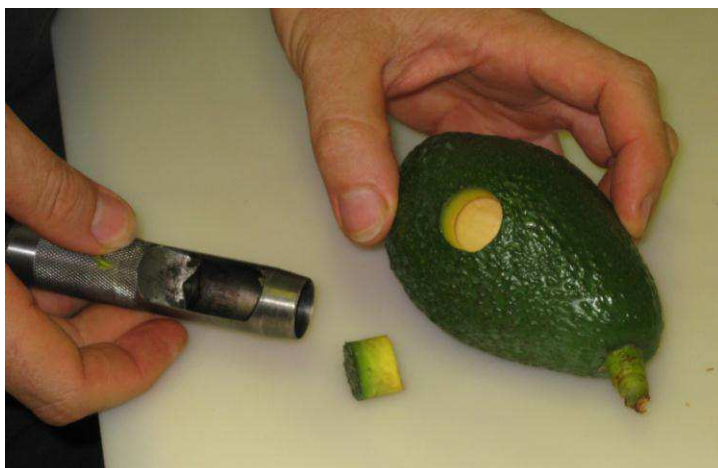
The above photos were taken from Woolf A, Clark C, Terander E, Phetsomphou V, Hofshi R, Arpaia ML, Boreham D, Wong M, White A (2003) Measuring avocado maturity; ongoing developments. *Orchardist* **76**, 40-45.



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It should take approximately 10 minutes to process (not dry) 10 individual fruit using the Hofshi corer.

NB: An adaptation of the Hofshi corer is available from a New Zealand company. For more information please contact the Avocados Australia office. Alternatively, hand-held 'cork borers' can be purchased from some hardware stores (see below for an example). Make sure the diameter is at least 15.9mm.



Hand held 'cork borer' available from some hardware stores (photo provided by Matt Weinert, DEEDI, Mareeba)

WARNING

After the flesh is cut/mixed, move IMMEDIATELY to the weighing step below. Any delay will result in moisture loss before weighing, causing inaccurate results.

Drying procedure

(a) Conventional Oven

- Preheat oven to 100 to 110°C.
- Use a shallow, ovenproof container. Weigh the dry/empty container and record this weight.
- Spread at least 100g of the shredded avocado (if using the grated sample method) or all the pieces from the core samples (if using the corer sampling method) evenly onto the container and weigh. Record this weight. Use a balance with 2 decimal places if the wet flesh weight is less than 20gm, as may be the case if measuring individual fruit DM with the corer.
- Place the container in the centre of the oven and leave undisturbed for five hours. During drying, be careful to avoid burning the avocado flesh.
- Avoid or at least minimise opening the oven door during this period. An easily read oven thermometer is useful to monitor the actual oven temperature.
- After five hours, allow to cool in a dry environment for no more than five minutes, and re-weigh to determine dried avocado weight.
- With initial tests, redry the sample for a further 30 minutes and then re-weigh to ensure that the sample is fully dried.

(b) Domestic Food Dehydrator (models that go to 60-65°C)

- Use approximately four shallow, heatproof containers (exact number will depend on the size of the fruit).
- Weigh the dry/empty containers and record these weights.
- Spread at least 100g of the shredded avocado (if using the grated sample method) or all the pieces from the core samples (if using the corer sampling method) evenly amongst the containers.
 - Weigh the fruit in the containers. Record the weight of each of the containers.



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- Place the containers in the dehydrator and leave undisturbed for one day, weigh, then dry for another day and re-weigh to make sure it is dry.

(c) Microwave oven

- Use a shallow, microwave-proof container. Weigh the dry/empty container and record this weight.
- Spread at least 100g of shredded avocado (if using the grated sample method) or all the pieces from the core samples (if using the corer sampling method) evenly onto the container and weigh. Record this weight.
- Set microwave at medium-low for 15 to 20 minutes. **Note: You may need to adjust power setting and time depending on the microwave model.** Avoid burning the flesh.
- Dry to a constant weight by reheating and re-weighing. You can also use the 'snap' test (see below), to determine if the sample is fully dry. Note the time taken for future reference (if you use a different amount of flesh, the setting may need to be changed).
- When first trying the microwave method, keep a constant watch on the sample until you are confident of your settings. To avoid possible damage to your microwave, always place a container of water on the turntable.

HINT

A simple way to determine if the sample is fully dried is to take a shred of the dried flesh about five cm long, place it lengthwise between the thumb and forefinger, and try to bend it. If it is brittle and snaps cleanly, it is fully dried. If it bends without snapping, more drying time is required.

3. Calculate percentage of dry matter

Use the following calculation:

$$\frac{\text{Weight of dried avocado sample (minus weight of container)} \times 100}{\text{Weight of fresh avocado sample (minus weight of container)}}$$

NB: if you have dried the samples using a domestic food dehydrator with multiple containers you will need to take an average of the DM percentages you calculated for each container.

Please note: There are **no DM standards** for over-maturity, but this fruit should not be marketed. Do not leave fruit on trees beyond the normal picking period. Picking over-mature fruit results in poor flavour and increased fruit diseases and flesh disorders, as well as reducing the yield of the next crop.

