



## A GUIDE FOR SUPPLY CHAIN QUALITY MANAGERS



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# Australian Avocados – A Guide for Supply Chain Quality Managers

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## PURPOSE OF THIS GUIDE

*Avocado consumers want the perfect avocado - a fruit that has been grown for quality, picked at the optimum maturity, handled with care along the supply chain, ripened to bring out the best flavours and presented at its best, ready for consumption. The challenge is to meet the consumers' expectations every time.*

*Australian avocados are recognised for their high quality and freshness. Our supply chains – from our farmers to our retailers - invest significant resources to ensure the product they supply is of the highest quality and can meet the customers' expectation.*

*As Australian avocados are usually airfreighted to our export markets, they are the freshest available and provide added shelf life for retailers. However, as avocados are living organisms, managing the supply chain process and getting it right every time can be challenging.*

This guide aims to build the knowledge and skills of those involved in supporting the supply of Australian avocados. By handling Australian avocados more effectively, we aim to build demand and increase profits from the category.

This guide is complemented by other resources available from Avocados Australia, including a:

- Training Guide: 'A Guide for Fresh Produce Retail Managers'
- Training Guide: 'A Guide for Fresh Produce Retail Staff'
- Instructional video on Avocado Ripening and Storage
- Facts sheet and instructional videos on measuring dry matter content
- Presentation (powerpoint) to support training of retail produce managers and staff
- Poster (A4 size) for displaying back-of-store to remind staff about the appropriate handling of avocados

**For more details and access to resources visit:  
[www.avocado.org.au/global](http://www.avocado.org.au/global)**



## AUSTRALIAN AVOCADO PRODUCTION

Australian farmers' produce about 70,000 tonnes (2018) of avocados a year.

Australia's production volumes are increasing as demand for product increases. It is anticipated that volumes will reach 100,000 tonnes per year by 2024.

### Availability of Australian avocados

By growing in different production regions across Australia and planting different varieties, our farmers can supply avocados all year round.

There are 8 main production regions, however most avocados are grown in Far North Queensland; Central Queensland and Western Australia.



The table below shows the availability of fruit from the different production regions across the year.

Harvest periods for Hass and Shepard Avocados												
Growing Areas	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
FAR NORTH QLD												
CENTRAL QLD												
QLD - OTHER												
NSW - NORTH & CENTRAL												
TRI-STATE												
WESTERN AUSTRALIA												

KEY: QLD = Queensland NSW = New South Wales VIC = Victoria SA = South Australia

WA = Western Australia

\* The Tri-State area includes production in the Sunraysia and Riverland regions which together cover parts of Southern NSW, Victoria and South Australia.

Hass variety  Shepard variety

## Packaging

Australian avocados are usually supplied in:

- 5.5 kilogram single layer trays, or
- 10 kilogram bulk boxes.

## Varieties

There are two main avocado varieties grown and marketed by Australian farmers – Hass and Shepard.

### Hass

Hass is the main variety exported by Australia and accounts for about 80% of Australian production.

It has a distinctive pebbly skin which usually turns from green to a rich purplish–black colour as it ripens.

Hass is more oval than other varieties and has a pale green flesh with creamy texture.

Hass is available all year round however supply is lighter from February to April.



### Shepard

Shepard avocados are a 'green skin' variety. They are referred to as 'green skins' as their skin stays green as they ripen.

Shepard have a smooth skin, a golden buttery flesh which does not go brown when cut, meaning they stay brighter in salads and wraps for longer.

Shepard avocados represent about 15% of total Australian avocado production and are only grown in the warmer northern production regions of Australia. They are available from February to May, when production of Australian Hass is lower. They provide the opportunity for retailers to offer Australian avocados all year round and their arrival on the market each season presents excitement in the category for consumers.





# AVOCADO QUALITY AND RIPENESS

## Attributes of good quality avocado

Good quality avocados, of any variety, should:

- Look fresh and have good symmetrical shape
- Have no skin blemishes or visible damage
- Have no internal defects such as bruising, rots or flesh discolouration
- Be mature and ripen evenly
- Taste great when they are ripe.

## Maturity

Maturity is measured by the percentage of dry matter in the fruit. Fruit is only harvested once it has reached optimal maturity levels. This ensures that the fruit has the best flavour when it is ripe. The optimal maturity level are as follows:

- Hass - no less than 23% dry matter
- Shepard - no less than 21% dry matter.

These minimum dry matter standards are important as they have a significant impact on fruit quality and flavour.

For further information on measuring dry matter check the online resources, including facts sheets and instructional videos at: [www.avocado.org.au/global](http://www.avocado.org.au/global)



## DIFFERENT STAGES OF RIPENESS

It is important to understand the different stages of ripeness, so that communicating with suppliers and customers is easier, particularly when customers are looking for specific ripeness profiles in their orders.

**All avocados soften as they ripen.** Ripeness can be ranked on a scale of 1 to 5 based on the firmness of the fruit:

- **Stage 1: Hard**
- **Stage 2: Pre-conditioned**
- **Stage 3: Breaking (softening)**
- **Stage 4: Firm ripe**
- **Stage 5: Ripe**

Hass avocados generally change colour from green to a purplish-black colour as they ripen; and although colour can be a good indicator of ripeness it is not always consistent. Sometimes the fruit can remain partially green when ripe or already have colour when they are on the tree; hence firmness is the best indicator of ripeness.

The same stages apply for Shepard avocados; however, their skin remains green when ripe.

The chart on the following pages shows the different levels of ripeness and corresponding optimum storage conditions and measures of firmness.

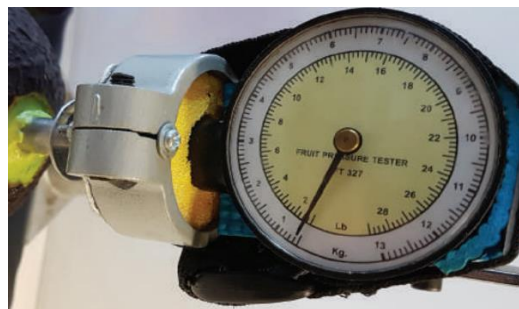
## Measuring firmness

There are 3 ways to measure firmness.

- 1) Apply **gentle pressure with the thumb** to the stem end of the fruit to determine the stage of ripeness. As the fruit ripens the 'give' in the fruit will increase. Fruit with no 'give' or only slight 'give' is at Stages 1 – 2. Fruit that deforms 2 – 3 mm with slight and gentle thumb pressure is at Stage 4 and 5 respectively.



- 2) **Penetrometer.** This is commonly used instrument to assess firmness in avocados. It is regarded as reasonably accurate; however, it is a destructive test, meaning the fruit is damaged in the assessment process.



- 3) **Densimeter.** This instrument allows non-destructive testing of avocado firmness to be carried out. Its results can be variable, being strongly affected by operator technique.



The chart on the following page provides a summary of different ripeness stages showing the typical colour of Hass with corresponding measurements of firmness using the above methods and a description of use, handling and storage considerations.



# Avocado Stages of Ripeness



**1 HARD**



**2 PRE-CONDITIONED**  
(Rubbery)



**3 BREAKING**  
(Softening)



**4 FIRM RIPE**



**5 RIPE**

<b>Description</b>	<p>No give with strong thumb pressure.</p> <p>Slight give with strong thumb pressure.</p> <p>Deforms 2–3mm with moderate thumb pressure.</p> <p>Deforms 2–3mm with slight thumb pressure.</p> <p>Deforms easily with gentle hand pressure.</p>				
<b>Use</b>	<p><b>Just Picked</b> Can be cold stored, easy to transport.</p> <p><b>Ripening</b> Ready to eat in about three days when held at room temp</p> <p><b>Good For Retail</b> Ready to eat in two days or less when held at room temp</p> <p><b>Ready to Eat</b> Good for slicing</p> <p><b>Eat Now</b> Good for slicing, smashing, spreading</p>				
<b>Handling</b>	<p>Susceptible to skin damage when dropped</p> <p>Susceptible to bruising</p> <p>Susceptible to bruising</p> <p>Highly susceptible to bruising from squeezing or dropping</p> <p>Highly susceptible to bruising by squeezing or dropping</p>				
<b>Storage</b>	<p>Ripen at 16–20°C, or store at 5°C (Hass) or 7°C (green skins)</p> <p>Continue ripening at 16–20°C</p> <p>Ripen at 16–20°C or hold at 5°C (Hass) or 7°C (green skins)</p> <p>5°C (Hass) or 7°C (green skins)</p> <p>5°C (Hass) or 7°C (green skins)</p>				
<b>Firmness</b> Penetrometer Densimeter	<p><b>&gt;10kgf</b> <b>&gt;91</b></p> <p><b>5–10kgf</b> <b>90–91</b></p> <p><b>2–5kgf</b> <b>86–89</b></p> <p><b>1–2kgf</b> <b>74–85</b></p> <p><b>0.5–1kgf</b> <b>65–73</b></p>				

Note for Hass: Firmness, rather than skin colour is the better indicator of ripeness - depending on maturity, Hass avocados can remain partially green when ripe or already have dark skin colour at Stage 1  
Note for green skins: The same stages apply for green skin varieties, however their skin remains green when ripe



**Hort**  
**Innovation**



## MANAGING FRUIT ALONG THE SUPPLYCHAIN

Successfully managing fruit through the supply chain process plays an important role in the quality of the final product presented to the consumer and what they are prepared to pay.

Understanding the supply chain process will help with understanding the best management practice that should apply in handling Australian avocados.

### HANDLING FRUIT

It is important for staff to remember that avocados bruise easily, especially once they start to ripen, so fruit needs to be handled with care.

Packages need to be handled and stacked carefully and pallet loads secured to prevent damage to the fruit.

Rubbery to softening fruit will bruise if dropped more than 10 cm and firm ripe to soft ripe fruit will bruise if dropped more than 3 cm.

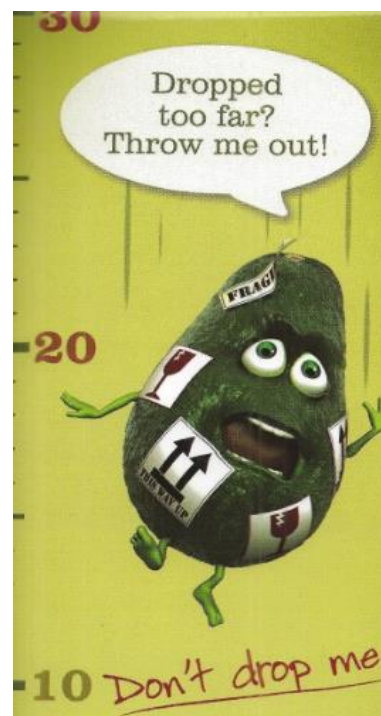
### THE IMPORTERS' ROLE

Typically, fruit is received by the importer, who will have responsibility for holding and pre-conditioning (ripening) the fruit, so that it is suitable to be received by retailers.

The importers role is to:

↓	<b>Receive the incoming fruit</b> and ensure it meets specifications in regard to quantity, size, quality and ripeness
↓	<b>Plan a pre-conditioning (ripening) schedule</b> for the fruit, based orders to be filled and on the above assessment of fruit.
↓	<b>Store the fruit</b> until ready for pre-conditioning
↓	<b>Pre-condition the fruit</b> (or organise a third party)
↓	<b>Store the fruit</b> after pre-conditioning
↓	<b>Dispatch the fruit</b> as per orders

For each of these steps it is important the correct handling procedure are observed and that accurate records are maintained to ensure that quality can be optimised.



## RECEIVING FRUIT

When receiving fruit from the Australian exporter, it is important that product complies with fruit receival advice. The following steps will assist with this process and assist in scheduling the ripening and supply schedule:

- **Check / record delivery details** including information such as brand, variety, delivery date, type and number of packages.
- **Check / record label details** including details such as the packer, grower, pack date, pallet, number, product ID, and fruit count / fruit size.
- **Sample fruit** – Check the pulp temperature age of fruit and if the fruit is early, mid or late season fruit. See details regarding Australian seasonality.
- **Check packing fruit, quality and ripeness** - When quality assessing the product details such as weight, presentation, fruit ripeness, external appearance (major and minor defects) and compliance to specification needs to be recorded.
- **Check if dry matter (DM) levels are provided** in relation to the consignment.
  - **Hass should be a minimum of 23% DM**
  - **Shepard should be at minimum of 21%DM.**
  - If there is not a DM test available and there are concerns about the maturity of the fruit, especially if it is early season fruit, a dry matter test may need to be conducted.
- **Provide feedback to the exporter.** Send copy of receival assessment record to the packer if there are issues with the product or if requested. This can assist the packer in addressing fruit quality problems that might be occurring at production, packhouse or during transport.

## PLANNING ORDERS AND DETERMINING THE RIPENING SCHEDULE

Depending on the requirements of your customers, the capacity of the ripening facilities to take fruit, the information compiled as part of the receival assessment process, and the expected time to ripen the fruit, a decision can be made on whether to store the fruit when it is received or ripen it immediately.

Fruit that is already starting to soften (ripen) when received should be ripened immediately. Other fruit that is hard (unripe) when received can be stored for up to 14 days prior to ripening. Fruit age and pulp temperature on arrival are key factors in determining how long fruit can be stored (see next slide for more details).

With this information it is possible to plan the ripening program to optimise the supply of ripened, quality avocados.

The table below shows the indicative ripening times, assuming fruit is harvested mid-season and has been exposed to ethylene.

Variety	Ripening temperature	Ripening time (days from start of ethylene treatment)		
		Stages 1-2	Stage 2-3	Stage 3-4
Hass	16°C	6-7	3-4	2-3
	18°C	4-5	2-3	1-2
	20°C	3-4	2-3	1
Shepard	16°C	5-6	2-3	2
	18°C	3-4	1-2	1
	20°C	2-3	1	1

## UNDERSTANDING AVOCADO RIPENING

Unlike other fruits, avocados don't start to ripen until they are picked from the tree.

Once picked, avocados naturally release low levels of ethylene, a plant hormone which accelerates the ripening process.

In modern avocado supply chains, ripeners treat commercial quantities of avocados with ethylene under controlled conditions in specially designed facilities. This is called 'pre-conditioning' and ensures the fruit will ripen evenly and the quality will be optimal.

## PRE-CONDITIONING (RIPENING) AND STORING FRUIT

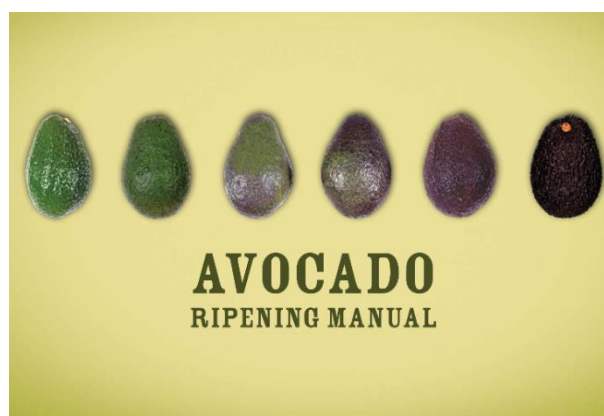
The process of pre-conditioning or ripening fruit is a skilled activity that requires knowledge of the product and how it will perform, the requirements of your customers, and the capacity of the ripening facilities to take fruit.

The ripening process can take anywhere from 4 to 14 days from the start of ethylene treatment. Variety, ripening temperature and desired ripeness level are key factors in determining the ripening time. In addition, other factors can have an impact, including:

- Fruit maturity (the more mature the fruit the faster it will ripen)
- Fruit age and temperature management
- Production conditions (farm and block location and production conditions)
- Fruit age and prior exposure to ethylene can also have an effect on ripening time.

For more detailed information about pre-conditioning and temperature management for storing avocados pre- and post-ripening, refer to the '*Avocado Ripening Manual*', which provides detailed information

This Manual is available at [www.avocado.org.au/global](http://www.avocado.org.au/global)



## UNDERSTANDING FRUIT QUALITY

### Internal fruit quality defects

The major causes of poor fruit quality are bruising, rots, vascular browning and grey-brown flesh.

All of these conditions can be avoided if good handling and storage practices are followed by those in the supply chain and at retail level.



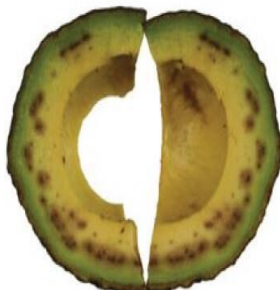
**Bruising** results when fruit is not handled with care. It can be caused by dropping or squeezing the fruit, excessive handling and poor packaging.

Bruising will become more evident as the fruit ripens. Dropping softening fruit or soft fruit at a short height (3cm or more) can cause bruising.



**Rots** can start to occur in fruit that is at an advanced stage of ripeness, has been in the supply chain for too long and/or has been ripened at high temperatures (>22°C), accelerating the aging process.

If rots are a persistent problem, check with your supplier about the management of fruit prior to receipt.



**Vascular browning** is the condition where vascular bundles running through the fruit begin to turn brown and appear as brown strands. This can occur where fruit has been held for too long prior or at incorrect temperatures in the supply chain.

If this is a persistent problem, check with your supplier.



**Grey-brown flesh** (or Diffuse Discolouration) is the condition where the areas of flesh turn a grey to brown colour. It can be caused when fruit is held for too long and at the incorrect temperatures, or where the ripening processes is interrupted by poor temperature management.

If this is a persistent problem, check the handling processes and the temperatures that fruit is being held. Also check with your supplier.

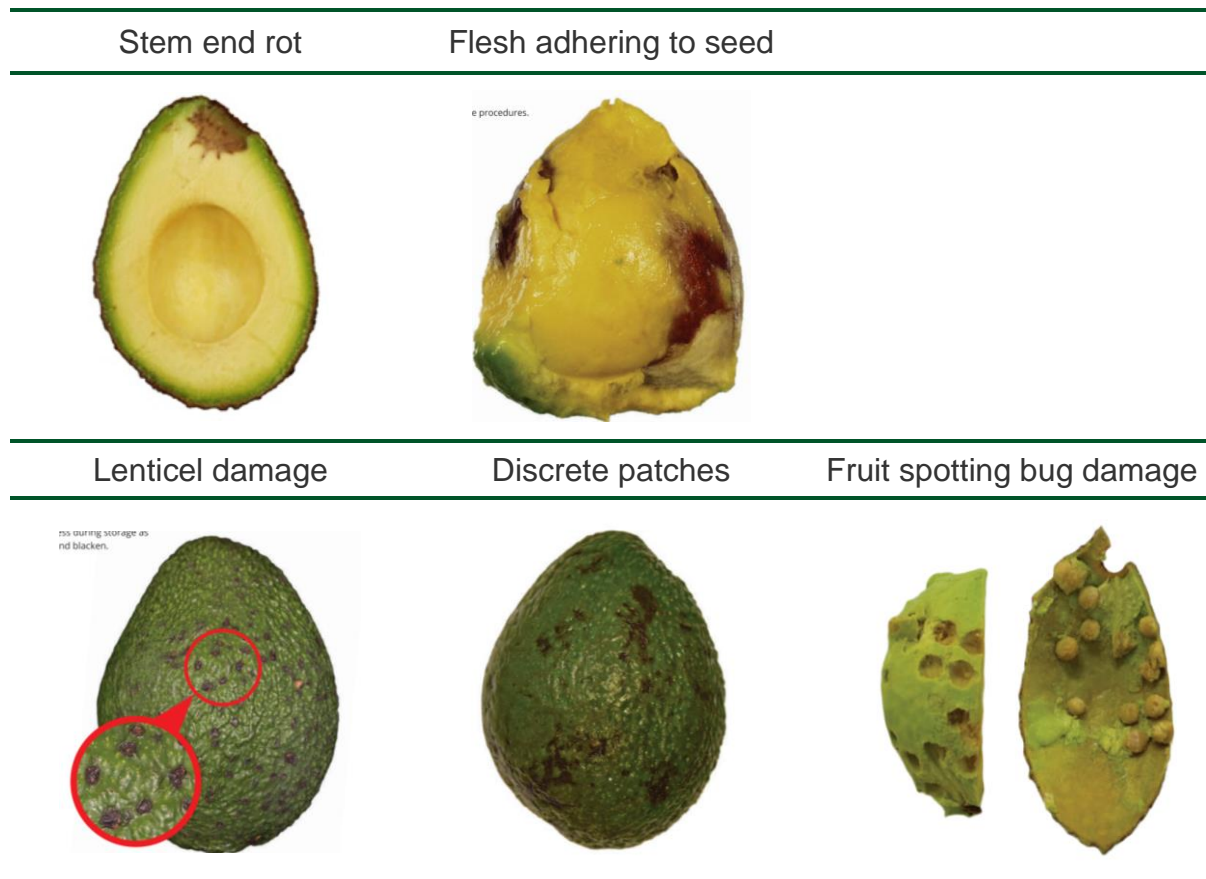
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Source: DAF Queensland



Other conditions that occur can include

- Uneven ripening
- Flesh adhering to the seed
- Slow ripening
- Premature ripening
- Poor skin colour (Hass)
- Insufficient saleable life
- Poor flavour
- Lenticel damage (external defect)
- Discrete patches on skin (external defect)



If you would like more information on quality disorders and retail management refer to our other resources:

- 'Avocado Fruit Quality Problem Solver'
- 'A Guide for Fresh Produce Retail Managers'

Available at: [www.avocado.org.au/global](http://www.avocado.org.au/global)

## WHAT RETAILERS REQUIRE

*Retailers need to be able to provide fruit that meets their customers' expectations and delivers the best eating experience for their customers - by doing so their customers will continue to buy Australian avocados.*

## SUPPORTING YOUR RETAIL CUSTOMERS

As retailers become more familiar with the category and adopt strategies such as 'ripe and ready' programs (see page 12), their expectations and requirements will change.

There are a few guiding principles that will help in meeting retail customers' expectations as well as assisting to maintain the quality of the fruit and improve category performance.

### **Fruit quality**

- Only provide fruit that has reached the minimum maturity/dry matter levels
- Only provide fruit that meets the quality, size and ripeness specifications of your retailer
- Maintain best-practice temperature management through to store.

### **Handling fruit**

- Always ensure staff handle fruit with care to reduce damage to fruit
- If practical, keep fruit in its original packaging to minimise handling of individual fruit
- Make sure fruit trays / cartons are stacked correctly and pallets secured, to ensure fruit is not damaged in transit to the customer's premises.

### **Ordering fruit**

- Support retailers that require fruit delivered at different ripeness stages, so you can optimise stock control.
- Where possible, support retailers who wish to order smaller volumes more often, so that they are not required to store fruit for too long.

### **Holding fruit**

- Schedule the ripening of your fruit so that fruit is only held for the optimum time before being dispatched to customers
- Ensure fruit is held and transported at optimum temperatures.

### **Dispatching fruit**

- If you have fruit of similar ripeness, prioritise the older fruit for sale. Check to see if the date the fruit was packed is recorded on the packaging. If not, ask your supplier.
- Check all paperwork is completed correctly to allow traceability of the product, adjustment of stock / sales levels and invoicing to be completed correctly.

### **Communicate**

- Provide advice to your retailers about the quality and robustness of the fruit you supply, especially if there are any known quality issues with the fruit. This will allow the retailer to manage the fruit appropriately when it reaches their store.

## 'ripe and ready' PROGRAM

A 'ripe and ready' program involves consistently providing ripe avocados for sale which are suitable for consumption within the next day; and helping customers identify these.

Research has shown that many customers prefer to buy fruit to eat that evening or the next day. To assist customers, fruit which is ripe and firm ripe fruit (stages 4 & 5) is identified by stickers and /or signage.

Implementing a 'ripe and ready' program requires more effort from everyone in the supply chain. However providing this support and delivering fruit that is ready for consumption, has shown to increase sales by up to 30%.

It is important to work with retailers that are planning to implement a 'ripe and ready' program, so they can source fruit at suitable ripeness levels and in appropriate volumes.



**australian avocados**  
**ripe and ready to eat**



## ADDITIONAL INFORMATION AND SUPPORT

Avocados Australia is the peak industry body representing avocado farmers in Australia.

One of our primary aims is to increase demand and overall category profit for Australian avocados. We do this by working with farmers, exporters, importers and retailers both in Australia and in our export markets.

We support industry research & development and marketing & promotions activities, including supply chain, retailers' and consumer education programs.

To learn more about Australian avocados visit [www.australianavocados.com.au](http://www.australianavocados.com.au)

To access training materials and other resources visit [www.avocado.org.au/global](http://www.avocado.org.au/global) (access via the QR code on the next page).

**If you would like more information, please contact  
Avocados Australia**



**Avocados Australia Limited**

**Office: Level 1, Suite 8, 63 Annerley Road, Woolloongabba QLD 4102, Australia**

**Post: PO Box 8005, Woolloongabba QLD 4102, Australia**

**Phone: +61 7 3846 6566**

**Email: [admin@avocado.org.au](mailto:admin@avocado.org.au)**

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