AUSTRALIAN AVOCADO SUPPLY CHAIN **Checklists**

Hort Innovation

Contents

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Avocados Australia

01. Introduction

This booklet is designed to be used in conjunction with the *Australian avocado supply chain best practice guide*. It outlines the key actions needed to maintain the postharvest quality of avocados. These range from ensuring the trees are well nourished before they even flower, to managing ripe fruit at the retail distribution centre.

A number of records are suggested as a way of ensuring activities are correctly performed and recorded. Some of these are needed by all relevant businesses – such as chemical application records, or those relevant to traceability. Others are for the operators' own information, such as a harvest diary, or reject bin analysis data. While it takes time to keep records of such activities, they are an essential tool for efficient business operation, allowing system improvement from month to month and season to season.

Space is left for the business (farm, packhouse, etc.) to determine which processes have the highest priority. For example, cooling after harvest may be a medium priority if the weather is cool, but a very high priority if picking during midsummer heat.

The status of each activity can be noted by the relevant staff; completed, underway, or not done. Each section is available electronically (in the library section of the online *Avocados Australia BPR*) as well as in print, so that a new checklist can be printed and used each season.

Further detail on recommended practices can be found in the *Australian avocado supply chain best practice guide*, or the online *Avocados Australia BPR*.

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Queensland Government

02. Pre-harvest

	STEP	GOOD MANAGEMENT PRACTICES	USEFUL RECORDS	PRIORITY H/M/L	STATUS
NUTRITION	Soil and fertiliser	Take soil samples annually to guide the orchard nutrition program. Moderate use of nitrogen and potassium as this can reduce calcium in fruit. Add mulch or compost to help retain calcium in the soil. Apply gypsum, dolomite or lime at flowering or during early fruit development.	Test data		
	Leaf analysis	Analyse the youngest fully expanded leaves from the summer flush. Check nutrient levels are within recommendations.	Test data		
	Fruit analysis	Monitor nitrogen to calcium ratios in mature fruit to ensure it is optimum (i.e. relatively low) for suppression of anthracnose. *N.B. Fruit from blocks with low ratios are best suited to distant markets.*	Test data		

Notes

	STEP	GOOD MANAGEMENT PRACTICES	USEFUL RECORDS	PRIORITY H/M/L	STATUS
FUNGICIDE SPRAY SCHEDULING	**Always follow label directions and observe required withholding periods**				
	Copper sprays	Apply copper sprays: ■Every 28 days during fine weather. ■Every 21 days if it rains. ■Every 14 days if it rains continually.	Spray record		
	Strobilurin fungicides	Apply a strobilurin (e.g. azoxystrobin) at the first opportunity if rain interrupts the spray program. *N.B. that a maximum of three strobilurin sprays can be applied per season.*	Spray record		
		Apply a strobilurin as the last fungicide prior to harvest.			
IRRIGATION	Schedule irrigation	Develop an effective irrigation system. Check soil moisture regularly.	Soil moisture data		
		Avoid water stress, particularly during early fruit development. This will maximise calcium uptake.			
ORCHARD HYGIENE	Pruning	Manage the tree canopy for good ventilation. Remove old fruit, dead twigs and branches. Regularly disinfect cutting tools.	Diary of practices		
	Insects	Control insects, particularly those that can directly damage fruit e.g. fruit-spotting bug.			
	Tree health	Keep trees healthy to increase fruit disease resistance.			

03. Harvesting

	STEP	GOOD MANAGEMENT PRACTICES	USEFUL RECORDS	PRIORITY H/M/L	STATUS
PRE-SEASON	Equipment checks	Before harvest starts, check the operation of all harvesting, grading and packing equipment and of cool rooms and cooling systems.	Equipment maintenance schedule		
SCHEDULE HARVESTING	Dry matter sampling	Test dry matter, sampling at least 10 randomly selected fruit per block or zone.	Dry matter test results Harvest logbook		
	Harvest schedule	Commence harvest once dry matter levels reach: ■ ≥23% dry matter for Hass. ■ ≥21% dry matter for Shepard and other green skins. Harvest most mature (e.g. north-facing) blocks first. In hot weather (>30°C), start early in the day and pick exposed fruit first.			

Notes

	STEP	GOOD MANAGEMENT PRACTICES	USEFUL RECORDS	PRIORITY H/M/L	STATUS
PICKING	Check equipment	Inspect harvesting equipment, bags and bins for any sharp edges. Ensure rope extenders are used on mechanical work platform bags.	Equipment maintenance schedule		
	Training pickers	Show pickers how to avoid large drops and handle fruit gently. Picking method: ■Hass can be plucked. ■Other varieties must be clipped.	Staff training		
	Raining during harvest	Avoid picking fruit in wet weather. If fruit must be harvested wet, consider clipping Hass and apply a postharvest fungicide ASAP.	Harvest logbook		
BIN HANDLING	Cover bins	Protect harvested fruit from the sun: ■Cover bins. ■Place bins in the shade.	Staff training record Maintenance record		
	Transport	Transport fruit slowly (max 20km/h). Ensure roadways are well maintained.			
TRANSFER TO PACKHOUSE	Daily transfer to packhouse (preferred)	Transfer fruit to packhouse ASAP to allow it to be packed and cooled within 24 hours of harvest.			
	Non-daily transfer to packhouse	Keep harvested fruit in a cool room at the orchard and transfer to packhouse within 3 days.			

04. Packhouse

	STEP	GOOD MANAGEMENT PRACTICES	USEFUL RECORDS	PRIORITY H/M/L	STATUS
BIN RECEIVAL	Unloading	Do not leave bins in direct sun; place in a covered area.			
	Check fruit maturity meets minimum standards	Measure the percentage dry matter of early season fruit (if maturity has not previously been confirmed).	Dry matter test results		
	Check fruit quality	Undertake receival quality assessment to identify problems caused by poor harvesting or transport practices.	Fruit quality		
		Aim to pack and cool within 24 hours of harvest.			
	Check pulp temp to determine if immediate cooling necessary	If fruit cannot be packed immediately, use a probe thermometer to check fruit pulp temperature: **Pulp <20°C** Keep below 20°C and pack within 48 hours of receival. **Pulp 20–30°C** Either pack within 24 hours OR room cool to below 16°C and pack within 3 days of receival. **Pulp >30°C** Forced-air cool below 16°C and pack within 3 days of receival.	Temperature		
	Check traceability	Ensure bins are identifiable to block so that fruit can be traced through the supply chain.	Inventory		

	STEP	GOOD MANAGEMENT PRACTICES	USEFUL RECORDS	PRIORITY H/M/L	STATUS
COOLING	Cooling fruit before packing	Use a forced-air system to cool fruit efficiently. Avoid cooling below the dewpoint if there is no dryer on the packing line.			
PACKING	Packing line checks and cleaning	Check for sharp edges, fruit jamming and worn brushes, rollers or padding. Replace brushes if they become stiff and/or hard to clean. Clean surfaces that contact the fruit if they become dirty.	Equipment maintenance Cleaning		
	Bin retrieval	**Bins picked first should be packed first.** If fruit has been cooled, minimise re-warming: ■ Take fruit out of the cool room just before packing. ■ Return packed trays to the cool room ASAP.	Fruit inventory		
	Bin tip system	Ensure fruit feed out slowly and drops are minimised. Adjust speed so fruit do not remain in water dumps for >2 minutes. Use an approved sanitiser in water dumps and change water when it becomes dirty.	Chemical register		

Notes

	STEP	GOOD MANAGEMENT PRACTICES	USEFUL RECORDS	PRIORITY H/M/L	STATUS
FRUIT CLEANING AND TREATMENTS	Cleaning	If wash water recirculates, add a sanitiser and change water when it becomes dirty. Minimise time on brushes (ideally ≤30 seconds) to that needed to clean fruit. Use brushing systems that do not rely on fruit to fruit contact to move along the line e.g. removal bar, brushes that rotate and travel.			
	Fungicide	Check if fungicide is registered for destination market. Treat fruit within 24 hours of harvest for best control of disease. Apply fungicide as a non-recirculated spray. Treat fruit for at least 30 seconds. Lower the pH of the fungicide solution if using an alkaline (pH>7) water source.	Postharvest chemical use		
	Insecticide treatment	Only use insecticide if required for Interstate Certification Agreement (ICA) protocol requirements.	Postharvest chemical use		
	Drying	Ensure temperatures in heated tunnels do not exceed 50°C. Avoid packing wet fruit; reduce speed or increase dryer temperature if labels don't stick.			

	STEP	GOOD MANAGEMENT PRACTICES	USEFUL RECORDS	PRIORITY H/M/L	STATUS
GRADING	Grading and packing	Load fruit so that it is well spaced on the line, avoiding fruit crowding, rubbing or bumping. Add padding and baffles to reduce impacts. Minimise all drops on packing line (ideally <100mm).			
	Specifications	Define, record and agree specifications with customers. Train packers to use specifications. Monitor packed product to confirm specifications are met.	Staff training Packed product assessment		
	Reject bin analysis	Regularly sample fruit from reject bins and record reasons for rejection (e.g. sunburn, damaged, rot). Provide feedback to grower / packhouse manager on key quality issues.	Reject bin analysis		
	Size grading	Check equipment operation prior to start of season. Regularly check carton / tray weights of packed product.	Equipment maintenance		

Notes

	STEP	GOOD MANAGEMENT PRACTICES	USEFUL RECORDS	PRIORITY H/M/L	STATUS
PACKAGING	Labelling	Ensure labels meet customer requirements, including grower information and packed on dates.			
	Packaging and handling	Use cartons with 5-10% vented surface area (exposed) and sufficient strength to withstand supply chain handling. Place cartons on pallets carefully and secure well with locking sheets and strapping.	Staff training		
SAMPLING	Library trays	Retain library trays at the end of each batch and store for up to four weeks before ripening and quality assessment.	Library tray quality assessment		
	MRL testing	Sample and send fruit to laboratory as required by target market and/or food safety system.	Chemical analysis		

	STEP	GOOD MANAGEMENT PRACTICES	USEFUL RECORDS	PRIORITY H/M/L	STATUS
COOLING	Incomplete pallets	Place incomplete pallets into cool room if held overnight or for longer periods.			
	Complete pallets	Cool packed fruit ASAP, preferably using a forced-air system: ■ Monitor pulp temperature at the centre of a pallet. ■ Switch fan off once fruit approaches target temperature. ■ Store Hass at 5°C or green skin varieties at 7°C.	Cooling log		
STORAGE	Holding before dispatch	Leave >5cm air gap around all sides of stored pallets. Hold fruit for no more than 2 days before dispatch.	Cooling log		

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05. Transport

	STEP	GOOD MANAGEMENT PRACTICES	USEFUL RECORDS	PRIORITY H/M/L	STATUS
PRE-DISPATCH	Maintain the cool chain	Only dispatch fruit that have been thoroughly cooled.	Temperature on dispatch		
		Where possible, load pallets directly from cool-room to truck. Otherwise minimise exposure to ambient temperature (<15min).	Staff training		
	Truck selection	Use trucks with proven cooling capacity and airbag suspension.			
	Produce compati-bility	Check produce compatibility for mixed loads. Hard green avocados are not compatible with ethylene producing products such as ripening bananas, avocados, pawpaw or tomatoes.	Consignment record		

Notes

	STEP	GOOD MANAGEMENT PRACTICES	USEFUL RECORDS	PRIORITY H/M/L	STATUS
TEMPERATURE MANAGEMENT	Air circulation	Secure and stabilise the load while ensuring good air circulation: ■ Place the first pallet hard against the front of the trailer. ■ Use foam spacers to provide air gaps around pallets. ■ Position stabilising bars between the rows. ■ Ensure the trailer is fully loaded for long distance transport.			
	Truck temp	Set truck thermostats to 5°C (Hass) or 7°C (green skins) with the sensor placed in the delivery air. Truck should be precooled before loading. Use data loggers (preferably 2) to monitor temperature in each load. Place data loggers several trays down in pallets located in different parts of the trailer.	Dispatch advice. Transport consignment docket. Temperature records.		
ON ARRIVAL	Unloading	Transfer pallets directly from the truck to cool room, especially during hot weather.			

Notes

06. Ripening/Wholesaler

	STEP	GOOD MANAGEMENT PRACTICES	USEFUL RECORDS	PRIORITY H/M/L	STATUS
RECEIVAL	Retrieve temp loggers	Download loggers and check whether fruit has been kept cool during transport. Provide feedback to the packhouse or transport company if necessary.	Temperature logs		
	Check pulp temp	Check pulp temperature of fruit several layers down the pallet, on a number of pallets: ■ If fruit arrives warm (≥12°C), but has been warm for <24 hours (based on logger data), cool to 5 – 7°C immediately. ■ If fruit has been warm for >24 hours, or no logger records are available, place directly into ripening.	Quality control		
	Check fruit condition	Check fruit firmness and colouring on arrival. If fruit has any 'give', then it must be placed directly into ripening.	Quality control		

Notes

	STEP	GOOD MANAGEMENT PRACTICES	USEFUL RECORDS	PRIORITY H/M/L	STATUS
STORAGE BEFORE RIPENING	Cool room settings	Store Hass at 5°C or green skins at 7°C with 80-90% relative humidity.	Temperature records		
	Ethylene	Check storage rooms do not contain >1ppm ethylene. If levels >1 ppm are detected, vent the room, or remove with a scrubbing system.			
	Monitor fruit in storage	Check stored fruit every 2–3 days for softening or colouring changes. Transfer to ripening if softening is detected.			
	Stock rotation	Rotate stock based on fruit age (days from harvest), as well as fruit firmness. Ripen older, and/or softening fruit first. Aim to always commence ripening within 2 weeks of harvest.	Inventory		

Notes

	STEP	GOOD MANAGEMENT PRACTICES	USEFUL RECORDS	PRIORITY H/M/L	STATUS
RIPENING	Calibration	Calibrate rooms annually for ethylene injection process, temperature sensors and room venting.	Calibration report		
	Tempera-ture	Ripen early season fruit at 18–20°C and late season fruit at 16–18°C. Use a forced-air system to accurately manage fruit temperature. Monitor temperature during ripening.	Ripening logbook		
	Ethylene	Apply ethylene for 1–2 days once fruit pulp reaches the target temperature. **Trickle system** – continuous flow to maintain ≥10ppm ethylene. **Shot system** – inject every 6–8 hours to achieve 100ppm ethylene.	Ethylene measurements		
	Venting	Monitor CO_2 levels, and ventilate the room if concentrations exceed 1% CO_2. **Trickle system** – constant venting for 1 room air change per hour. **Shot system** – open doors to vent every 6–8 hours.			
	Monitor ripening	Check fruit firmness twice daily using hand-feel. Confirm ripeness stage using a penetrometer or densimeter.	Ripening logbook		

	STEP	GOOD MANAGEMENT PRACTICES	USEFUL RECORDS	PRIORITY H/M/L	STATUS
COOLING	Removal from ripening	Stop ripening once fruit reach customer firmness specifications (breaking to firm-ripe; stages 3 to 4).	Ripening logbook		
		Use a forced-air system to cool Hass to 5°C and green skin varieties to 7°C.			
ORDER PREPARATION AND DISPATCH	Handling	Cartons / trays of ripe fruit must be handled with care to avoid bruising.	Staff training		
	Quality assessment	Monitor success and uniformity of ripening. If required provide feedback to packing sheds or grower suppliers. Check fruit quality against buyer specifications using an assessment template.	Ripe fruit quality assessment		
	Holding fruit before dispatch	Hold ripe Hass at 5°C and green skin varieties at 7°C. Dispatch fruit to retailers ASAP after cooling, preferably within 3 days. Fruit that have become fully ripe (stage 5) should be dispatched immediately.			
	Dispatch and transport	Set transport temperature to 5°C. Minimise exposure of ripe fruit to ambient temperatures – maximum 15 minutes.	Retail transportation record		

07. Distribution Centre

	STEP	GOOD MANAGEMENT PRACTICES	USEFUL RECORDS	PRIORITY H/M/L	STATUS
RECEIVAL	Sample	Randomly select at least 3 trays per consignment, including trays from different pallets and/or different growers or pack dates.			
	Temp	Use temperature probe to check pulp temperature: ■ Hard fruit (Stage 1) may be 4–20°C. ■ Pre-conditioned fruit (Stage 2) are ripening and should be 10–20°C ■ Breaking to ripe fruit (Stages 3–5) should be 4 to 10°C (can vary between DC's).	Quality assessment		
	Firmness	Test firmness using hand pressure, a densimeter or penetrometer. Breaking to firm-ripe fruit (Stages 3–4) is ideal for ripe in-store programs.			
	Quality	Assess major and minor defects against specifications.			
		Check fruit age on carton. Specifications may state maximum days between harvest and retail. In general, fruit should be delivered to the DC within 3 weeks of harvest.			

	STEP	GOOD MANAGEMENT PRACTICES	USEFUL RECORDS	PRIORITY H/M/L	STATUS
HOLDING FRUIT	Temp	Fruit that is still hard-green (Stage 1) and is to be held at the DC for less than 24 hours can be stored at 16–20°C. Pre-conditioned fruit (Stage 2) is ripening and should be held at 16–20°C, and closely monitored. Keep ripe fruit (Stages 3–5) refrigerated, preferably 5°C for Hass and 7°C for green skin varieties.			
	Storage	Avoid storing avocados with ethylene sensitive products.			
STOCK MANAGEMENT	Storage times	Fruit should be dispatched from the DC to the retail store ASAP, ideally within 48 hours.			
	Stock rotation	Dispatch the softest fruit first, then by order of receival to the DC.	DC avocado inventory		
	Handling	Ripe avocados are highly susceptible to damage. Handle pallets and cartons carefully to avoid bruising.			
DISPATCH	Transport from DC to retail store	Transport stock in refrigerated trucks, and minimise time that fruit are exposed to ambient temperatures. Pallets should never be left in hot sun on loading docks.	DC transport log		

Notes

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