

**The California Avocado**

# **Pre-Conditioning and Ripening Manual**



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# Introduction

This manual provides basic information on Pre-Conditioning/Ripening and Handling California Hass Avocados at the warehouse level.

<b>Warehouse Receiving and Handling</b>
<b>Ripening Room Procedures</b>
<b>Conditioning Cycle</b>
<b>Warehouse and Shipping</b>
<b>Store Handling and P.O.S.</b>
<b>Symptoms and Causes</b>

**Pre-Conditioning/Ripening avocados results in increased avocado sales and customer satisfaction.**

This manual, when used by your warehouse personnel insures your stores will have avocados that are:

**“*RIPE FOR TONIGHT!*”**

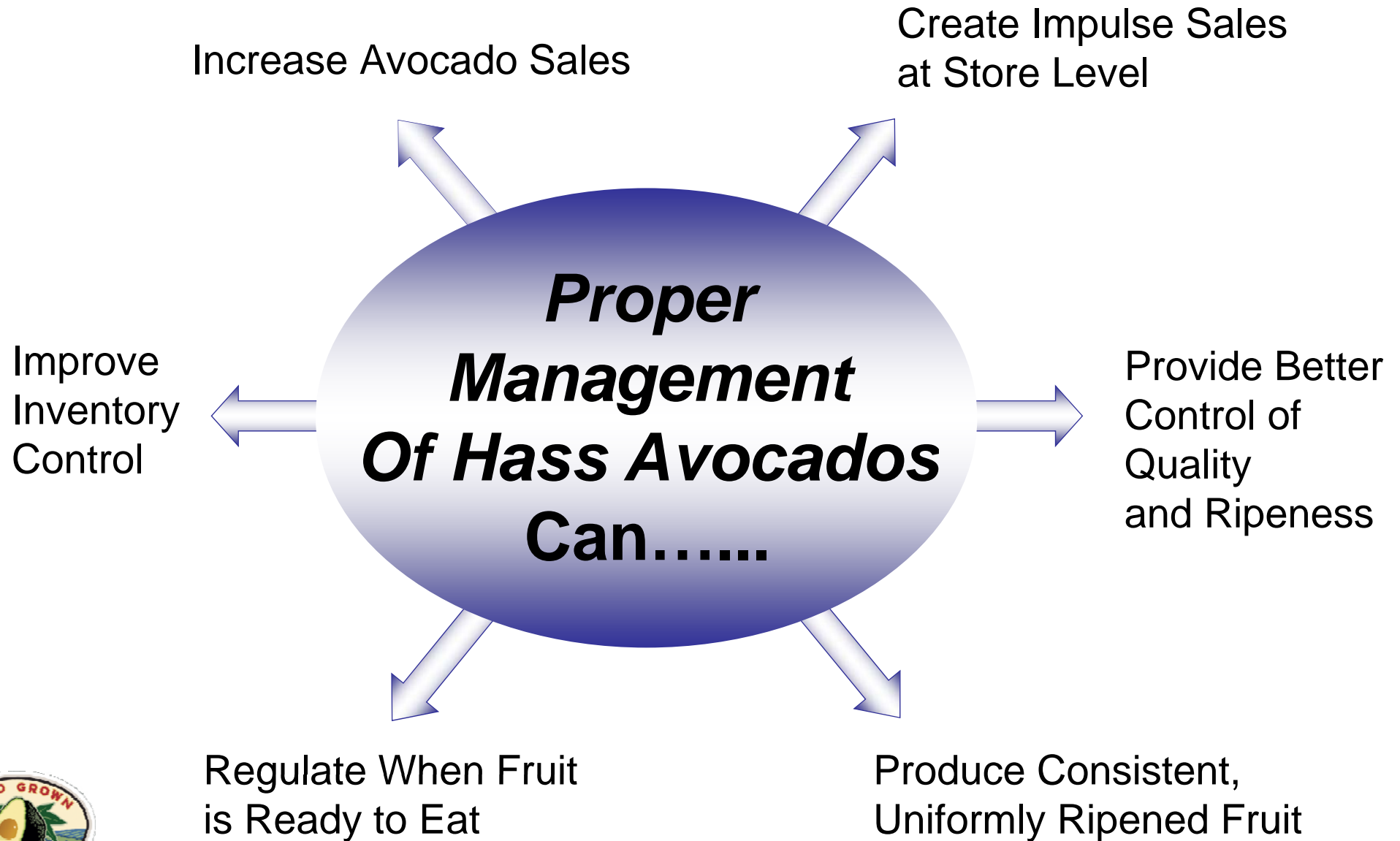


# Glossary of Terms

- Pre-Conditioning: The process of exposing firm/hard avocados to ethylene to stimulate ripening
- Ripening: The softening process using controlled time and temperature
- PPM: Parts Per Million
- CFM: Cubic Feet Per Minute



# The Benefits of Pre-Conditioning and Controlled Ripening



# Warehouse Receiving and Handling

## Receiving Checklist for Hass Avocados

- ✓ **Measure Avocado Pulp Temperature**  
Min. 40°F / Max. 50°F
- ✓ **Determine stage of ripeness at arrival**  
Use a penetrometer or similar piece of equipment (if Buttons present, check to see if they “Pop”)
- ✓ **Confirm Pack Date**  
Source of Fruit



# Receiving Fruit



## Checking Temperature:

- Check multiple locations within pallet (top to bottom, inside and outside)
- Insert produce thermometer in fruit for 15 seconds (for first fruit probe twice)
- Record temperature on inspection or processing log
- Move fruit into cooler immediately
- Hold Pre-Conditioned fruit at 38°F - 42°F



# Forced Air Room Requirements for Pre-Conditioning/ Ripening of Genuine California Hass Avocados

{ Avocados can be Pre-Conditioned/Ripened in  
Banana Ripening Rooms but cooling will be slow }

## Heating, Refrigeration, and Circulation:

- ✓ Equipment must be adequate to raise and lower the temperature from 65°F - 41°F in 4 - 16 hours
- ✓ Air Flow rate should be 0.5 cfm/16 fruit in room

## Avocados produce 2 - 3 times more heat than Bananas

- ✓ Fans must provide strong circulation
- ✓ Forced Air Systems result in the best heating and cooling of the fruit



# Pre-Conditioning/Ripening Procedures for Non-Forced Air Rooms

When it comes to ripening avocados, bananas, and tomatoes, it is best to handle each commodity separately due to different ethylene exposure, venting and temperature requirements.

## Warehouse Stacking: (Air-Stacking)

(To be used when rooms are not forced air)

Avocados should be stacked in an alternating four-block or five-block pattern. Adequate refrigeration and good air circulation will control heat build-up.



# Proper Pre-Conditioning/Ripening Procedures

1. Do not mix labels from various handlers (fruit from one packer may ripen differently from that of another packer)
2. Record pulp temperatures and button firmness from top to bottom boxes throughout the room. Check boxes two times per day, recording temperatures and times on the Processing Log
3. Turn on air circulation system
4. Heat fruit to 60°F - 68°F (Do not exceed 70°F pulp temperature during cycle). Temperature controls the rate of ripening.
5. Use an Ethylene Generator or bottled ethylene to maintain ethylene at 10 - 100 ppm throughout the entire conditioning cycle (for bottled ethylene follow label requirements)
6. Vent the room at least two (2) times per day for 20 minutes or use continuous exhaust fans to minimize the Carbon Dioxide level

DO NOT EXCEED 1 percent CARBON DIOXIDE LEVELS

7. Optimum relative humidity level 90 - 95 percent
8. Cool fruit to 40°F - 42°F to slow ripening
  - When removing fruit, label ALL boxes with Pre-Conditioned stickers
  - Check fruit condition two times per day and log the information



# California Avocado Commission Processing Log Sheet

Room Number:

To Be Conditioned (date/time):

For Shipment (date/time):

Number of Boxes:

Car or Truck Number:

Unload Date/Time:

Day/Date	Time	Variety	Source of Origin	Pack Date	Room Air Temperature	Firmness	Thermos Set	Remarks
	a.m.							
	p.m.							
	a.m.							
	p.m.							
	a.m.							
	p.m.							
	a.m.							
	p.m.							
	a.m.							
	p.m.							



**This form is only a sample and should be modified by the appropriate technical experts and legal advisors to meet the needs of your particular operation (see Disclaimer at the end of the Manual)**

# Keys to Success for Ripening Avocados

## Ethylene Conditioning:

1. The room should be heated, allowing the pulp temperature to rise and stabilize between 60°F - 68°F
2. Use an Ethylene Generator or bottled ethylene to maintain ethylene at 10 - 100 ppm throughout the entire conditioning cycle (for bottled ethylene follow label requirements)
3. Vent the room at least two (2) times per day for 20 minutes or use continuous exhaust fans to minimize the Carbon Dioxide level  
DO NOT EXCEED 1 percent CARBON DIOXIDE LEVELS
4. Maintain a 60°F - 68°F pulp temperature during the conditioning cycle

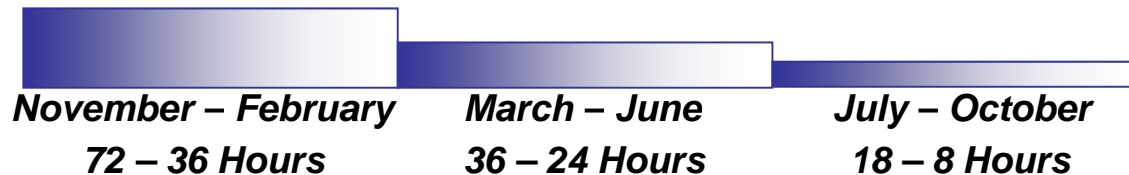
\*Temperatures above 77°F will stop ripening\*



# Keys to Success for Ripening Avocados

5. Keep relative humidity 90 - 95%
6. Conditioning time varies depending on:
  - Time of the year
  - Maturity of fruit at harvest
  - Age of fruit from harvest
  - Adverse weather (rain, cold temperatures)

Use the following chart as a guide for California fruit:



**Early season (Nov. – Feb.) avocados take longer to ripen than avocados harvested later in the season. Fruit age after harvest will also influence how the fruit will respond to ripening management.**

7. Stop conditioning fruit when fruit reaches pressure (fruit will continue to soften until properly cooled)
8. Fruit stored in the warehouse should be cooled down to 40°F - 42°F pulp temperature
9. Label Pre-Conditioned boxes with stickers  
(Available from the California Avocado Commission Merchandising Department)



# Warehouse Handling and Shipping

After conditioning, the fruit should be firm.  
Further ripening of the fruit can be controlled by time and temperature.

## WAREHOUSE STORAGE of Pre-Conditioned Fruit

40°F - 42°F	-----	<i>Firm Fruit For:</i> 10 - 14 Days
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*\*Older or Stressed Fruit Will Hold for Less Time\**

NOTE: Avocados store better (less chill injury) after Pre-Conditioning

## RIPENING GUIDE After Pre-Conditioning

Ripened fruit is defined as ready to be consumed.

Pulp Temperature:		Days required for fruit to ripen for display case:
50°F	-----	7 - 10 Days
60°F	-----	3 - 6 Days
68°F	-----	2 - 4 Days

These are general guidelines - constant monitoring is best

***\* Temperatures >70°F Can Cause Irregular Ripening and greater decay\****



# Uneven Ripening: Symptoms and Causes

## Common Symptoms of Uneven Ripening

- Checker-boarding: fruit at various stages of ripening in the same lug
- Uneven peel color in mid-to-late season fruit
- Soft spots on fruit
- Soft neck or side of fruit

## Common Causes of Uneven Ripening

- Improper ripening techniques
- Improper amount of ethylene gas, incorrect exposure time, wrong temperature, humidity below 85%
- Temperatures above 70°F (ripening stops above 77°F)
- Improper air flow/circulation can cause hot spots to develop
- Excessive carbon dioxide buildup above 1% inhibits ripening
- Excessive holding periods prior to beginning the ripening cycle
- Wide variation of pulp temperatures on arrival at the warehouse
- Fruit was below 42°F before Pre-Conditioning



# Chill Damage: Symptoms and Causes

## Common Symptoms of Chill Damage

- Grayish-brown discoloration of pulp
- Discoloration of the vascular bundles (stringy veins) running down the length of the fruit
- Scalding, pitting, and discoloration of the skin
- Fruit does NOT ripen properly

## Common Causes of Chill Damage

Low storage temperature below 41°F

### Causes of poor air temperatures

- Poor air circulation
- Low transportation temperature
- Fruit was placed in direct air flow from refrigeration unit
- Fruit overheated (90°F), then cooled rapidly
- Fruit exposed to extreme temperature



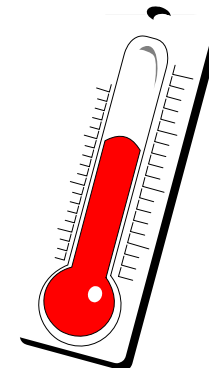
# Warehouse Shipping

## Mixed Loads

- Avocados are very sensitive to temperature and produce ethylene. They can be transported with citrus, melons, eggplant, guavas or papayas.
- Because they produce ethylene, avocados should not be transported with leafy vegetables (lettuce, endive, etc.), and other ethylene sensitive produce to avoid damage such as loss of green color to green vegetables and ethylene rust and browning on lettuce.

## Temperature

- Optimum temperature for shipping is 41°F - 45°F. Temperatures below 41°F can cause chill damage.



**40°F – 45°F**



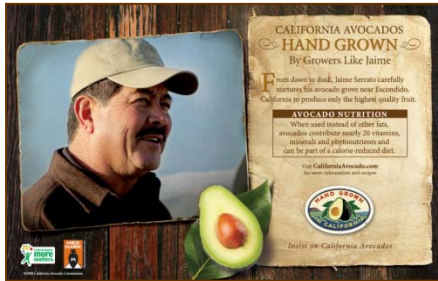
# Store-Level Handling and Merchandising

Avocados should be brought inside the store immediately upon arrival.

1. Place boxes with ripe fruit on top and those with hard fruit on the bottom.
2. Avocados store best under refrigeration. (When no further ripening is desired.)
3. To promote further ripening, hold at 60°F - 68°F.
4. Handle avocados with care.
5. Avocados should NOT be displayed on the wet rack or near misting systems.
6. Rotate display daily and remove poor quality fruit.
7. Feature RIPE avocados in separate displays to sell more fruit.
8. Display next to tomatoes, garlic, guacamole mix, lemon and limes to increase produce department sales.
9. Identify RIPE avocados with RIPE or READY TO EAT stickers. Stickered fruit will sell faster and stimulate impulse buying.



# Support Materials



To Order, contact the California Avocado Commission Merchandising Department at 1-800-344-4333 or visit our website at [www.CaliforniaAvocado.com/Retail](http://www.CaliforniaAvocado.com/Retail)

# For Technical Assistance

**PLEASE CALL OR WRITE:**

**MERCHANDISING DEPARTMENT  
CALIFORNIA AVOCADO COMMISSION  
12 MAUCHLY, SUITE L  
IRVINE, CA 92618  
(800) 344-4333 – PHONE  
(949) 341-1970 – FAX**

***CaliforniaAvocado.com/Retail***



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