The California Avocado

Pre-Conditioning and Ripening Manual
Introduction

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

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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

Proper Management Of Hass Avocados Can......

Increase Avocado Sales
Create Impulse Sales at Store Level

Improve Inventory Control
Provide Better Control of Quality and Ripeness

Regulate When Fruit is Ready to Eat
Produce Consistent, Uniformly Ripened Fruit

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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 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

<table>
<thead>
<tr>
<th>Day/Date</th>
<th>Time</th>
<th>Variety</th>
<th>Source of Origin</th>
<th>Pack Date</th>
<th>Room Air Temperature</th>
<th>Firmness</th>
<th>Thermos Set</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
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</table>

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 60ºF - 68ºF

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 60ºF - 68ºF pulp temperature during the conditioning cycle

   *Temperatures above 77ºF will stop ripening*
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:

<table>
<thead>
<tr>
<th>Time of the Year</th>
<th>Maturity of Fruit at Harvest</th>
<th>Age of Fruit from Harvest</th>
<th>Adverse Weather</th>
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</thead>
<tbody>
<tr>
<td>November – February</td>
<td>72 – 36 Hours</td>
<td>18 – 8 Hours</td>
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<tr>
<td>March – June</td>
<td>36 – 24 Hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July – October</td>
<td>18 – 8 Hours</td>
<td></td>
<td></td>
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</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Temperature (°F)</th>
<th>Firm Fruit For:</th>
</tr>
</thead>
<tbody>
<tr>
<td>40°F - 42°F</td>
<td>10 - 14 Days</td>
</tr>
</tbody>
</table>

*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.

<table>
<thead>
<tr>
<th>Pulp Temperature (°F)</th>
<th>Days required for fruit to ripen for display case:</th>
</tr>
</thead>
<tbody>
<tr>
<td>50°F</td>
<td>7 - 10 Days</td>
</tr>
<tr>
<td>60°F</td>
<td>3 - 6 Days</td>
</tr>
<tr>
<td>68°F</td>
<td>2 - 4 Days</td>
</tr>
</tbody>
</table>

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 70ºF (ripening stops above 77ºF)
➢ 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 42ºF 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.
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

<table>
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<th>STAGES OF RIPE</th>
<th>USE THIS GUIDE WHEN ORDERING FRESH CALIFORNIA AVOCADOS</th>
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<td>STAGE 2</td>
<td>PRE-CONDITIONED</td>
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<td>STAGE 3</td>
<td>BREAKING</td>
</tr>
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<td>STAGE 4</td>
<td>FIRM RIPE</td>
</tr>
<tr>
<td>STAGE 5</td>
<td>RIPE</td>
</tr>
</tbody>
</table>

**STORAGE**

Stage 1 & 2 can be held at warm temperature 60-70°F to achieve great consumer response. Stages 3-5 should not be held at 60°F to 70°F for more than 2 days.

For More Information:
800-384-4323
CaliforniaAvocado.com/Batch

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**American Summer Salad with California Avocado**

**NEEDS**
- 1 lb California Avocado
- 1 cup red bell pepper
- 1 cup cherry tomatoes
- 1 cup cucumber
- 1 cup arugula
- 1/4 cup balsamic vinaigrette
- Fresh herbs to garnish

**INSTRUCTIONS**
1. Cut avocados, bell peppers, tomatoes, and cucumber into bite-sized pieces. Place in a large salad bowl.
2. Toss with balsamic vinaigrette. Season with salt and pepper, if desired.
3. Serve immediately, or chill in the refrigerator for up to 2 hours before serving.

For more information and recipes, visit CaliforniaAvocado.com

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**Classic Guacamole**

**NEEDS**
- 2 California Avocados
- 1/2 cup diced onion
- 1/4 cup diced tomato
- 1/4 cup chopped fresh cilantro
- 1/4 cup chopped fresh lime juice
- 1/4 tsp salt
- 1/4 tsp black pepper

**INSTRUCTIONS**
1. In a medium bowl, mash the avocados with a fork. Add the onion, tomato, cilantro, lime juice, salt, and pepper. Mix well.
2. Cover and refrigerate for at least 2 hours.
3. Serve chilled, garnished with additional lime wedges and chopped fresh cilantro, if desired.

For more information and recipes, visit CaliforniaAvocado.com
For Technical Assistance

PLEASE CALL OR WRITE:

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CALIFORNIA AVOCADO COMMISSION
12 MAUCHLY, SUITE L
IRVINE, CA 92618
(949) 341-1955 – PHONE
(949) 341-1970 – FAX

CaliforniaAvocado.com/Retail
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