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HORTICULTURE INNOVATION LAB

UCDAVIS UNIVERSITY OF CALIFORNIA

Challenges in Postharvest Handling of Tropical Fruit

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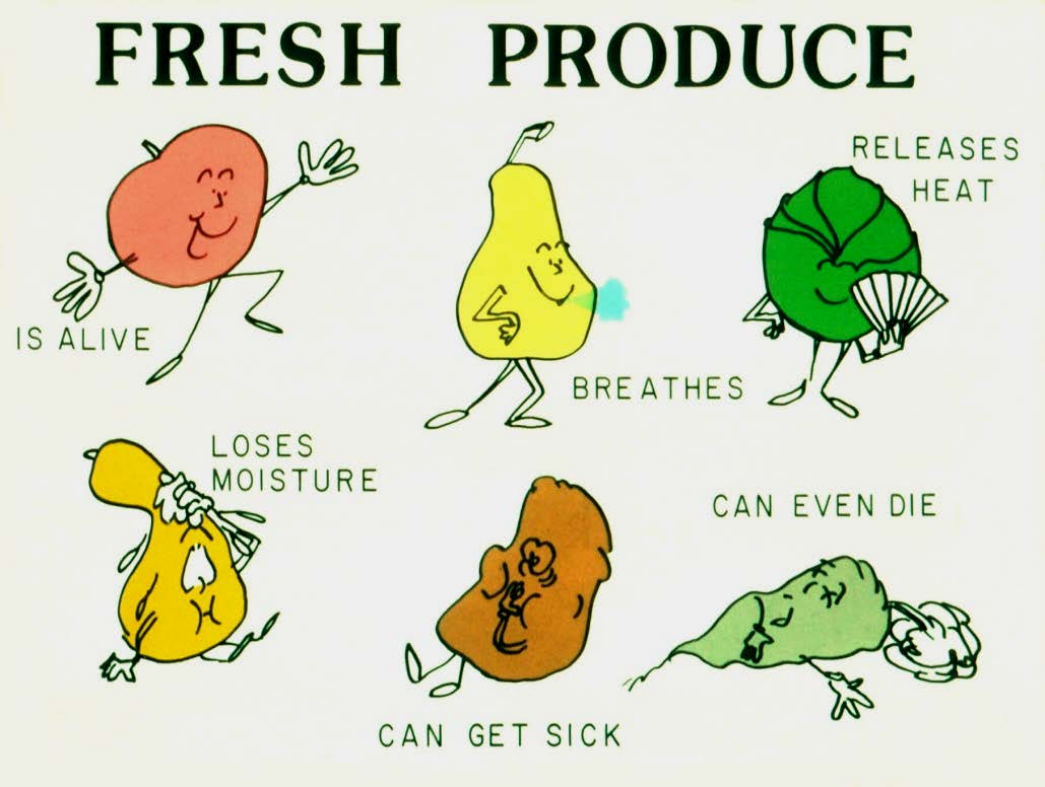
University of California

Characteristics of Horticultural Crops

- High water content
- Easily damaged
- Alive – a biological system
- Deterioration begins at harvest

Factors Contributing to Postharvest Losses

- Respiration
- Water loss
- Damage
- Diseases
- Ethylene
- Physiological disorders



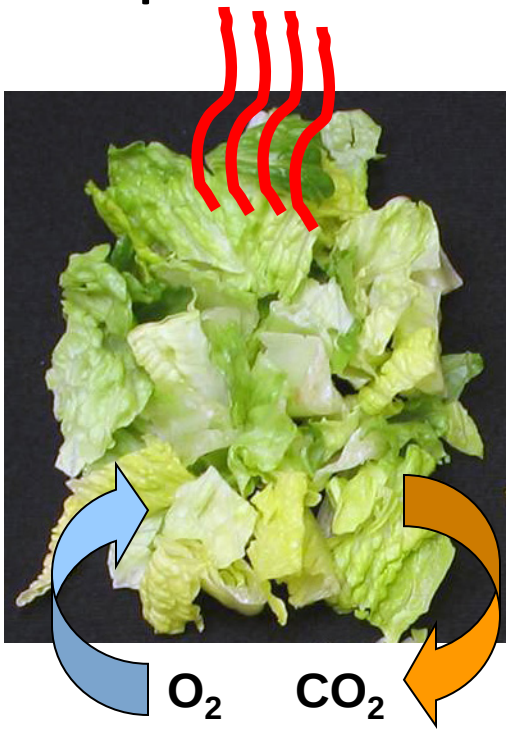
TIME & TEMPERATURE

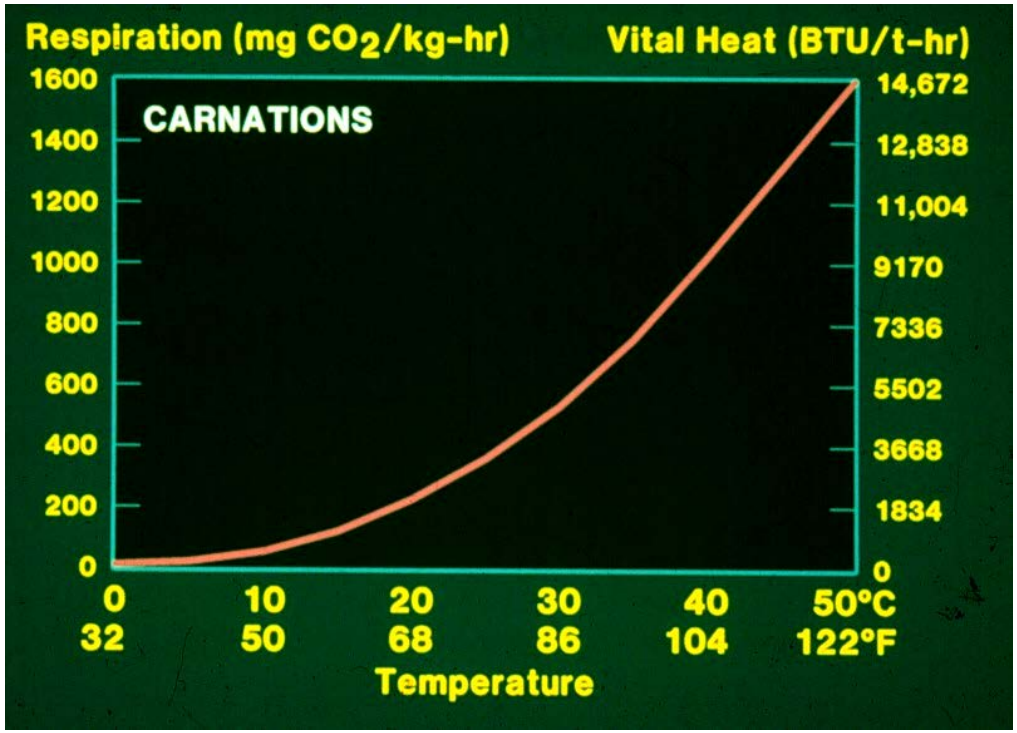
Temperature - why is it important?

- Rate of deterioration α rate of respiration
- Respiration:

  Sugar + O_2 → CO_2 + H_20 + Energy (Heat)

- Respiration increases exponentially with T



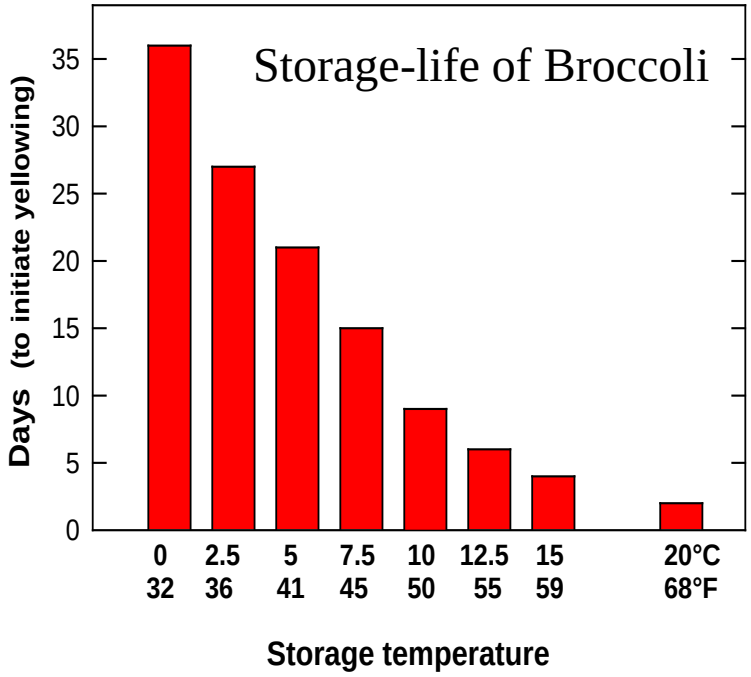


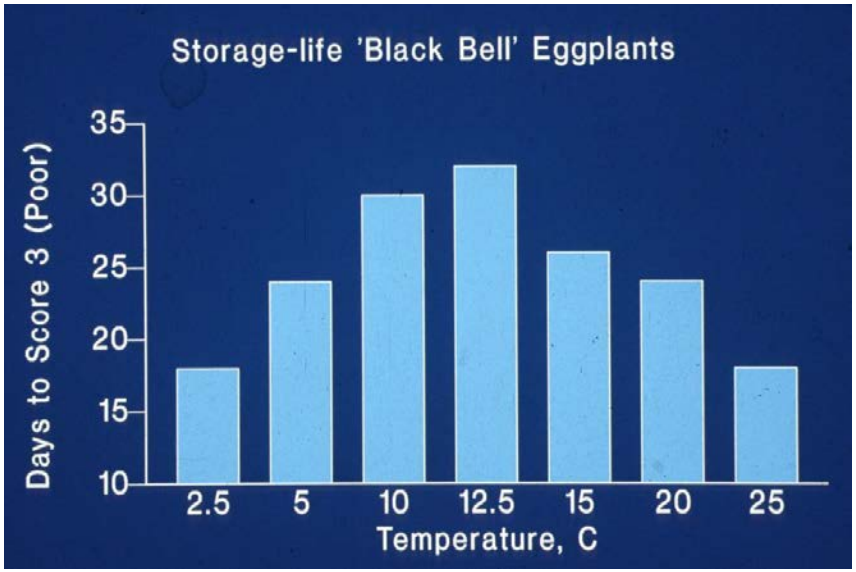
Temperature Management

- Reduce respiration rate
- Reduce decay
- Reduce water loss
- Reduce ripening and deterioration

Two Groups of Products Temperature Compatibility

- Non-chilling sensitive products—store near 0°C
- Chilling sensitive products—store around 10°C (varies)





Chilling Injury of Mango

Damage to mango appearance and eating quality caused by exposing the fruit to temperatures below 12°C

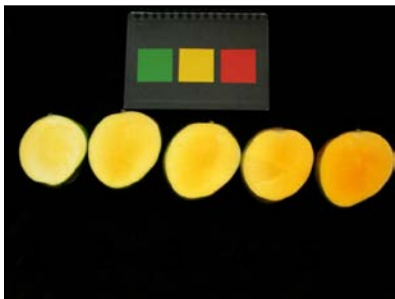
- Lenticel spotting
- Surface pitting
- Poor color development
- Uneven ripening
- Grayish or black skin color
- Internal browning
- Loss of flavor

Chilling Threshold Temperatures* for Different Varieties/Maturities of Mangos

Variety	Maturity/Ripeness Stage**				
	1	2	3	4	5
Ataulfo**	>13	>13	>13	>13	>13
Keitt	13	10	7-10	7	7
Kent	13	13	13	10	10
Tommy Atkins	13	13	13	7-10	7

*Based on continuous exposure for 3 weeks

**Ataulfo fruit developed chilling injury at all temperatures (°C) tested; a chilling threshold temperature was not established.



Differences in Chilling Sensitivity Among Mango Varieties Browning of Peel and Pulp After Storage

		Time in Storage (days)				
Variety		0	3	6	9	12
Choke Anan	Peel	1.0	1.0	1.0	1.0	1.0
	Pulp	1.0	1.0	1.0	1.0	1.0
Nam Dok Mai	Peel	1.0	1.0	2.2	2.5	3.5
	Pulp	1.0	1.0	1.0	1.0	1.0

Subedi & Walsh 2011

Keep Temperatures Low After Harvest

Mechanisms to Reduce Deterioration in Addition to Temperature Management

- Careful handling to reduce injury
- Harvest maturity
- Modified atmospheres
- Hot water treatment
- Chitosan
- 1-MCP (ethylene action inhibitor)
- Drying or other processing

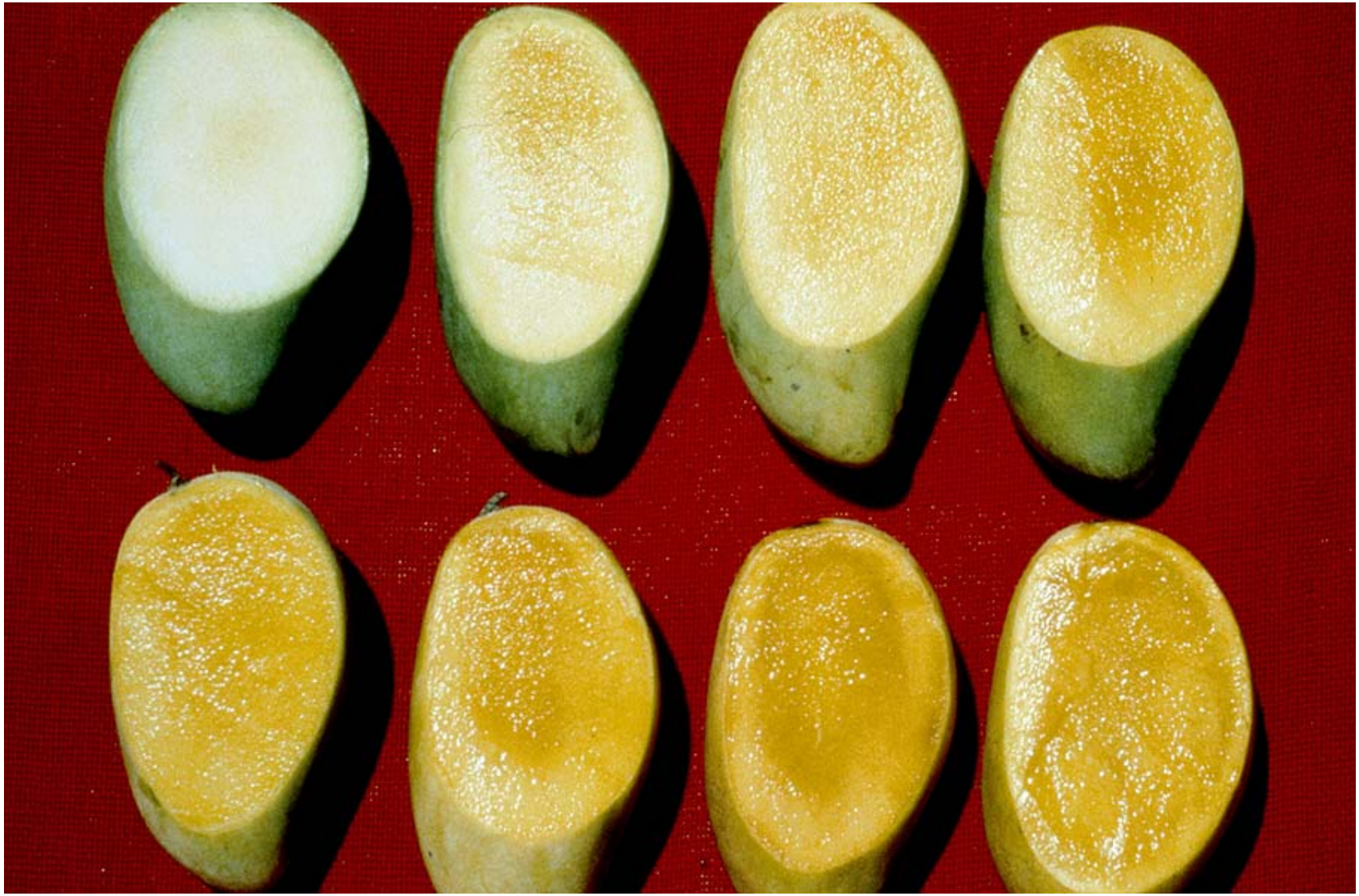
Careful handling to Reduce Injury and Reduce Decay

- **Care in harvest and handling**
  - Do not throw, squeeze, etc.
  - Avoid rough & dirty surfaces
  - Minimize product contact
- **Packaging and packing**
  - Pack gently
  - Use boxes strong enough to support weight above them
  - Do not overfill box

Wounding During Harvest and Handling

Impact Bruising

Harvest Maturity



Effect of Harvesting and Storage Conditions on the Postharvest Quality and Shelf Life of Mango Fruit

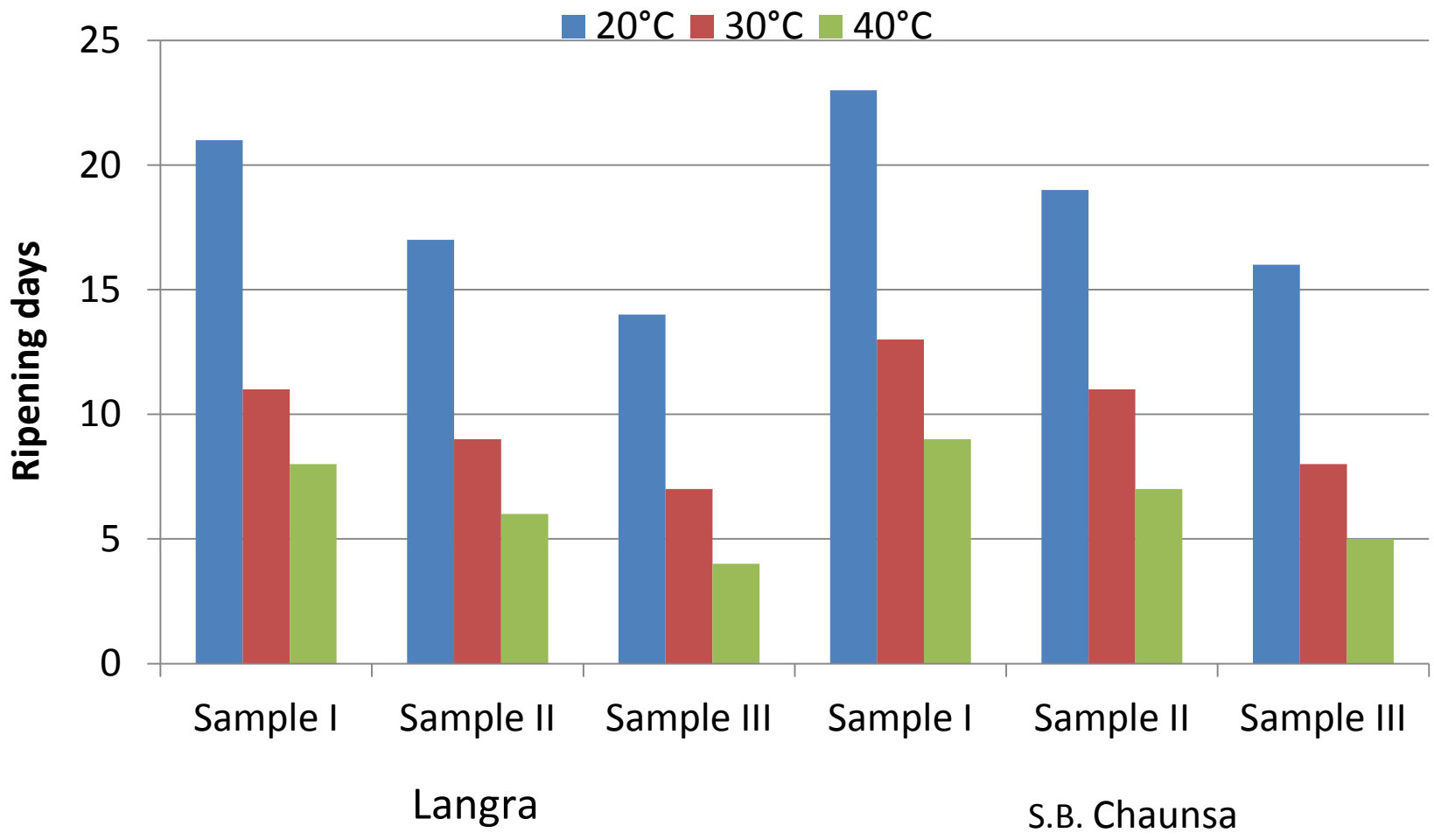
M.K. Baloch and F. Bibi
Gomal University
Pakistan

Color and Firmness at Harvest for Langra and S.B. Chaunsa Mangos Harvested at different days from fruit set

Variety	Sample	Days after Full Bloom	Color	Firmness
Langra	I	80	0	10
	II	95	0.5	9.5
	III	110	1.5	9.0
Chaunsa	I	80	0.6	9.3
	II	95	0.9	9.2
	III	110	1.8	8.7

Baloch & Bibi 2012

Time for Mango Fruit Harvested at Different Maturity Stages to Ripen



Baloch & Bibi 2012

Modified Atmospheres can be a useful supplement in Postharvest Handling

- **Reducing oxygen**
- **Increasing carbon dioxide**
- **Removing carbon dioxide**
- **Removing ethylene and other volatiles**

Composition of Air

78.08%	Nitrogen (N_2)
20.95%	Oxygen (O_2)
0.93%	Argon (Ar)
0.03%	Carbon dioxide (CO_2)
0.0001%	Ethylene (C2H4) (1 ppm)

Modified or Controlled Atmospheres can be a useful supplement in Postharvest Handling

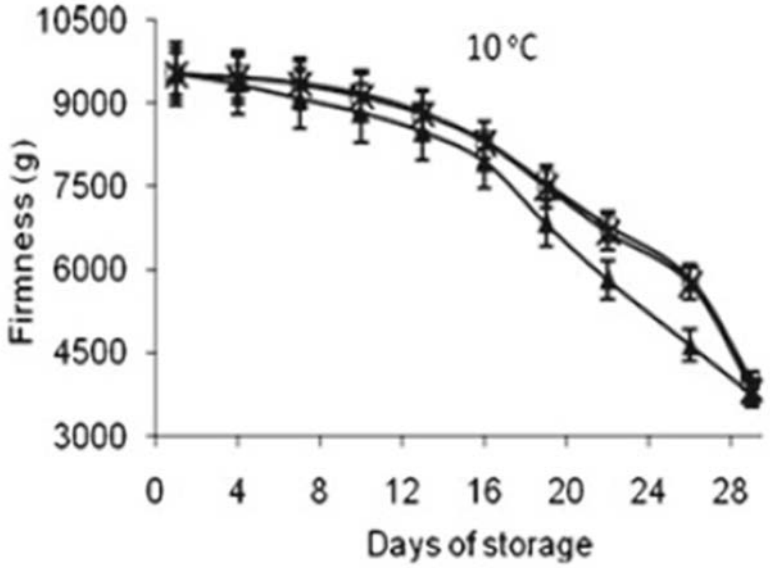
Cantaloupe; Bag in Box to provide high CO2

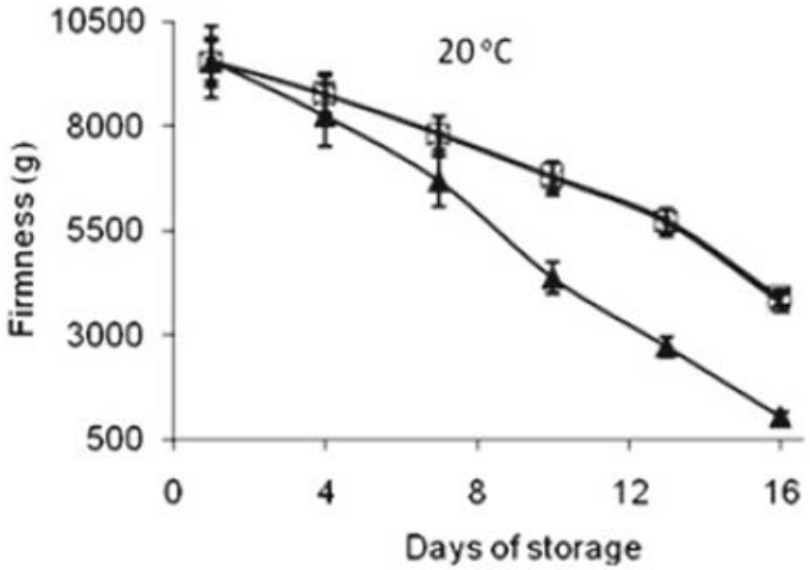
Strawberry: Pallet shrouds with injected CO2 for Botrytis control

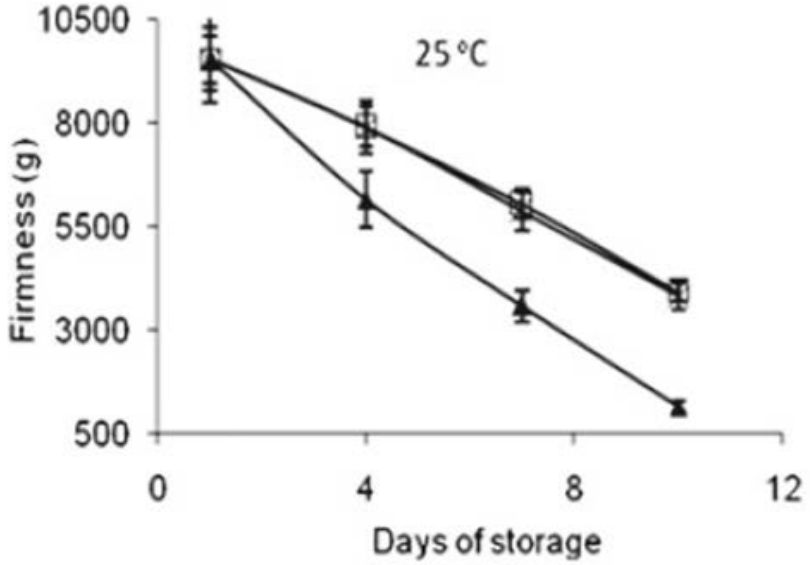
Modified Atmospheres may:

- ❖ **Be a good supplement to temperature**
- ❖ **Maintain green tissues**
- ❖ **Retard ripening**
- ❖ **Reduce discoloration**
- ❖ **Retard microbial growth**
- ❖ **Reduce water loss**

Changes in Firmness of Guavas Stored in Modified Atmosphere Packages





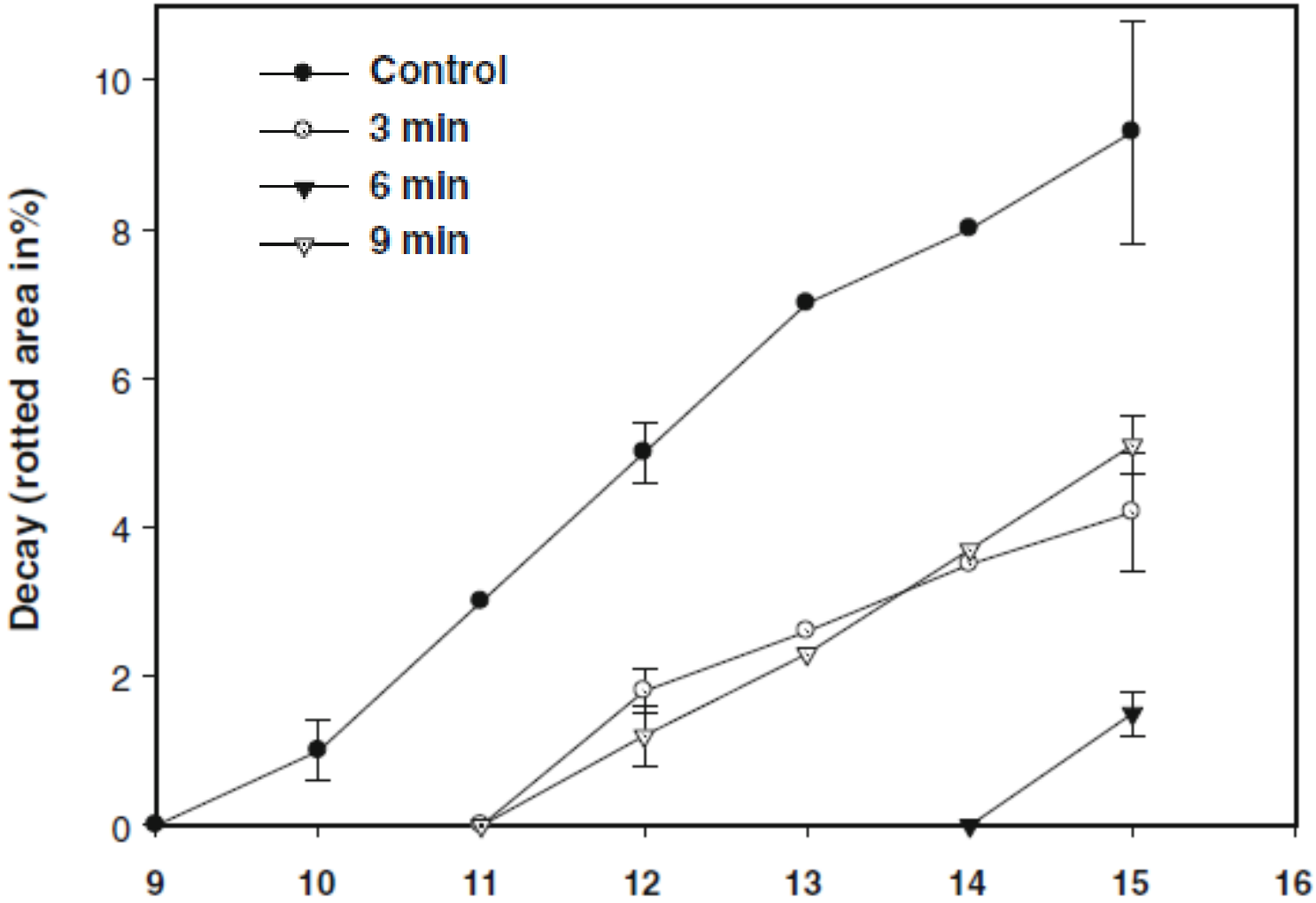


CS PCG-LFR-3 PCG-LFR-4

S. Mangaraj et al. 2012

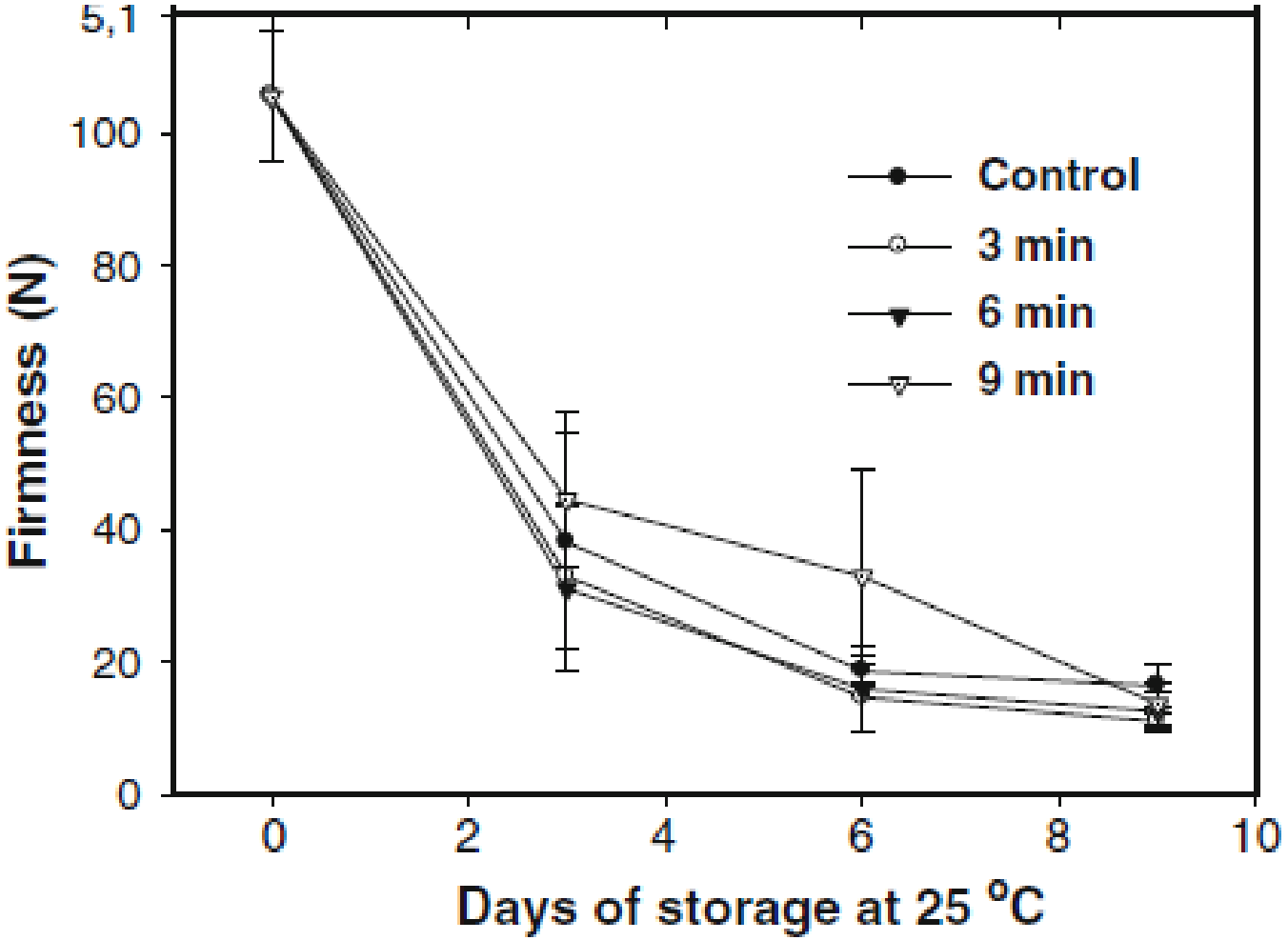
Hot Water Treatment for Anthracnose Control

Effect of Hot Water Immersion at 55°C on Development of Anthracnose



Chavez-Sanchez et al. 2013

Change in Firmness of Papaya Fruit Treated with Hot Water at 55°C



Chavez-Sanchez et al. 2013

Use of Chitosan to Reduce Deterioration

Macrothink Institute™

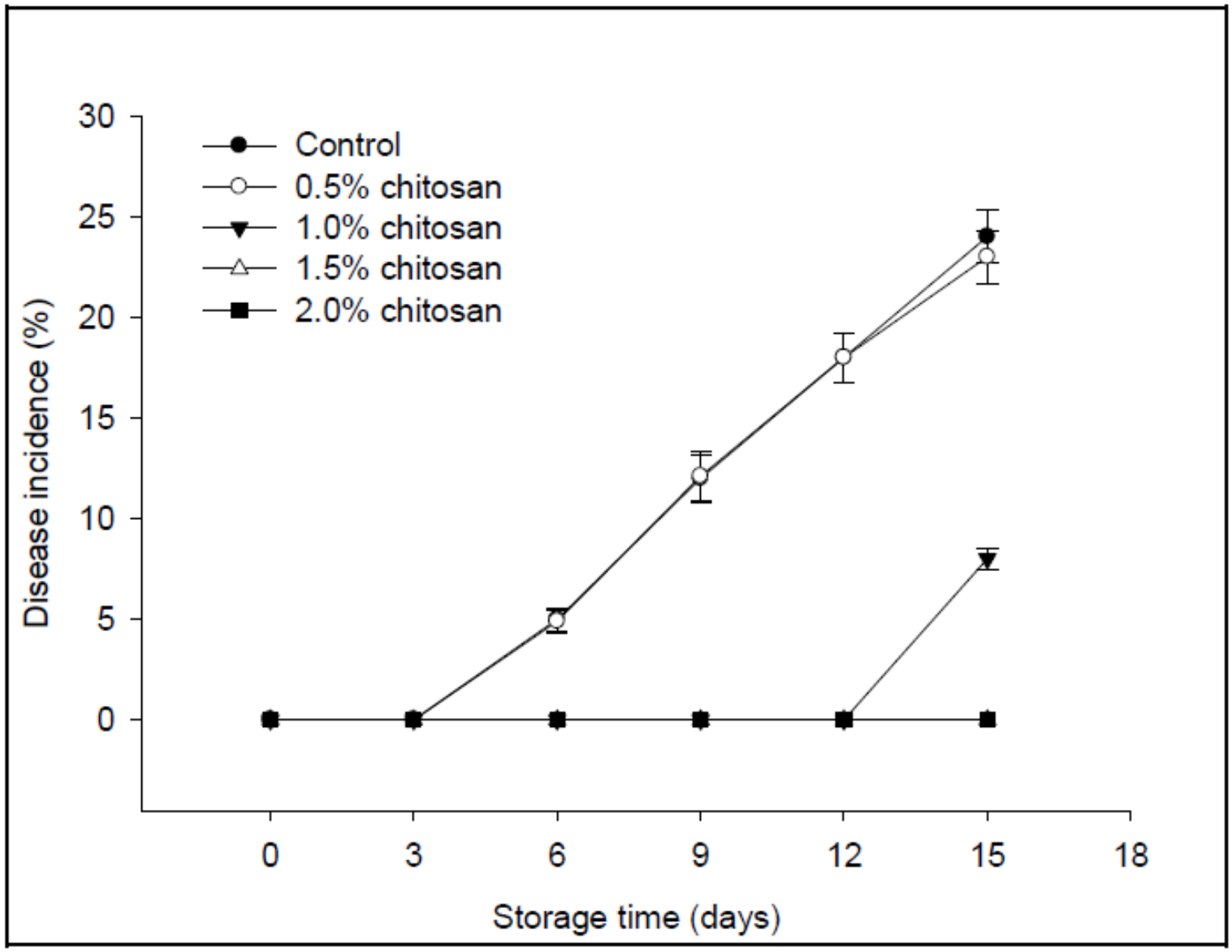
Journal of Biology and Life Science
ISSN 2157-6076
2012, Vol. 3, No. 1

Control of Anthracnose by Chitosan through Stimulation of Defence-Related Enzymes in Eksotika II Papaya (*Carica papaya* L.) Fruit

Asgar Ali (corresponding author)

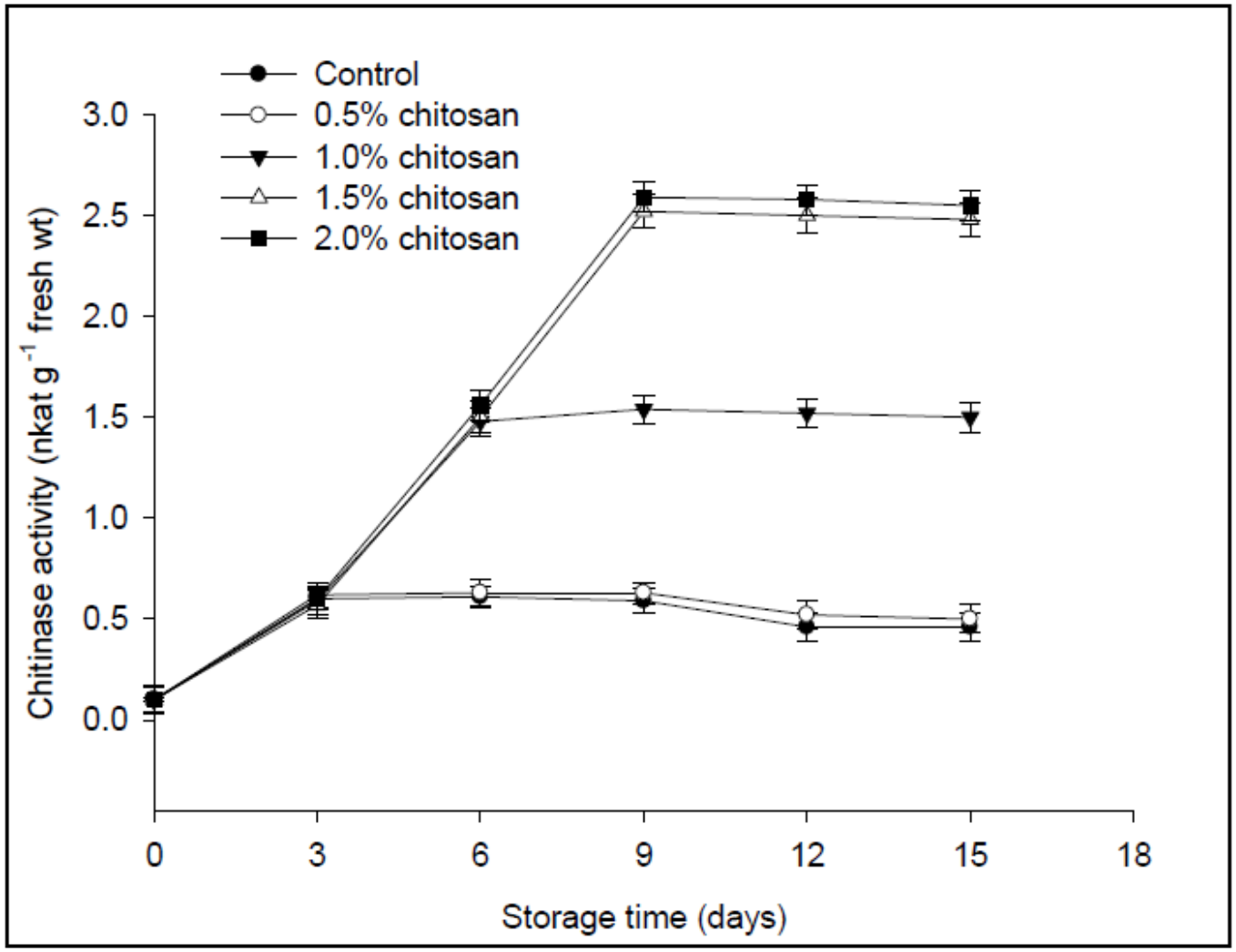
Ali et al. 2012

Effect of Chitosan on Development of Anthracnose in Papaya



Ali et al. 2012

Chitinase Activity in Papaya Fruit Treated with Chitosan and Inoculated with *Colletotrichum gloeosporiodes*

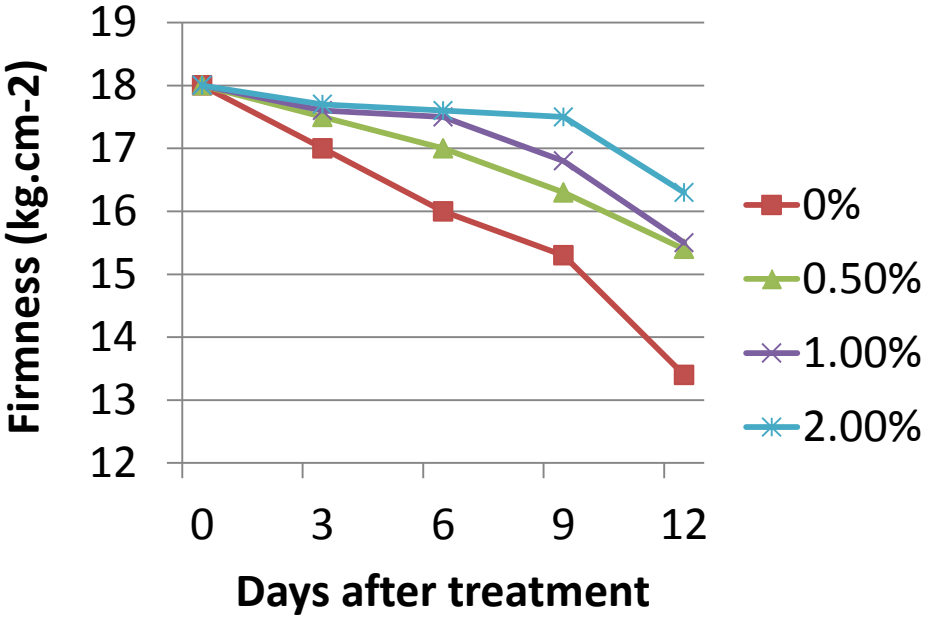


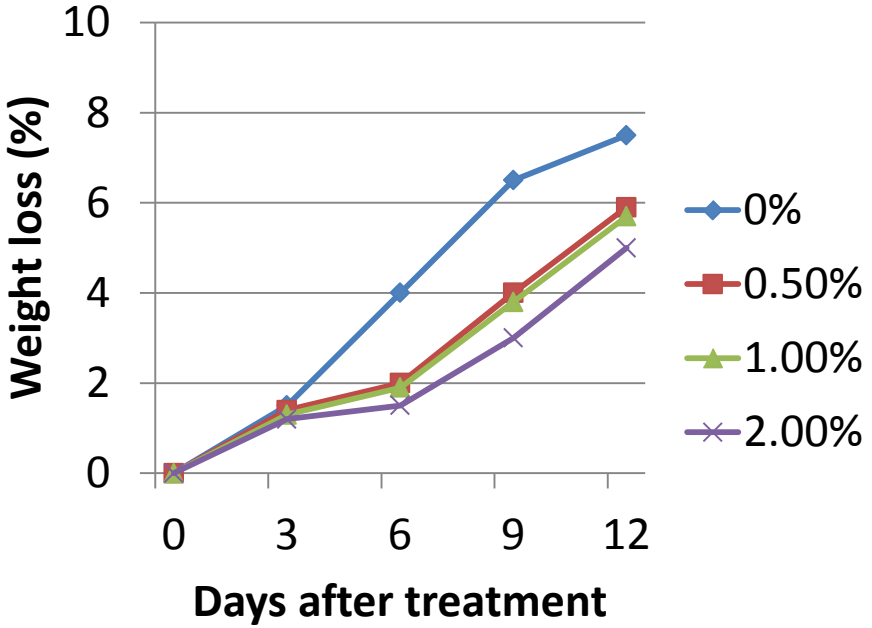
Ali et al. 2012

Effects of Chitosan Coating on Postharvest Life and Quality of Guava Fruit During Cold Storage

Hong, et al. Chinese Academy of Tropical Agricultural Sciences, China

Effect of Chitosan Coating on Firmness and Weight Loss of Guava Fruit during Storage at 11C



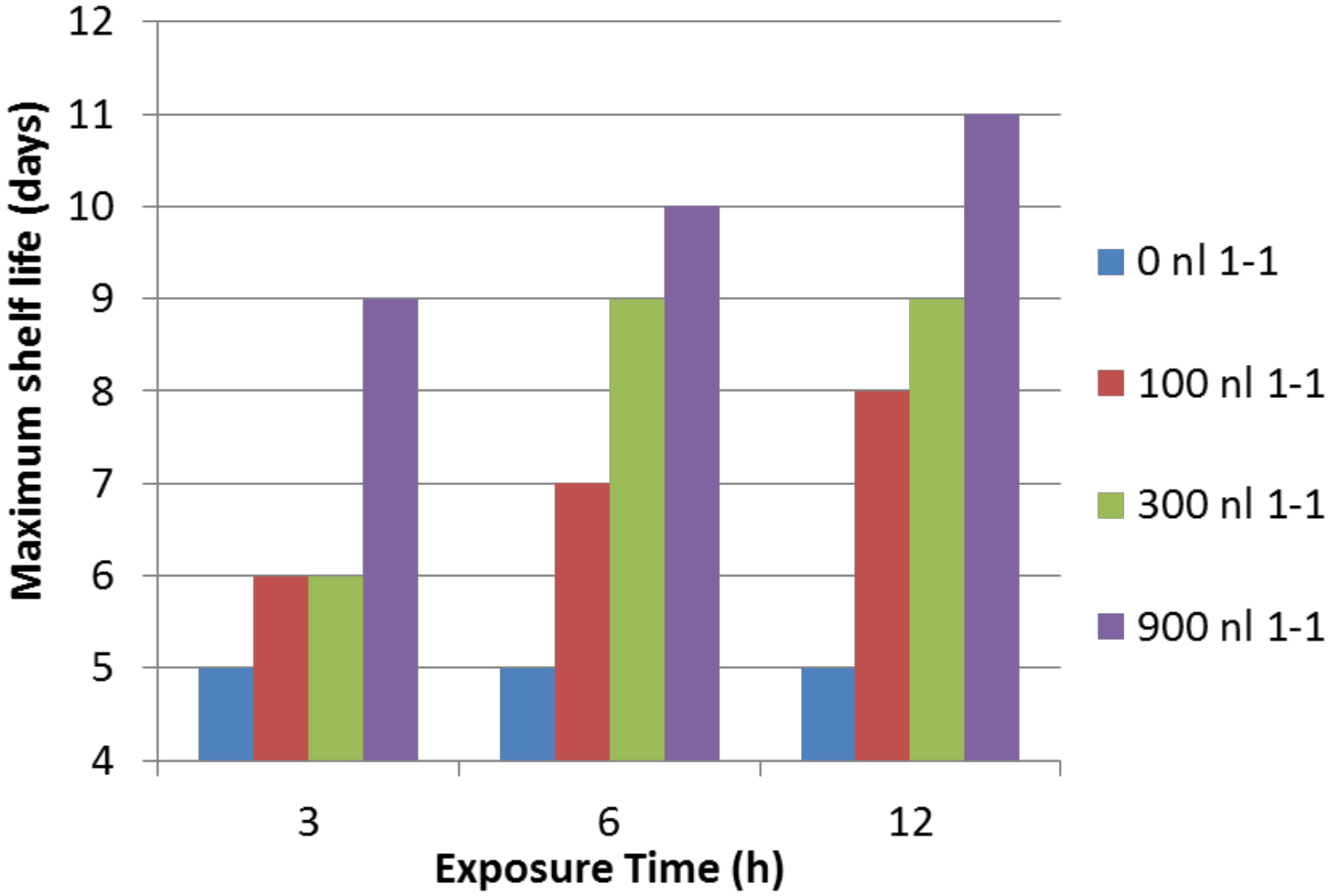


Hong et al. 2012

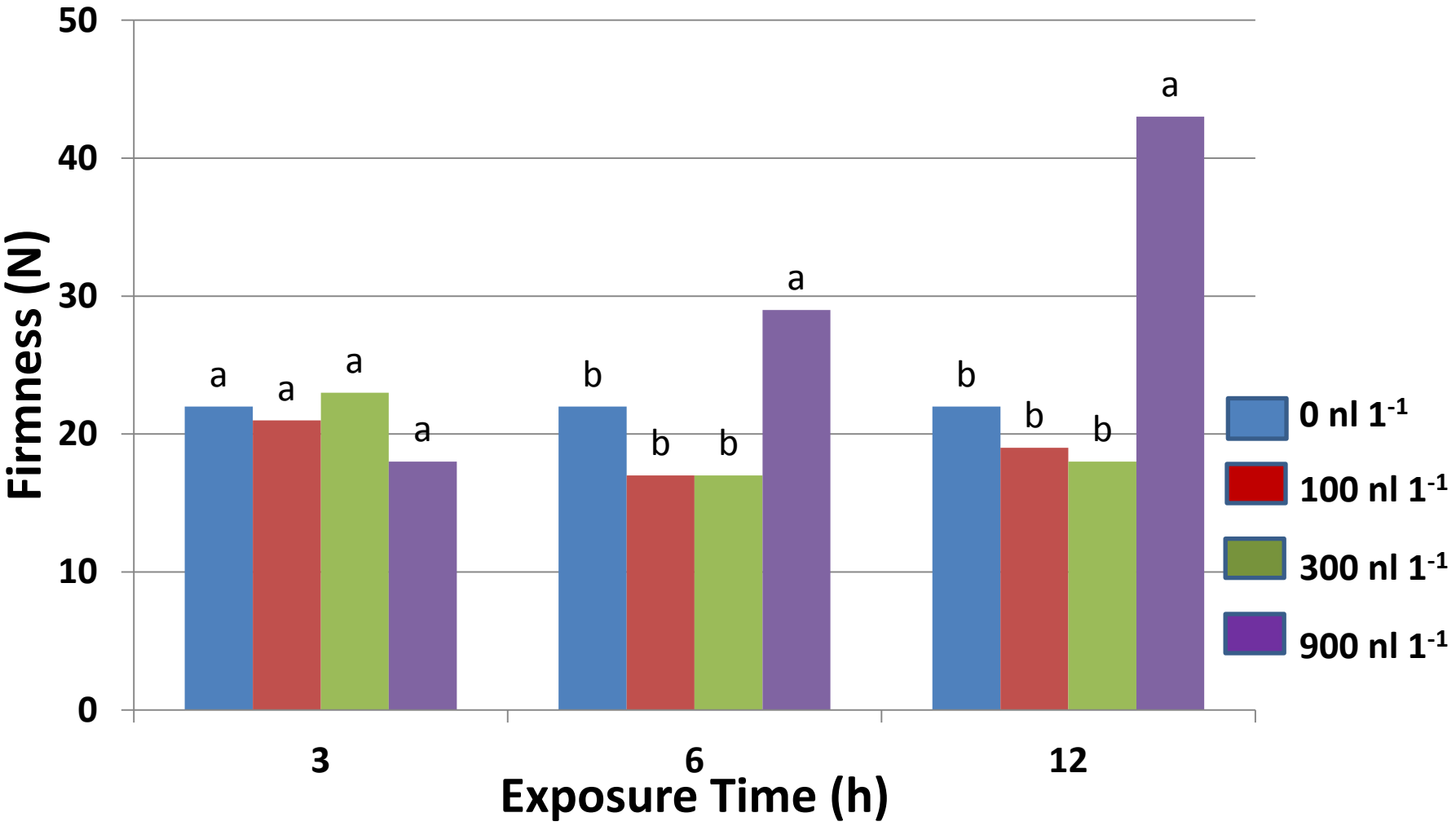
1-Methylcyclopropane

- Binds to ethylene receptor
- Inhibits the effects of ethylene
  - Reduced respiration
  - Reduced yellowing
  - Reduced softening
- Eventually the fruit must ripen

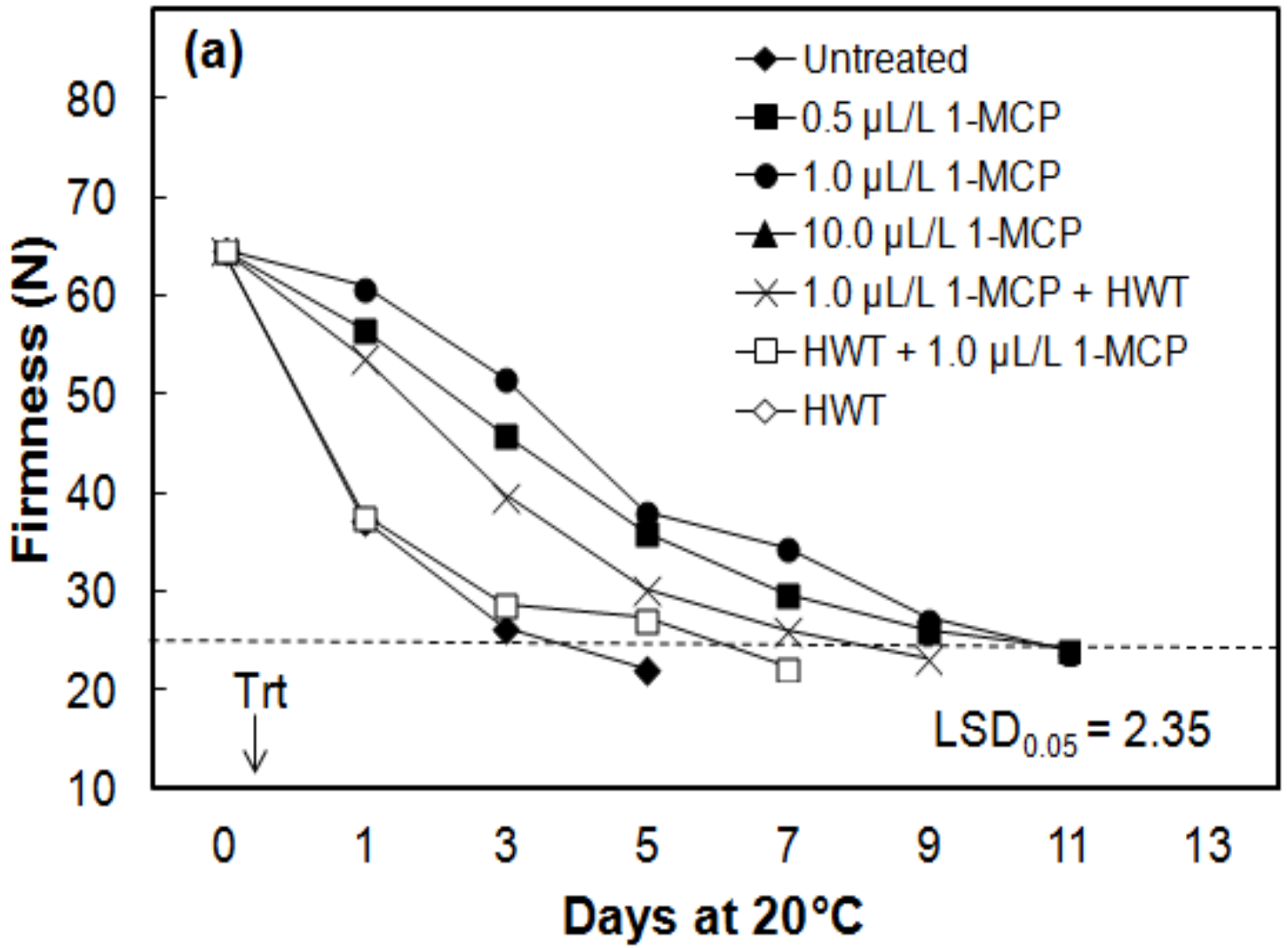
Maximum Shelf Life and respiration rate of Guava Fruit Treated with 1-MCP and Stored at 25°C



Firmness of ‘Pedro Sato’ Guava Fruit after 1-MCP Treatment and Full Ripening at 25°C



Effect of 1-MCP on Keitt Mango Ripening



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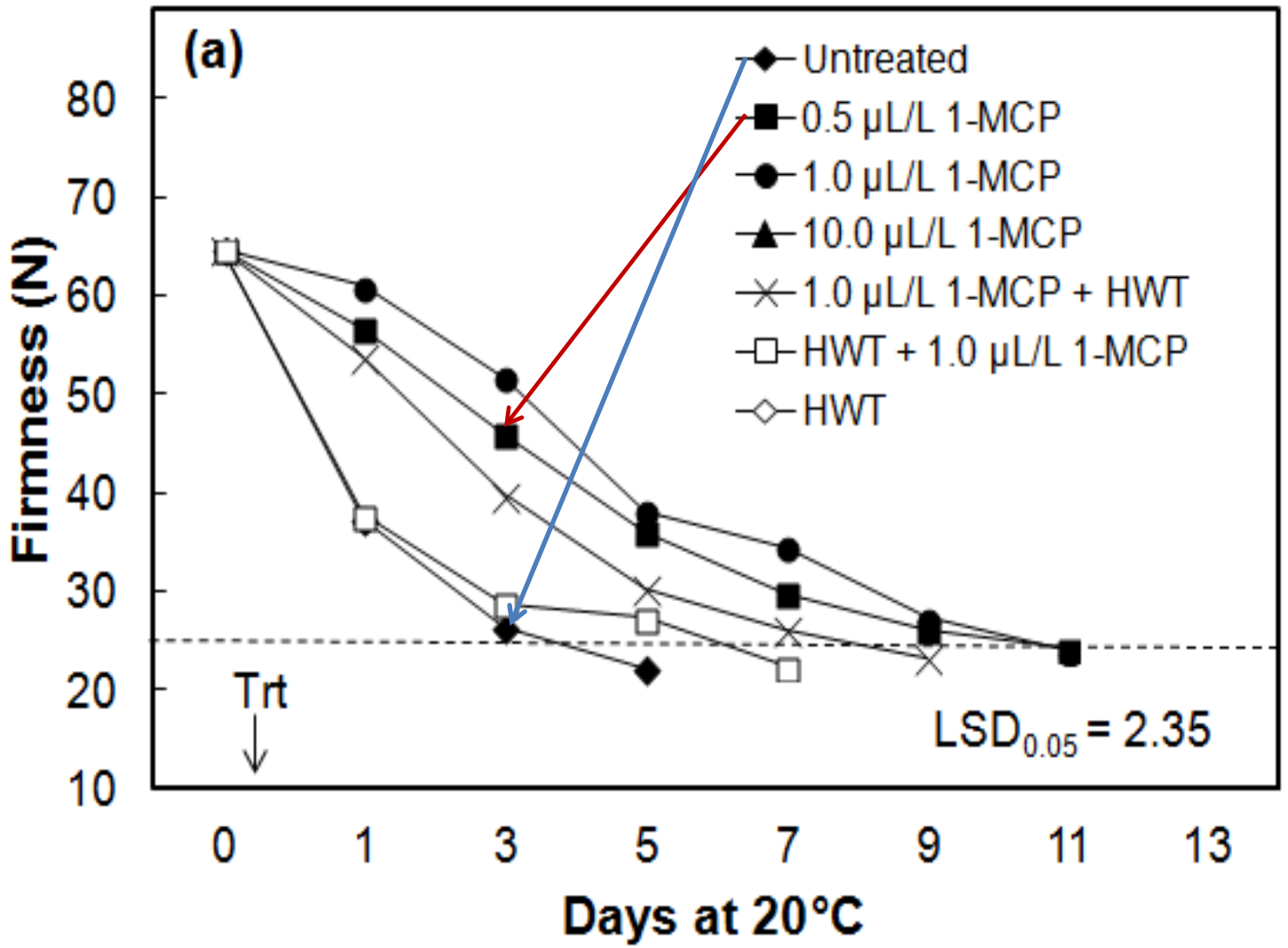

Processing to Preserve Fruit after Harvest

- Drying
- Fruit leathers
- Juicing
- Canning

Horticulture Innovation Lab Chimney Dryer

- Inexpensive
- Efficient
- High air speed

Basic Postharvest Handling Principles

1) Harvest at correct maturity
2) Reduce physical handling
3) Protect product from sun, delays
4) Keep packingline simple and clean; ensure good worker hygiene
5) Select, classify, and pack carefully
6) Align cartons, strap pallet
7) Cool as soon as possible
8) Know market and product requirements
9) Coordinate efficient & rapid handling
10) Train and compensate workers adequately

Details Do Make the Difference!!

Problems often result from not adhering to basic principles

Questions?

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