




# 2018 | THE ALMOND CONFERENCE

MAXIMIZING ALMOND QUALITY AND SHELF LIFE

ROOM 306-307 | DECEMBER 4, 2018





The background of the slide is a collage of three images. The top right shows a close-up of several almonds with their characteristic brown, textured skins. The bottom left and right show rows of almond trees in an orchard, with green foliage and brown trunks. A large, semi-transparent green rectangle is overlaid on the left side of the slide, containing the title text.

# Managing Humidity and Temperature to Preserve Almond Quality





# Today

1. Almond Physical and Chemical Properties
2. Interactions with Environmental Factors
3. Findings from Shelf Life Studies
4. Simple Means to Preserve Quality

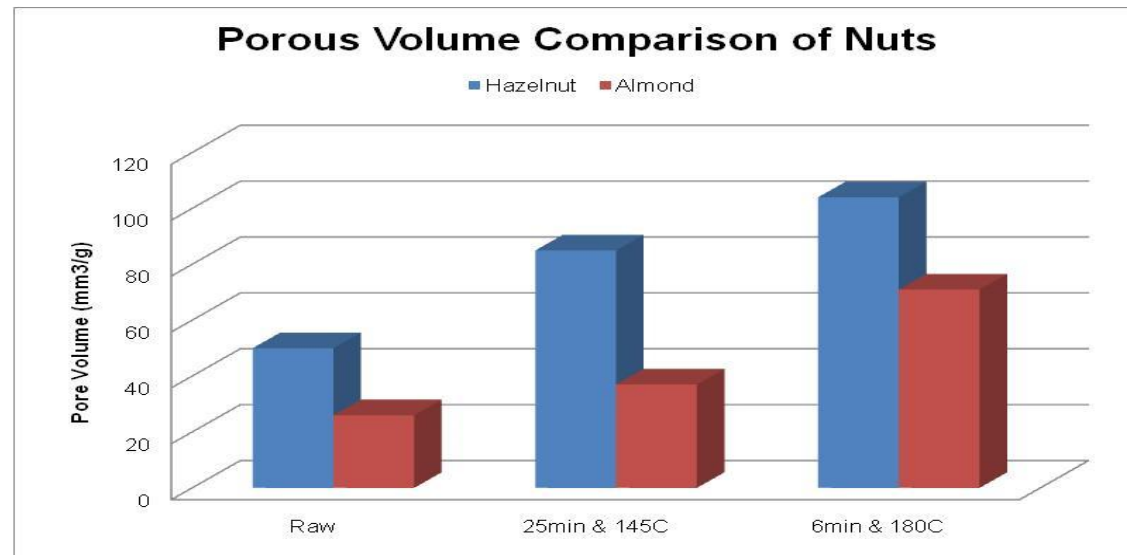
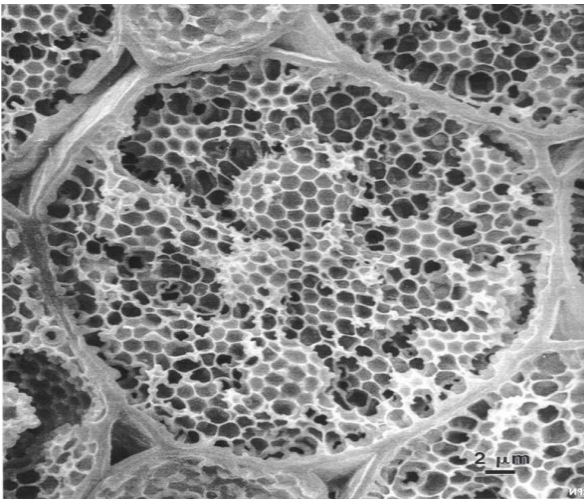
Guangwei Huang

Associate Director, Food Research and Technology

Almond Board of California

# Physical and Chemical Properties of California Almonds

- Low water content: < 6% (no bacteria and mold growth)
- Tight cellular structure: less porous
- Right fatty acid profile: high in mono-unsaturated and low in poly-unsaturated (S:M:P = 8:66:26)
- High natural antioxidant content: vitamin E in flesh and flavonoids in skins

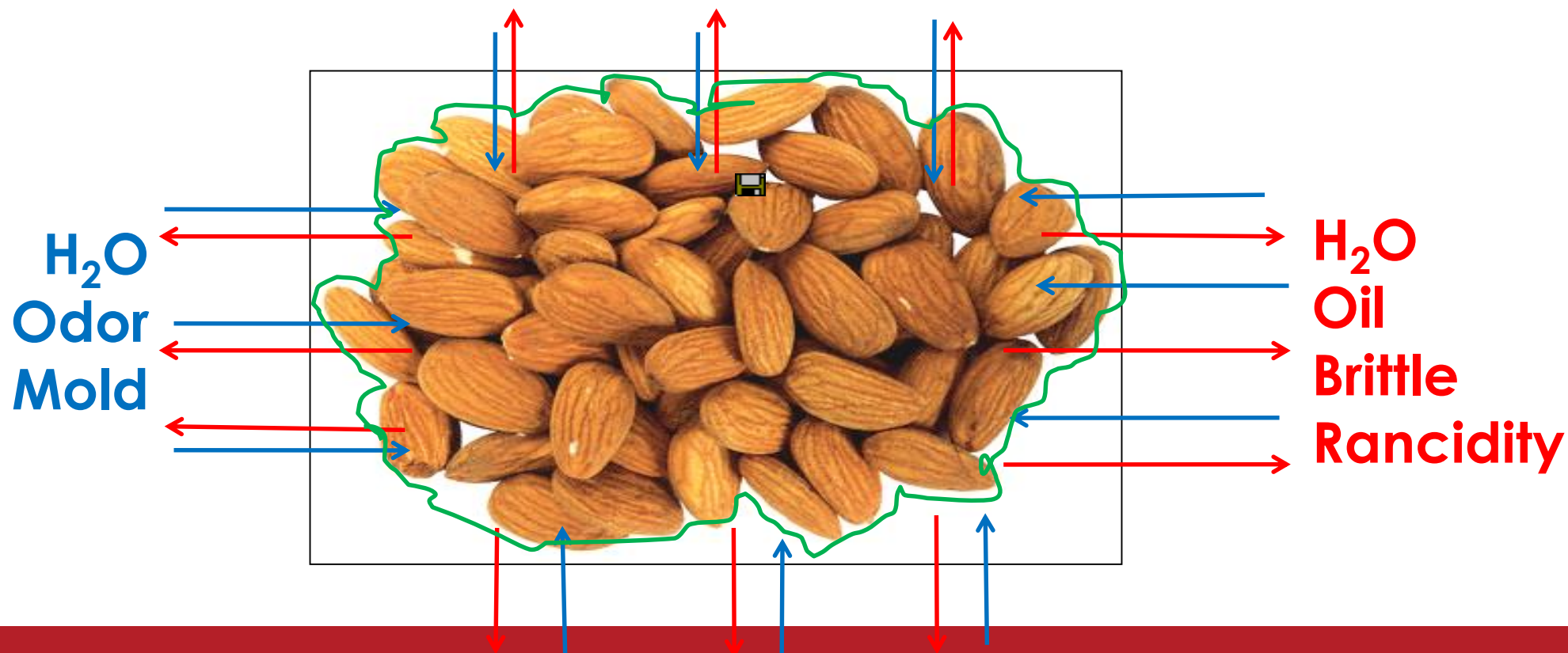


Adapted from Perrein presentation to ABC 2007

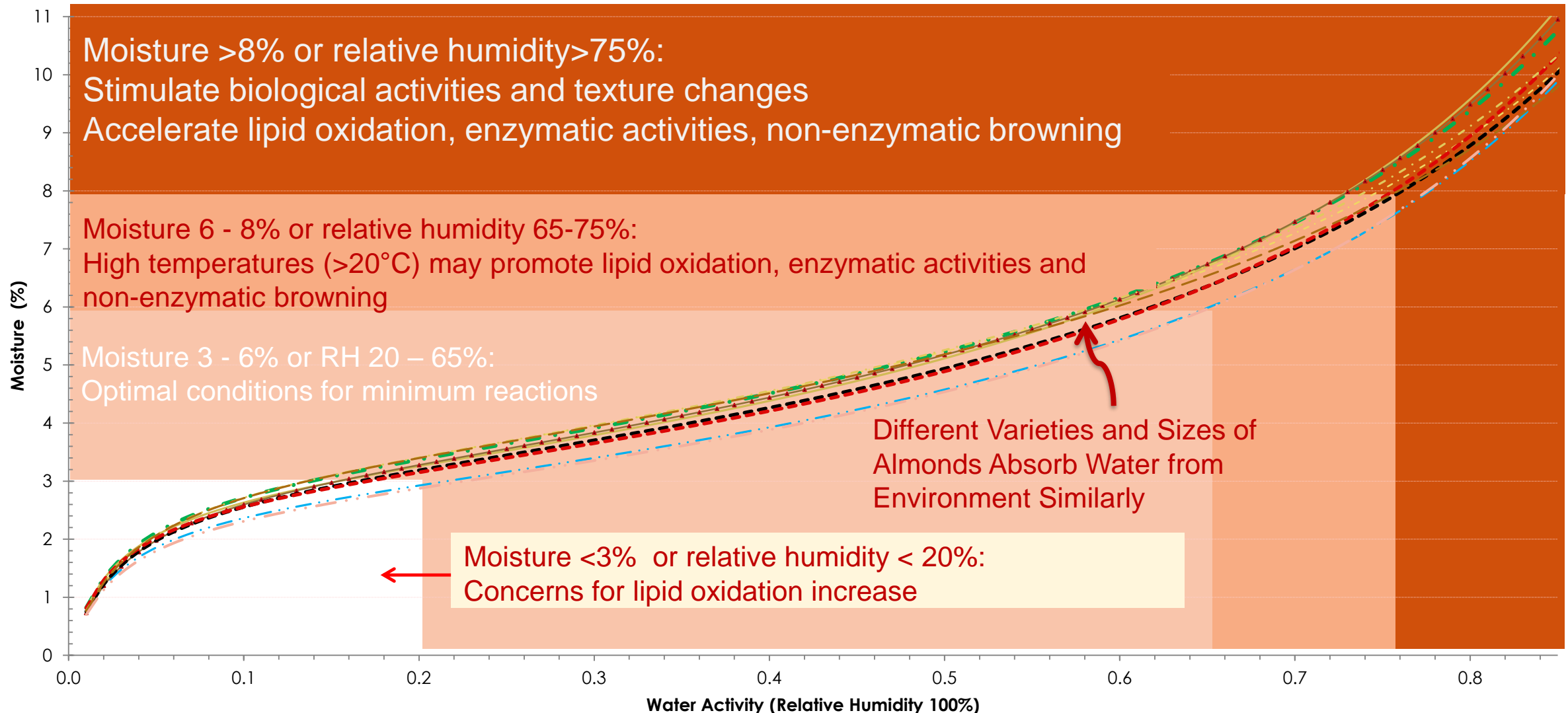
# Almond Interactions with Environment

Temperature, humidity, packaging, processing conditions affect quality  
(oil migration, water migration, flavor fading, etc.)

Environment:      Temperature      ↓      ↑      Humidity      ↑      ↓



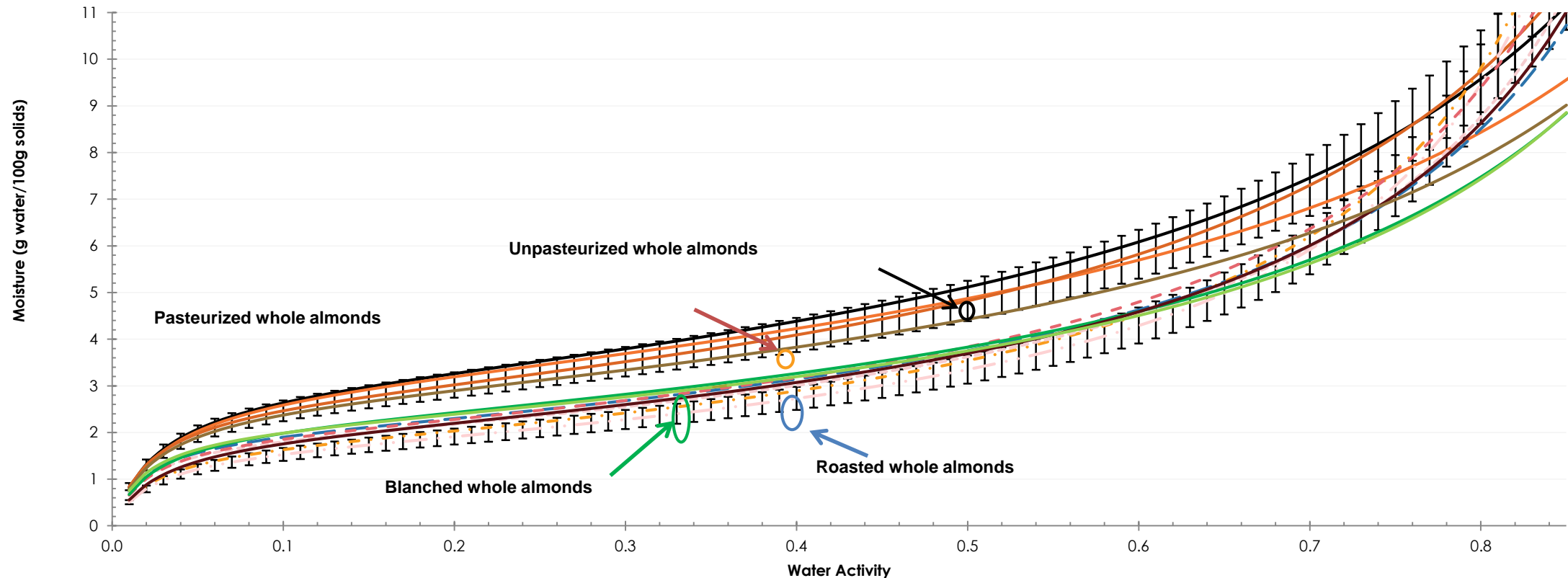
# Water Sorption Isotherm of Raw Almonds – Impact of Relative Humidity on Moisture



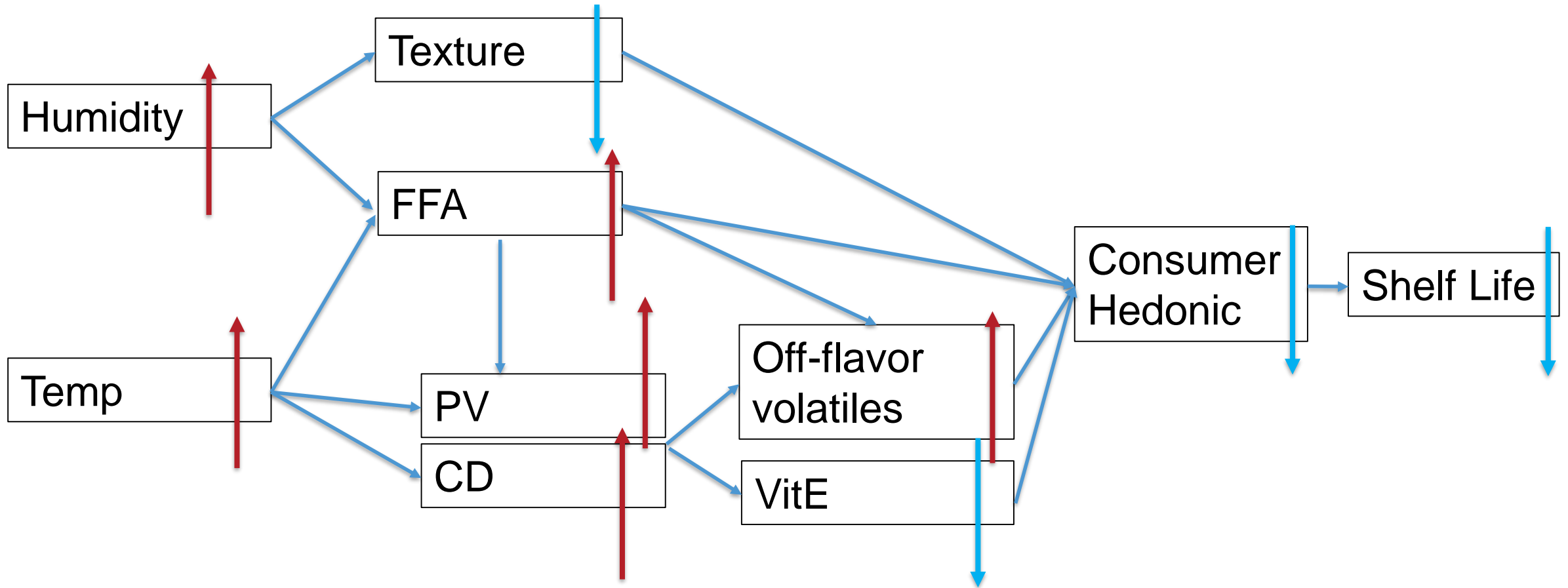


# Water Sorption Isotherm of Processed Almonds – Impact of Relative Humidity on Moisture

- Pasteurization (PPO & Steam) was not found to impact moisture sorption
- Roasting & blanching were found to reduce moisture sorption
- Varieties & sizes have little impact on moisture sorption

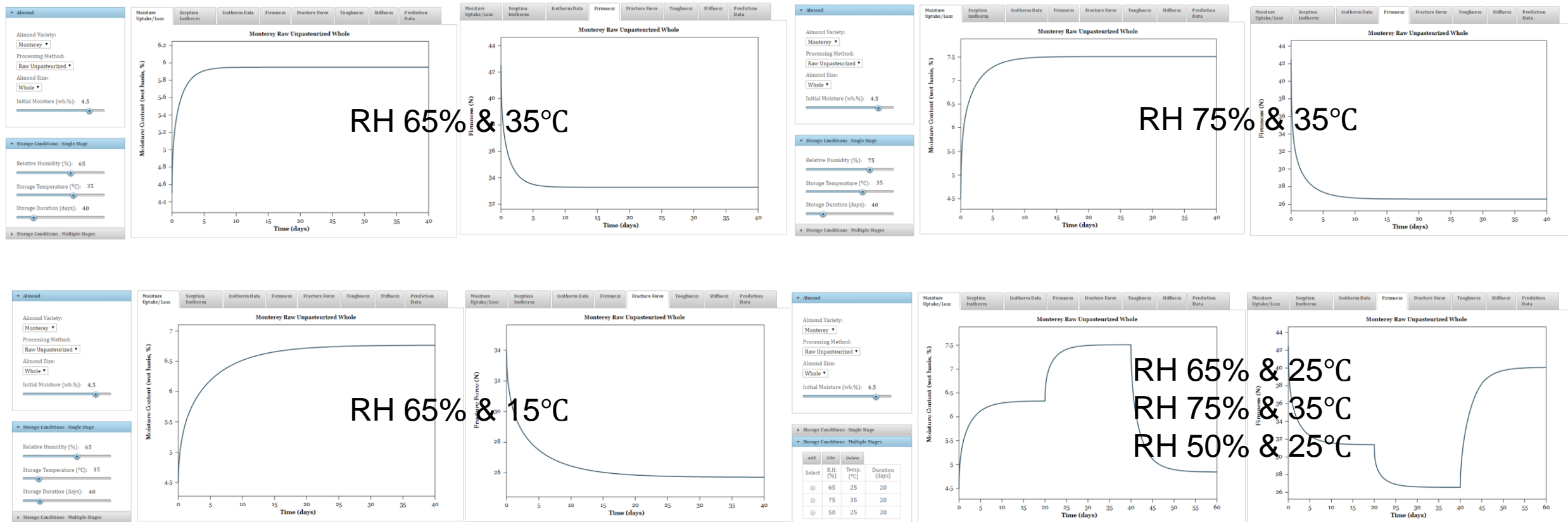


# Dynamics of Shelf Stability Parameters



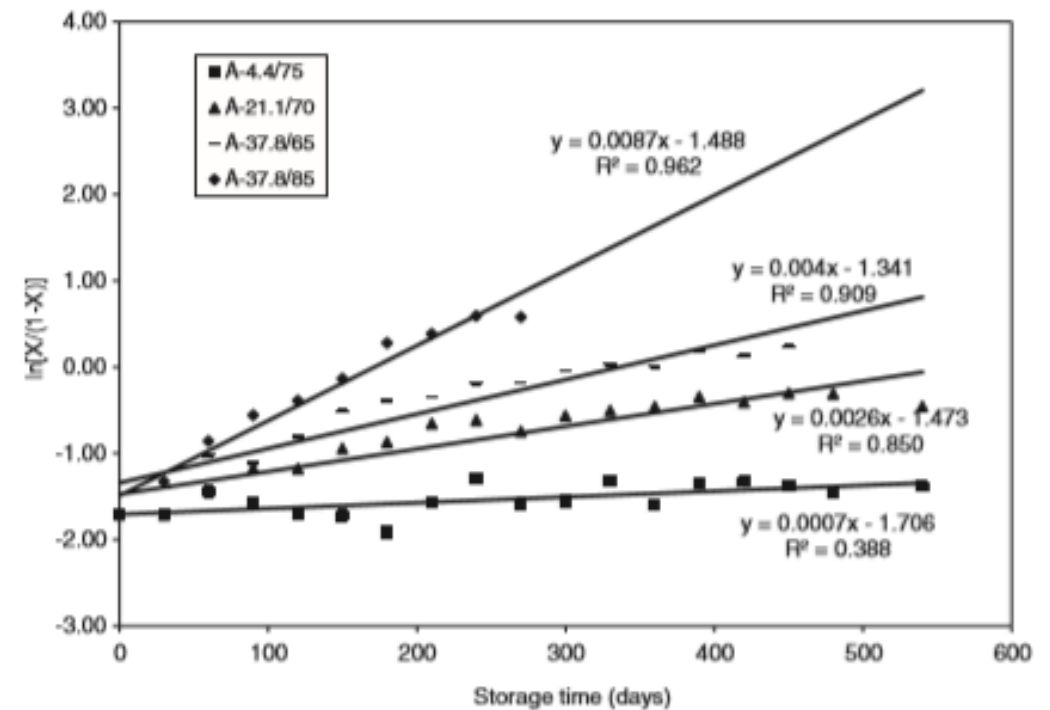
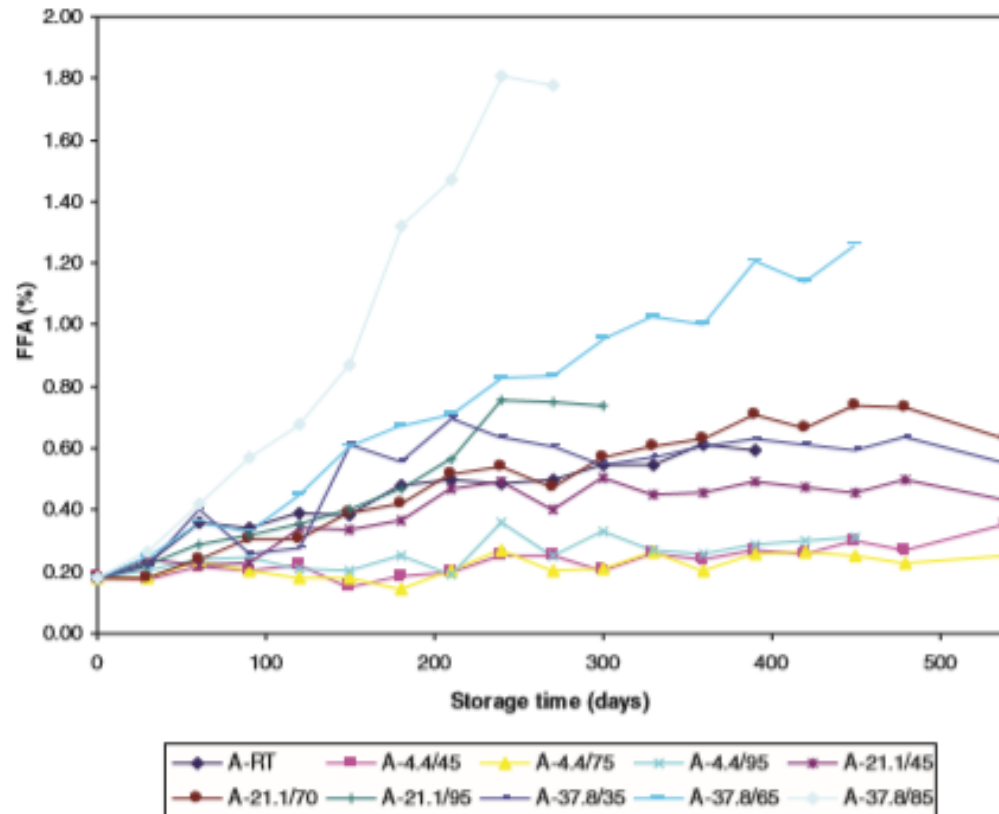


# Impact of Temperature and Humidity on Moisture and Texture of Almonds (Online Tool)



<http://www.almonds.com/almond-calculator/index.html>

# Impact of Temperature and Humidity on FFA in Whole Almonds



# Major Findings from Almond Shelf Life Study (University of Georgia, 2015)

	Raw NP	Light Roasted NP
Unlined carton (UCs) (600 ± 5 g)	X	
Polypropylene bag (PPBs) (300 ± 5 g) <sup>a</sup>	X	X
High barrier bag (HBBs) (300 ± 5 g)		X

<sup>a</sup> Bags were flushed with food-grade N<sub>2</sub> and sealed, providing a “pillow-pack” design. The headspace was analyzed in multiple samples, and the initial O<sub>2</sub> level was < 0.5%.

- Kernel acceptability or rejection by consumers is complex ,
  - No single chemical indicator or sensory attribute leads to sample rejection
- For raw kernels, texture changes (due to moisture migration) had much more influence on consumer panel rejection than did odor or flavor changes
- For roasted kernels, flavor (most important) and texture (but *not* odor) were significant predictors of overall acceptability





# Shelf Life Extension Benefits from Packaging

## Shelf Life and Packaging Extension (month)

Conditions		Raw NP <sup>1</sup>			Roasted NP <sup>2</sup>		
Temp (°F)	rH (%)	UC	PPB	Extension	PPB	HBB	Extension
40	90	4.8	>24	>19	>16	>16	?
59	50	14.6	>24	>9	>16	>16	?
	65	12	23.3 <sup>3</sup>	>11	>16		?
77	50	15.6	>24	>8	>16	>16	?
	65	11	14.5	>3	15		1
95	50	5.0	10.6	>5	13.8	15.8	2
	65	1.4	5.7	>4	10.6		>5

<sup>1,2</sup> Samples not rejected by consumer panel at the end of storage of 24 months for raw and 16 months for roasted

<sup>3</sup> Samples removed from study before rejection due to storage cabinet failure

# Summary – Shelf Life Preservation Recommendations

- Current Recommendation: Storage for all almond forms in cool and dry conditions (<50°F/<10°C and <65% relative humidity).
- Lower humidity (< 60%) will ensure longer stability due to lower moisture (<5.5%).
- With proper packaging, product can have longer stability even slightly higher humidity such as ~65%.
- A cool temperature of <50°F/<10°C is optimal, but a higher temperature that does not stimulate insect activity may work as well to control moisture migration (<59°F/<15°C ).
- Almonds are a shelf-stable nut that can have more than two years of shelf life when stored at the recommended conditions.



*Thank You!*

Any Questions?







# **Maximizing Almond Quality and Shelf Life: CPG Manufacturer Perspective**

Mark Kline, Sr. Manager, Nut & Energy Sourcing, Global Commodities

December 4<sup>th</sup>, 2018

The Almond Conference

**HERSHEY** 

# HERSHEY SUPPLIERS QUALITY EXPECTATIONS

## Supplier Quality Expectations Manual

<https://www.thehersheycompany.com/en-us/shared-goodness/shared-business/responsible-sourcing.html#tab1>



“Give them quality. That’s the best kind of advertising in the world.”

# HERSHEY SUPPLIER APPROVAL PROCESS

- **Assess suppliers Food Safety and Quality Management System**
  - **Global Food Safety Initiative (GFSI) certification & compliance**
- **Conduct site visit & facility audit**
- **Evaluation of product/test loads**





# Hershey's Preferred Almond Requirements



- Flavor
- Shape
- Size
- Texture
- Grade

# ALMOND QUALITY: FOREIGN MATERIAL

- Preventative programs in place
  - Glass and hard/brittle plastic program
- FM prevention, detection and control steps
  - E.g. x-ray, metal detectors, magnets, filters, screens
  - Documentation of root cause and corrective actions
- Zero tolerance for High Risk Foreign Material
  - E.g. glass, plastic, ferrous & non-ferrous metal, other nut meats



# ALMOND QUALITY: FLAVOR & STABILITY

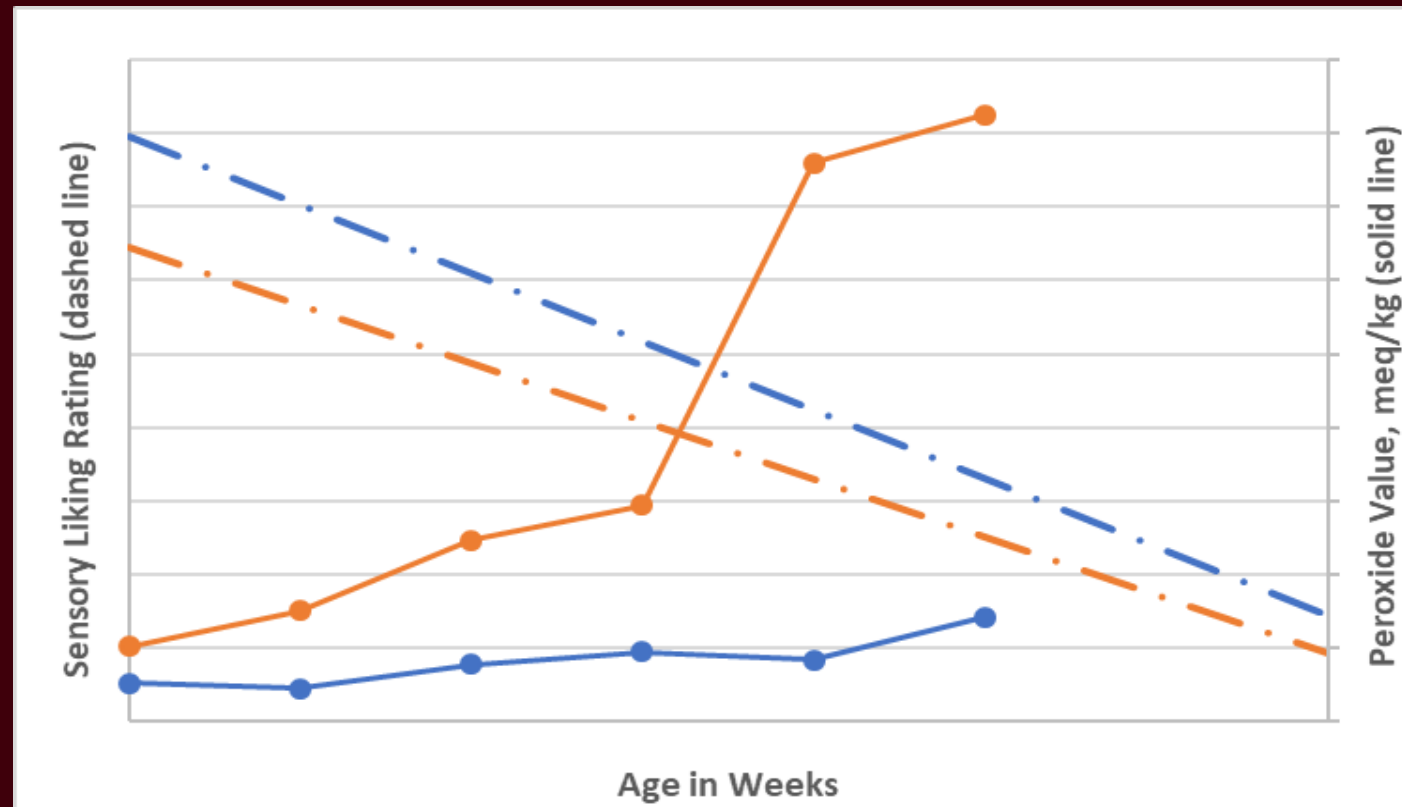
- Initial flavor is as important as final shelf-life flavor
- Case Study – Kisses with Almonds





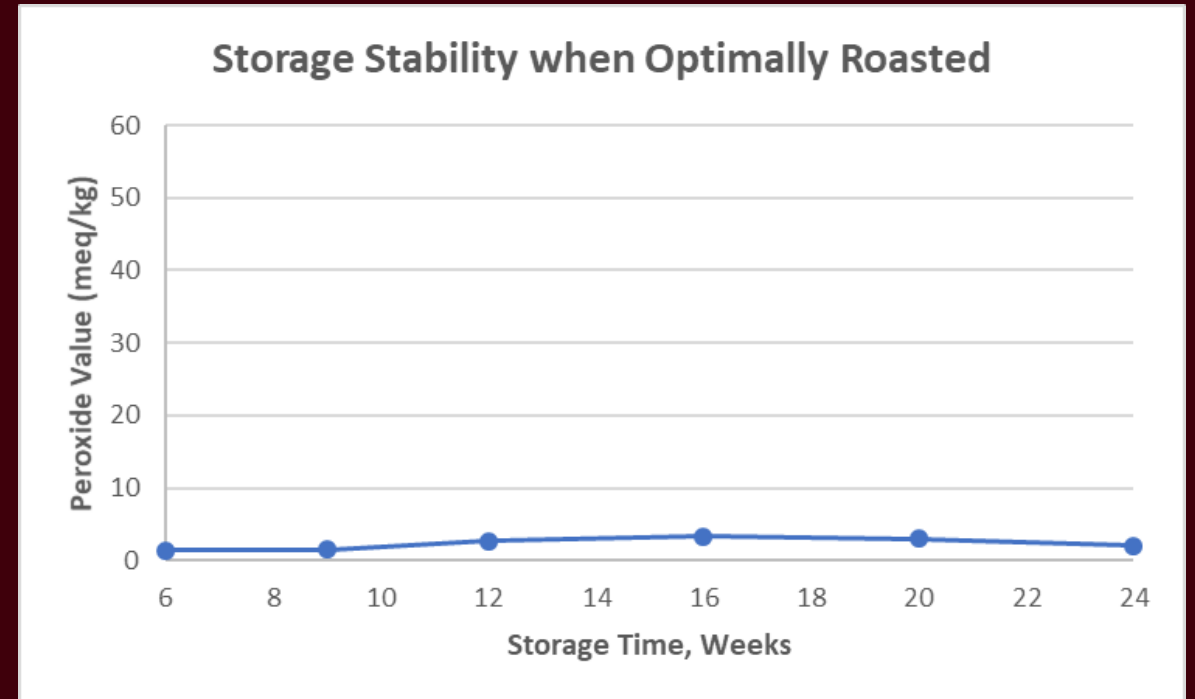
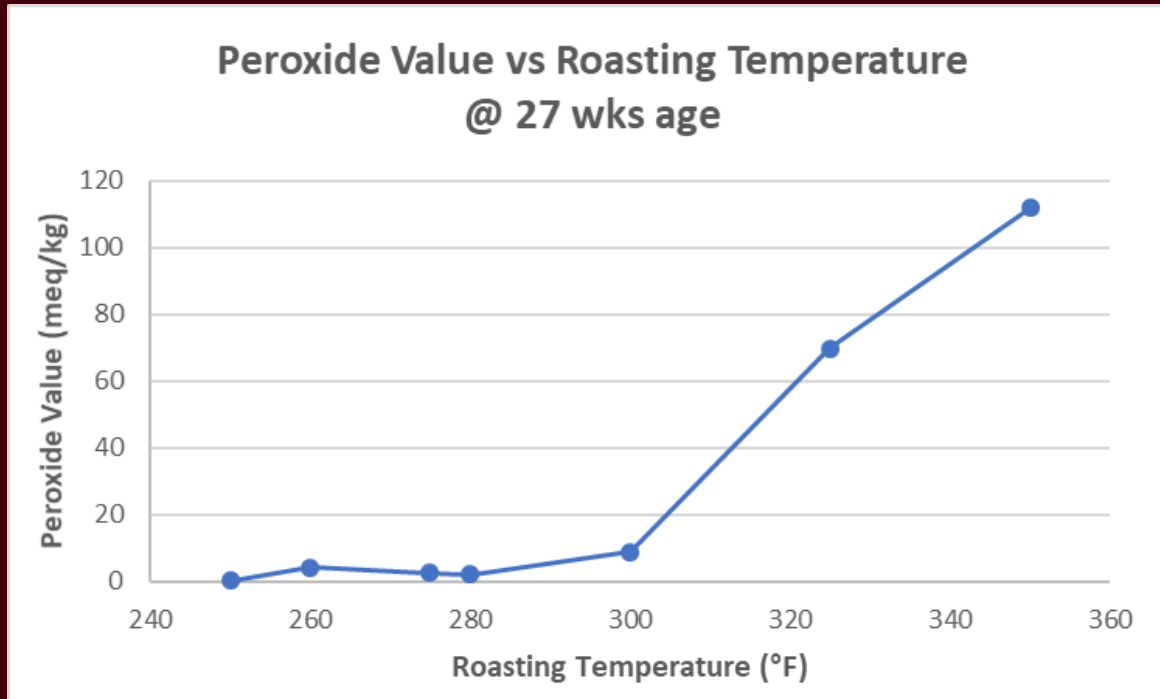
# ALMOND QUALITY: FLAVOR & STABILITY

- Sensory liking over-shelf life is correlated to oxidative stability.



# ALMOND QUALITY: FLAVOR & STABILITY

- Controlling temperature during roasting can mitigate oxidative degradation through shelf life.



# Managing Quality for Almond Processing

Anthony Melo

Director of Quality

Blue Diamond Growers



# Overview

- Almond Processing Design
- Variability
- Quality Checks/Inspections
- Know Your Customer (Specifications)
- Cost of Quality
- People and Culture
- Summary





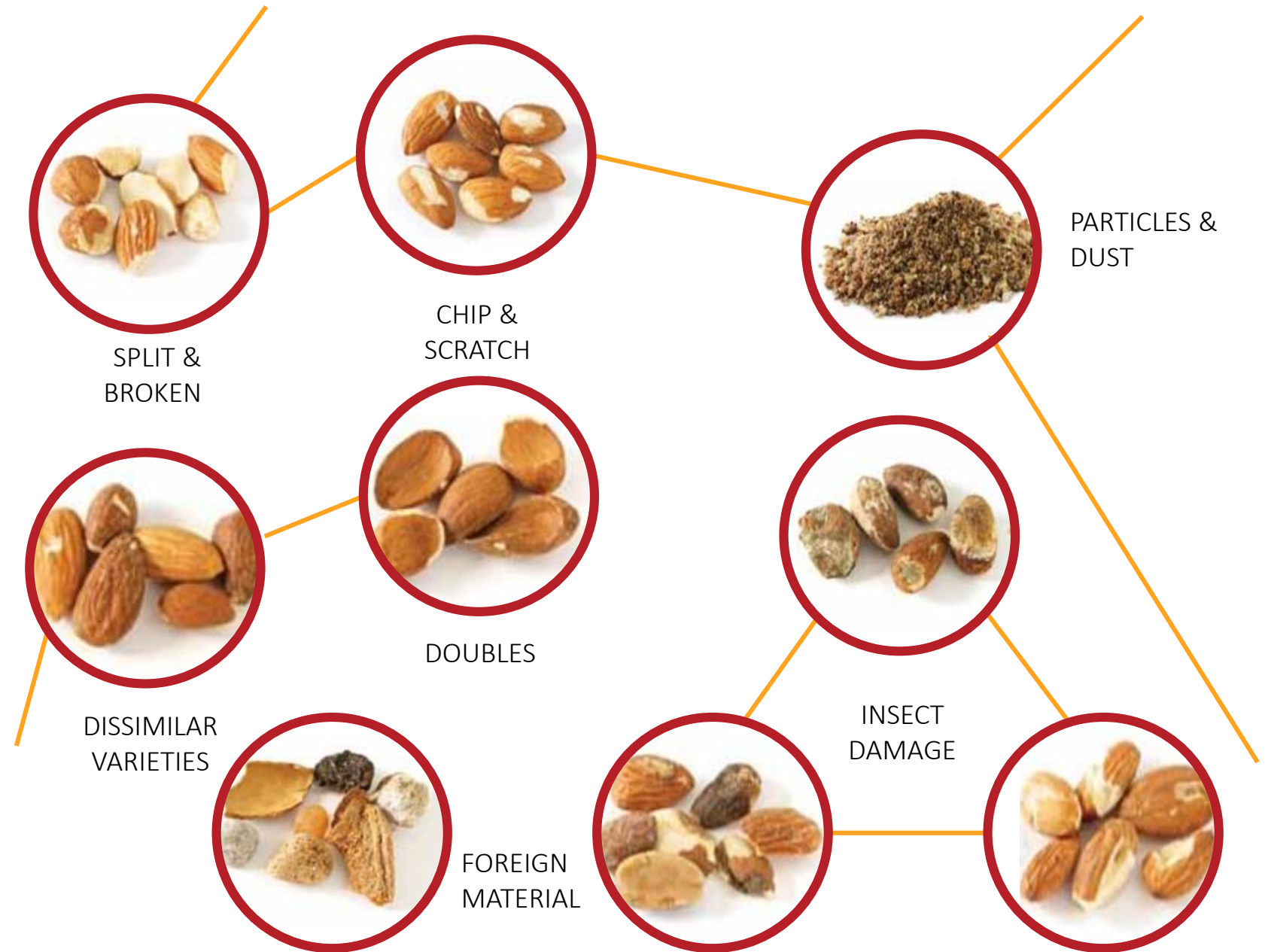
# Almond Processing Design

- Design For Success
  - Foreign Material and Sizing
  - Appearance (chip/scratch)
  - Insect Damage
- Make sure you have the right equipment
- Develop training simultaneously
- Effective first, Efficient second



# Variability

- Reducing variability increases the ability to meet customer requirements
- Lot's of tools in statistics to understand variability in a process
- Keep it simple



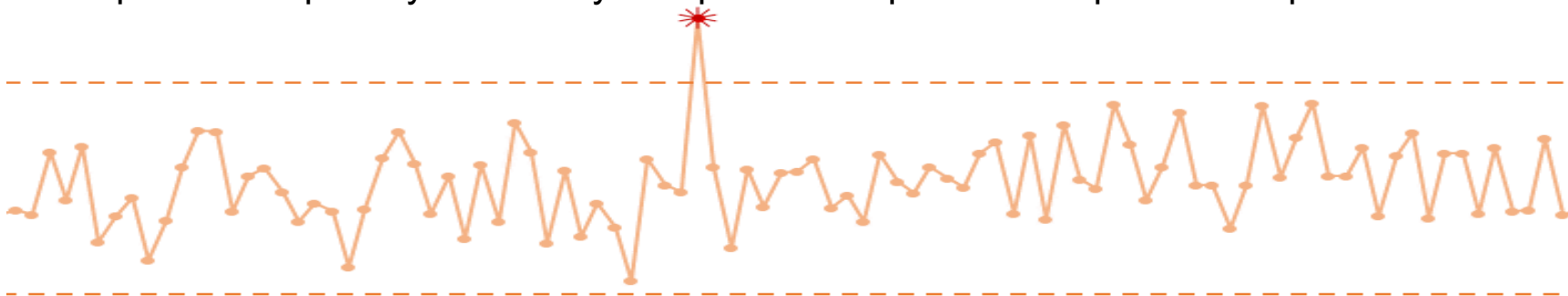
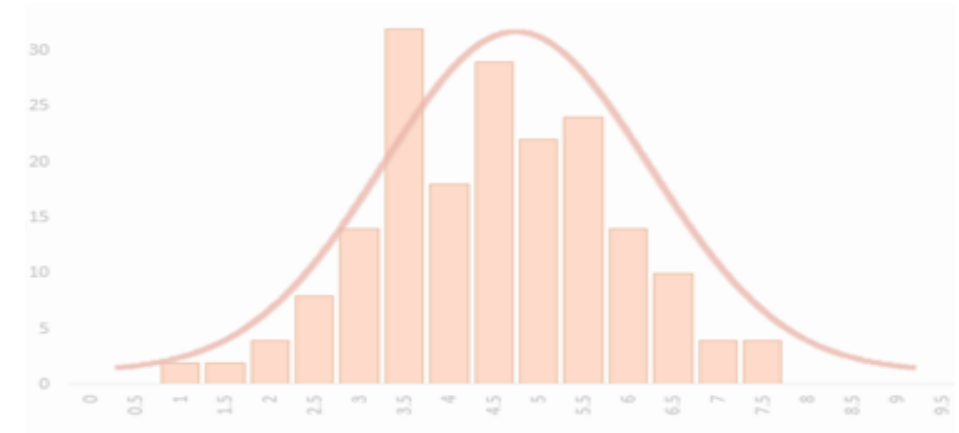
# Quality Checks/Inspections

- Validate the process
- Verify the process (hourly checks)
- Processes will drift, be prepared to change
- Processes are perfectly designed to give us the results we receive. If we don't like the results, change the process.



# Know Your Customer (Specifications)

- Meet with your customer
  - Just because there is a spec doesn't mean it's right
- Customer Requirements is the key focus
  - SIPOC (Suppliers, Inputs, Process, Outputs, and Customers)
- Calculate your specifications before committing (Cpk)
  - “In process improvement efforts, the process capability index or process capability ratio is a statistical measure of process capability: the ability of a process to produce output within specification limits.”





## Cost of Quality

- There is a cost to quality
  - Cost of inspection
  - Cost of rework
  - Cost of meeting specifications
- Sometimes good enough, is good enough



# People and Culture

- Hiring
- Set everyone up for 100% success
- Expectations
- Accountability
- Empower
- Full Use of Time and Abilities
- Professional Job Design





# Summary

- Design for Success
- Know your customers
- Understand that there is variability
- Understand cost of quality
- Don't forget your people
- Don't over complicate; be extraordinary at the basics



Thank you!

