WHAT YOU SHOULD CONSIDER BEFORE YOU GROW
CEUs – New Process

Certified Crop Advisor (CCA)

• Sign in and out of each session you attend.
• Pickup verification sheet at conclusion of each session.
• *Repeat this process for each session, and each day you wish to receive credits.*

Pest Control Advisor (PCA), Qualified Applicator (QA), Private Applicator (PA)

• Pickup scantron at the start of the day at first session you attend; complete form.
• Sign in and out of each session you attend.
• Pickup verification sheet at conclusion of each session.
• Turn in your scantron at the end of the day at the last session you attend.

Sign in sheets and verification sheets are located at the back of each session room.
AGENDA

• Gabriele Ludwig, Almond Board of California, moderator
• Harbinder Maan, Almond Board of California
• William Matthews, University of California Agricultural Issues Center
• Doug Parker, University of California
WHAT YOU SHOULD CONSIDER BEFORE YOU GROW

Harbinder Maan
Associate Director, Trade Marketing and Stewardship, Almond Board of California

California Almonds
Almond Board of California
AGENDA

1. Snacking fueling growth for almonds
2. Global markets, almond board of California consumer programs
3. Varieties, importance of flavor
4. Summary
1. SNACKING FUELING GROWTH FOR ALMONDS

• What is driving growth, trends?
• Where do our Almonds go?
• Innovation in Almond products
“SNACKIFICATION” OF SOCIETY – DRIVEN BY THE MILLENNIAL GENERATION

• Referred to as the “snackification” of society, these consumers are shedding the traditional custom of eating three meals a day in place of eating smaller portions more frequently, or snacking.

• Instead of cooking and having a traditional meal at home, time-pressed consumers are increasingly turning to snack foods with 29% of consumers reporting eating snacks 3 or more times a week.

• Snack oriented categories continue to outperform the broader packaged food market by a wide margin.

• As a results we are seeing significant growth of sales in biscuits, snack bars, savory snacks, confectionery, ice cream, bakery snacks (cakes and pastries) and yoghurt. All big categories for almonds
GLOBAL SNACKING TRENDS – INNOVA RESEARCH

HEALTH AND WELLNESS KEY INHERENT ACROSS ALL

• Clean label
  - Driven by the need to include fewer ingredients
  - Fewer preservatives
  - Free from [gluten and lactose]

• Portable and on the go
  - Increased snacking occasions
  - Convenience

• Plant based variety and lifestyle
  - Hero ingredients: natural source of fiber, protein (energy and satiety), minerals and or/vitamins
  - Better for the planet

• Across categories
  - Almonds driving innovation usage and forms in the key categories that drive growth
ALMONDS DOMINATE THE USE OF NUTS GLOBALY

• Introductions of the majority of nut types have increased from 2015-2016.
  - Almonds increased its lead vs #2 hazelnuts for total introductions

### Nut Introductions by Nut Type: Change from 2015-2016

<table>
<thead>
<tr>
<th>Nut Type</th>
<th>2015</th>
<th>2016</th>
<th>Change (#)</th>
<th>Change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almond</td>
<td>9,005</td>
<td>9,422</td>
<td>+417</td>
<td>+5%</td>
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<tr>
<td>Hazelnut</td>
<td>6,356</td>
<td>6,162</td>
<td>-194</td>
<td>-3%</td>
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<tr>
<td>Peanut</td>
<td>5,316</td>
<td>5,983</td>
<td>+667</td>
<td>+13%</td>
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<tr>
<td>Cashew</td>
<td>3,003</td>
<td>3,544</td>
<td>+541</td>
<td>+18%</td>
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<tr>
<td>Walnut</td>
<td>1,515</td>
<td>1,976</td>
<td>+461</td>
<td>+30%</td>
</tr>
<tr>
<td>Pistachio</td>
<td>926</td>
<td>1,072</td>
<td>+146</td>
<td>+16%</td>
</tr>
<tr>
<td>Pecan</td>
<td>949</td>
<td>1,024</td>
<td>+75</td>
<td>+8%</td>
</tr>
<tr>
<td>Macadamia</td>
<td>519</td>
<td>532</td>
<td>+13</td>
<td>+3%</td>
</tr>
<tr>
<td>Mixed Nuts*</td>
<td>125</td>
<td>388</td>
<td>+263</td>
<td>+210%</td>
</tr>
<tr>
<td><strong>Global Nut Introductions</strong></td>
<td>21,606</td>
<td>24,669</td>
<td>+3,063</td>
<td>+14.2%</td>
</tr>
</tbody>
</table>

*Mixed Nuts include non specified and mixed nuts.
**Global Nut Introductions is lower than the sum of the nut types, since products containing more than one type of nut are counted only once.
While the total snack nut category still represents the largest pure almond volume share at 56.9%

Milk substitutes (15.7%, +1.5ppt) gained ice cream, chocolate (9.8%, +0.4ppt), bars (6.6%, +0.4ppt), nut & seed butters (4.9%, +0.3ppt), and cereal (3.9%, +0.2ppt) saw more modest gains.
Total snack nuts category represents the largest pure almond volume share at 54.3%, followed by chocolate confectionary (17.1%) and total marzipan (15.6%).

After these top-3 categories, shares decrease notably, with RTE bakery cakes ranking 4th (4.8% share) and cookies/biscuits/sweet pastries in 5th (3.2% share).
ALMOND FORMS AND ALMOND APPLICATIONS - INNOVA

- Whole almonds
- Almond pieces
- Almond paste, butter
- Almond milk
- Almond flour

Form

Stand-alone product

Other applications - Snack categories
EXAMPLES: ALMONDS ARE OFTEN SEEN IN PRODUCTS WITH ALLERGY FREE CLAIMS OR WITH ADDED VALUE

- Mainly as a key ingredient for gluten-free and for lactose-free products.
PRODUCT EXAMPLES: BAKERY

**Vaasan**
Finland

**Bodytrim**
Australia

**Sanford**
Argentina

**Galletas Greco**
Colombia

**Vaasan Kotiuunin**
*Toscapulla: Frozen Buns Topped With Almonds*

**Bodytrim Ultra Low Carb**
*Protein Indulgence Cookies*

**Okebon Molino Natural Galletitas**
*Con Almendras Y Chia: Cookies With Almonds And Chia*

**Greco Kurabie Galletas Con Almendras: Mediterranean Almond Cookies**

**Georg Goess**
United States

**Colussi**
Italy

**Delicato Bakverk**
Sweden

**Auchan**
Spain

**Georg Goess Cinnamon Stars: Nut And Almond Cookie**

**Colussi Panforte Del Palio Con Frutta Candita E Mandorle: Gingerbread With Candied Fruits And Almonds**

**Delicato Pepparkaksrulle: Marzipan Roll**

**Auchan Polvorones Sin Azucares Anadidos: No Added Sugar Polvoron**
PRODUCT EXAMPLES: CONFECTIONERY

**Ferrero Raffaello**
Coconut Specialty With Whole Almond

**Laima**
Estonia

**Carrefour**
Tunisia

**Lotte**
Japan

**Arcor**
Argentina

**Hershey**
Chile

**Cenmaco**
Spain

**Britvic**
Malaysia

**Laima Exclusive Riga Black Balsam Sokolades Kofeksu**
Izlase Ar Pildijumu: Selection Of Chocolates With Filling

**Carrefour Selection Pepites De Poire: Dark Chocolate With Pear Pieces**

**Lotte Chocolantant Chocolate And Orange**

**Arcor Rocklets Almendras Con Chocolate Con Leche Confitado: Candy And Milk Chocolate Coated Almonds**

**Hersheys Kisses Creamy Milk Chocolate With Almonds**

**Pablo Garrigos Iba Ez Turron A La Piedra: Almond And Cinnamon Soft Turron**

**Tango Milk Choc With Fruit And Nuts**
PRODUCT EXAMPLES: SNACKS

Fangjiapuzi Putian Green Food

Morefood

Mani

Dongwoonongsan

Xiangzhiwei Almonds

China

Mani Salted Almonds

South Korea

Quorum

Linan Ajie Fry Food

Meme

System Frugt

Germany

China

Israel

Finland

Bonvallis

Kaixinyoushi Almond Kernels

Meme Date Snack With Peanuts

Earth Control Viikunaherkut: Fig Snack

Feigenfruchtschnitte Mit Mandeln: Compressed Fig Fruit with Almonds

Dida Cat Daily Nuts
PRODUCT EXAMPLES: BARS

Abbott
United States
Zoneperfect Nutrition Bars With Chocolate, Almond And Raisin

General Mills
United Kingdom
Nature Valley Popcorn Bars With Salted Caramel, Almond And Pretzel

Cloetta
Norway
Cloetta Muesli Bite Seeds: Muesli Bar With Milk Chocolate

Probiotec
United Kingdom
Celebrity Slim Program Fruit And Nut Meal Replacement Bar

Kind Bar
United States
Caramel Almond and Sea Salt

Rise Bar
United States
Rise Chocolatey Almond Protein Bar

General Mills
United States
Nature Valley Protein Chewy Bars With Peanut, Almond and Dark Chocolate

Pure Organic
United States
Pure Bar Dark Chocolate Berry Bars
<table>
<thead>
<tr>
<th>Brand</th>
<th>Country</th>
<th>Product Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Everfrut</td>
<td>Ecuador</td>
<td>Everfrut Muesli Natural Mora Y Chia: Natural Muesli With Blueberry And Chia</td>
</tr>
<tr>
<td>Lotte Mart</td>
<td>South Korea</td>
<td>Lotte Mart Choice L Almond Granola</td>
</tr>
<tr>
<td>Colussi</td>
<td>Italy</td>
<td>Misura Multigrain Muesli Crocante Con Mandorle E Uveta: Multigrain Crunchy Muesli With Almonds And Raisins</td>
</tr>
<tr>
<td>Got Milk Snacks</td>
<td>United States</td>
<td>Got Milk Crunchy Granola Cereal: Blueberry with Greek Yogurt</td>
</tr>
<tr>
<td>Jumbo</td>
<td>Netherlands</td>
<td>Jumbo Muesli Twister Amandel En Appel: Muesli With Almonds And Apple</td>
</tr>
<tr>
<td>Post Foods</td>
<td>Guatemala</td>
<td>Post Honey Bunches of Oats Cereal With Crispy Almonds</td>
</tr>
<tr>
<td>Lark Fine Foods</td>
<td>United States</td>
<td>Lark Ellen Farm Sweet And Salty Trail Mix</td>
</tr>
<tr>
<td>Brand</td>
<td>Country</td>
<td>Product Description</td>
</tr>
<tr>
<td>----------------------</td>
<td>---------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>Stop And Shop</td>
<td>United States</td>
<td>Natures Promise Unsweetened Vanilla Almond Milk</td>
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<tr>
<td>Tj Alpha</td>
<td>China</td>
<td>Alpha Almond Juice</td>
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<tr>
<td>Isota Bio</td>
<td>Indonesia</td>
<td>Organic Rice and Almond Drink</td>
</tr>
<tr>
<td>Indolakto</td>
<td>Indonesia</td>
<td>Indoeskrim Tasty Max Vanilla Choco Almond Ice Cream Bar</td>
</tr>
<tr>
<td>Alpro</td>
<td>Spain</td>
<td>Asturiana Alpro Almendras Sabor Chocolate: Almond Drink with Chocolate Flavor</td>
</tr>
<tr>
<td>Foodmatch</td>
<td>United States</td>
<td>Divina Kalamata Fig Spread with Almonds</td>
</tr>
<tr>
<td>Rapunzel Naturkost</td>
<td>Italy</td>
<td>Rapunzel Crema di Mandoile Bianca: White Almond Cream</td>
</tr>
<tr>
<td>Bertolini</td>
<td>Italy</td>
<td>Casa Del Dolce Risotto Dolce Al Finissimo Mandorlato E Cioccolato: Sweet Rice With The Finest Almonds And Chocolate</td>
</tr>
</tbody>
</table>
UNITED KINGDOM: PRODUCT EXAMPLES

- **Waitrose**: Waitrose 1 Spiced Plum And Almond Crumble
- **Marks And Spencer**: Marks And Spencer The Collection Filled Medjool Date Selection
- **Lidl**: Alesto Sports Mix
- **Tesco**: Tesco Four Nut And Maple Crisp Cereal
- **Asda**: Asda Extra Special Macaron Selection
- **Holland And Barrett**: Holland And Barrett Good Stuff Alluring Sweet And Savory Almonds
- **Aldi**: Specially Selected Intense Wasabi Almonds
- **Kelloggs**: Kelloggs Glorious Nut Muesli
CHINA: PRODUCT EXAMPLES

- **Hershey**
  - Hershey's Kisses Assorted Chocolates

- **Lehefeng**
  - Youme Assorted Nuts

- **Fangjiapuzi Putian Green Food**
  - Xiangziwei Almonds

- **Buff Bake**
  - Buff Bake Snickerdoodle Protein Almond Spread

- **Mamma Chia**
  - Mamma Chia Chia Vitality Bar: Peanut Butter and Sea Salt With Chia

- **Jinhua Koukoufu**
  - Koukoufu Almonds

- **Laiyifen**
  - Laiyifen Daily Nuts Classic Faction

- **Metro**
  - Fine Life Top Selected Almond
INDIA: PRODUCT EXAMPLES

Haldirams
- **Haldirams Pista Badam Biscuits: Indian Biscuits With Pistachio And Almond**

True Elements
- **True Elements Seeds And Nuts Muesli Snack**

Conserve Italia
- **Yoga Bars Nuts And Seeds Crunch**

Britannia
- **Britannia Good Day Nuts Cookie With Pista, Cashew And Almond**

Mondelez
- **Cadbury Dairy Milk Marvellous Creations Cookie Nut Crunch Milk Chocolate**

Mtr Foods
- **Mtr Badam Drink With Rose Flavor**

Patanjali Ayurved
- **Patanjali Navratna Elaichi Soan Papdi**

Saravana Stores
- **Saravana Almonds**
ALMOND BOARD CONSUMER PROGRAMS

• Snacking and health at the heart of the Almond Board of California consumer programs
• Global consumer snacking tracking study
GLOBAL MARKETING OVERVIEW – DIFFERENT NEEDS, DIFFERENT STRATEGIES, GLOBAL SNACKING

**North America:**
- Position almonds as Savvy Snackers go-to snack.

**North America:**
- Position almonds as Savvy Snackers go-to snack.

**EU 3:**
- Position almonds as a naturally satisfying snack that enhances “Jane’s” day
- Increase consumption of Almonds amongst all family members within our target
- Increase gifting of Almonds during festivals.

**Asia:**
- China, India, S. Korea, Japan

**S. Korea:**
- Increase the consumption of almonds as a mid-morning snack and create differentiation between almonds and walnuts and peanuts.

**India:**
- Increase consumption of Almonds amongst all family members within our target
- Increase gifting of Almonds during festivals.

**EUROPE:**
- UK, France, Germany
- Position almonds as a naturally satisfying snack that enhances “Jane’s” day

**Exploratory Markets:**
- Mexico, Brazil, Indonesia, Saudi Arabia, South America, Italy

**China:**
- Differentiate almonds and apricot kernels
- Elevate California
- Establish clear and consistent naming of almonds
- Drive usage at afternoon snack occasion with almond benefit of skin and beauty
LEVERAGING HEALTH BENEFITS
NUTRITION RESEARCH HIGHLIGHTS / 150++ PUBLISHED STUDIES

Heart Health: Almonds can lower total and LDL cholesterol when included in a healthy diet.

Weight Management: Almonds have a powerful satiating effect that provides long-term satisfaction and fullness and prevents over-eating.

A new way of calculating calories found that whole almonds provide about 20% fewer calories than originally thought.

Diabetes: Almonds lower the blood sugar impact of carbohydrate foods that they are eaten with, which affects fasting insulin levels.

- Almonds are the tree nut highest in the antioxidant vitamin E
- Consuming natural antioxidants from foods may have beauty benefits, working from the inside to help nourish and protect skin.
HEART HEALTH
- High in monounsaturated (“good”) fat
- No cholesterol or sodium
- A top food source of the antioxidant vitamin E

LEARN MORE>

POWERFUL NUTRITION
- Tree nut highest in six essential nutrients
- Prebiotic potential
- Plus protein and fiber

LEARN MORE>

ENERGY
- 6 grams of protein per ounce
- 12 vitamins and minerals
- 13 grams of “good” monounsaturated fats
- Rich in magnesium

LEARN MORE>

GLUTEN FREE
- Naturally 100% gluten free
- Lots of forms to choose from
- No-stress substitutions

LEARN MORE>

DIABETES
- Low glycemic index
- May improve certain risk factors
- Curb cravings

LEARN MORE>

WEIGHT MANAGEMENT
- 6 grams of power-packed protein
- 3.5 grams of satisfying fiber
- Good fit with popular weight-loss plans
- Just 150 calories per ounce

LEARN MORE>
## EXECUTIVE SUMMARY: GLOBAL

### Total Sample

<table>
<thead>
<tr>
<th>Awareness</th>
<th>Total Sample</th>
<th>Almonds 2016 (n=5,000)</th>
<th>Almonds 2015 (n=4,500)</th>
<th>Gap ('16 vs. '15)</th>
<th>Top Nut</th>
<th>Second Nut</th>
<th>Almond Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top-of-Mind – First Mention</td>
<td></td>
<td>21%</td>
<td>19%</td>
<td>+2 pt</td>
<td>Almonds</td>
<td>Walnuts</td>
<td>#1</td>
</tr>
<tr>
<td>Positive Story, Almonds – % of total</td>
<td></td>
<td>26%</td>
<td>23%</td>
<td>+3 pts</td>
<td>Almonds</td>
<td>Walnuts</td>
<td>#1</td>
</tr>
<tr>
<td>Almonds as first mentions in chocolate</td>
<td></td>
<td>30%</td>
<td>29%</td>
<td>+1 pt</td>
<td>Almonds</td>
<td>Hazelnuts</td>
<td>#1</td>
</tr>
<tr>
<td>Almonds as first mentions in bakery</td>
<td></td>
<td>28%</td>
<td>28%</td>
<td>-</td>
<td>Almonds</td>
<td>Walnuts</td>
<td>#1</td>
</tr>
<tr>
<td>Almonds as first mentions in snacks</td>
<td></td>
<td>22%</td>
<td>21%</td>
<td>+1 pt</td>
<td>Peanuts</td>
<td>Almonds</td>
<td>#2</td>
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</table>

### Attitudes

<table>
<thead>
<tr>
<th>Awareness</th>
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<th>Almonds 2016 (n=5,000)</th>
<th>Almonds 2015 (n=4,500)</th>
<th>Gap ('16 vs. '15)</th>
<th>Top Nut</th>
<th>Second Nut</th>
<th>Almond Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almond liking (% Top 2 Box)</td>
<td></td>
<td>54%</td>
<td>55%</td>
<td>-1 pt</td>
<td>Almonds/Cashews</td>
<td>#1 (tie)</td>
<td></td>
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<tr>
<td>Almond health (% Top 2 Box)</td>
<td></td>
<td>54%</td>
<td>56%</td>
<td>-2 pts</td>
<td>Almonds/Walnuts</td>
<td>#1 (tie)</td>
<td></td>
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<tr>
<td>Healthy</td>
<td></td>
<td>29%</td>
<td>30%</td>
<td>-1 pt</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Beauty</td>
<td></td>
<td>28%</td>
<td>27%</td>
<td>+1 pt</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Nutritious</td>
<td></td>
<td>27%</td>
<td>28%</td>
<td>-1 pt</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Skin</td>
<td></td>
<td>27%</td>
<td>29%</td>
<td>-2 pts</td>
<td>-</td>
<td>-</td>
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</tr>
</tbody>
</table>

### Usage

<table>
<thead>
<tr>
<th>Usage</th>
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<th>Almonds 2016 (n=5,000)</th>
<th>Almonds 2015 (n=4,500)</th>
<th>Gap ('16 vs. '15)</th>
<th>Top Nut</th>
<th>Second Nut</th>
<th>Almond Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy Users (% several x/week+)</td>
<td></td>
<td>24%</td>
<td>23%</td>
<td>+1 pt</td>
<td>Almonds</td>
<td>Peanuts</td>
<td>#1</td>
</tr>
<tr>
<td>Almonds eaten most as a snack</td>
<td></td>
<td>23%</td>
<td>24%</td>
<td>-1 pt</td>
<td>Peanuts</td>
<td>Almonds</td>
<td>#2</td>
</tr>
<tr>
<td>Almonds eaten most in other foods</td>
<td></td>
<td>23%</td>
<td>24%</td>
<td>-1 pt</td>
<td>Almonds</td>
<td>Peanuts</td>
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<tr>
<td>Time of day for Almond snacking</td>
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<td>Afternoon</td>
<td>Afternoon</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Almond form for snacking</td>
<td></td>
<td>Natural w/ skin</td>
<td>Natural w/ skin</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
USAGE: DAY PART FOR ALMONDS AS A SNACK (GLOBAL)

- Almonds tend to be consumed more frequently in the afternoon and morning dayparts. While evenings and “all day” still remain substantial, though both appear to be tapering off slightly in popularity.

Q17: And which of these times of day best describe when you typically eat almonds by themselves (e.g., as a snack)?

Base: Snack on almonds in Q16.
VARIETIES AND THE IMPORTANCE OF FLAVOR

- Why should you care?
- How different are almond varieties?
WHAT DIFFERENTIATES ALMONDS - FLAVOR PROFILE – KEY SENSORY ATTRIBUTES FOR ALMONDS

**Sweet Aromatic flavor**  
**Marzipan/ Benzaldehyde flavor**  
**Musty/Earthy flavor**  
**Woody flavor**  
**Unripe/Beany flavor (NSD)**  
**Hay flavor**  

* 90% Confidence Level (Duncan’s)  
** 95% Confidence Level (Duncan’s)  
NSD: Not Significantly Different

Amaretto flavor key flavor differentiator between varieties
WHY AND WHERE IS FLAVOR IMPORTANT?

Consistent consumer experience is important

Food Categories
- Low almond flavor desired

1. Almond Milk
2. Almond flour/meal, for baking and gluten free cooking

Food Categories
- Strong almond flavor/aroma desired

1. Snacking
2. Chocolate
3. Almond butter
4. Baking
SUMMARY

• Almonds deliver on all of today’s snacking trends
• Innovation continues to grow and new categories like almond milk and almond meal are fueling better tasting alternatives for many consumers
• Almond versatility is highlighted by the breadth of use as a snack and ingredient
• Almonds healthy halo is firmly established in many markets around the world
• Consumers and media love almonds
• Almonds poised for continued growth around the world!
What to Plant: Almonds or Other Crops?
The Almond Conference
December 5, 2017
Sacramento, California

Prepared by Daniel A. Sumner
with collaborators
Antoine Champetier, Tristan Hanon,
Hyunok Lee, William A. Matthews, Jeremy Murdock, and Donald Stewart
University of California Agricultural Issues Center

Presented by William Matthews
Motivation, Orientation and Overview

Growers chose among many options based on site specific soil, climate and institutional factors.

Since the other presentations in this session are evaluating irrigation water availability and almond demand and global markets, we highlight a few other crucial economic issues

1. Farm costs and returns data for comparing crops
2. Demand and market prospects for other commodities
3. Low interest rates and high labor costs for almonds versus other crops
4. Simulations of supply (pollination) and demand and impacts on almonds
5. Government subsidy policy including crop insurance
Every commodity in every location has a different set of cost and returns characteristics.

Cost studies are accurate in details only for the time and place specified.

Growers, buyers, investors, bankers, researchers and others must interpolate and extrapolate to make use of the studies. And, these studies do not forecast future returns or costs.
The relative net returns of almonds and alfalfa helps explain part of the decline in hay acres

But,

- Milk cow numbers (the major demand factor for alfalfa) have been flat in California for a decade.
- Alfalfa acres has also fallen in the other states, which have no tree nut expansion
- Idaho has dairy expansion and ships alfalfa to California so there is more going on than just nuts!

The future of almonds depends on demand growth, but demand growth applies to competing commodities too!

For example, alfalfa depends on milk demand growth in Asia…
Dairy Consumption in China

Index Measure (2000=100)

Per capita protein from dairy

Demand in Asia depends on economic growth driving markets, but markets are only useful for California crops if the markets are open.

Consider the Korean-U.S. Free Trade Agreement that improved access to the world's 11th largest economy. The agreement came into force just in 2012 and is allowing US products to compete with those from the many other places that have FTAs with Korea.
## KORUS-FTA access improvement for tree nuts

<table>
<thead>
<tr>
<th>Tree Nut Product</th>
<th>Base Rate</th>
<th>FTA Terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almonds, Shelled</td>
<td>8%</td>
<td>Duty free year 1 (Jan 1, 2012)</td>
</tr>
<tr>
<td>Almonds, In Shell</td>
<td>8%</td>
<td>Duty free year 1 (Jan 1, 2012)</td>
</tr>
<tr>
<td>Walnuts, Shelled</td>
<td>45%</td>
<td>Straight line decline to duty free at year 15 (2026)</td>
</tr>
<tr>
<td>Walnuts, In Shell</td>
<td>30%</td>
<td>Straight line decline to duty free at year 6 (2017)</td>
</tr>
</tbody>
</table>
Interest Rates, Credit and Labor

- Low interest rates and more credit availability, means lower capital for establishment.
- Our cost and returns studies have documented declines in interest rates for both operating capital and capital recovery (land prep, trees, irrigation etc.)
- The rate of return required for a good investment is lower is cost of capital is lower.
- At the same time labor costs have risen, but tree nuts have lower shares of hired labor costs compared to other tree and vine crops and capital intensive vegetables, and labor regulations in California are driving cost higher over the next 5 years.

<table>
<thead>
<tr>
<th>Year</th>
<th>Operating Cost Interest Rate</th>
<th>Capital Recovery Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>5.75</td>
<td>5.75</td>
</tr>
<tr>
<td>2016</td>
<td>4.75</td>
<td>3.75</td>
</tr>
</tbody>
</table>

Source: UC AIC Cost and Returns Studies, Almond Orchard Establishment Studies
Interest Rates Have Declined Substantially Over Past 20 Years
Lows in the past two years. It is hard to see rates lower, leaving only up side risk for the cost of capital. This reminds us of Paul Rhode’s explanation of the expansion of California trees and vines in the early 20th Century.
Potential Effects of Negative Developments on Almonds: The Pollination Nexus

Consider economic model simulations of impacts of potential negative developments affecting almonds and honeybees

- Largest impacts from changes in almond demand; That is, impacts to the almond industry and growers.
- Uses data on input cost shares, production relationships and market patterns
- Uses an inelastic demand for almonds consistent with recent estimated and market patterns (when quantity available drops price rises by proportionately more).
- Uses an elastic long run almonds supply for downward shocks that build in some adjustment costs but recognizes that alternative crops are available if almonds become less attractive

*Source:* “Simulating Bees, Almonds, and Honey”, Lee, Sumner, and Champetier 2017
## Impacts of Shifts up in Almond Costs or Shifts down in Almond Demand

<table>
<thead>
<tr>
<th>Variable</th>
<th>Water Price Increase (20%)</th>
<th>Almond Market Downturn (20%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almond Quantity</td>
<td>-3.3%</td>
<td>-15.9%</td>
</tr>
<tr>
<td>Almond Price</td>
<td>9.4%</td>
<td>-11.7%</td>
</tr>
<tr>
<td>Almond Pollination Fee</td>
<td>-2.7%</td>
<td>-19.5%</td>
</tr>
<tr>
<td>Almond Grower Revenue and Cost</td>
<td>5.8%</td>
<td>-25.8%</td>
</tr>
</tbody>
</table>
### Impact of Shifts in Pollination Demand or in the Costs of Pollination

<table>
<thead>
<tr>
<th>Variable</th>
<th>Self-Fertile Acreage Increase (11%)</th>
<th>Increased Bee Colony Loss (20%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almond Quantity</td>
<td>0.5%</td>
<td>-0.1%</td>
</tr>
<tr>
<td>Almond Price</td>
<td>-1.4%</td>
<td>0.3%</td>
</tr>
<tr>
<td>Almond Pollination Fee</td>
<td>-13.3%</td>
<td>2.9%</td>
</tr>
<tr>
<td>Almond Grower Revenue</td>
<td>-0.9%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Almond Grower Cost</td>
<td>-2.2%</td>
<td>0.2%</td>
</tr>
</tbody>
</table>
Farm Bill, Commodity Subsidies and Almonds

• Leaders of Agriculture Committees in Congress say the new farm bill is coming in early 2018.
• Crop insurance and insurance-style programs have emerged as central

1. Subsidies help crops compete for land and water (still some upland cotton and lots of rice in California)
2. Crop insurance subsidy makes eligible crops more attractive to bankers
3. Subsidy by increasing supply of feed crops, insurance and other subsidies cause a bit more use in feeding rations
4. Dairy does have a subsidy program that may encourage more cows, but more for small farms in the east than big farms in the west.
Federal Farm Commodity Subsidy as a Percent of Value
(Almonds about 3% from crop insurance)
Tree crops used to claim little federal farm subsidy

- Trade and domestic promotion paid with taxpayer support and checkoff funds
- R&D programs
- Nutrition programs, including school lunch provide demand support
- Environmental cost share programs are available
- But these are small in relation to size of the industry

- But now tree crops also use crop insurance subsidy extensively. These programs are much more like a production subsidy like the program grains, oilseeds and cotton
Does crop insurance subsidy affect what is grown, where and by how much? Yes, but no data yet for tree nuts.

- The premium subsidy has two potential impacts on area planted to a specific crop:
  1. Crop insurance subsidy is much like any production subsidy. This production impact occurs even with risk neutral farmers.
  2. Also, crop insurance subsidy stimulates more insurance and even more of the crop with subsidized insurance.

Econometric estimation using acreage and insurance data for national field crops shows large and significant impacts of crop insurance subsidy on cropping patterns and choice across crop. (Yu, Smith, Sumner (2017))

Research on trees, vines, vegetables, and other specialty crops is underway.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Net Acres Insured (Thousands)</th>
<th>Liability ($ Millions)</th>
<th>Premium Subsidy ($ Millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CAT</td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>Almonds</td>
<td>257</td>
<td>749</td>
<td>3,578</td>
</tr>
<tr>
<td>Grapes</td>
<td>217</td>
<td>466</td>
<td>1,242</td>
</tr>
<tr>
<td>Rice</td>
<td>51</td>
<td>496</td>
<td>507</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>10</td>
<td>246</td>
<td>580</td>
</tr>
<tr>
<td>Calif. total</td>
<td>6,653</td>
<td>9,982</td>
<td>290</td>
</tr>
<tr>
<td>CA share of U.S.</td>
<td>2.3%</td>
<td>9.9%</td>
<td>5.0%</td>
</tr>
</tbody>
</table>

Source: Risk Management Agency, USDA
Crop Insurance Program: Total Liabilities, Subsidy, and Indemnity, CA Almonds Total, 1996-2016 ($ Billions)

Note: Left axis is subsidy and indemnity. Right axis is for liabilities.

Subsidy for almonds is about 3% of crop revenue
Final Remarks

• No one can reliably predict prices or costs and revenues into the future for the horizon of an almonds orchard, and especially not relative to the other available investments.
• We can, however, outline the major considerations facing and industry
• Here we have highlighted a few of those for almonds
• We have focused on issues broader than almond costs and returns, to emphasize issues such as growing demand for other commodities, interest rates, trade agreements, and farm policy as affecting the relative position of almonds.

We close with two additional points:
1. Global competitors have not yet challenged California’s dominant position in global markets but that is not guaranteed.
2. The suitability of almonds to California conditions and the competitive vigilance of the California industry are the best guarantors of success. But, that does not necessarily mean industry growth. If marginal costs rise as production strains suitable resources, other regions in the world may be in a better position to expand.
Thank you
aic.ucdavis.edu
Consider Water Before You Grow

California Institute for Water Resources

Doug Parker
Director, California Institute for Water Resources
Strategic Initiative Leader, UC ANR Water Initiative
doug.parker@ucop.edu
ciwr.ucanr.edu | @ucanrwater
Where does your water come from?

- Irrigation District?
  - Where do they get it?
- Own water right?
  - How secure/senior is it?
Groundwater Use in California: 2005 – 2010 Average

• Is Groundwater your Primary Water Source?

• Is Groundwater a Supplement to Surface Water Supplies?
  • Normal Year?
  • Drought Year?
Variation in Annual Precipitation

COEFFICIENTS OF VARIATION OF TOTAL PRECIPITATION, WY 1951-2008

Source: Dettinger et al (2011)
U.S. Drought Monitor

California

April 22, 2014
(Released Thursday April 24, 2014)
Valid 7 a.m. Eastern

Statistics type: Traditional (D0-D4, D1-D4, etc.) Categorical (D0, D1, etc.)

Drought Condition (Percent Area):

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Nothing</th>
<th>D0-D4</th>
<th>D1-D4</th>
<th>D2-D4</th>
<th>D3-D4</th>
<th>D4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>4/22/2014</td>
<td>0.00</td>
<td>100.00</td>
<td>100.00</td>
<td>96.01</td>
<td>76.68</td>
<td>24.77</td>
</tr>
<tr>
<td>Last Week</td>
<td>4/15/2014</td>
<td>0.00</td>
<td>100.00</td>
<td>99.80</td>
<td>95.21</td>
<td>58.76</td>
<td>23.48</td>
</tr>
<tr>
<td>3 Months Ago</td>
<td>1/21/2014</td>
<td>1.43</td>
<td>98.57</td>
<td>94.18</td>
<td>99.91</td>
<td>92.71</td>
<td>0.00</td>
</tr>
<tr>
<td>Start of Calendar Year</td>
<td>12/31/2013</td>
<td>2.61</td>
<td>97.39</td>
<td>94.25</td>
<td>87.53</td>
<td>27.59</td>
<td>0.00</td>
</tr>
<tr>
<td>Start of Water Year</td>
<td>10/1/2013</td>
<td>2.03</td>
<td>97.37</td>
<td>95.95</td>
<td>84.12</td>
<td>11.36</td>
<td>0.00</td>
</tr>
<tr>
<td>One Year Ago</td>
<td>4/23/2013</td>
<td>2.84</td>
<td>97.16</td>
<td>63.42</td>
<td>30.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

View More Statistics

Intensity:
- D0 - Abnormally Dry
- D1 - Moderate Drought
- D2 - Severe Drought
- D3 - Extreme Drought
- D4 - Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author(s):
Richard Helm, NOAA/NCDC
# 2015 CVP Allocations

<table>
<thead>
<tr>
<th>Year 2015</th>
<th>Contractors</th>
<th>Feb 27, 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>North of Delta</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Agricultural Contractors (Ag)</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Urban Contractors (M&amp;I)</td>
<td>25%*</td>
</tr>
<tr>
<td></td>
<td>Wildlife Refuges (Level 2)</td>
<td>75%**</td>
</tr>
<tr>
<td></td>
<td>Settlement Contractors/Water Rights</td>
<td>75%**</td>
</tr>
<tr>
<td></td>
<td>American River M&amp;I Contractors</td>
<td>25%*</td>
</tr>
<tr>
<td></td>
<td>In Delta - Contra Costa</td>
<td>25%*</td>
</tr>
<tr>
<td></td>
<td><strong>South of Delta</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Agricultural Contractors (Ag)</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Urban Contractors (M&amp;I)</td>
<td>25%*</td>
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<tr>
<td></td>
<td>Wildlife Refuges (Level 2)</td>
<td>75%**</td>
</tr>
<tr>
<td></td>
<td>Settlement Contractors/Water Rights</td>
<td>75%**</td>
</tr>
<tr>
<td></td>
<td><strong>Eastside Division Contractors</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Friant - Class 1</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Friant - Class 2</td>
<td>0%</td>
</tr>
</tbody>
</table>
2015 SWP Allocations

- December 1 10%
- January 15 15%
- March 2 20%
The Importance of Groundwater for Drought Relief

• Groundwater Usage
  – Normal Year 38%
  – Drought Year 60%
Groundwater

Central Valley, California

Equivalent water height anomaly (cm)

Trend: $-1.5 \pm 0.1$ cm/year

Famiglietti and Rodell, 2013
California Groundwater Management

- 2014 Sustainable Groundwater Management Act
  - Local Management with State Oversight
  - Groundwater Sustainability Agencies (2017)
  - Groundwater Sustainability Plans (2020/2)
  - Fully Implemented (2040/2)
Groundwater Basin Prioritization
Number of Basins by Prioritization Level

- Very Low: 350
- Low: 50
- Medium: 100
- High: 300
Percentage Water Use by Basin Prioritization

- High-Medium: 96%
- Low-Very Low: 4%
Planning for Uncertain Water Supplies

• Irrigation Efficiency
• Fallowing a Portion of Your Land
  • Growing any Annual Crops?
  • What is in Your Portfolio?
• Deficit Irrigating Your Orchard

• What about the Long-Run? (Climate Change)
Achievements in Water Conservation

Adoption of New Irrigation Technologies

Surface Sprinkler Drip Subsurface Drip

Evolution of Technologies
Management of New Systems
Optimization by Crop and Cropping Systems
Irrigation Optimization and Management

• Irrigation System Optimization
  • Distribution Uniformity

• Irrigation Management (When to Irrigate and How Much)
  • California Irrigation Management Information System (CIMIS)
    • Crop Coefficients
  • Hand Held Probes
  • Wireless Technologies
  • Web-Based Solutions
    • CropManage

University of California
Agriculture and Natural Resources
California Institute for Water Resources
Climate change and water in California

1950

Average of four commonly used climate scenarios – see cal-adapt.org for more information.

2090
CA Water Facts

- 43 MAF Surface Storage
- 150+ MAF Groundwater Storage
- 15 MAF Snowpack
  - Decreasing to 10-11 MAF with Climate Change
Climate change and water in California

Average of four commonly used climate scenarios – see cal-adapt.org for more information.

University of California
Agriculture and Natural Resources  California Institute for Water Resources
Climate change and temperature in California

Average of four commonly used climate scenarios – see cal-adapt.org for more information.
Thank You
What’s Next

Tuesday, December 5 at 1:45 p.m.

• Common Errors in Orchard Set Up– Room 308-309
• Repositioning Plant-Based Protein – Room 306-307
• The Science and Practice of Intentional Recharge in Almond Orchards – Room 312-313
• Produce Safety Rule for Farms: How to Comply and What About the Grower Exemption? – Room 314
CEUs – New Process

Certified Crop Advisor (CCA)
- Sign in and out of each session you attend.
- Pickup verification sheet at conclusion of each session.
- Repeat this process for each session, and each day you wish to receive credits.

Pest Control Advisor (PCA), Qualified Applicator (QA), Private Applicator (PA)
- Pickup scantron at the start of the day at first session you attend; complete form.
- Sign in and out of each session you attend.
- Pickup verification sheet at conclusion of each session.
- Turn in your scantron at the end of the day at the last session you attend.

Sign in sheets and verification sheets are located at the back of each session room.
Research Poster Sessions

Wednesday, December 6
3:00 p.m. – 5:00 p.m.

Featured topics:
• Irrigation, nutrient management
• Breeding
• Soils, if related to organic matter input
• Sustainability, irrigation improvement continuum, life cycle assessment, dust
• Food quality and safety

Thursday, December 7
1:30 p.m. – 2:30 p.m.

Featured topics:
• Insect and disease management
• Fumigation and alternatives
• Biomass (including biochar-related efforts)
• Pollination
• Almond Leadership Program
2017 Research Update Book

• Pickup your copy at the ABC Booth in Hall A+B
• Includes a one-page summary of every current ABC-funded research project