VARIETIES: PRODUCTION AND QUALITY ATTRIBUTES — LESSONS LEARNED AND THE PATH FORWARD FROM THE COMMERCIAL PERSPECTIVE

ROOM 312-313 | DECEMBER 4, 2018
Continuing Education Units (CEU’s)

• What type of CEU’s are offered at conference?
  – Tuesday – Certified Crop Advisor (CCA)
  – Wednesday – Certified Crop Advisor (CCA)
  – Thursday – Certified Crop Advisor (CCA) and Department of Pesticide Regulations (DPR)

• Where are the CEU sign in sheets?
  – CEU sign in sheets will be in the back of each session
  – There are separate forms on Thursday for the CCA and DPR credits

• Special instructions for Thursday
  – PCA’s will need to pick up their scantrons in the morning before the first session of the day. They will also need to return the scantron at the end of the day to the CEU booth. This is in addition to signing in and out of each session.
AGENDA

• Karen Lapsley, Almond Board of California, moderator
• Grant Thorp, Plant and Food Research Australia
• John Slaughter & Kaylan Roberts, Burchell Nursery
• Chuck Fleck, Sierra Gold Nurseries
• Grant Zaiger, Zaiger Genetics
• John Duarte, Duarte Nursery
• Mark Kline, The Hershey Company
ALMOND BREEDING: IS THERE A ROLE FOR NEW GENETIC TECHNOLOGIES?

ROOM 312-313 | DECEMBER 4, 2018
NO variety fits all needs......
Top 10 Almond Varieties

Source: USDA Incoming Receipts
# Almond Variety Development Objectives

<table>
<thead>
<tr>
<th>Agronomic</th>
<th>Commercial</th>
<th>Food Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>High yields</td>
<td>Faster production, high yields</td>
<td>Good kernel quality and shelf life</td>
</tr>
<tr>
<td>Pest &amp; Disease resistance</td>
<td>Varieties with low inputs for maintenance</td>
<td>Range of flavor based on application</td>
</tr>
<tr>
<td>Self fertile</td>
<td>Greater efficiency</td>
<td>Consistent kernel size and shape</td>
</tr>
<tr>
<td>Locally adapted</td>
<td>Improved pollinizers for Nonpareil</td>
<td>Textural integrity</td>
</tr>
<tr>
<td>Smaller trees with optimal tree architecture</td>
<td></td>
<td></td>
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<tr>
<td>Consistent ripening</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drought tolerant</td>
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</tbody>
</table>
Almond Flavor Volatiles and Sensory Properties

Benzaldehyde is generated by the disruption of almond tissue (e.g. chewing) which enables the amygdalin to come into contact with hydrolytic enzymes to form hydrogen cyanide and benzaldehyde

Benzaldehyde = amaretto aroma

Benzaldehyde = amaretto aroma

Odor Threshold = 0.5 ppm

Bitterness = Combination of amygdalin levels and enzymatic hydrolysis rates

- Amygdalin ranges between 76.50 ± 23.99 -1.77 ± 1.74 mg/Kg
- Benzaldehyde ranges between 17,995 ± 5,887 - 587.7 ± 272.9 ng/g
SELF INTRODUCTIONS AND COMPANY HISTORY

• John Slaughter & Kaylan Roberts, Burchell Nursery
• Chuck Fleck, Sierra Gold Nurseries
• Grant Zaiger, Zaiger Genetics
• John Duarte, Duarte Nursery
• Mark Kline, The Hershey Company
Almond Varieties: Production and Quality Attributes
CPG Manufacturer Perspective
Mark Kline, Sr. Manager, Nut & Energy Sourcing, Global Commodities
December 4th, 2018
The Almond Conference
Consumers have enjoyed Hershey’s Milk Chocolate with Almonds for over 100 years.

THANK YOU ALMOND INDUSTRY!
HERSHEY’S ALMOND PORTFOLIO
Breeding and Varietal Selection:

- Desired phenotypes are produced through breeding and selection.
- Manufacturers prefer narrow deviation from mean for desired quality attributes.
- Selection must work for industry and meet Consumer’s need.
Hershey’s Preferred Almond Requirements

- Flavor
- Shape
- Size
- Texture
- Grade
INITIAL FLAVOR IS AS IMPORTANT AS FINAL SHELF-LIFE FLAVOR

<table>
<thead>
<tr>
<th>Positive Attributes</th>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almond</td>
<td>The nutty aromatic characteristic of roasted almonds</td>
</tr>
<tr>
<td>Roast/Toast</td>
<td>The aromatic associated with food items that have been browned by heat treatment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Negative Attributes</th>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Painty</td>
<td>The aromatic associated with ages fats or oils</td>
</tr>
<tr>
<td>Cardboard</td>
<td>The aromatic associated with wet cardboard; age, package, or process related.</td>
</tr>
</tbody>
</table>
ICONIC BRANDS: CLASSIC FORMS
ICONIC BRANDS: CONSUMERS FEEDBACK IS KEY

Transition to chopped almonds
ICONIC BRANDS: CONSUMER FEEDBACK IS KEY
10 almond categories

- Chopped almond applications
- Whole almond applications
  - Size: 30/32 – 40/50 CPO
  - Dimensions:
    - Flat almonds – bar applications
    - Short almonds – molded applications
MEETING CONSUMER NEEDS IS KEY TO DRIVING GROWTH
Thank you!
Sierra Gold Nurseries
Almond Trees for the Next Generation of Orchards
Almond Trees for the Next Generation of Orchards

- Vigorous and Productive
- Multi-pest Resistant
- Adaptable to Local Conditions
Almond Trees for the Next Generation of Orchards

Titan SG1®

Almond Rootstocks

Superior Almond Yields & Boron Tolerance

Katherine Jarvis-Shean, UCCE
Almond Trees for the Next Generation of Orchards

Titan SG1®
Almond Rootstocks

Superior Asphyxiation Survival

Days to Plant Death

- Titan SG1
- Viking
- Krymsk 86
- Bright’s
- Rootpac-R
- Nemaguard
- BB 106
- Lovell
- Empyrean 1
- Nickels
- Hansen 536

17  22  27  32  37
Almond Trees for the Next Generation of Orchards

Titan SG1®

Almond Rootstocks

Nonpareil/ Titan SG1®

Monterey/ Titan SG1®
Almond Trees for the Next Generation of Orchards

Titan SG1®

- Advanced Clonal Selection Peach/Almond Hybrid
- Excellent Vigor
- Root Knot Nematode Resistant
- Well-Anchored Deep Rooting, and Drought Tolerance.
- Tolerates Boron, High pH Soils, and Salinity.
- Best performance is on Well-Drained Soils
Tolerance of Biotic Pests

- Nematodes
- Phytophthora
- Crown Gall
- Oak Root Fungus
Soil Environment Tolerance -

- Salinity
- Root Asphyxia
- Anchorage
- Boron
Almond Trees for the Next Generation of Orchards
Almond Scion Varieties

- Productivity
  Tree Architecture, Vigor and Fruiting Habit

- Kernel Quality
  Color, Texture, Size, Flavor, Low Doubles, Blanching, etc.

- Disease & Insect Tolerant
  NOW, Rust, Scab, Hull Rot, Botrosthyria, etc.

- Orchard Lifespan
  Reduced Hedging and Heart-rots
Almond Trees for the Next Generation of Orchards

Almond Scion Variety Target Categories

- Self-Fruitful ‘Nonpareil’
- Self-Fruitful ‘Carmel’
- Self-Fruitful ‘Sonora’
- Self-Fruitful ‘Butte’
- Self-Fruitful ‘Monterey’
Almond Trees for the Next Generation of Orchards
Almond Scion Variety Testing

- **Australian SF Almond Varieties** (University of Adelaide)
  - ‘Mira’
  - ‘Vela’
  - ‘Capella’

- **Spanish Almond Varieties from (CIBAS)**
  - ‘Penta’
  - ‘Makako’
  - ‘Maxima’ -> 2g not SF
Introducing our New JET™ Growing System

The Ellepot Advantage
Almond Trees for the Next Generation of Orchards

Almond Orchard Establishment

The Ellepot Advantage
Sierra Gold Nurseries

Almond Trees for the Next Generation of Orchards

Thank You
Grant Zaiger

Zaiger Genetics
Bennett-Hickman

Presenter: John Duarte - President
Variety Comparison

Bennett-Hickman
US PP26,083 P3

Nonpareil
Bennett-Hickman
US PP26,083 P3

Nonpareil
Facts

• 34-day bloom time.

• Harvests 14 days after Nonpareil, (unlike Monterey).

• Release is outstanding.

• As of today, no graft incompatibilities.

• Strong seller in all almond growing areas.

• Of the recently, 1 million almond trees sold;
  – 85% is 50/50 Nonpareil, Bennett-Hickman
Kernel Quality

- Identifies as Nearly Identical to Nonpareil
- Can be used the same ways a Nonpareil Kernel
- Roasts well
- Large and slightly darker than Nonpareil
- Crunchier and more flavorful than Nonpareil
Yields and Profits

• Full stature tree, not quite as tall as Nonpareil.

• Thick branches.

• Dense nodes, profuse flowering.

• Produces 15-25% more than Nonpareil.

• Perfect Bloom coverage.

• Highest priced nut and higher production than Nonpareil.

• Same irrigation as Nonpareil with higher yield.
Bennett-Hickman Branches and Nodes
Bennett-Hickman Bloom
Processors currently receiving Bennett Hickman as a Nonpareil type:

- Blue Diamond Growers
- Hilltop Ranch
- Hughson Nut Co.
- Famoso Nut Co.
In the Field

- Very easy release
- Very clean shake
- No second shaking pass
- Light polling
# Bennett-Hickman Alleles Compatibility

<table>
<thead>
<tr>
<th>100%</th>
<th>50%</th>
<th>0%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monterey</td>
<td>Nonpareil</td>
<td>Wood Colony</td>
</tr>
<tr>
<td>Butte</td>
<td>Mission</td>
<td></td>
</tr>
<tr>
<td>Sonora</td>
<td>Aldrich</td>
<td></td>
</tr>
<tr>
<td>Fritz</td>
<td>Price</td>
<td></td>
</tr>
<tr>
<td>Padre</td>
<td>Ne Plus</td>
<td></td>
</tr>
<tr>
<td>Winters</td>
<td>Carmel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Livingston</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Independence</td>
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</tbody>
</table>
Bennett - Hickman

Huller Turn Out: 28.9%

Inshell Crack Out: 71.0%

% of Inshell vs. Meats: 76%

Size: 26.8
Oldest Bennett Planting
Avg. Lbs/Ac Harvest from 2014-2017

<table>
<thead>
<tr>
<th>Price</th>
<th>Nonpareil</th>
<th>Bennett Hickman</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989.25</td>
<td>2250.00</td>
<td>2927.25</td>
</tr>
<tr>
<td>2160.00</td>
<td>3000.00</td>
<td>3750.00</td>
</tr>
</tbody>
</table>
Scheuber Ranch Almond Lbs per Acre

- **Bennett-Hickman**
  - Tree spacing: 16x21
  - Total Trees: 2508
  - Acres: 19.35

- **Nonpareil**
  - Tree spacing: 16x21
  - Total Trees: 2341
  - Acres: 18.05
It’s Nearly Identical to Nonpareil

Bennett-Hickman Variety Continues to Shine

At Duarte Nursery’s Bennett-Hickman Field Day near Hughson, nearly 100 growers stood around and heard Jim Duarte announce that last year he harvested 1,700 pounds on three-year-old Bennett-Hickman trees from the Schenker Ranch. Meanwhile, the Nonpareils, which are 50 percent of the orchard, were 57 percent less. In addition, Bennett-Hickman is commanding the Nonpareil price from almond processors.

Mel Machado, Director of Member Relations at Blue Diamond, stepped up with a processors point of view. “The standard answer on any variety is that it takes years to qualify as a variety,” he said. “You need data from several different areas. You can’t decide from one sample or one orchard. You need it from all over the state – from Chico to Arvin.”

Regarding the Bennett-Hickman variety, Machado noted, “So far, so good. What I see at this point is that there is nothing in that variety that scares me and we are paying it at Nonpareil prices.”

“We have received a few loads over the last couple years, and what we have seen in both the kernel and in-shell is that it’s indistinguishable,” Machado said. “It will be several years before we get that determination because we have only received loads from Stanislaus County, so we need to get the same from Kern and Butte before we know what is going on, but so far, it does look good.”

“We sold our growers who are planting it that we will pay the Nonpareil price for both indshell and kernel,” said Rich Miller, Grower Relations Representative with Hilltop Ranch in Ballico. “We feel that it is a very strong look alike to Nonpareil, and I think there is going to be a good spot for it in the industry. Bennett-Hickman is a blonde nut, which is appealing to a lot of markets, and it is aesthetically pleasing – an excellent looking kernel with great flavor. We’ve shown it to many international buyers, and it has been received very well. We are looking forward to getting it in.”

Bennett-Hickman’s bloom starts about a week earlier than Nonpareil and goes a week to 10 days after Nonpareil. The historical challenge for Nonpareil has been having a pollinator that will pick up the beginning of Nonpareil and not bloom out and disappear before the Nonpareil is in full bloom, and still be a good producer. “Bennett-Hickman does both of those jobs,” said John Duarte, President of Duarte Nursery. “We have had the wettest year in 20 years in 2017 and the worst frost year in 40 years this past winter.
Risk Mitigation

• Modesto planting observations:
  – 2018: Bennett-Hickman 15% more buds than Nonpareil (after severe frost year).
  – 2017: Pollination was excellent with very wet bloom period.
Sales and Trend

Bennett Sales by Year
Bennett Mix by Year

DUARTE TREES & VINES
Bennett-Hickman Availability

• Duarte Nursery is the exclusive seller
• Bennett-Hickman is available for 2019
Bennett
New Almond Variety
August 16th, 2019
Tours · Presentations · Lunch
Field Day
9AM - 11AM
631 Service Rd., Modesto, CA
Find us on Facebook

You’re Invited
22nd Annual Friends Day
Friday, May 3rd, 2019 | 9am - 2pm
Tours · Trade Show · Lunch
1-800-Grafted
1555 Baldwin Rd.
Hughson, CA 95326
RSVP to events@duartenursery.com
What’s Next

Tuesday, December 4 at 12:00 p.m.

• Almond Breeding: Is There a Role for New Genetic Technologies? – Room 312-313
• FSMA Scorecard: How Does Your Operation Stack Up? – Room 306-307
• Speed Talks: Nutrient, Salinity and Soil Health – Room 308-309

Tuesday, December 4 at 12:30 p.m.

• Almonds in the Global Marketplace – Room 314
Join the social media conversation at #AlmondConf
What’s Next

Tuesday, December 4

• State of the Industry – Hall C at 4:15 p.m.

Be sure to join us at 5:30 p.m. in Hall A+B for Dedicated Trade Show Time and Opening Reception, sponsored by FMC Agricultural Solutions