

Overview of ABC and It's Technical Toolbox: Water, Nitrogen and Sustainability



Central Valley Almond Day

Sebastian Saa, Sr. Manager Agricultural Research
June 2018

Index

- Our industry and ABC role
- ABC new structure and a overview of our research programs
- The ABC toolbox and outreach program

The Scope of the California Almond Industry

- **Spanning 500 miles (800 km)** throughout the Central Valley
 - 2017/18: 1,300,000 A total*
 - 1,000,000 A bearing*
- **6,800 growers - 101 handlers**
 - 74% of operations are 100A or less*
 - >90% family-owned*
- **100% of U.S. production**
 - 80% of worldwide production*
 - Shipments 66% export; 38% domestic
- **\$5.2 billion in farm value 2016/17***
 - California's #1 ag export**
 - Top U.S. specialty export crop
- **97,000 almond industry-related jobs** generated in Central Valley,
 - 104,000 statewide***
 - \$11 billion contributions to State GDP

Sources:

*Almond Board of California, Almond Almanac 2017 Annual Report

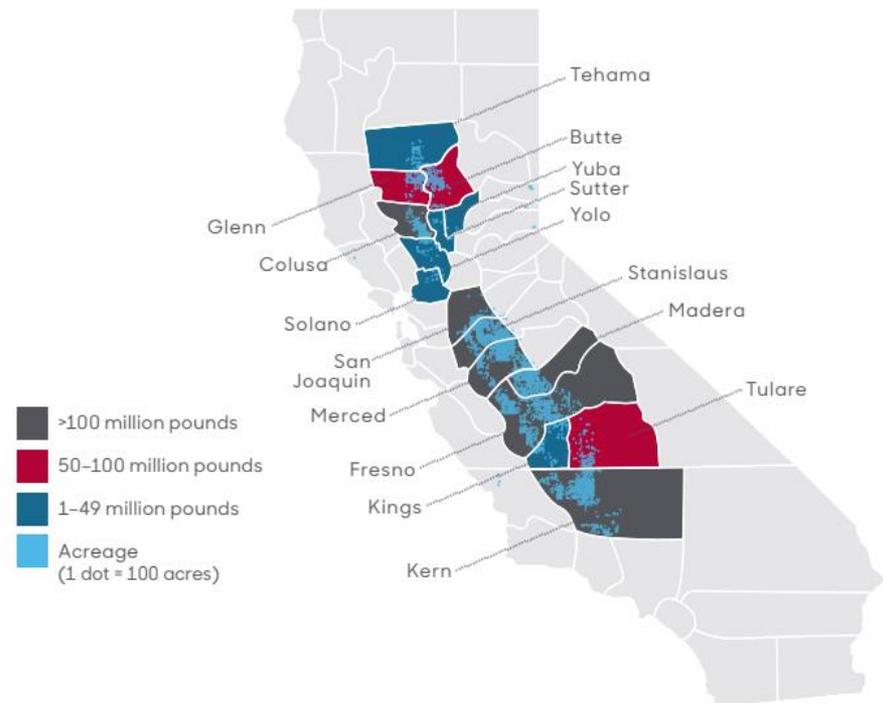
**USDA Agricultural Statistics Service, Pacific Region (NASS/PR)

***U.S. Department of Commerce, Foreign Trade Statistics

*** Source: *Economic Impacts of the California Almond Industry*: UC Ag Issues Center

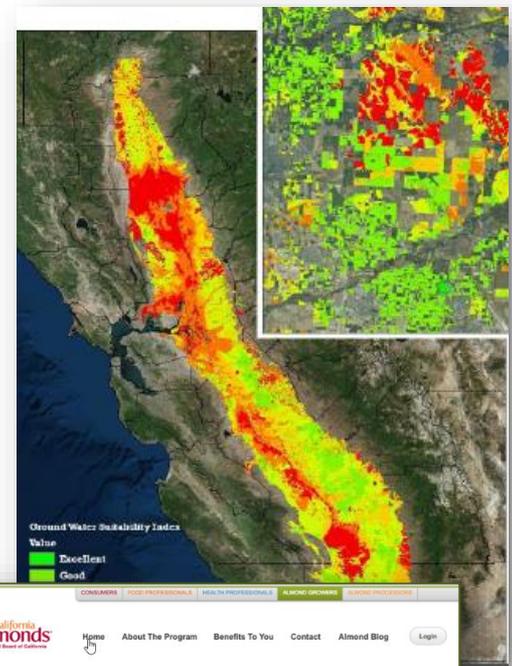
Where Almonds Are Grown

PRODUCTION BY COUNTY | CROP YEAR 2016/17



Leaning Forward into a Challenging Future

- Anticipated **20% increase** in production by 2020
- Demand must **grow ahead** of supply
- Investments in **global marketing**, targeted **research** needed
- Challenges for **agricultural resources** never higher



California Almonds
Home About The Program Benefits To You Contact Almond Blog Login

Welcome to the CALIFORNIA ALMOND SUSTAINABILITY PROGRAM Online System
CREATE ACCOUNT
Already have an Account? Login

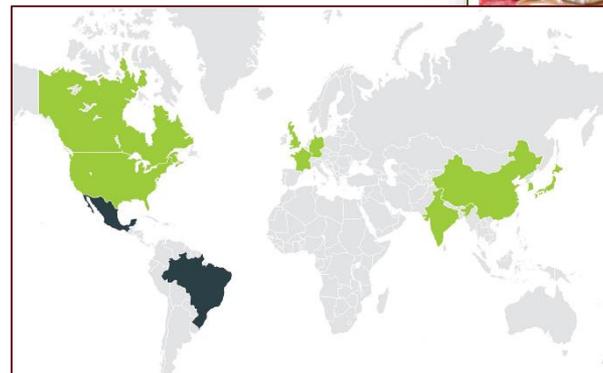
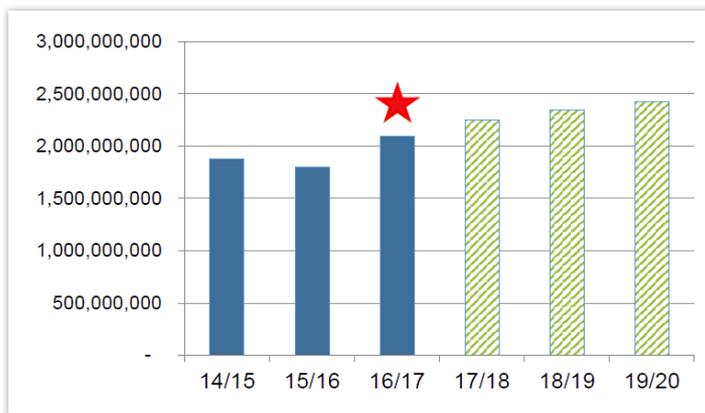
CREATE ACCOUNT ABOUT THE PROGRAM BENEFITS TO YOU USER LOGIN

Username: Forget

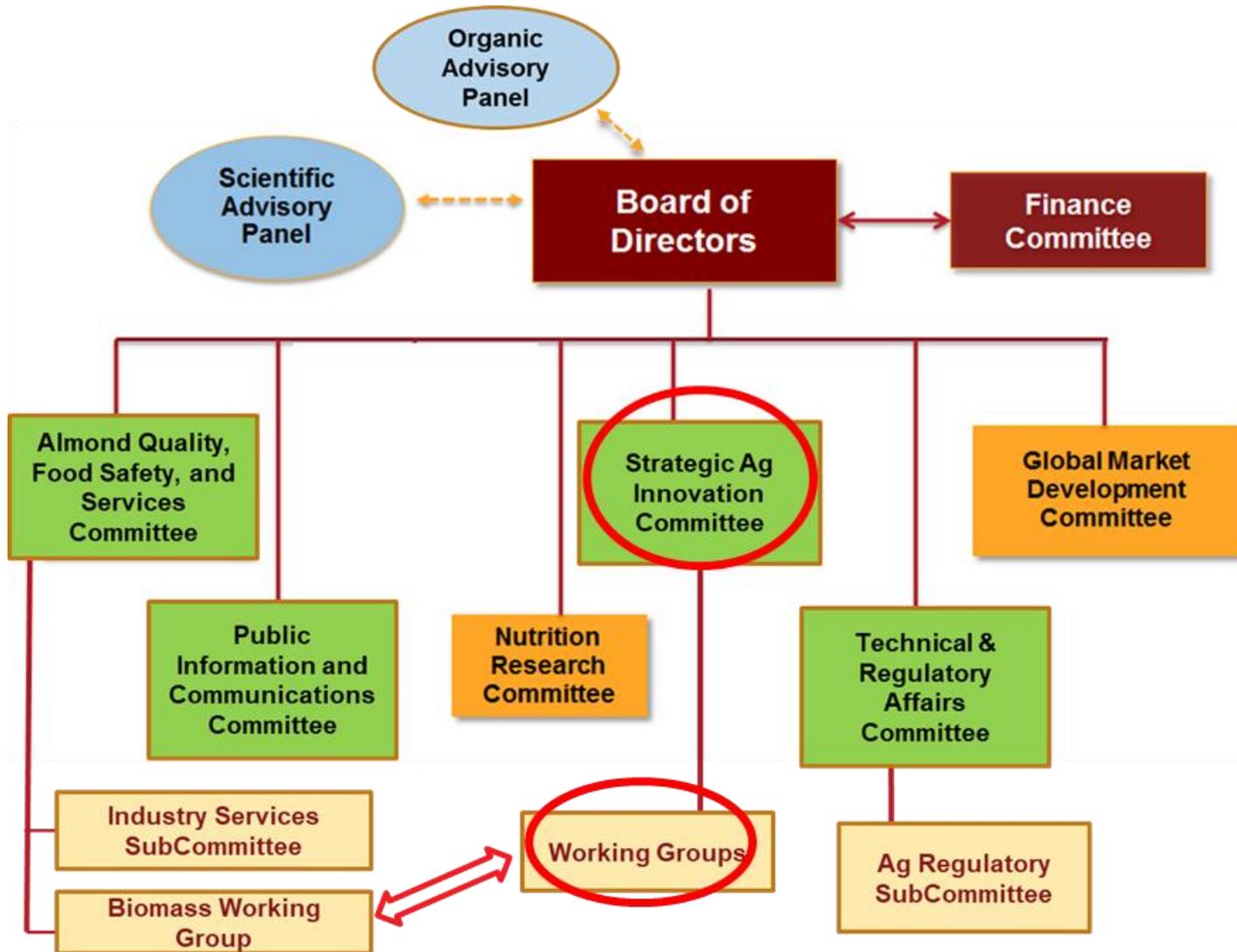
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Remember Login Login

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Almond Board of California (ABC) Organization

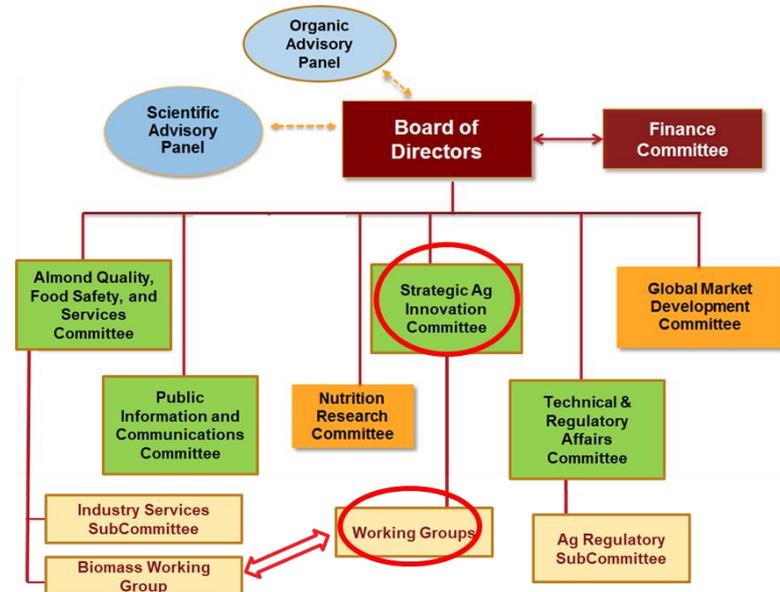


Almond Board of California (ABC) Organization

- Grower-enacted “Federal Marketing Order” established in 1950
 - Represents growers and handlers (processors)
 - “Quasi governmental”
- Under USDA supervision
- Board and Committees all volunteers
- Funded by assessment \$.04/lb* provides
 - Global Market Development
 - Scientific Research
 - Industry Education
 - Quality and Food Safety
 - Regulatory Issues

*\$.01/lb of it is extra assessment

2018 – 2019 Board of Directors - members



Grower dollars at work

- 70% of ABC funds are invested in global market development. These programs are fueled by knowledge, fact and science:
 - Over 500 research projects
 - Nutrition research program leading to first ever qualified heart health claim
 - Demand-building programs in 11 countries
- Investment has driven:
 - Significant grower return increases, from \$0.97/lb in 2011
 - Production has more than tripled
 - Almond industry overall revenue growth of more than 9X



With our current programs reaching 11 countries.



Increased investment in current markets:
U.S., China, Germany, India, France, U.K.,
South Korea, Canada

New launches: Mexico, Italy, Japan

Leveraging Health Benefits



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.

20%

fewer
calories

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.



Vitamin E

A handful of almonds (30g) provides you with approximately 65% of your daily requirement of vitamin E.

- 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.

theguardian

News Sport Comment Culture Business Money Life & style | 1

News Science Nutrition

Mediterranean diet 'cuts strokes and heart attacks in at-risk groups'

Research shows diet can reduce risk for people who smoke, have type 2 diabetes or exhibit other unhealthy characteristics

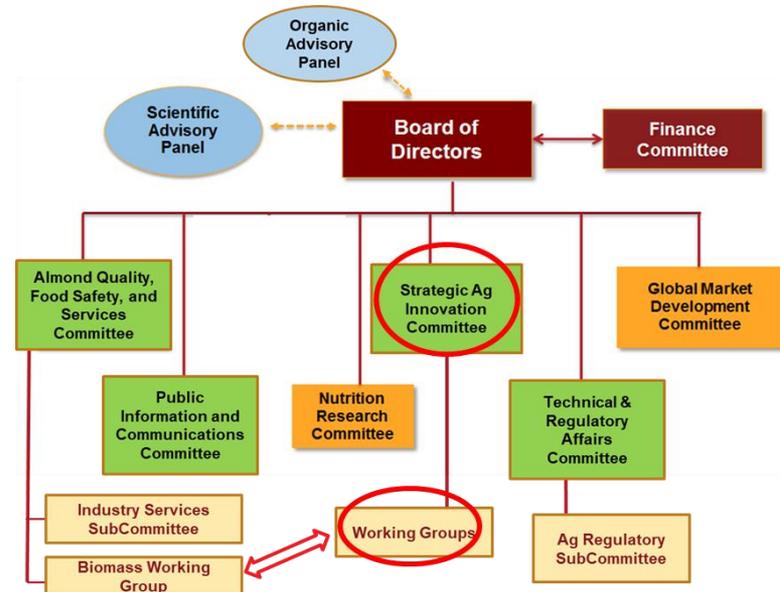


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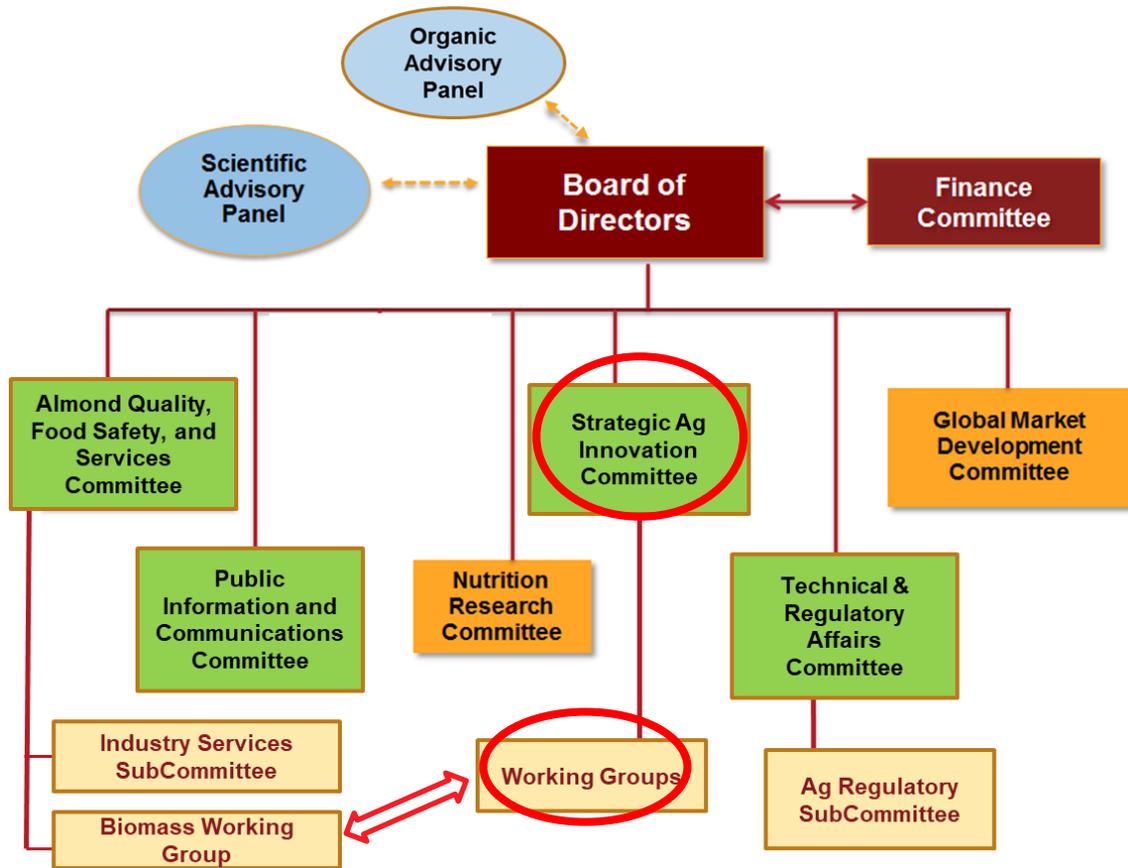
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2018 – 2019 Board of Directors - members



New Ag. & Env. Affairs Committee Structure



- Strategic Ag Innovation Committee
- Seven Working Groups:
 - Sustainability/CASP
 - Biomass (Reports to AQFS & Services Committee)
 - Pest Management
 - Orchard, Tree, Rootstock
 - Pollination & Bee Health
 - Irrigation, Nutrients and Soil Health
 - Harvest

Sustainability Workgroup

Environmental Regulatory Issues Affecting Almond Production

Water Availability

- Sustainable Groundwater Management Act (SGMA)
- Bay-Delta Water Quality Control Plan (WaterFix, Unimpaired Flows)
- Federal Energy Regulatory Commission (FERC)

Water Quality

- Porter Cologne Act (CV-SALTS, ILRP)
- Clean Water Act (TMDLs)
- Waters of the United States (WOTUS)

Air Quality

- Clean Air Act (PM2.5, PM10, ozone (smog))
- AB32 (Climate Change/ Greenhouse Gas reduction)

Pesticide Regulation

- Ecological and Human Health Risk Assessments
- Endangered Species Act (ESA)
- Export Market requirements



Biomass Working Group

Pest Management Priority Areas

- ➔ Implement measures for early detection of pests and utilize precision methods delivered through a suite of advanced technology tools
- ➔ Increase use of IPM
 - Precision application and technology tools
 - Improve application and farming practices that keep the ingredient on target and minimize off-site movement for minimal waste and environmental benefits
 - Develop a suite of technological tools to better detect and control pests at all stages of production and processing
 - Sniffers / spectral detection
 - Molecular / genetic detection / PCR applications for soil pest detection
 - Bio-pesticide control
 - Breeding (use new technologies?) for resistance
 - Insect mating disruption
 - Outreach on Integrated Pest Management
 - Post Harvest Controls

Niederholzer et al., 2016
Maximize coverage and reduce drift



Symmes et al., 2017
NOW



Adaskaveg et al., 2017
Epidemiology of bacterial spot



Yaghmour et al., 2017
Hull Rot symptoms



Michailides et al., 2017
Aflatoxin

... Molds that can produce aflatoxin in almond orchards in California

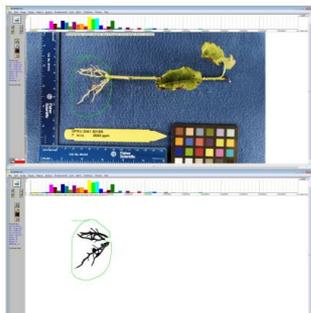


Orchard, Tree, Rootstock: Summary of priority areas

➔ Rely on advanced research to develop rootstocks, varieties, and orchard management practices to improve orchard health, efficiency, and reduce environmental impacts while maintaining / improving desirable almond characteristics

- Variety development
 - Self fertility, dwarfed/reduced stature, yield, disease/insect resistance, desirable market characteristics
- Rootstock development (Higher priority than variety development)
 - Soil pest resistance, salinity/drought tolerance
- Consider / advance GMO and gene editing capabilities, particularly for rootstocks and balance with negative perceptions
- Canopy management
 - Investigate, develop and breed for tree architecture (e.g., hedgerow, trellising) and next generation equipment (e.g., sprayers, harvesters)
 - Co-dependent with equipment development and manufacturer engagement

Velasco et al., 2017
Rootstock anatomy



Duncan et al., 2010
Rootstock field trial



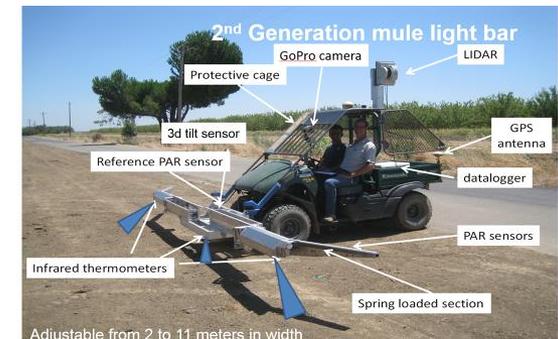
Krymsk 86

M2624

Lampinen et al., 2017
Variety field trial



Lampinen et al., 2017
Canopy light interception



Pollination & Bee Health: Summary of priority areas

- Demonstrate the ability to provide a safe, nutritional environment for pollinators, ensure a sufficient supply of honey bees for almonds, and reduce reliance on honey bees in the long term.
 - Leverage alliances and partnerships
 - Secure optimal funding for honey bee health, varroa mite management, tech transfer teams and forage polices
 - Continue research and outreach
 - Focus is **assessing pesticide impact and minimizing exposure** to ensure that almond orchards are a safe environment for bees.
 - Integrated pollination
 - Encourage an integrated approach, expanding opportunities for self-compatible varieties, expanded forage areas and a combination of honey bees/native pollinators.

vanEngelsdorp et al., 2017
Alliance and Partnership



Nino et al., 2017
High varroa mite



McFrederick et al., 2015
Colony health

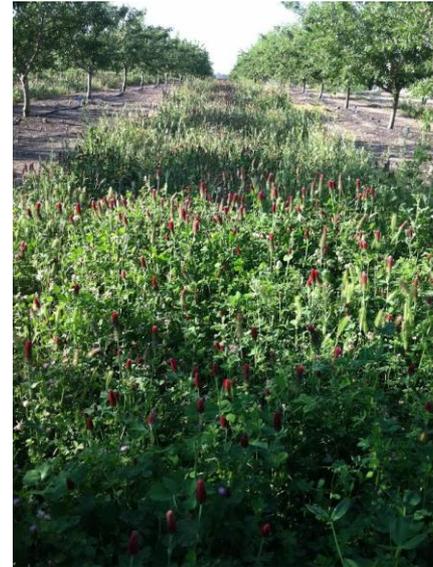


Synk et al., 2017
Cover crop and forage



Consider Planting Supplemental Forage

- Supplemental forage provides bees natural nutrition before and after almond bloom, when there is a dearth of pollen
- On going ABC-funded research demonstrates
 - Hives having access to supplemental forage have higher survivorship and perform better
 - Forage does not compete with almond blossoms -- bees go to almonds first
- Contracts are emerging that discount hive rental price if forage is planted
- More information at [Almonds.com/BeeBMPs](https://www.almonds.com/BeeBMPs)



Harvest: Summary of priority areas

→ Reconsider current harvest practices/ Encourage adoption of lower-dust harvesting

- Dust affects neighbors/employees
- Frees up orchard floor management (ants, weeds/cover crops, composts, etc.)
- May widen uses of almond hulls (biomass usage)



Future?



Outreach from 9 years of harvest dust research

MANAGING DUST AT HARVEST

Everyone involved in the growing and harvesting of California Almonds should be aware that dust affects all who are present at harvest, including workers, neighbors and the community. Follow these steps, based on Almond Board-funded research findings, to reduce harvest dust.

Start with a clean orchard.

Clean orchard floors make all dust management practices easier. Clean floors help you reduce suction fan speed on pickup machines. That can knock a lot of dust out of the process without losing harvest efficiency.

Plan your route.

Take every opportunity to blow dust back into the orchard using the tree canopy as a natural filter. Note that the trees and their canopies can help capture dust before it reaches roads and homes. Plan your passes and travel direction to direct dust away from roads, homes and sensitive locations such as schools, hospitals and day-care centers. If you are near a busy road, consider placing traffic signs to warn motorists of harvest activities.

Go low, but not too low.

Set sweeper heads to optimum level. Don't set heads any lower than is necessary to recover the crop. Often, wire tines can be set to as high as 0.5' off the ground and still do a good job sweeping. If set too low, the sweeping head will move an excess amount of dirt into the windrow, increasing dust from the pickup machine substantially.

Use wire tines.

If possible, only use wire tines on sweeper heads. Sweepers that use wire tines without rubber flaps can help reduce dust.

Avoid extra sweeper passes.

Use fewer blower passes when and where possible. One blower pass instead of three can reduce the amount of dust produced by half.



Irrigation, Nutrients, and Soil Health: Summary of priority areas

→ Ability to target water and nutrient application in an automated way, that is ideally at the individual tree level, using the ability to monitor the status of water and nutrient levels via advanced technology

– Precision ag, improved technologies to determine:

- Tree water status/ ET /Soil available moisture
- Soil available N

– Integrated irrigation / nutrient management decision support and operating systems

- Easy for growers and operators to use

→ Increase Irrigation Continuum Adoption

→ Diversified Water Supply

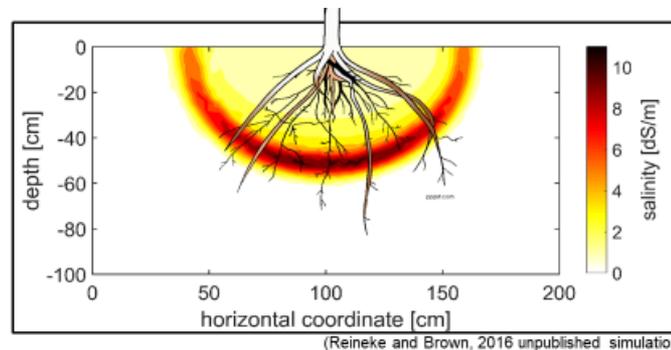
- Recharge
- Water reuse

→ Define soil health relevant to almond growing

Volder et al., 2017
Winter water recharge



Brown et al., 2017
Salinity studies



(Reineke and Brown, 2016 unpublished simulation)

Brown et al., 2014
Total Nutrient Demand



When outreach is the next step...

- Besides our long term collaboration with **UC F.A. and researchers**, our research results go to our **CASP program**, which is part of our sustainability workgroup, and to our Global Communications office

California Almond Sustainability Program

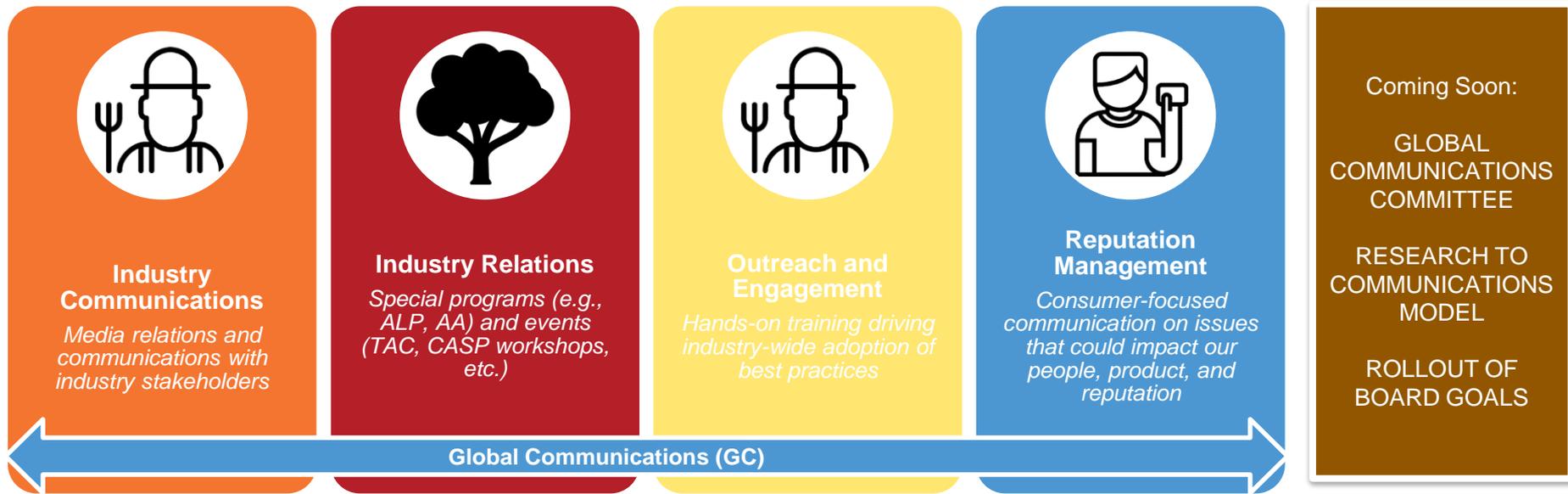
The California Almond Sustainability Program (CASP) formalizes grower sustainability practices and ensures continuous improvement through grower self-assessments.

- A baseline of industry-wide practices
- Based on more than 40 years of research
- LCA analysis now published
- Broad understanding the ag ecosystem's impact on people and the planet



When outreach is the next step...

- Besides our long term collaboration with UC F.A. and researchers, research results go to our CASP program, which is part of our sustainability workgroup and to our **Global Communications** department



Together we develop valuable tools and resources for our growers and processors

CASP Online: SustainableAlmondGrowing.org

Self-Assessment Modules

- Assess your practices while learning about alternative + best practices
- Contribute to telling the almond sustainability story

Irrigation Calculator

- Performs basic water demand calculations with user-submitted system information and auto-updates from CIMIS
- Provides irrigation schedule and run time

Nitrogen Calculator

- Estimates N need + timing of applications based on yield estimates
- Provides ILRP required N Management Plan

Together we develop valuable tools and resources for our growers and processors: Example of data resource

- <http://www.almonds.com/growers/resources/research-database>



2017

RESEARCH UPDATE

ALMOND BOARD OF CALIFORNIA



The screenshot shows the website's navigation menu with categories: CONSUMERS, FOOD PROFESSIONALS, HEALTH PROFESSIONALS, ALMOND GROWERS, ALMOND PROCESSORS, NEWSROOM, and GROWING GOOD. Below the menu are links for Growing Safe Product, Resources, Sustainability Program, Programs & Events, In the Orchard, and Current Issues. A search bar is located in the top right corner with the text 'English US/Canada' and a search icon.

RESOURCES

- INDUSTRY RESOURCE DIRECTORY
- RESEARCH DATABASE**
- SUPPLIERS & EXPORTERS LIST
- INDUSTRY STATISTICS AND MAPS
- INDUSTRY ECONOMICS
- ALMOND ALMANAC AND FACTSHEETS
- ALMOND POLLINATION DIRECTORY

RESEARCH DATABASE

Together we develop valuable tools and resources for our growers and processors: Example of recommended management practices

– Comprehensive “Honey Bee Best Management Practices for California Almonds”

- With 3 “Quick Guides”: General-Decision Maker; Applicator-Specific; and Supplemental Forage

– Available on Almond Board website www.Almonds.com/BeeBMPs



HONEY BEE BEST MANAGEMENT PRACTICES QUICK GUIDE FOR ALMONDS

All parties involved in honey bee pollination of California Almonds and/or applying pest precautions to ensure both honey bee hive health and the best possible pollination of it:

1. **Communication should occur between all pollination stakeholders** about stakeholders, as illustrated in the “Honey Bee BMP Communication Chain for Calif.” Grower and beekeeper should agree on which products may be applied if a treat deemed necessary, growers should give beekeepers 48-hour notice before treatment.
2. **Agreements should include a pesticide plan that outlines which pest control** Grower and beekeeper should agree on which products may be applied if a treat deemed necessary, growers should give beekeepers 48-hour notice before treatment.
3. **If applying pesticides, contact your local county agricultural commissioner** Communication Chain for California Almonds” on the reverse to give advance notice managed hives.
4. **Avoid applying insecticides during almond bloom** until more is known, particularly (young developing bees in the hive). If treatment is necessary, only apply fungicides insecticides with fungicides.
5. **Any fungicide application deemed necessary during bloom should occur** when bees and pollen are not present. This timing avoids contaminating pollen.
6. **Provide clean water for the bees to drink.** This will ensure that they spend no searching for water. Either cover or remove water sources before a pest control is applied after a treatment is made. Check water levels throughout bloom and refresh as needed.
7. **Do not directly spray hives with any pesticide spray application.** Ensure the nozzles when near hives. Spray applications that come in contact with bee hives or the pollination of the crop.
8. **Do not hit flying bees with any spray application materials.** Bees that come into contact with spray droplets on their wings.
9. **Report suspected pesticide-related bee incidents** to the county agricultural commissioner cannot be addressed without the data from these incidents. See “Honey Bee BMP Communication Chain for California Almonds” on the reverse for reporting details.
10. **Beekeepers and growers should agree on hive removal timing.** The University removal when 60% of the flowers on the latest blooming variety are at petal fall. The place, and bees that forage outside the orchard (up to 4 miles) seeking alternate forage risk of coming in contact with insecticide-treated crops.

Clark, B.S., Oshida, C. and Decker, V. eds. 2014. Honey Bee Best Management Practices for California Almonds. Almond Board of California.



Almond Board of California
1100 9th St., Suite 3020
Modesto, CA 95234 USA
T: 209.529.8200

A digital version of this publication is also available:
Honey Bee Best Management Practices
Applicator/Driver Honey Bee Best Management Practices for Almonds

APPLICATOR/DRIVER HONEY BEE BEST MANAGEMENT PRACTICES QUICK GUIDE FOR ALMONDS

Pesticide applicators should follow these precautions to ensure both honey bee and the best possible pollination of the California Almond crop:

1. **Read labels carefully and follow directions.** Do not use pesticides with label cautions that read “highly toxic to bees,” “toxic to bees,” “residual if residual toxicity.”
2. **Before applying pesticides at any time of year, contact the county commissioner to notify beekeepers with nearby managed hives.** for pesticide products with “toxic to bees” label statements” and reconfirm applications, particularly during almond bloom.
3. **Water should either be covered or removed before a pest control or applied and refilled after the treatment is made.** Providing clean drink will ensure that they spend more time pollinating the crop than sea.
4. **Do not directly spray hives with any pesticide spray application.** should turn off nozzles when near hives for all materials applied. Spray applications in contact with bee hives could adversely affect bee health and the pollination of the crop.
5. **Do not hit flying bees with spray applications.** Does that come in contact with bees will not be able to fly because of the weight of spray droplets on their wings.
6. **Report suspected pesticide-related bee incidents** to the county agricultural commissioner. Bee health concerns cannot be tracked data from these incidents.

“Hit or avoidable” to be avoided bees “toxic to bees” statements on its label. beekeepers will inform the applicator must be notified if they have received notification by the applicator before the planned application.

A digital version of this publication is available at Almonds.com/BeeBMPs.

Also available:
Honey Bee Best Management Practices for California Almonds
Honey Bee Best Management Practices Quick Guide for Almonds

Clark, B.S., Oshida, C. and Decker, V. eds. 2014. Honey Bee Best Management Practices for California Almonds. Almond Board of California.



Almond Board of California
1100 9th St., Suite 3020
Modesto, CA 95234 USA
T: 209.529.8200

FORAGE YOUR WAY TO BETTER HONEY BEE HEALTH

Studies show that planting forage provides honey bees with better nutrition, and healthy honey bees mean better pollination! Although planting forage may not be the best fit for all growers, it can provide a number of benefits where orchard conditions are favorable.

The benefits of planting forage

As almond tree acreage grows, so does the need for pollinators. Besides the nutritious pollen and nectar that almond trees provide for honey bees, one of the ways almond growers can support pollinator populations is to provide an alternate source of honey bee nutrition before and after almond bloom.

Supplemental feeds are often used to support honey bee nutrition while pollen and nectar are unavailable. However, forage plantings provide a robust source of nutrition that nurtures more vigorous foragers.

Continuing Almond Board-funded studies have examined the health, growth and survival of honey bee colonies that were fed supplemental feeds and forage. The results indicate that planting forage could increase queen and colony survival, as well as provide healthier colonies.

Should you plant forage?

In addition to providing robust food resources for honey bees, growers who plant forage may benefit from a number of other improvements to their orchards, including:

- improved soil fertility
- improved water infiltration
- improved soil moisture conservation
- fixed nitrogen
- increased organic material
- increased beneficial insects
- soil stabilization and erosion control

Whether it's young orchards needing soil stabilization, or reducing erosion in older orchards, cover crops between tree rows are appropriate for all orchards. If row plantings are not an option for your orchard, consider planting forage along orchard margins or in open fields nearby. Hedgerows, with their long bloom periods, are also an option to provide bee forage, beneficial insects and soil benefits to the grower.



©2016 Almond Board of California



Together we develop valuable tools and resources for our growers and processors: Example of recommended management practices



It is our most recent outreach material. If **interested or not interested, visit Spencer and Rebecca at the booth!**

You will definitely get interested after talking with them!

Together we develop valuable tools and resources for our growers and processors: Example of fact-sheets



GROWING GOOD

Almond Sustainability 2017



GUIDE TO CALIFORNIA ALMONDS

ALMOND PRODUCTION BY COUNTY

VARIETIES AND BOOP

Variety	Boop	16/05	19/02	23/05	25/07	27/08	30/02	30/04
ALDRICH	Almond variety with a large, smooth, pointed almond.							
BUTTE	Almond variety with a large, smooth, pointed almond.							
CARMEL	Almond variety with a large, smooth, pointed almond.							
FRITZ	Almond variety with a large, smooth, pointed almond.							
INDEPENDENCE	Almond variety with a large, smooth, pointed almond.							
MARCONIA	Almond variety with a large, smooth, pointed almond.							
MONTEREY	Almond variety with a large, smooth, pointed almond.							
NONPAREIL	Almond variety with a large, smooth, pointed almond.							
PAIRE	Almond variety with a large, smooth, pointed almond.							
PRICE	Almond variety with a large, smooth, pointed almond.							
SONDRA	Almond variety with a large, smooth, pointed almond.							
WOOD COLONY	Almond variety with a large, smooth, pointed almond.							

USDA GRADES

Grade	16/05	19/02	23/05	25/07	27/08	30/02	30/04
Nonpareil	100%	100%	100%	100%	100%	100%	100%
Independence	100%	100%	100%	100%	100%	100%	100%
Monterey	100%	100%	100%	100%	100%	100%	100%
Butte	100%	100%	100%	100%	100%	100%	100%
Price	100%	100%	100%	100%	100%	100%	100%
Wood Colony	100%	100%	100%	100%	100%	100%	100%
Other	100%	100%	100%	100%	100%	100%	100%

USDA GRADES PRODUCT TESTS

Product	16/05	19/02	23/05	25/07	27/08	30/02	30/04
NONPAREIL							
INDEPENDENCE							
MONTEREY							
BUTTE							
PRICE							
WOOD COLONY							
OTHER							

FOODS

Food	16/05	19/02	23/05	25/07	27/08	30/02	30/04
ROASTED							
BLANCHED							
SLICED							
SHRIMP & CRUST							
SHRIMP & BROWN							
OTHER CAPSULES							
SPICED CAPSULES							

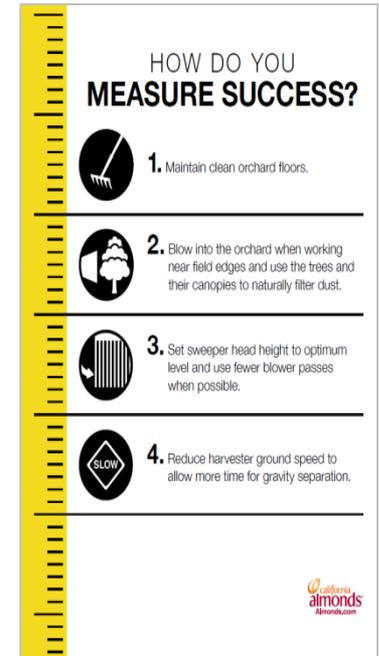
california almonds
Almond Board of California

Together we develop valuable tools and resources for our growers and processors: Example of Tool kit

Harvest Dust Tool Kit

4 Key Strategies:

- 1) Maintain clean orchard floors.
- 2) Blow into the orchard when working near field edges and use the trees and their canopies to naturally filter dust.
- 3) Set sweeper head height to optimum level and use fewer blower passes when possible.
- 4) Reduce harvester ground speed to allow more time for gravity separation.



Available upon request

ABC Educates Growers to Manage Harvesting Dust

Summary

- Demand must **grow ahead** of supply

- Investments in **global marketing**, targeted **research** needed

- Anticipated **20% increase** in production by 2020

- Challenges for **agricultural resources** never higher

With our current programs reaching 11 countries.



Leveraging Health Benefits

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

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



News.....



'IN-THE-ORCHARD' WORKSHOP

Harvest Prep | Machinery Modification | Crop Growth

INDUSTRY EXPERTS WILL COVER THE FOLLOWING TOPICS:

Preparing for Harvest

- Create dust management plan
- Maintain orchard floor management
- Consider your soil type/s

Modifying Your Machinery

- Adjust equipment to reduce dust
- Use of low-dust technologies

Don't Forget to Grow

- Address irrigation, fertility and pest management during and after harvest

Using CASP online tools to meet your growing needs

- Nitrogen calculator, mapping tool and irrigation calculator
- CASP how-to and calculator overview

RSVP:

Rebecca Bailey
rbailey@almondboard.com
(709) 342-3245

ALL WORKSHOPS
8:45 – 11:00 a.m.

WASCO

June 21

- Exit 99 on Woollomes, head West
- Turn left onto Stradley
- Right onto Schuster Rd.
- Stay on Schuster Rd. until Palm Ave.
- Turn right onto Palm Ave. (Right after Hwy 43 and the train tracks)

Orchard Host:
D&J Farm Management, LLC

CHOWCHILLA

June 26

- From 152, turn south at Red Top gas station
- Entrance is on the corner of Road 4 and Avenue 18 1/2

Orchard Host: Triangle T Ranch

MODESTO

June 27

901 Stone Road
Modesto, CA 95358

Orchard Host: Bowman Ranch

JOIN US

THE ALMOND CONFERENCE



california
almonds[™]
Almond Board of California

December 4–6
THIS IS HOW WE GROW.