



*the Almond*  
**CONFERENCE**  
2019

# Latest and Greatest Commercial Uses of Woody Almond Biomass



california  
**almonds**<sup>®</sup>  
Almond Board of California

# Session Speakers

Caleb Gervase, Van Duyn Farms

Karen Lapsley, ABC

Eric McAfee, Aemetis

Mike Woelk, Corigin







**AEMETIS**

# **Commercializing Below Zero Carbon Advanced Renewable Fuels**

**Eric McAfee - Chairman/CEO  
Aemetis, Inc. (Nasdaq: AMTX)  
December 2019**



## Disclaimer

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Certain of the statements contained herein may be statements of future expectations and other forward-looking statements that are based on management's current views and assumptions and involve known and unknown risks and uncertainties that could cause actual results, performance or events to differ materially from those expressed or implied in such statements. In addition to statements which are forward-looking by reason of context, the words “may, will, should, expects, plans, intends, anticipates, believes, estimates, predicts, potential, or continue” and similar expressions identify forward-looking statements.

Actual results, performance or events may differ materially from those projected in such statements due to, without limitation: (i) general economic conditions, (ii) ethanol and gasoline prices, (iii) commodity prices, (iv) distillers grain markets, (v) supply and demand factors, (vi) transportation rates for rail/trucks, (vii) interest rate levels, (viii) ethanol imports, (ix) changing levels of competition, (x) changes in laws and regulations, including govt. support/incentives for biofuels, (xi) changes in process technologies, (xii) the impact of acquisitions, including related integration issues, (xiii) reorganization measures and (xiv) general competitive factors on a local, regional, national and/or global basis, (xv) natural gas prices, and (xvi) chemicals and enzyme prices.

The matters discussed herein may also involve risks and uncertainties described from time to time in the company's annual reports and/or auditors' financial statements. The company assumes no obligation to update any forward-looking information contained herein and assumes no liability for the accuracy of any of the information presented herein as of a future date.

### **Non-GAAP Financial Information**

We have provided non-GAAP measures as a supplement to financial results based on GAAP. A reconciliation of the non-GAAP measures to the most directly comparable GAAP measures is included in the accompanying supplemental data. Adjusted EBITDA is defined as net income/(loss) plus (to the extent deducted in calculating such net income) interest expense, loss on extinguishment, income tax expense, intangible and other amortization expense, accretion expense, depreciation expense, and share-based compensation expense.

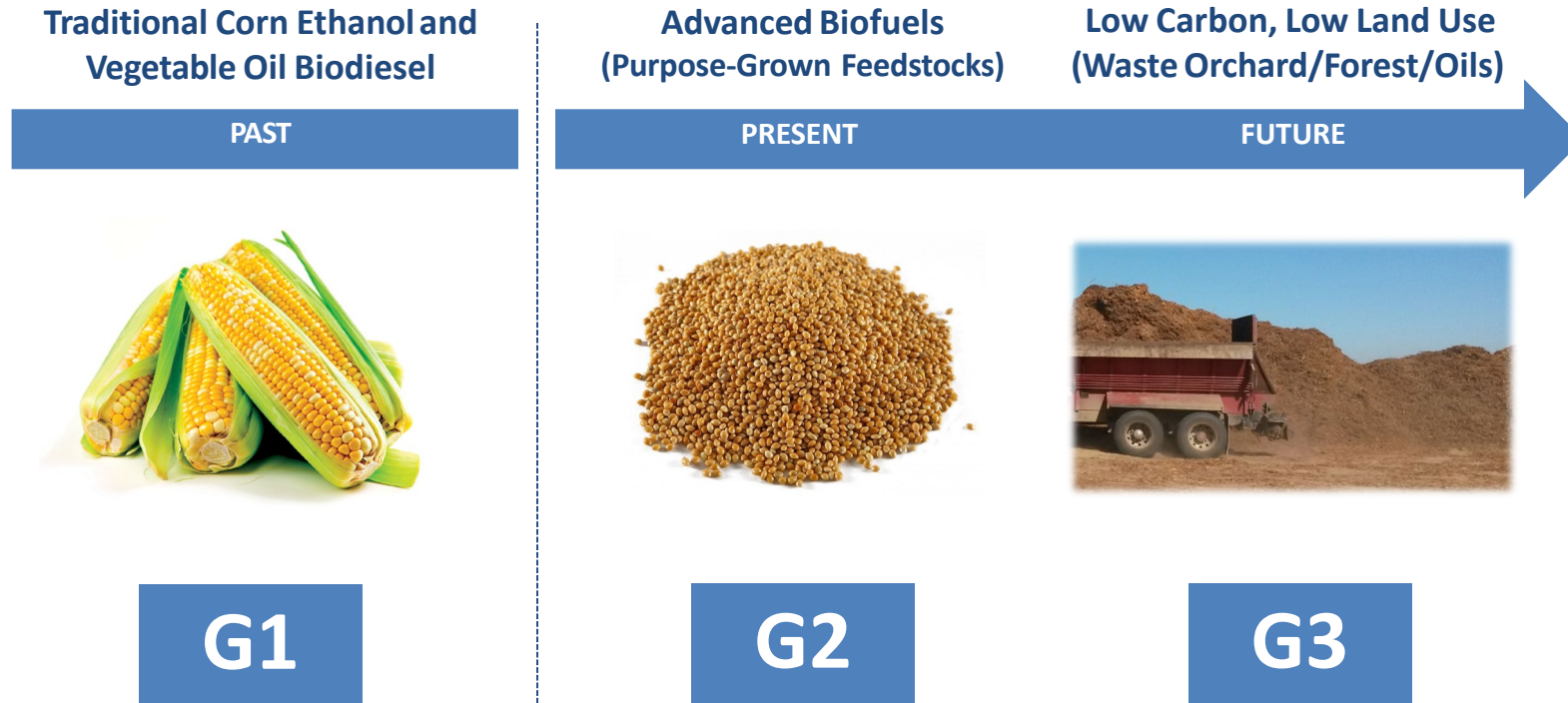
Adjusted EBITDA is not calculated in accordance with GAAP and should not be considered as an alternative to net income/(loss), operating income or any other performance measures derived in accordance with GAAP or to cash flows from operating, investing or financing activities as an indicator of cash flows or as a measure of liquidity. Adjusted EBITDA is presented solely as a supplemental disclosure because management believes that it is a useful performance measure that is widely used within the industry in which we operate. In addition, management uses Adjusted EBITDA for reviewing financial results and for budgeting and planning purposes. EBITDA measures are not calculated in the same manner by all companies and, accordingly, may not be an appropriate measure for comparison.





# Aemetis Mission

Aemetis is a renewable fuels company producing low carbon products to replace petroleum by the acquisition, development and commercialization of innovative technologies.





# Aemetis Overview

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- **Founded in 2006 by biofuels veteran (co-founder of Pacific Ethanol; EPM)**
- **\$170 million revenue in 2018; 110 million gallons per year biofuels capacity**
  - Own/operate 60+ million gallon ethanol plant in California
  - Own/operate 50 million gallon capacity Biodiesel and Glycerin refinery in India
  - Building \$56 million Dairy Biogas digesters, pipeline and cleanup system
  - Building \$200 million Cellulosic Ethanol plant (waste orchard wood feedstock)





# Management and Board of Directors

## Board of Directors



**John Block** - Former Secretary of Agriculture from 1981-86 under President Reagan

**Lydia Beebe** - Former 20-year Chevron corporate officer (38 years at Chevron)

**Fran Barton** - Former CFO of five high tech companies with revenues above \$1 billion

**Dr. Steven Hutcheson** - Molecular genetics founder of Zymetis, acquired in 2011 by Aemetis



### **Eric McAfee - Chairman and CEO**

- Founder of *Aemetis (NASDAQ: AMTX)* and co-founder of *Pacific Ethanol (NASDAQ: PEIX)*
- Founding shareholder of oil production company *Evolution Petroleum (NYSE: EPM)*
- Founded seven public companies and funded twenty-five private companies as principal investor



### **Todd Waltz - EVP and CFO**

- Joined Aemetis in 2007
- Served in senior financial management roles with Apple, Inc. for 12 years
- Ernst & Young CPA



### **Andy Foster - EVP and President, Aemetis Advanced Fuels**

- Joined Aemetis in 2006
- Senior executive at three Silicon Valley tech companies
- Served in the George H.W. Bush White House (1989-1992) as Associate Director - Office of Political Affairs and as Deputy Chief of Staff for Illinois Governor Edgar for five years

### **Sanjeev Gupta - EVP and President, Aemetis International**

- Joined Aemetis in 2007
- Manages India biodiesel and glycerin business
- Previously head of petrochemical trading company with about \$250 million revenues and offices on several continents





# Unique Attribute of Biofuels: “Below Zero” Carbon Emissions

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**Solar, Wind, Hydro and Nuclear electricity reduce emissions of new greenhouse gases compared to coal and petroleum, but do not consume CO<sub>2</sub> from the atmosphere.**

**Renewable fuels and biogas from plant materials consume CO<sub>2</sub> and can help reverse Climate Change using waste wood and renewable biogas feedstocks to produce Below Zero Carbon renewable fuels and Renewable Natural Gas.**

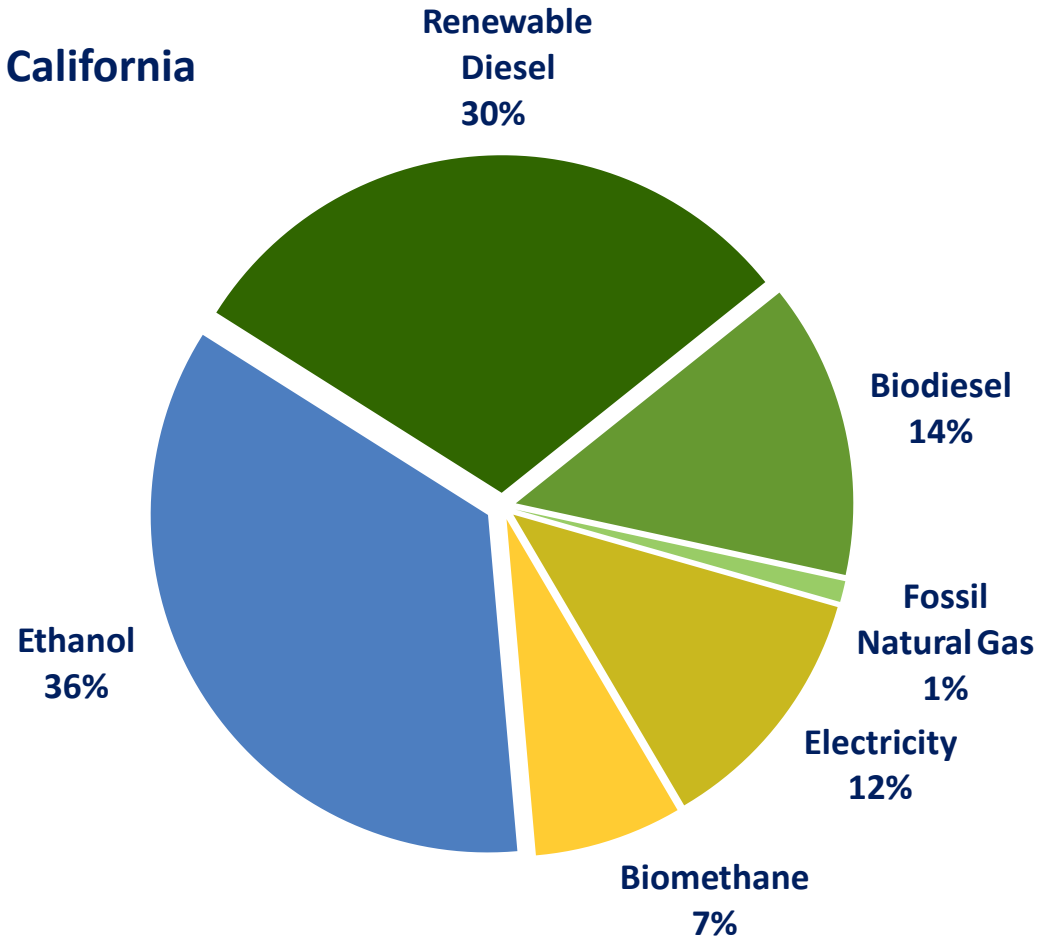


# California LCFS Carbon Reduction

## Biofuels Lead Carbon Reduction in California

California LCFS Carbon Credit Generation by Fuel Type - 2017

- Ethanol
- Renewable Diesel
- Biodiesel
- Fossil Natural Gas
- Electricity
- Biomethane



California Air Resources Board: "Low Carbon Fuel Standard Re-Adoption: Fuel Availability" - April 25, 2018







AEMETIS

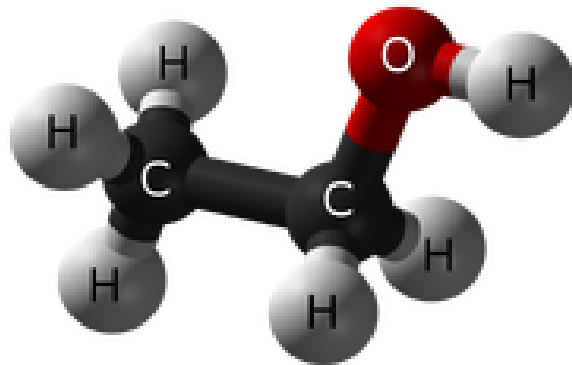
# Aemetis Below Zero Carbon Ethanol Overview



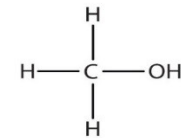
# Ethanol Molecule: High Octane, High Oxygen, EV Engine Fuel

## *Unique Properties of the Ethanol Hydrocarbon Molecule*

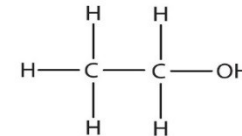
- Ethanol is 114 octane = prevents pre-ignition of fuel and lost power under high compression
  - Higher octane = higher compression engines = better fuel efficiency
  - Replaces benzene and other harmful BTEX aromatic additives in gasoline
- Ethanol is 34% oxygen by weight
  - Cleaner burning gasoline by adding oxygen to engine combustion
  - Significantly reduces air pollution
- Ethanol fuel cell generator powers electric motors for pickups, vans and trucks
  - 100% renewable fuel for electric vehicles (50 mpg at 1/3 cost of hydrogen)



methanol



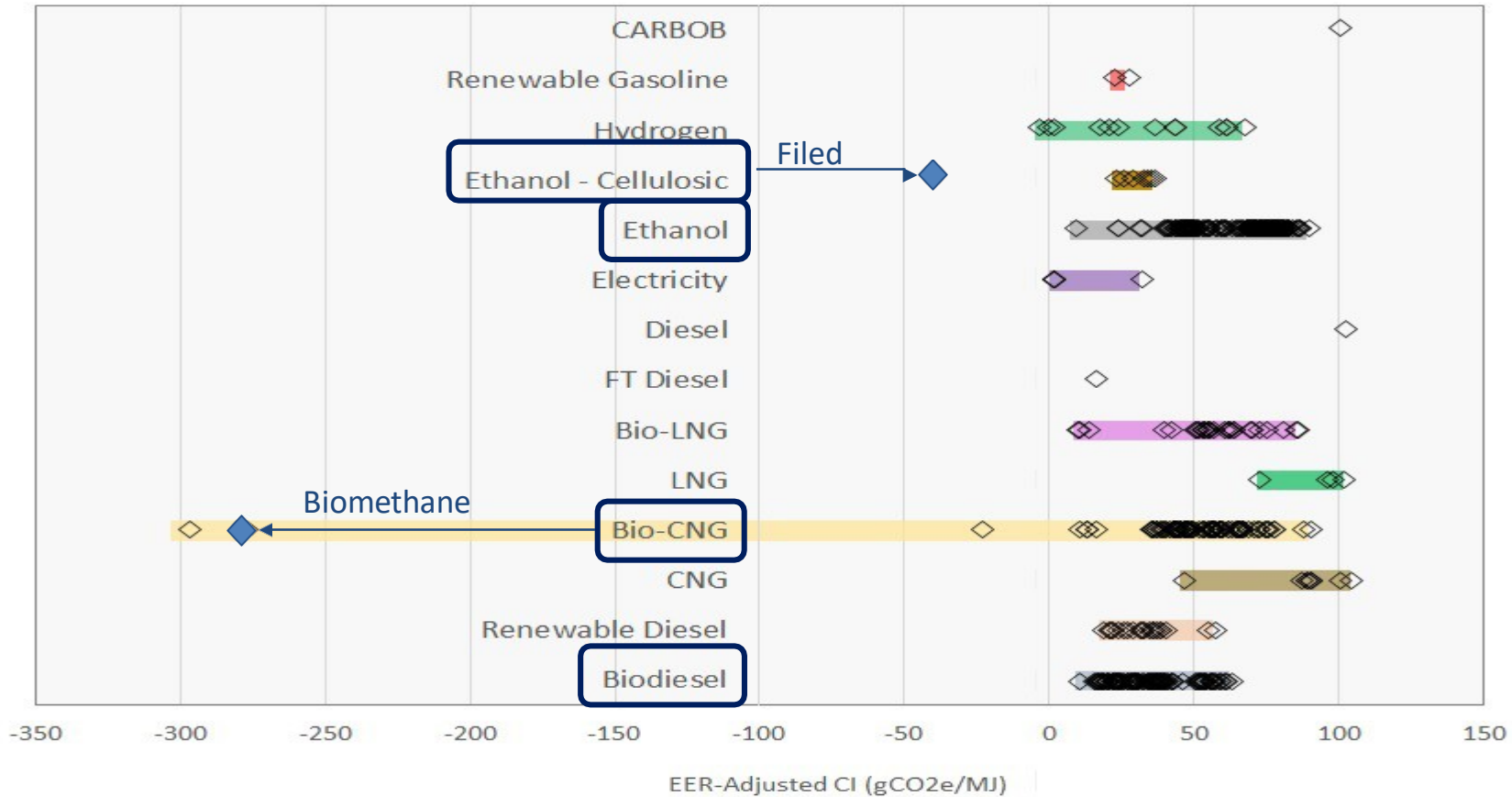
ethanol





# California LCFS Carbon Intensity Values

Carbon Intensity Values of Current Certified Pathways (2018)



Source: California Air Resources Board - October 2018



# Problem: California Orchard Waste Wood Burning

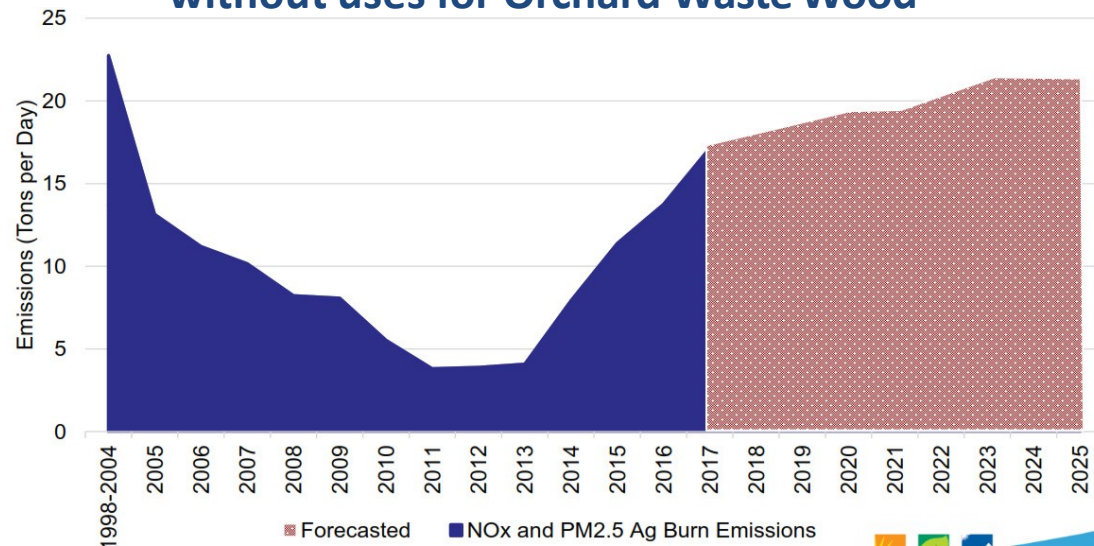
## Biomass-to-Energy Plants Closing in California

- Many biomass-to-electricity plants have shut down in California
- Lack of ability to compete with subsidized low-cost solar and wind electricity

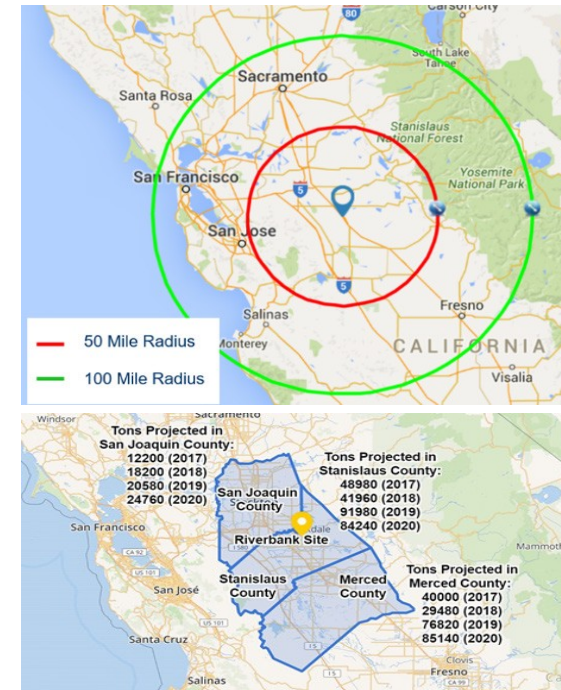
## About 1.5 million acres of almond and walnut orchards in Central California

- 2+ million tons/year of Ag Waste

## Open Burning Emissions Increasing without uses for Orchard Waste Wood



Source: San Joaquin Valley Air Control District Emergency Meeting on Open Burning November 2017

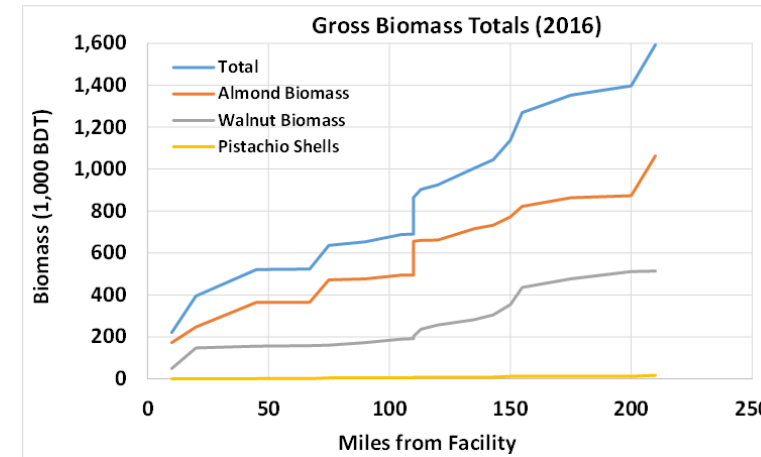
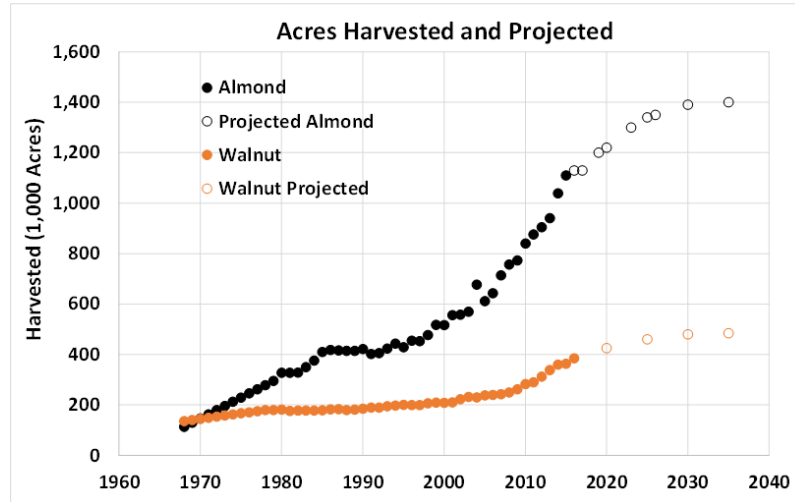




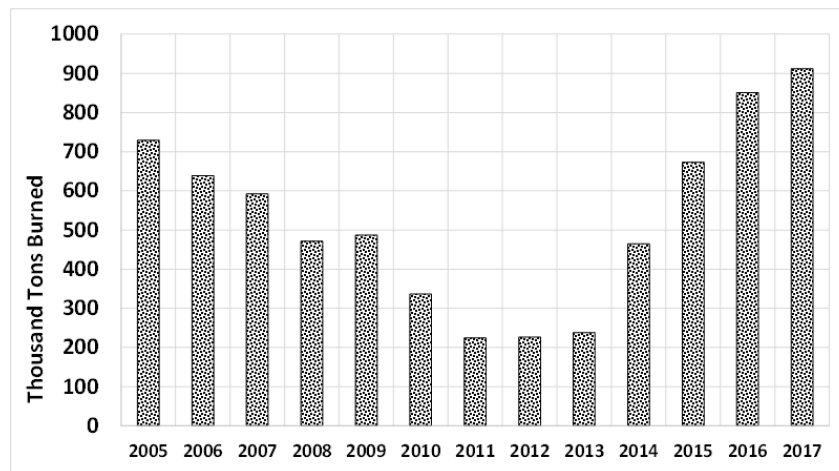
# UC Davis Feedstock Study Results



## Increase in Waste Wood



## Increase in Burning



## UC Davis Study Conclusions:

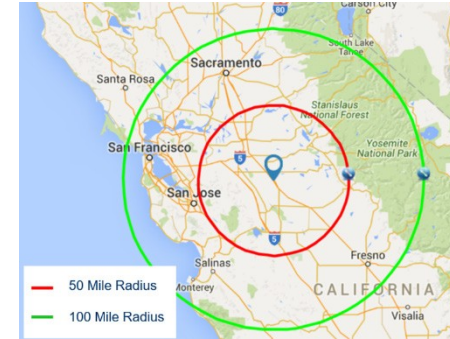
- Confirmed air emissions assumptions for carbon intensity score under LCFS
- Confirmed biomass growth and availability tonnage
- Confirms feedstock pricing and feedstock projected cost for 20 years
- Expanding supply due to lifecycle of trees



# Solution: Convert Orchard Wood Waste to Low Carbon Ethanol

## About 1.5 million acres of almond and walnut orchards in CA

- 20 year almond tree life = remove about 40,000 acres per year
  - Up to 40 tons per acre for each orchard removed
  - Orchard/vineyard wood waste = 2+ million tons per year
- Pistachio shells and hulls have limited uses



## California orchard waste can produce 160+ million cellulosic ethanol gallons per year

- At 80 gallons per ton of waste feedstock, requires 1.6 million tons of wood biomass per year
  - Also available Forest, Construction & Demolition wood waste
- Creates 30,000 direct/indirect jobs in Central Valley
- Attracts \$1.6 billion of new capital investment to California
- Eliminates air pollution from orchard, vineyard and forest wood burning



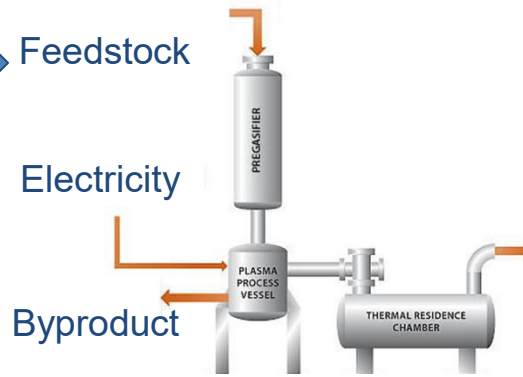


# Technology Overview: Biomass to Syngas to Cellulosic Ethanol

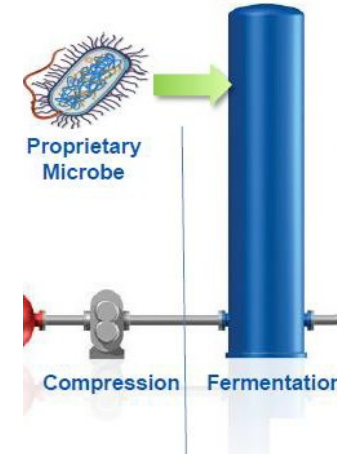
## Feedstock



## Gasification



## LanzaTech Fermentation



### Biomass

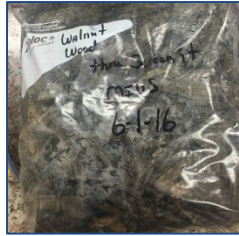
- Orchard/Vineyard Wood Waste
- Orchard Byproducts
- Forest Waste

## Ethanol Plant Integration

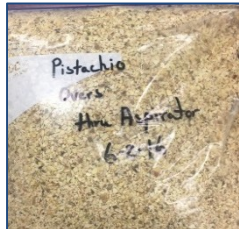
*Aemetis is building the first biomass-to-ethanol plant using LanzaTech process*



# Aemetis Integrated Demonstration Unit Completed



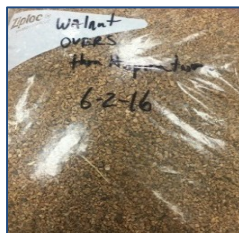
Walnut Wood



Pistachio Shell



Almond Wood



Walnut Shell



AEMETIS



Gasification



Gas Cleaning



Fermentation





# Riverbank Site: Aemetis 55 Year Lease Signed

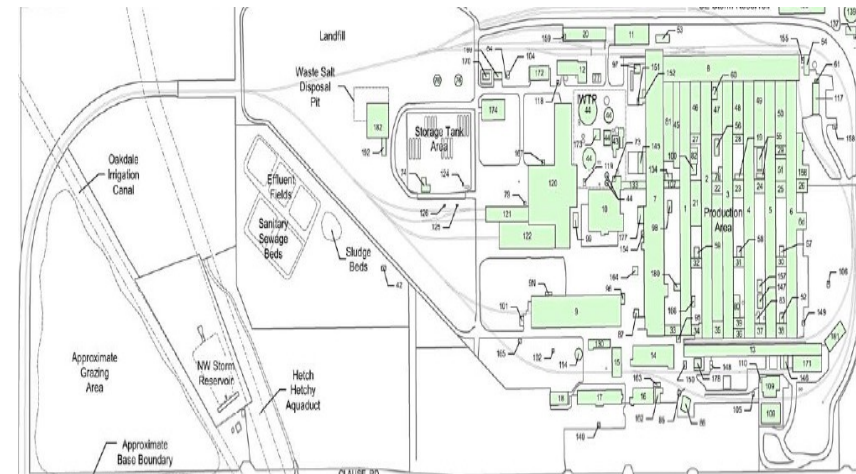


- Former US Army Ammunition Production Plant near Modesto, CA
- Additional space for expansion
- Existing Power and Building Infrastructure
- 100% Hydroelectric Power
- Rail spur in place
- Waste wood feedstock storage areas adjacent to plant



## Site Status:

- Site Layout Complete
- Key Permits Complete



# USDA 9003 Loan Approval for \$125 million Loan

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## Loan Overview

- \$125+ million principal amount
- 80% USDA loan guarantee
- 20 year term
- USDA Conditional Letter signed 2019
- Other financing term sheets signed

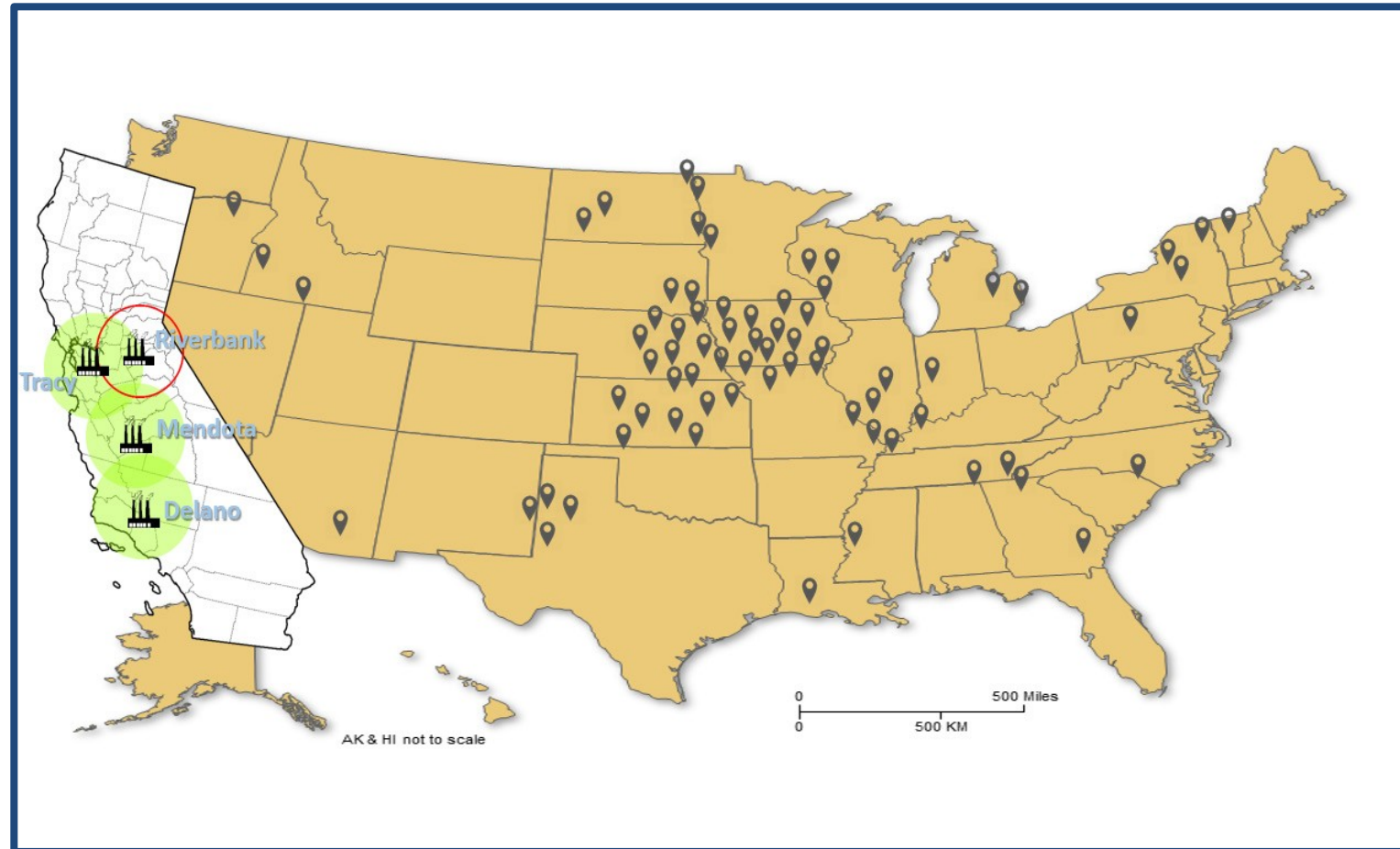
## Milestones

- Environmental Assessment Complete
- 20 year Feedstock Contracts Complete
- Ethanol Off-Take Contracts Complete
- Integrated Demonstration Unit operated for 120 days
- Bank Approved Financial Model Complete
- Technical Report Complete
- Process Engineering Complete
- Detailed Engineering Work Ongoing





## Future Expansion in California: 160 million gallons at 4 plants







**AEMETIS**

[www.Aemetis.com](http://www.Aemetis.com)

**Eric McAfee - Chairman/CEO  
Aemetis, Inc. (Nasdaq: AMTX)**



# corigin



In 2020 the almond industry will produce

857,000 tons of shells

924,000 tons of hulls

2,008,000 tons of trees

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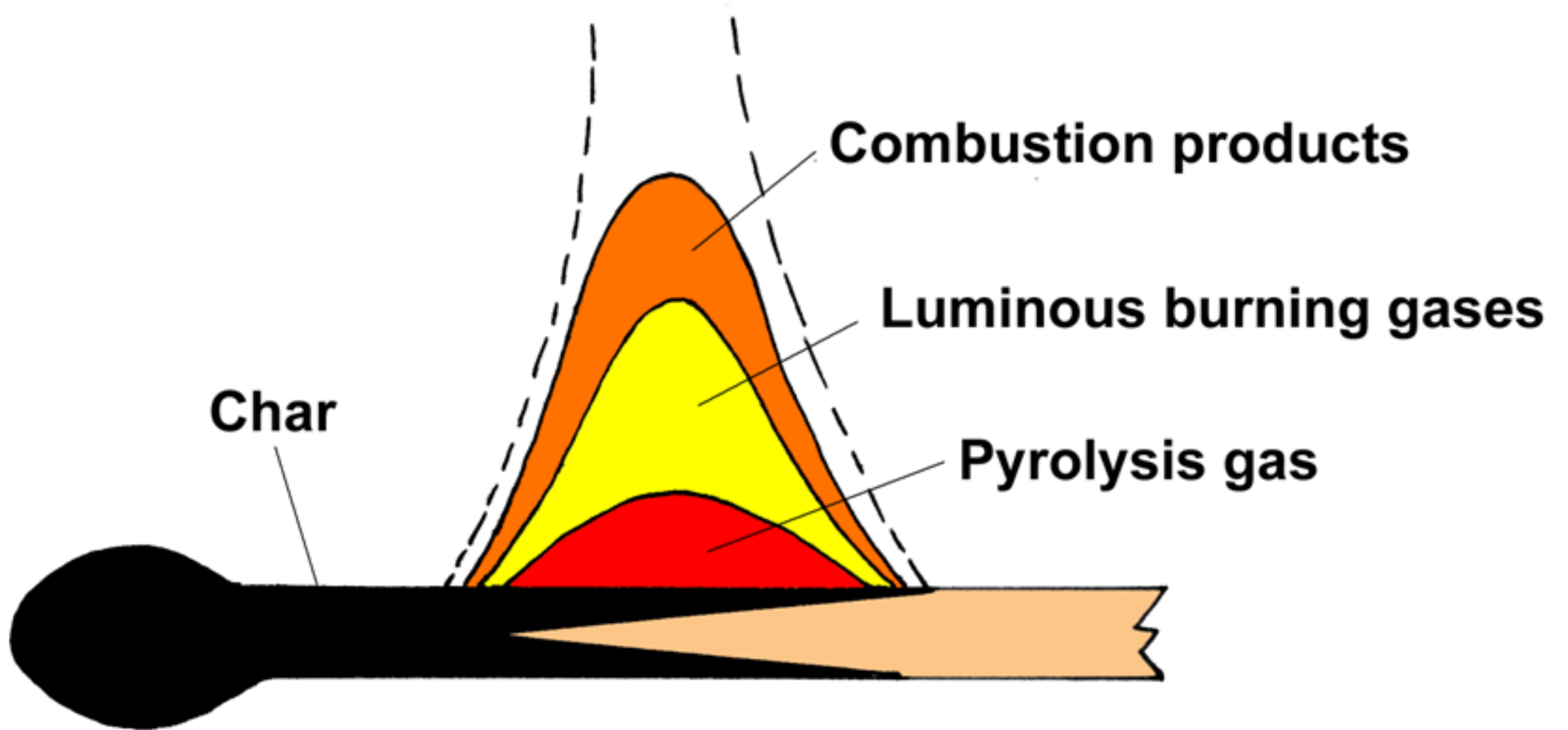
3,789,000 of orchard waste



Could convert to **\$3.8B** of  
biochemicals  
biocarbons  
& bio-oils

With the potential to sequester  
**3.8 million** tons of CO<sub>2</sub>  
(and sell CO<sub>2</sub> offsets @ \$20-30/ton)

# Thermal Deconstruction





Corigin's process converts 2,000 pounds of shells into 1,600 pounds of product



600 lbs (75 gal) Bio-distillate, Plant Growth Stimulant

600 lbs of Biochar Soil Amendment

400 lbs of Bio-oils and Volatiles

Biogas – Energy Source used to sustain the process

We convert orchard wastes into high-value organics to help farmers

1. improve crop and livestock economics
2. reduce chemical & fertilizer loads
3. sequester carbon in soils for centuries

# Corigin Summary

- We're building a highly profitable and scalable business
- Begin commercial production in April 2020, Merced CA
- Field trials show very promising results
- Granted OMRI and CDFA regulatory approval for flagship products
- Permits filed with San Joaquin Air Pollution Control District
- Closed seed financing round – funds initial capex, GTM to profitability
- Experienced management and great board of directors



# Technology Evolution ~ Circa 1999, 3 tons biomass per hour

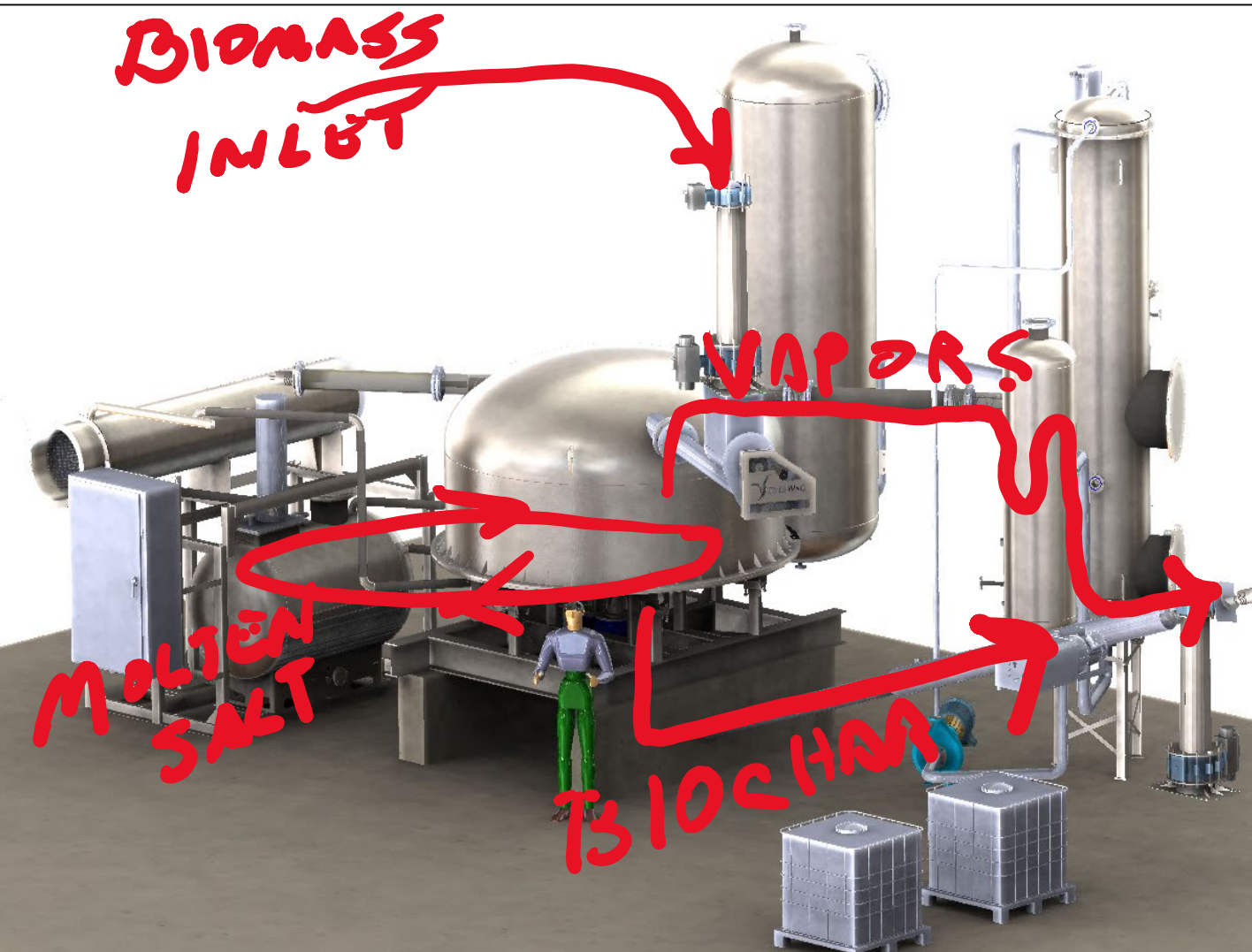


# Technology Evolution ~ Circa 2015, 100 pounds biomass per hour





# Technology Evolution ~ Circa 2019, ½ to 5 tons biomass per hour



- Merced Plant online April 2020
- 3,200 tons biomass initial capacity
- 20,000 tons at max capacity

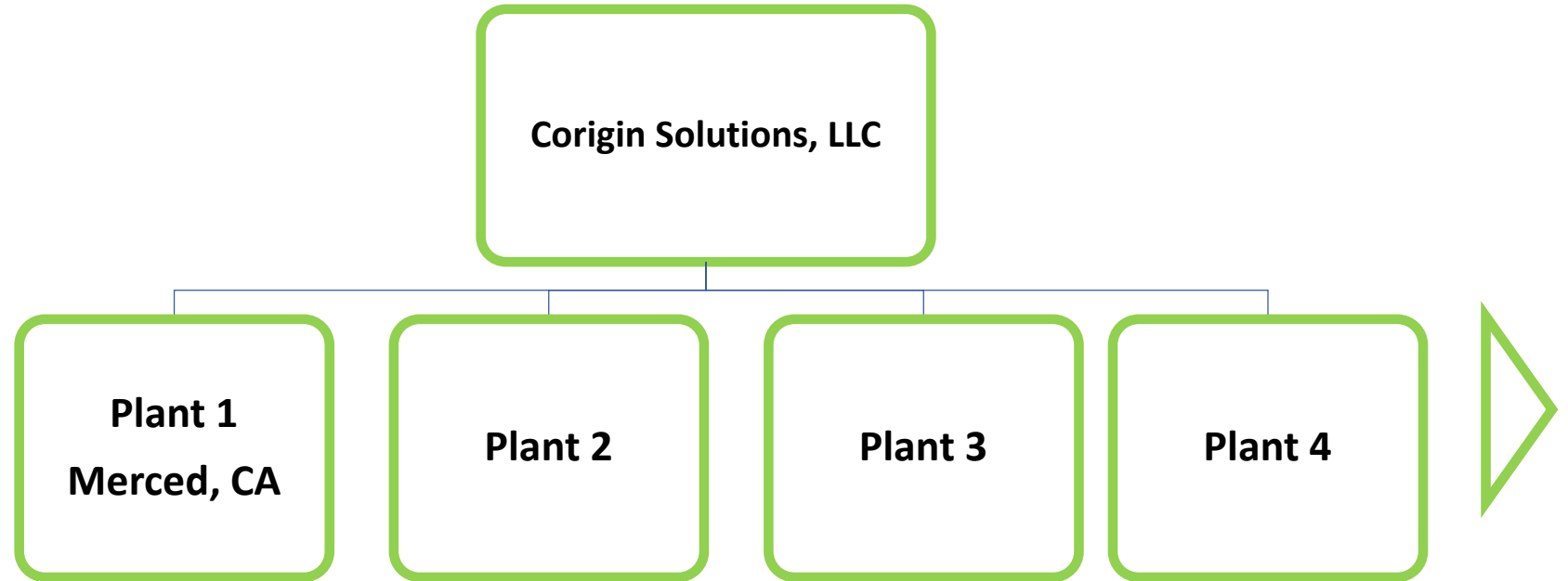




# Strategy to Scale

Equity in parent. Funds plant #1.

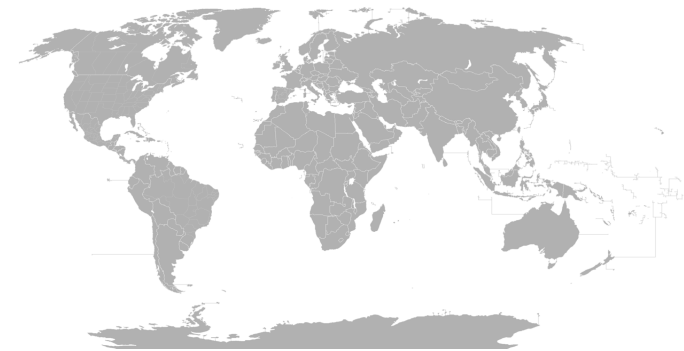
Non-dilutive capital used to scale – build copy exact plants



**Prove the economic model with the first plant.**

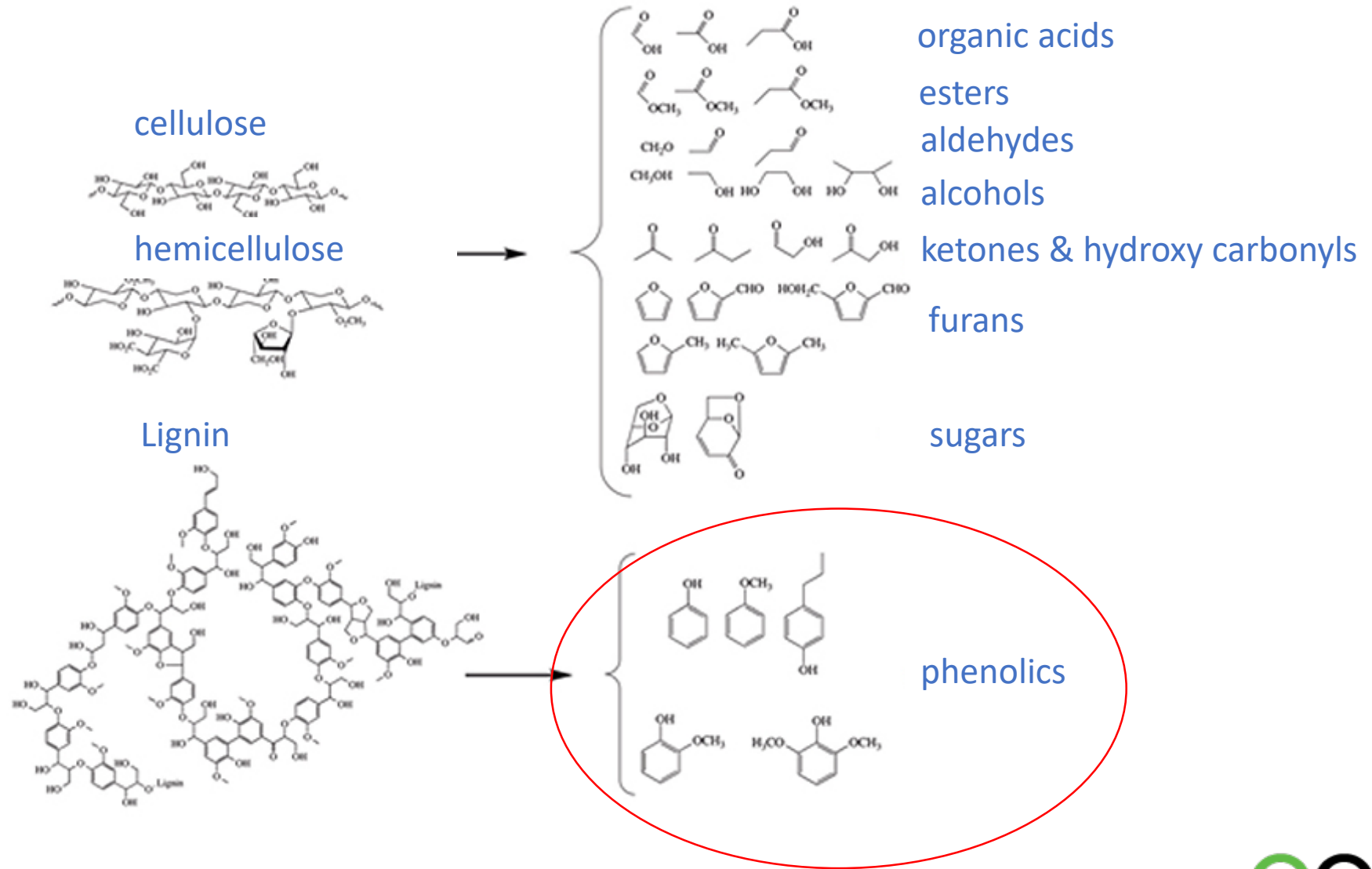
- Each plant will convert 20,000 tons of farm waste per year
- Tax exempt bonds used to finance additional capex for plant #1

**Build additional plants throughout North America and the world**

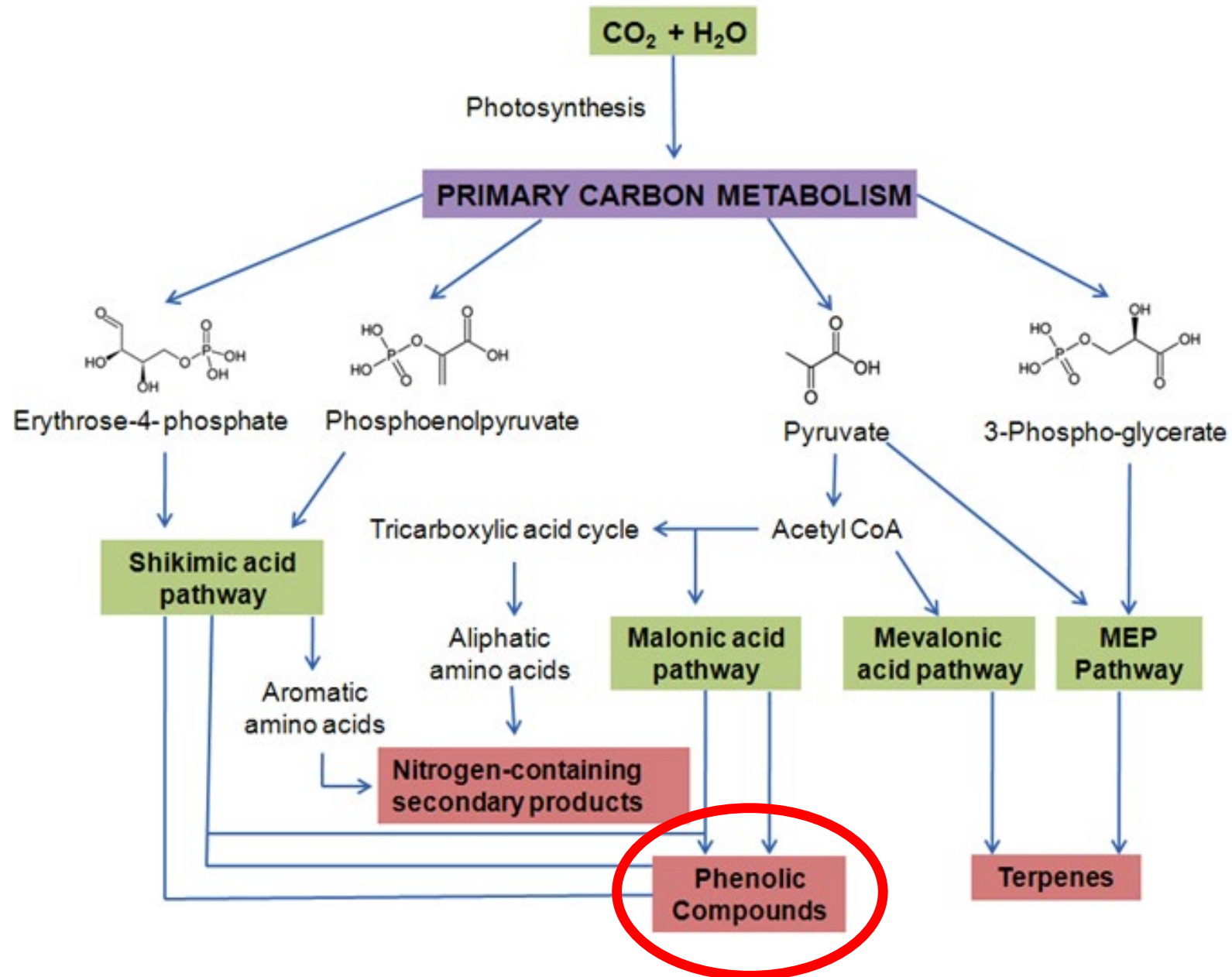


**corigin**

# Bio-distillates



# Phenolics are Plant's Natural Defense Weapons





# Coriphol™ – Approved Organic Plant Growth Enhancer



## Coriphol

**100% Organic**  
**Distilled from California Almond Shells**  
**For Foliar and Drip Applications**

**For use in soil and foliar applications**  
**1 U.S. GALLON (3.79 L)**

Pyroligneous acid may enhance plant growth. For use on organic and conventional crops and horticulture including vegetables, fruit & nut trees, grains, scrubs, flowers and turf.

#### Application Guidelines

*(These are general use guidelines and may be adjusted as needed.)*

Soil Pretreatment - Dilute with water to a ratio of 1:100 and spray onto soils to achieve 2-4 inches of penetration. Wait 2-weeks before planting.

Seedlings & Growing Plants - Dilute with water to a ratio of 1:500 to 1:1000 for foliar spray or drip/root irrigation. Repeat every 2-3 weeks.

Spraying is best done in morning or evening conditions. If it rains within 24-hours of use, the application should be repeated after the plants have dried.

Avoid use during flowering stages.

Don't use in combination with alkaline pesticides.

*Tightly reseal the container and store at room temperature out of direct sunlight. Wear hand and eye protection when handling. Not for human consumption.*

#### CONTAINS NON-PLANT FOOD INGREDIENT

10% pyroligneous acid produced from almond shells  
pH 2.5-3.3  
Density: 1.01 g/ml  
Acetic acid equivalent: 5.1%

VISIT OUR WEBSITE:  
[www.corigin.co](http://www.corigin.co)

PLEASE RECYCLE THIS CONTAINER

## corigin

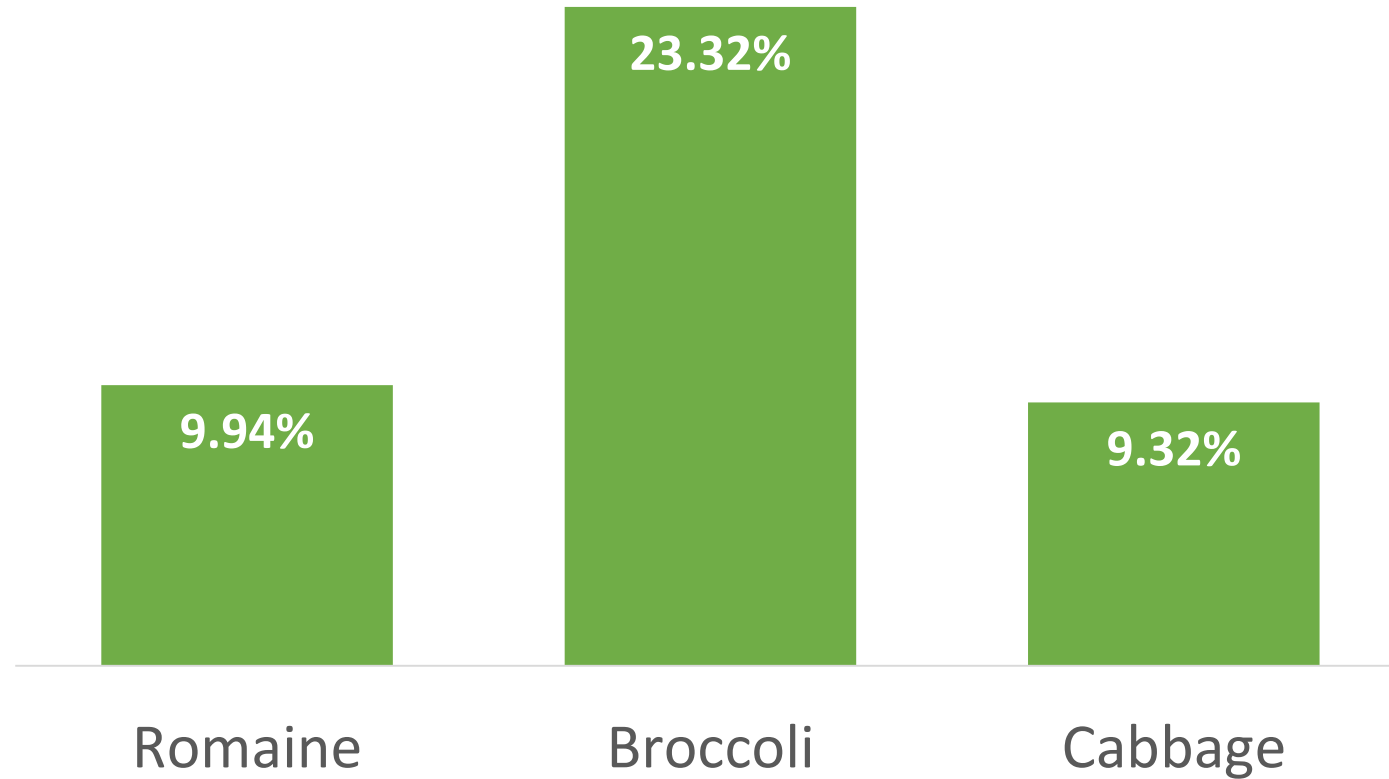
Corigin Solutions, LLC.  
1041 Eve Lane  
Livermore, CA 94550



# corigin

# Coriphol Field Trial Results: 0.25% conc. applied in drip & foliar

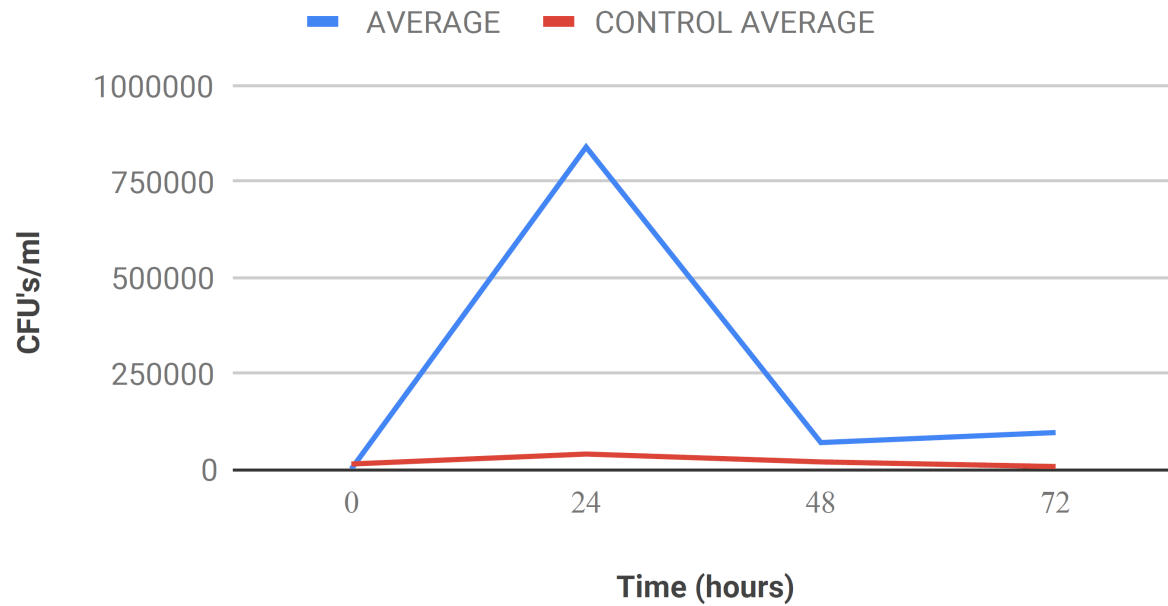
## Crop Yield vs Full Fert Control



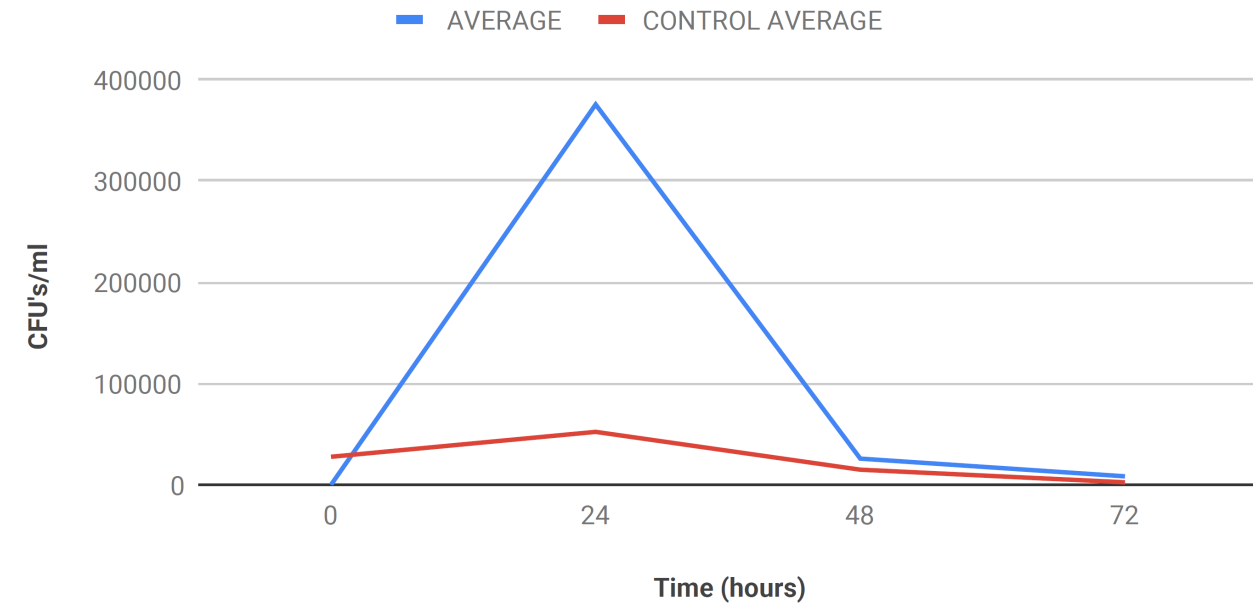
- Coriphol used with half fertilizer loads on Romaine and Broccoli
- \$120 in product cost per acre
- \$245 in fertilizer savings per acre

# Microbial Stimulant – 0.1% solution in greenhouse media

## TSA Bacterial Count Averages



## KB Bacterial Count Averages





# Bio-pesticide Potential

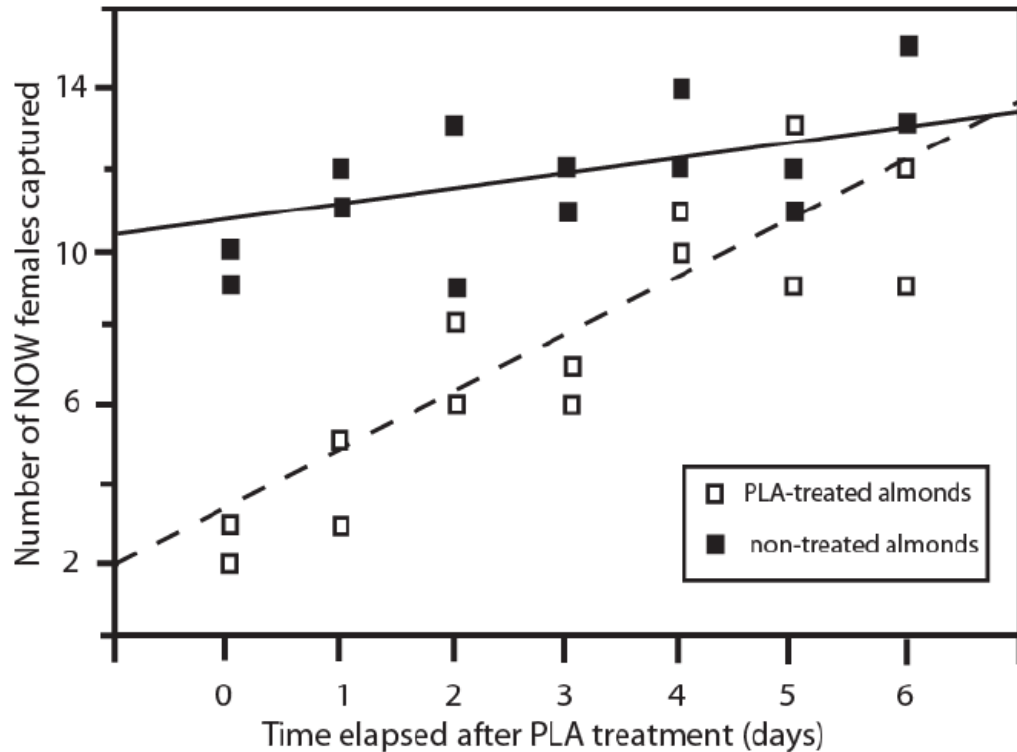




# Coriphol Repels Navel Orangeworm at Hull Split (USDA-ARS Study)

*“There was a significant difference in response to volatiles emitted from almonds undergoing hull-split when treated with 0.01% solution of PLA.”*

### Female Flight Response at Hull Split



### Ovipositional Response at Hull Split

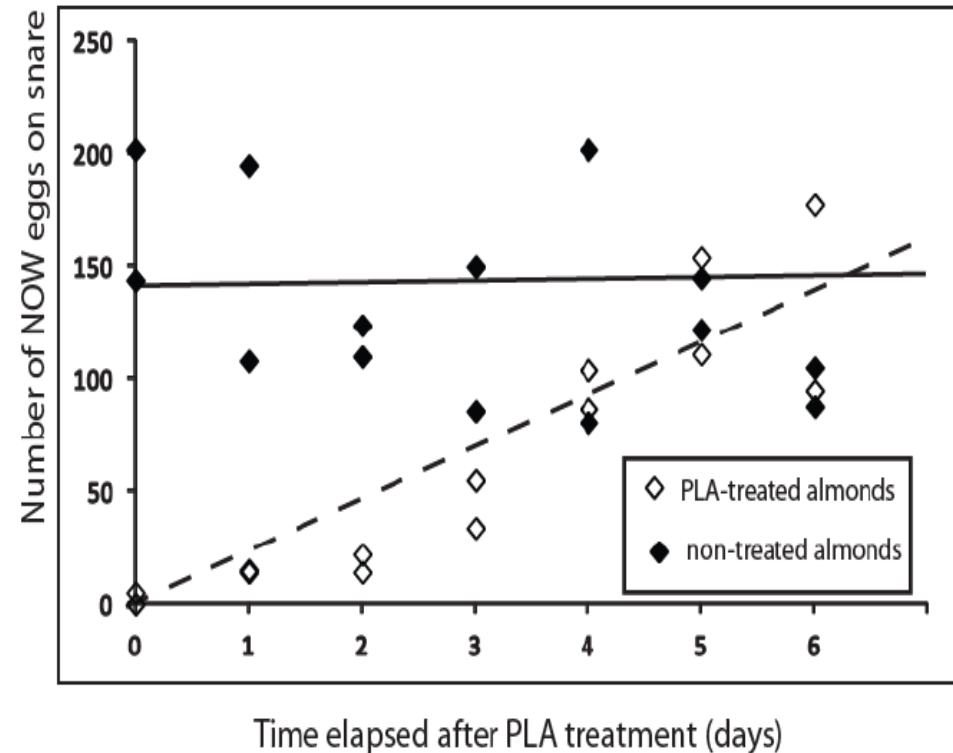


Figure 2. Temporal navel orangeworm ovipositional response to olfactory cues from almonds at hull-split following treatment with PLA.

Figure 1. Temporal navel orangeworm flight-response to olfactory cues from almonds at hull-split following treatment with PLA.

# Coriphol Repels Asian Citrus Psyllids – (USDA-ARS Study)

97.5% and 89.9% of ACP's were driven to untreated orange saplings compared to the sprayed saplings with a 1% and 0.1% PLA solution respectively.

**Table 3. Actual Preference Probabilities**

Host	0.0%	0.001%	0.01%	0.1%	1.0%
0.0%		0.311	0.185	0.101	0.025
0.001%	0.689		0.375	0.347	0.051
0.01%	0.815	0.653		0.485	0.064
0.1%	0.899	0.515	0.625		0.375
1.0%	0.975	0.949	0.936	0.625	
Overall	0.845	0.607	0.530	0.389	0.128

Actual preference probabilities for ACP host A (column) when simultaneously exposed to host B (row).



# Corichar™ – Approved Organic Soil Amendment and Feed Additive



## Application Guidelines

*(These are general use guidelines and may be adjusted as needed.)*

Biochar performs best when incorporated into the root zone. Typical application rates vary from 1 to 5 cubic yards per acre. Biochar should be prewetted and mixed with nutrients and/or soil microbial inoculants before applying to soil.

Specialty Crops: As a broadcast, till 1-5 cubic yards into topsoil and irrigate 2-weeks or more before planting. Alternatively, apply in a furrow band.

Perennial Crops: New plantings incorporate 1-10 cubic yards per acre into root zone.

Row Crops: Broadcast or furrow band 1-5 cubic yards per acre.

Landscape: Fold into soils at approximately 1% by volume, 1-gallon biochar for 100 gallons of topsoil.

*Tightly reseal the container and store out of direct sunlight. Biochar can spontaneously combust if left exposed to air and sunlight. Wear hand and eye protection when handling. Not for human consumption.*

## CONTAINS NON-PLANT FOOD INGREDIENT

100% biochar produced from almond shells

VISIT OUR WEBSITE:  
[www.corigin.co](http://www.corigin.co)

PLEASE RECYCLE THIS CONTAINER

# corigin

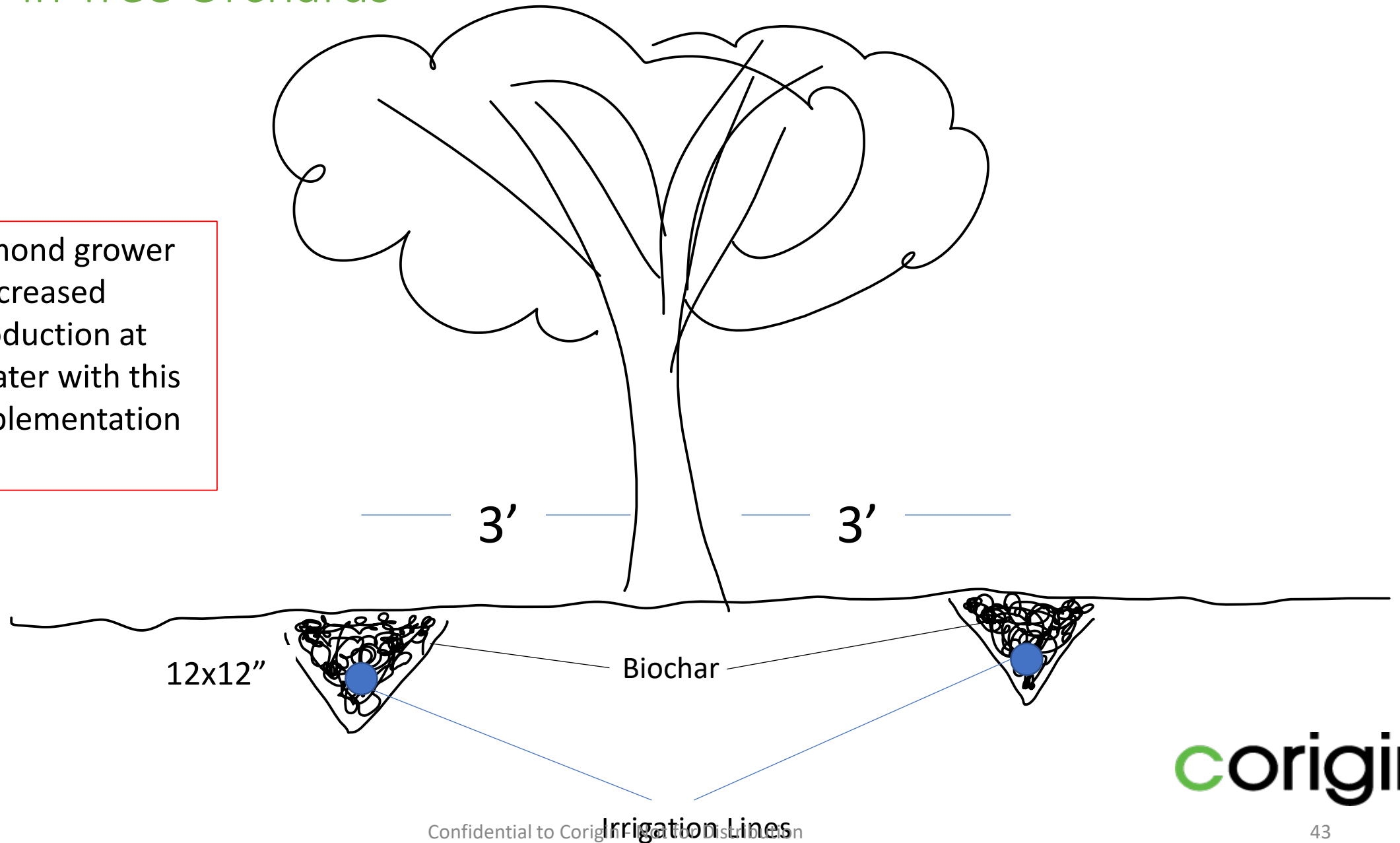
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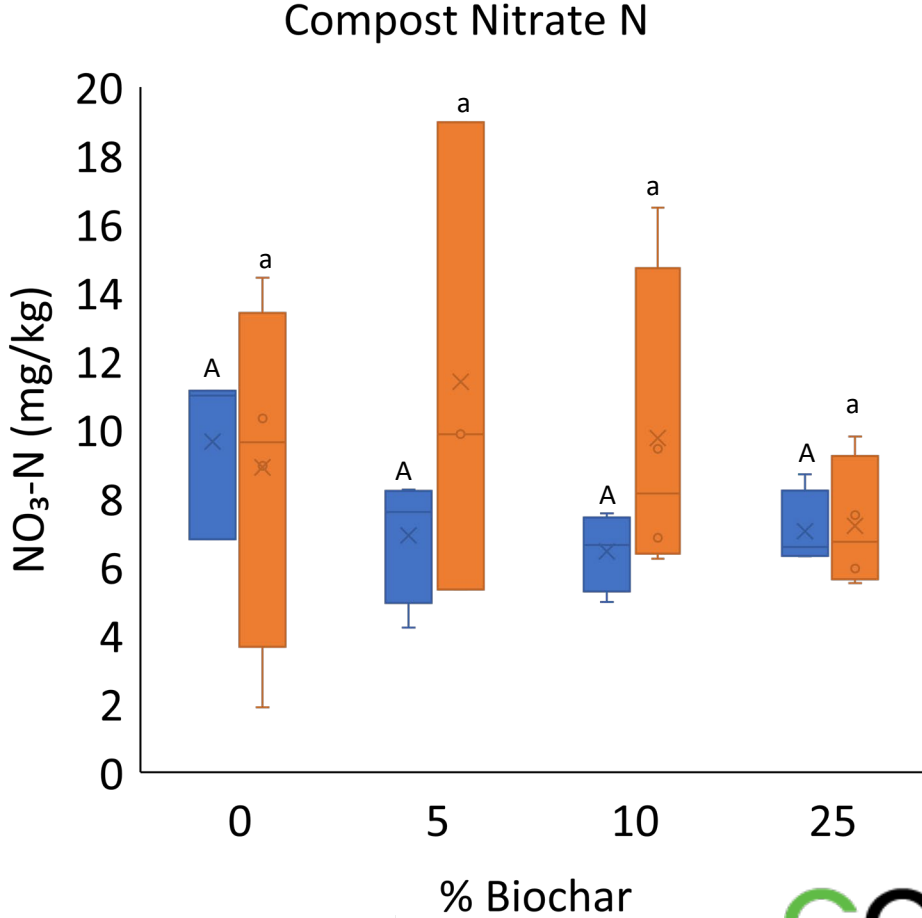
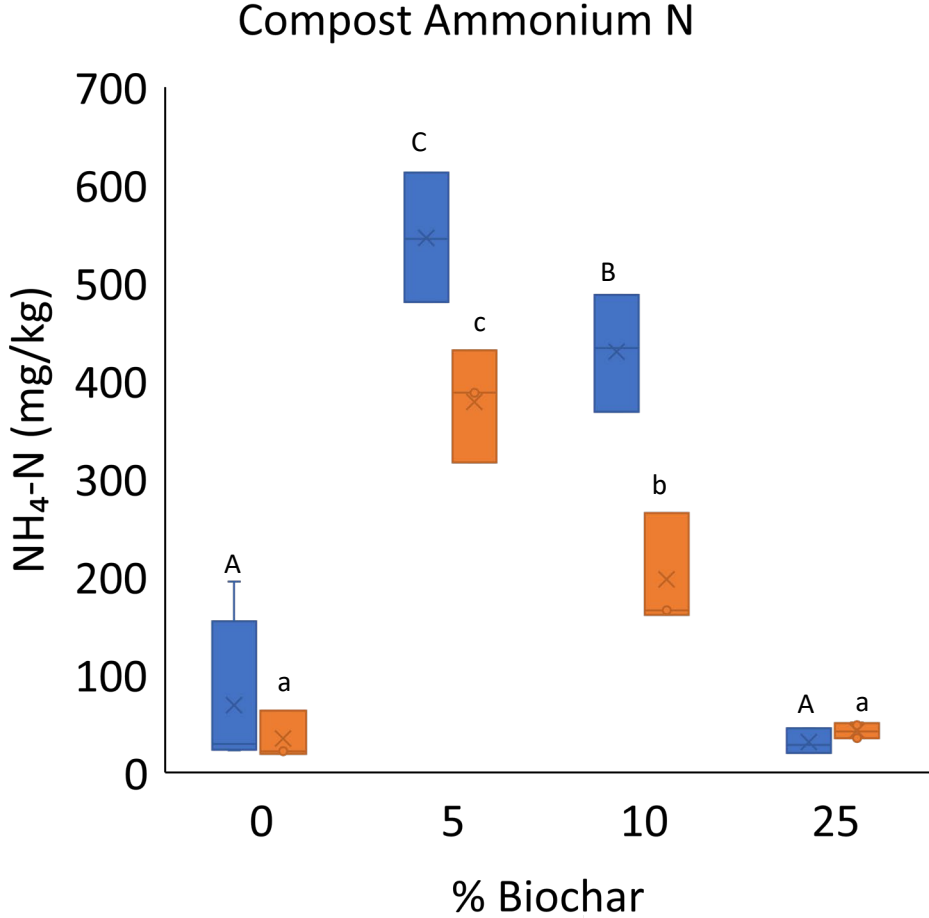
# Biochar in Tree Orchards

A major almond grower saw 25% increased almond production at 20% less water with this biochar implementation design.



# UC Davis / Corigin – Platform to increase manure compost nitrogen retention and reduce nitrogenous emissions

Compost priced on nitrogen content. Opportunity to create high-value soil amendment with composters.



■ Dairy Manure ■ Poultry Litter  
 Confidential to Corigin - Not for Distribution





1 ton of almond shell biochar...

5 CM



1 ton of almond shell biochar = 3 tons of Carbon Dioxide



## Management

**Michael Woelk:** CEO & Co-Founder. Repeat science and tech entrepreneur.

**Christian Roy, Ph.D.:** CTO, inventor of four pyrolysis technologies, President of Pyrovac Inc.

## Board of Directors

**Michael Woelk:** CEO & Co-Founder. - Repeat science and tech entrepreneur.

**Charlie Sweat:** Managing Director Sweat Equities, former CEO of Earthbound Farms

**Colin Thomas Roy:** Chairman Highview Power, former co-head of investment banking Merrill Lynch Europe

**Jim Boettcher:** Co-Founder. Founding partner of Focus Ventures.

**John Garamendi Jr.:** Co-Founder. Fifth generation California rancher, expertise in policy & government relations.

**Don Kendall:** Former Solar City board member, energy & cleantech investor







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2019

# Latest and Greatest Commercial Uses of Woody Almond Biomass

 **california  
almonds**<sup>®</sup>  
Almond Board of California