

## SPOTLIGHT ON: Coproducts

California Almond farmers and processors have always taken responsibility for the crops' coproducts—hulls, shells and the tree itself—ensuring they're put to beneficial use rather than sent to landfill. A changing market for these materials has led Almond Board of California to focus research investment on new uses.

These innovations will bring value to the California Almond community and the local environment while contributing to zero waste and addressing greater needs across industries such as food, pharmaceuticals and automotive.

### MIMICKING MOTHER NATURE

Just like a tree falling in the forest provides nutrients to those around it, researchers are exploring the potential for recycling almond coproducts back into the soil and how that might affect orchard health.

- **WHOLE ORCHARD RECYCLING**, a process in which entire almond orchards are ground up at the end of their lives and the woody materials incorporated into the soil. Preliminary findings indicate this may return nutrients to the soil, increase water infiltration and storage<sup>1</sup>, and slow the release rate of carbon dioxide, a greenhouse gas, into the atmosphere<sup>2</sup>.
- **BIOSOLARIZATION** (anaerobic soil disinfestation), which uses almond hulls and shells, water, tarps and the power of the sun to naturally deplete the soil of oxygen, making it inhospitable to key soil pests. Researchers hypothesize that this approach may lead to increases in soil fertility and decreased reliance on traditional soil pest control methods.

### A GENUINE BIOECONOMY

ABC is committed to innovative new uses of almond coproducts that can support California in creating a genuine bioeconomy where every byproduct is an input for another valuable product.

Research is underway investigating how components of almond hulls and shells can be transformed to provide value to other industries.

- **EXTRACTING** sugars from almond hulls to serve as fuel or a food ingredient, and the remaining fibrous material has value as an additive for foods, moisturizers, pharmaceuticals or even biochar.
- Through **TORREFACTION** (heating to controlled temperature), almond shells can be transformed to a charcoal-like product ideal for strengthening biodegradable plastics, such as tires, flower pots, garbage cans and more.

## IN 2016, CALIFORNIA ALMOND ORCHARDS GREW:<sup>3</sup>

**130 MILLION  
TREES<sup>4</sup>**

Clean the air and, at the end of their lives, are used to create alternative energy or improve soil quality

**1.492  
BILLION  
POUNDS OF  
SHELLS**



Natural source of livestock bedding and other value-added uses

**4.262 BILLION  
POUNDS OF  
HULLS**

Nutritious feed for dairy cows which reduces water needed to grow other feed crops



Considering the inherent properties of trees and use of coproducts, **CURRENT ALMOND FARMING PRACTICES ARE OFFSETTING ABOUT 50% OF ORCHARD CARBON EMISSIONS?**

**2.131 BILLION  
POUNDS OF  
KERNELS**



Healthy, nutrient-dense protein powerhouse

Almond Board has funded **58 COPRODUCT RESEARCH PROJECTS SINCE 1977**



With further production improvements and policy changes, including new options for coproducts, the **CALIFORNIA ALMOND COMMUNITY COULD EVENTUALLY BE CARBON NEUTRAL OR EVEN CARBON NEGATIVE.**

1. 16-PREC3-Holtz. Almond Orchard Recycling. 2. Alissa Kendall, et al. Lifecycle-based Assessment of Energy Use and Greenhouse Gas Emissions in Almond Production, Part I: Analytical Framework and Baseline Results. *Journal of Industrial Ecology* 2015. 3. Almond Board of California. Supplement to the Almond Industry Position Report. July 2017. 4. USDA-NASS. 2015 California Almond Acreage Report. April 2016. USDA-NASS. 2016 California Almond Objective Measurement Report. July 2016.



*"The Almond Board, in collaboration with our industry partners, are working every day to bring profitable, innovative solutions for coproducts back to growers and hullers/shellers. Having a robust economic outlook while remaining committed to environmental sustainability are not mutually exclusive, which is why I'm excited to be a part of this effort."*

— Rory Crowley, second-generation almond farmer  
Chico, California

**FARM PROFILE:** almonds, walnuts

**ACRES OF ALMONDS:** 150