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USDA Secures New Long-Term Fire-Retardant Contract, Saving Taxpayers Hundreds of Millions



U.S. Secretary of Agriculture Brooke L. Rollins signed a new five-year contract for American made fire retardant with Perimeter Solutions, supporting the U.S. Forest Service and Department of the Interior's aerial wildland fire suppression programs. The agreement secures significant savings, putting the American taxpayer first, while strengthening our manufacturing base by keeping fire-retardant production made in America.

"At USDA we are negotiating contracts that respect the American taxpayer and align with President Trump's common sense business mindset that ensures we are not being taken advantage of anymore. This contract is a tremendous win for America's taxpayers, our rural communities, and the brave men and women who fight wildfires every day," said Secretary Brooke Rollins. "By locking in historic cost savings and bringing every step of the fire-retardant supply chain back to American soil, we are protecting lives, saving communities from destruction, and keeping America safe, strong, and resilient. This agreement proves that when we put America first, we get the best results for our people and our land."

Through this contract, USDA secured total savings of \$153 million over the next five years, including a negotiated direct price reduction and additional cost savings transitioning to full-service bases and powder retardant by 2030.

The agreement also ensures that 100% of Perimeter's fire-retardant manufacturing will take place in the United States, advancing USDA's commitment to America First and American Manufacturing. USDA additionally secures the lowest price available in the global market, ensuring U.S. taxpayers receive the best possible value.

Background

Federal, State, and Tribal wildfire organizations utilize aerially delivered long-term fire retardants, primarily derived from ammonium phosphate, to slow wildfire spread and reduce intensity.

Fire retardant is a critical tool to ensure ground crews can safely establish containment lines and protect lives and property.

In 2024, federal agencies dropped 48.6 million gallons of fire retardant to fight wildfires.

All fire retardants used by the agencies fall into the Environmental Protection Agency's "practically non-toxic" category for mammals, including humans, and aquatic species.

CDFA Awards \$13.75 Million to Support **Community Food Hubs Across California**

The California Department of Food and Agriculture Office of Farm to Fork (CDFA-F2F) is awarding \$13.75 million through its new Farm to Community Food Hubs Grant Program to 12 nonprofits, Tribal-led organizations, farmers, and others to plan, implement, or expand community food hubs across the state.

Food hubs aggregate, distribute, and market products from local producers to wholesale, retail, and institutional buyers. They help small- and mid-scale farmers reach larger markets, improve healthy food access, and support local economies.

This one-time funding supports new and existing hubs that promote local farming, indigenous food production, climate resilience, and fair employment for food system workers.

Five planning grants (Track 1) will fund feasibility studies, business strategies, logistics, and evaluation plans for new hubs in Colusa, Fresno, Modoc, Los Angeles, Santa Cruz, Sacramento, Tuolumne, and Yolo counties.

Seven implementation grants (Track 2) will fund infrastructure and operations for five years, expanding food hubs and boosting access for California producers. Projects prioritize public institutions and nonprofit buvers like K-12 schools, food banks, food-is-medicine programs, and Tribal-run initiatives. Track 2 recipients will partner with at least 159 producers—98% using climate-smart practices, 97% farming 500 acres or less, and 71% considered socially disadvantaged.

CDFA-F2F received 165 applications totaling over \$148 million. With \$13.75 million available, the program was oversubscribed nearly 11-fold.

More than \$2.2 million was awarded to Tribal-led organizations, surpassing the goal to allocate at least 10% to California Native American Tribes and Tribal nonprofits.

Visit the Farm to Community Food **Hubs Grant Program webpage for** project summaries and an interactive awards map.

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See 'good fire' demo on Oct. 11 amid redwoods at Central Coast Fair

Learn how fire is used to manage the natural landscape at the Central Coast Good Fire Fair on Saturday, Oct. 11. The fair is free and open to the public from 10 a.m. to 3 p.m. at Henry Cowell Redwoods State Park in Felton in Santa Cruz County.

There will be educational activities for kids and adults. See live fire demonstrations, take quizzes to win prizes and learn tips to help protect your home from wildfire.

"While the Central Coast endured severe wildfire in 2020, we'd like to show people that some fire can be good," said Barb Satink Wolfson, UC Cooperative Extension fire advisor for San Benito, Santa Clara, Monterey and Santa Cruz counties.

Beneficial fire can be used to remove dry grass and shrubs that could fuel a catastrophic wildfire. "Good fire" also can help plants that rely on fire to reproduce.

"You can witness a live prescribed fire in the redwood grove and learn how fire can be used to benefit our coastal ecosystems," said Satink Wolfson.

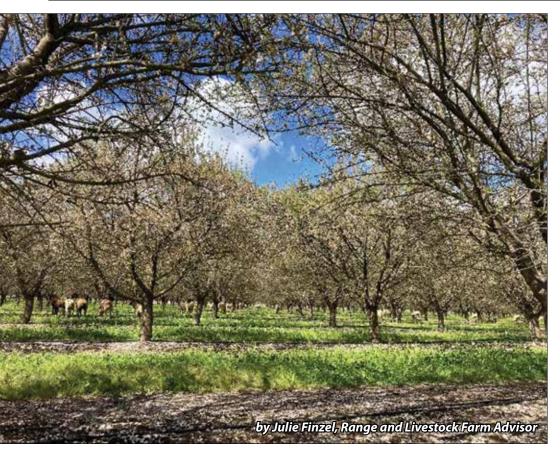
Weather permitting, wildfire experts will light prescribed fires in the redwood grove. Kids can explore a wildland fire engine. Scientists also will lead fire science experiments, such as lighting a fire and then using a leaf blower to demonstrate how wind makes fire move faster.

Representatives of California State Parks, CAL FIRE, Indigenous groups, BurnBot and the Central Coast Prescribed Burn Association are scheduled to exhibit.

Snacks and beverages will be available for purchase from food trucks.

The Central Coast Good Fire Fair is sponsored by UC Agriculture and Natural Resources' Fire Network and California State Parks.

Measuring Fecal Pathogens in Almond Orchard Soils Post-Grazing



nterest in using sheep to help manage cover crops and improve soil health in orchards is growing. However, food safety concerns exist because almond harvest is done in part on the ground.

In response to this concern, my team and I designed a two-year research project to measure fecal pathogens in the soil of grazed almond orchards. We have two study sites; both are managed using cover crops and sheep grazing. We collected manure samples from the sheep, soil samples prior to grazing, and soil samples zero to 120 days post-grazing in regular, timed intervals on grazed and ungrazed blocks. Pathogen analysis focused on variants of E. coli, including E. coli O157:H7.

While this was a two-year study, we currently only have results from the first year to share. In Year 1, six out of 20 manure samples tested positive E. coli O157:H7 from Farm A and nine out of 20 manure samples tested positive for generic E. coli from Farm B. From a total of 300 soil samples collected, two soil samples tested positive, both post-grazing. On Farm A, one soil sample from Day Zero post-grazing tested positive for generic E. coli. On Farm B, one soil sample from Day 60 post-grazing tested positive for both generic E. coli and E. coli O157:H7. Both samples were from the wetting zone under the tree canopy. We were not able to test to determine if the positive samples were from sheep or from another source. But it should be noted that past Day 60, there were no positive

samples for any fecal coliforms on either orchard. The current standard practice is to have animals removed a minimum of 120 days prior to harvest.

Another concern when integrating grazing into orchard management is potential costs. As part of this study we looked at potential costs and returns when integrating sheep grazing. In our analysis we included a grazing fee of \$60/acre for 2 passes through an orchard (of note, sheep only made one pass in both orchards in this study). Cost savings included less mowing, one less herbicide application, reduced sweep and mow for naval orangeworm winter sanitation, and less compost application. No reduced revenue or additional revenue was included in the calculations. Altogether, our budget analysis showed a potential savings of \$7 an acre.

The preliminary findings from this study are promising. No samples tested positive for fecal

pathogens past 60 days post-grazing indicating that the current 120 day rule is sufficient to maintain the food safety of ground-harvested almonds post-grazing. Further, our budget analysis indicates that integrating sheep grazing can have a positive impact on the bottom line for almond producers. Sheep producers in the southern San Joaquin valley have mobile operations, well-suited to seasonal orchard grazing. However, sheep producers must place priority on the well-being of their sheep and maintaining a strong business model. As a result, the availability of sheep for orchard grazing may be limited in some circumstances. It is important to work closely with the livestock producer to balance the almond production schedule with the logistics of livestock production.



CDFA Announces One Vacancy On The Rendering Industry Advisory Board

CDFA's, Meat, Poultry and Egg Safety Branch (MPES) is announcing one vacancy on the Rendering Industry Advisory Board (RIAB). The RIAB makes recommendations to the Secretary on matters pertaining to:

- Adoption, modification, and repeal of regulations and procedures
- Rate and collection of license fees and penalties
- Posting and noticing changes in bylaws, general procedures, or orders
- All matters pertaining to Food and Agricultural Code (FAC) Division 9, Part 3, Chapter 5, including, but not limited to, the inspection and enforcement program, annual budget, necessary fees to provide adequate services, and regulations required to accomplish the purposes of the chapter.

Current vacancy:

Industry member – The Advisory Board will consider a variety of state-licensed rendering practitioners for this vacancy, including, but not limited to, the following: licensed renderers, dead haulers, and transporters of inedible kitchen grease.

This vacancy was created because a current member is leaving the Board. The membership term for this vacancy will be 36 months. Board members receive no compensation but are entitled to reimbursement for transportation to and from meetings and for per diem expenses for lodging, meals, and incidental expenses.

Animal rendering plays a critical role in California's agricultural circular economy. Rendering recently deceased animals and inedible kitchen grease serves the dual purpose of recycling valuable materials and sanitarily disposing of potentially harmful waste. This process transforms material that would otherwise fill landfills into useful products like animal feed, biofuels, and industrial lubricants.

Applicants interested should submit resumes by October 16, 2025, to:

Mrs. Penny Arana Meat, Poultry and Egg Safety Branch 1220 N Street Sacramento, California 95814 penny. arana@cdfa.ca.gov

Additional information is available on the MPES web page at: http://www.cdfa.ca.gov/ahfss/mpes/index.html

You may also contact Branch Chief Paula Batarseh of the Meat, Poultry and Egg Safety Branch at (916) 900-5004.

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New online tool helps growers choose cover crops



By Michael Hsu

First for Western region, tool recommends species based on farmer goals, local conditions

For the first time, farmers in California and throughout the West have a decision-support tool that recommends cover-crop species based on growers' unique situations and goals.

"This tool is the first of its kind – publicly available, free to use, and validated by experts in the Western region, about Western cropping systems," said Sarah Light, University of California Cooperative Extension agronomy farm advisor for Sutter, Yuba and Colusa counties.

Light, president of the Western Cover Crops Council that spearheaded the project, is the principal investigator on the tool, which can be found at: https://westerncovercrops.org/ decision-tools/.

With this addition of the Western region (Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington and Wyoming), the resource now includes all 50 states.

Light credited a broad coalition of partners for their input and guidance in completing the two-year project – farmers, academics, technical assistance providers, seed company representatives and other agency and industry personnel.

"This project was a collaboration between the Western Cover Crops Council, Precision Sustainable Agriculture, and the U.S. Department of Agriculture's Natural Resources Conservation Service," she said. "This partnership enabled the project's success, as the WCCC verified the data, while PSA provided technical expertise around data stewardship and website development."

Tool offers recommendations, database of suitable cover-crop species

Cover crops can provide a wide range of benefits for growers and the environment, such as improving soil health, suppressing weeds, reducing erosion and sheltering pollinators. But choosing specific species from an enormous palette can be daunting.

"When farmers start using cover crops, they always ask what cover crops to start with," said Nick Andrews, Oregon State University organic vegetable Extension specialist and Western Cover Crops Council secretary. "That's always a complex decision to make, because it depends on their reasons for cover cropping, their soil and climate, when they can grow cover crops during the year, and other factors."

After pulling in auto-populated soil and climatic data at a given location, the new online tool allows farmers to select up

to three goals for their cover crops and adjust settings tailored to their own operation and setting. The tool then generates a custom list of recommended cover crops, which are sortable by goal priorities and filterable by a variety of characteristics.

Alternatively, growers can simply browse the tool's "onestop shop" of common cover-crop species, hand-picked by experts for their state.

"Not only does this tool help with species selection, but it's also now the most comprehensive database of cover-crop spe-



cies for our region," Light said. "It has comprehensive information – about the basic agronomics, environmental tolerances, growth habits, planting, soil conditions, termination and more - for each species."

Novel methods helped produce first-ever cover crop selection tool

See Cover Crops page 15

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UC, Almond Board to work together on new technology, new opportunities, new varieties

By Patty Guerra, UC Merced

A new partnership focused on a popular snack nut will offer exciting opportunities for students, research potential for faculty and the latest technology for farmers.

Representatives of the University of California and the Almond Board of California signed a memorandum of understanding, or MOU, at the UC Merced campus on Sept. 10. The MOU calls for the entities to work together over the next five years in such vital areas as automation, sustainability and new almond varieties.

Josette Lewis, vice president and scientific chief of the Almond Board, said the agreement between her organization and UC Merced and UC Agriculture and Natural Resources "marks a new chapter for our industry and our communities. Together, we are laying the foundation for a future where almond production is not only more productive, but also more resilient and sustainable."

The Almond Board of California is an industry organization dedicated to promoting California almonds to a domestic and international audience through marketing efforts and by funding and promoting studies about almonds' health benefits, as well as ensuring sustainable agricultural practices and food safety.

The MOU is the culmination of discussions that began several years ago, Chancellor Juan Sánchez Muñoz said.

"I'm delighted that we're here," the chancellor added. "I hope this is the beginning of other partnerships to benefit our students and the agricultural industry."

Two women and a man examine blossoms on almond trees

During an Almond Board tour of the UC Merced Smart Farm in March, visitors examine blooms on almond trees.

The pact calls for establishing demonstration plots at UC Merced's Experimental Smart Farm, where researchers will delve into best practices in irrigation automation, regenerative agriculture and new almond varieties and rootstocks. The farm, established in 2022 south of campus, is a 40-acre research facility dedicated to advancing agricultural innovation, sustainability and education.

"This initiative is designed to accelerate the adoption of sustainable farming practices, improve water and soil management, and support weather adaptation strategies for California's almond growers," said Sebastian Saa, Almond Board associate director of agricultural research.

The agreement also aims at developing the next generation of the agricultural workforce. The Almond Board will provide three scholarships for UC Merced students to attend the Almond Conference in Sacramento in December, where they will have the opportunity to connect with industry leaders.

"In many ways, UC Merced's advancements in agricultural technology have been happening for several years now," said Joshua Viers, associate vice chancellor of interdisciplinary research. "We're very excited that our students are going to be exposed to these new ideas and be able to work on the farm and work with the Almond Board in this new capacity."

UC Merced, located in the heart of the region that produces 80 percent of the world's supply of almonds, is a natural fit for this kind of effort.

"All of us working together makes us stronger," said Glenda Humiston, vice president of UC Agriculture and Natural Resources. "We each bring different strengths to the table."

Farmers also will benefit from the initiative, which calls for accelerating the adoption of cutting-edge technologies, supporting growers in meeting weather and resource challenges, and maintaining California's leadership in almond production. Workshops and training programs will be offered to growers looking to adopt sustainable practices and emerging innovations.

"We believe that by investing in students, supporting research and working together across institutions, we can create lasting impact," Lewis said, "not just for our industry, but for the Central Valley and all of California."

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Registration Opens for 2026 Farm Robotics Challenge

Student Innovators to Design, Build and Field-Test Robotics for Real-World Agriculture Challenges

By Kelly D Scott

A Hands-On Competition for the Future of Farming

The Farm Robotics Challenge—the only collegiate agricultural robotics competition of its kind—is officially launching its 2026 season. Registration is now open for undergraduate and graduate student teams from two-year and four-year colleges and universities across the U.S. and worldwide.

Organized by UC ANR Innovate (University of California Agriculture and Natural Resources) in partnership with the AI Institute for Next Generation Food Systems (AIFS), the Challenge tasks students with designing, prototyping, and field-testing robotics and AI-driven solutions to tackle real-world agricultural problems.

"Students work directly with farmers to identify and solve real problems," said Gabe Youtsey, chief innovation officer at UC ANR. "This hands-on experience prepares them for careers in ag tech while helping growers address pressing challenges."

\$50,000 Grand Prize Investment from Lead Sponsor

This year, the Reservoir—a venture capital investor and robotics incubator—joins as lead sponsor. The Reservoir will award a \$50,000 Grand Prize investment to the winning team, helping student-built prototypes transition into market-ready solutions.

"We're backing engineers, scientists and entrepreneurs with the grit to commercialize their solutions," said Danny Bernstein, CEO of the Reservoir.



University of Georgia team works on a drone platform controlled by a cell phone

Real-World Impact Through Grower Collaboration

Student teams are expected to work directly with growers to identify agricultural challenges that can be addressed using robotics, AI, and automation. Projects may target:

- Planting, weeding, harvesting, pest management, crop monitoring
- Data collection, mapping, and on-farm automation
- Autonomous navigation, intelligent algorithms, and custom attachments



University of Illinois team tests their robot in horseradish fields

Supported by Industry Leaders

Technology partner Bonsai Robotics continues its support, providing platforms for Al, computer vision, and autonomous systems.

Competition Timeline

- Registration Opens: August 2025
- Proposal Deadline: October 30, 2025
- Development Phase: November 2025 May 3, 2026
- Awards Ceremony: May 20, 2026

Over \$100,000 in prizes will be awarded across multiple categories. Select teams will receive travel stipends to showcase their projects at FIRA USA, North America's leading ag tech conference.

Legal & Entrepreneurial Support

Morrison Foerster will host webinars on startup law, IP protection, and venture financing. Free confidential office hours will be available to all participants.

Past Winners & Highlights

- 2025 Productivity Award: University of Hawaii at Mānoa for pineapple bloom detection and harvest optimization
- 2024 Grand Prize: Olin College of Engineering for autonomous mechanical weeding
- Innovation Award: University of Georgia for automated spraying drone platform

How to Participate

Prospective teams should:

- 1. Assemble members with diverse technical expertise
- 2. Secure a faculty or staff advisor
- 3. Partner with a grower to identify a meaningful problem
- 4. Design and test a robotics-based solution

Visit farmroboticschallenge.ai for official rules, updates, and registration. Don't miss the Info Session Webinar on September 10 at 4 p.m. PDT.

New: Farm Robotics Academy for Secondary Schools Launching in 2025–26, the Farm Robotics Academy equips educators and students with skills in robotics, AI, and automation. Learn more at farmroboticsacademy.ai.





Cover Crops

continued from page 10

Previously, deciding on a cover crop species was even more challenging because growers had to cobble together information from local Cooperative Extension farm advisors, scattered databases and tools borrowed from other regions across the U.S. This was less than ideal, of course, due to unique conditions in the West – such as the lack of a hard frost in many areas.

"We had to create a more nuanced tool for the West because of these complex growing systems and our long growing season," Light said.

The Western Cover Crops Council was the last of its sister regional councils to form, and the last to build its cover-crop selection tool.

"Our region is the largest in the country, and we also have a wide diversity of climates and cropping systems – everything from Alaska to the Pacific Northwest, the Rocky Mountains, the Southwest, and the Pacific Islands," Andrews said. "We worked with developers and testers who have built similar tools in the Midwest, Northeast and South and their expertise made this work possible."

The team's approach to validating the data in the tool was also notable. Light said that attempting to conduct separate research trials for dozens of species in 11 climatic zones across 13 states would be "an impossible amount of work."

Instead, the team gathered experts to rank the capacity of different species in achieving specific goals in specific locales. For example, the tool ranks species on nitrogen-fixing potential – but does not estimate the amount of nitrogen fixed by each species. Users can thus see which cover-crop species will best accomplish their goals in their own region and cropping system.

"This method of data verification allowed us to capture the knowledge of experts throughout the West to develop a comprehensive cover crop dataset for our region," Light said.

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UC ANR receives \$15.1 million to accelerate ag tech innovation

State investment will help California farmers, agriculture sector meet water, heat and labor challenges



A state award for UC ANR Innovate will help speed ideas from the lab into the hands of growers and producers, such as new technology to fine-tune irrigation.

By Hanif R Houston

UC ANR Innovate – the innovation program of University of California Agriculture and Natural Resources – has been awarded \$15.1 million to launch the state's first coordinated agricultural innovation network, connecting California's diverse food-producing regions to accelerate technology, support entrepreneurs and prepare the workforce of the future. This award is part of \$28.6 million in new Jobs First funding for California's agricultural sector, with UC ANR leading the statewide agricultural innovation cluster. The cluster spans agtech and food systems investments designed to strengthen competitiveness and resilience across the state.

Funded through the Governor's Office of Business and Economic Development (GO-Biz) and California Jobs First, this statewide effort will align research, industry and community partners across nine regions, ensuring that breakthroughs in one part of the state can be shared quickly and equitably across all of California agriculture. At \$15.1 million, it is the largest award made to date under the California Jobs First Regional Investment Initiative.

"This award allows us to do something California has never done before: build a single, statewide engine for agricultural innovation," said Gabriel Youtsey, chief innovation officer at UC ANR. "We will be able to seamlessly connect researchers, entrepreneurs, farmworkers and industry across major farming regions, moving ideas from the lab to the field faster than ever, and ensuring that every farmer – from small specialty growers to large scale producers – benefits from the tools needed to stay competitive."

"UC ANR's presence in every California county for over 100 years gives us unprecedented reach," said Glenda Humiston, UC vice president of agriculture and natural resources. "Our Cooperative Extension advisors know which technologies actually work in the field, which innovations farmers need most, and how to bridge the gap between research and reality. This funding transforms our local expertise into statewide impact, accelerating technology adoption that might otherwise take decades."

The stakes could not be higher. California's \$59 billion farm economy, which is responsible for more than a third of the nation's vegetables and three quarters of its fruits and nuts, faces intensifying pressure on multiple fronts. Drought, extreme heat and wildfire smoke are driving up costs and reducing yields. Pests and diseases are shifting in unpredictable ways, threatening specialty crops and permanent orchards.

Meanwhile, a shortage of skilled workers leaves many farms unable to adopt new

tools, and small and mid-sized growers are often the last to access solutions. Even when promising technologies exist, they spread slowly because efforts are fragmented across regions and lack the infrastructure to test, validate and scale innovations statewide. Without better coordination, California risks losing its longstanding leadership in food production.

This initiative meets the moment by establishing California's first statewide infrastructure to align regional priorities under a single network with shared industry leadership. It lowers the risks of bringing new technologies to market by incorporating field trials, farmer feedback and targeted innovation grants, while equipping growers and workers with the skills to adopt them. The effort is built around three integrated components:

- Statewide Network and Investment Hub Unites nine food-producing regions under a single vision. Guided by an advisory board of growers and agricultural leaders, the hub will coordinate priorities, host annual convenings and deploy \$2 million in innovation grants. It will also connect startups with investors, provide tools to navigate regulatory and market barriers, and create a statewide digital platform and shared brand to give California agriculture greater visibility on the global stage.
- Entrepreneur Support Programs Accelerates commercialization of new technologies through two pathways. Early-stage innovators will receive support to refine prototypes, strengthen business models, and prepare for regulatory approval. Market-ready companies will gain opportunities

See Ag Tech page 19



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Ag Tech

continued from page 16 to test solutions in the field, gather farmer feedback, and showcase technologies to buyers and investors. Both pathways use a common readiness framework to ensure innovations are validated and ready to scale across California agriculture.

• Workforce Investments - Builds the talent pipeline needed for adoption of emerging tools. Programs will upskill farmworkers with industry-aligned training, engage students in robotics and automation challenges, integrate drone and data science skills into classrooms, and provide hands-on field experiences that inspire careers in agricultural innovation.

"This investment positions California at the forefront of the agricultural technology revolution," said Dee Dee Myers, senior advisor to Governor Newsom and GO-Biz director. "We're building the infrastructure for innovation that will keep California agriculture competitive for decades. These aren't just incremental improvements; we're talking about transformative technologies that will reshape how food is produced."

Karen Ross, California Department of Food and Agriculture secretary, added, "California feeds the nation, but our agricultural leadership isn't guaranteed. Other states and countries are investing heavily in agricultural technology. This initiative ensures California doesn't just keep up but defines the future of farming globally."

The initiative fills a critical gap in agricultural innovation: the disconnect between technology development and on-farm use.

"I've seen too many promising agricultural startups fail because they couldn't find farmers to test their products or didn't understand how farms actually operate," said Connie Bowen, general partner of Farmhand Ventures. "This initiative builds the missing infrastructure: test sites, farmer feedback, technical expertise. We're creating the conditions for California to capture the growing agricultural technology market."

Western Growers, representing farmers who produce half of America's fresh fruits, vegetables and nuts, sees the initiative as essential for maintaining competitiveness.

"Every grower I know is trying to figure out how to do more with less: less water, less land, fewer inputs," said Walt Duflock, senior vice president of innovation at Western Growers. "Technology exists to solve these challenges, but adoption has been slow and fragmented. This coordinated approach changes everything."

The program specifically focuses on democratizing innovation, ensuring small and mid-sized farms aren't left behind in the technology transformation. By creating regional hubs and shared resources, even smaller operations can access cutting-edge tools and expertise.

"This isn't about replacing traditional farming, it's about giving every farmer the tools to thrive," noted Youtsey. "Whether you're managing 10 acres or 10,000, this initiative ensures vou have access to innovations that improve productivity, sustainability, and profitability."

Expected outcomes within five years include support for 200 agricultural technology startups, the creation of more than 2,000 jobs in the agricultural innovation sector, training for over 1,500 individuals in agricultural technology, and a strengthened position for California in the global agricultural technology market.

The initiative brings together a powerful coalition including the California Department of Food and Agriculture, Western Growers Association, California Farmworker Foundation, Agricultural Council of California, UC Santa Cruz, Center for Land-Based Learning, and regional partners across all nine food producing regions.

Implementation begins in late 2025, with innovation cohorts and regional technology demonstrations ramping up in early 2026.

For more information about participating in the initiative, contact Gabe Youtsey, chief innovation officer, at gdyoutsey@ucanr.edu.

Wheat That Makes Its Own Fertilizer

Bacterial Work-Around Aims to Reduce Pollution, Lower Costs for Farmers



Eduardo Blumwald, center, is a distinguished professor in the UC Davis Department of Plant Sciences. Lab members Hiromi Tajima, left, and Akhilesh Yadav are among those who have been working to develop wheat and rice that can stimulate bacteria in the soil to produce nitrogen the plants can use for fertilizer. Here, rice grows in their greenhouse on campus. (Trina Kleist/UC Davis)

by Trina Kleist

Scientists at the University of California, Davis, have developed wheat plants that stimulate the production of their own fertilizer, opening the path toward less air and water pollution worldwide and lower costs for farmers.

The technology was pioneered by a team led by Eduardo Blumwald, a distinguished professor in the Department of Plant Sciences. The team used the gene-editing tool CRISPR to get wheat plants to produce more of one of their own naturally occurring chemicals. When the plant releases the excess chemical into the soil, the chemical helps certain bacteria in the soil convert nitrogen from the air into a form the nearby plants can use to grow. That conversion process is called nitrogen fixation.

The study was published online in Plant Biotechnology Journal.

In developing countries, the breakthrough could be a boon for food security.

"In Africa, people don't use fertilizers because they don't have money, and farms are small, not larger than six to eight acres," Blumwald said. "Imagine, you are planting crops that stimulate bacteria in the soil to create the fertilizer that the crops need, naturally. Wow! That's a big difference!"

The breakthrough in wheat builds on the team's earlier work in rice. Research also is underway to extend this technology to other cereals.

Worldwide, wheat is the No. 2 cereal crop by yield and takes the biggest share of nitrogen fertilizer, using about 18% of the total. Globally, more than 800 million tons of fertilizer were produced in 2020 alone, according to figures from the United Nations Food and Agriculture Organization.

But plants take up only about 30 to 50% of the nitrogen in fertilizer. Much of what they don't use flows into waterways, which can create "dead zones" that lack oxygen, suffocating fish and other aquatic life. Some excess nitrogen in the soil produces nitrous oxide, a potent climate-warming gas.

The work-around: Protect the fixer

Nitrogen-fixing bacteria produce an enzyme called nitrogenase, the "fixer" in nitrogen fixation. Nitrogenase is only located in the bacteria, and it can only work in environments with very little oxygen.

Legumes such as beans and peas have root structures, called nodules, that provide a cozy, low-oxygen home for nitrogen-fixing bacteria to live.

Unlike legumes, wheat and most other plants don't have root nodules. This is why farmers use nitrogen-containing fertilizer.

"For decades, scientists have been trying to develop cereal crops that produce active root nodules, or trying to colonize cereals with nitrogen-fixing bacteria, without much success. We used a different approach," Blumwald said. "We said the location of the nitrogen-fixing bacteria is not important, so long as the fixed nitrogen can reach the plant, and the plant can use it."

To find a work-around, the team first looked at 2,800 chemicals the plants produce naturally. They found 20 that, among other jobs useful to the plant, also stimulate bacteria to produce biofilms. Biofilms are a sticky layer that surround the bacteria and create a low-oxygen environment, allowing nitrogenase to work. The scientists determined how the plant makes those chemicals and which genes control that process.

Then, the team used the gene-editing tool CRISPR to modify wheat plants to produce more of one of those chemicals, a flavone called apigenin. The wheat, now with more apigenin than it needs, releases the excess through its roots into the soil. In experiments they conducted, apigenin from the wheat stimulated bacteria in the soil to create the protective biofilms, allowing nitrogenase to fix nitrogen and the wheat plants to assimilate it.

The wheat also showed a higher yield than control plants when grown in a very low concentration of nitrogen fertilizer.

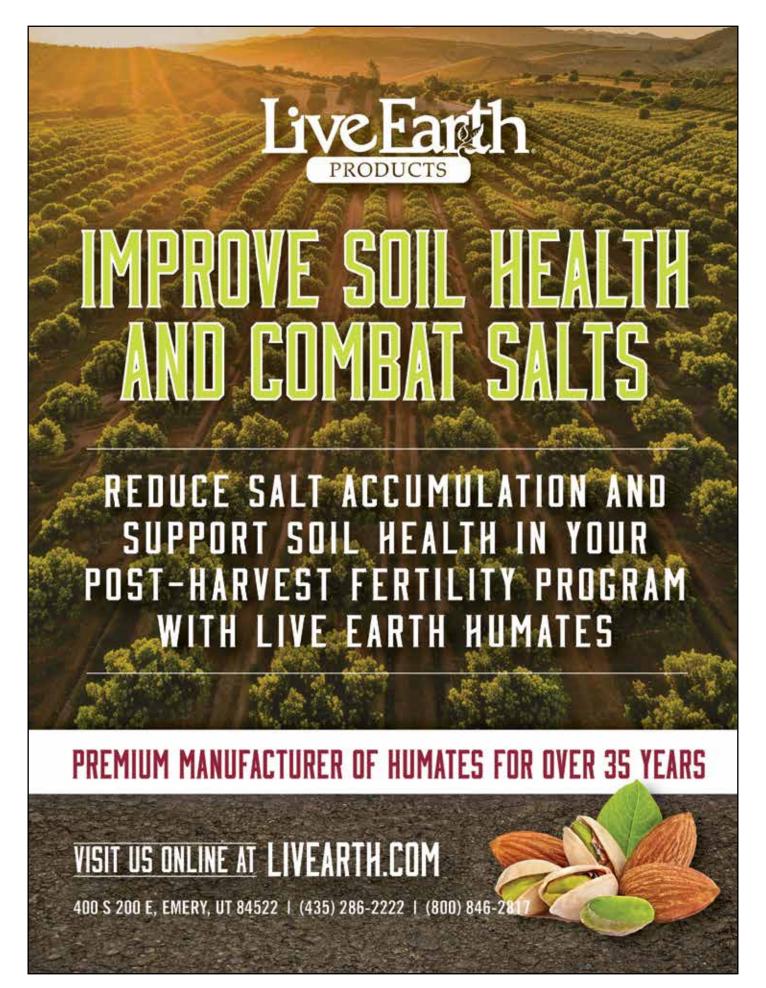
Farmers could save billions

Farmers in the United States spent nearly \$36 billion on fertilizers in 2023, according to U.S. Department of Agriculture estimates. Blumwald calculates that nearly 500 million acres in the U.S. are planted with cereals.

"Imagine, if you could save 10% of the amount of fertilizer being used on that land," he pondered. "I'm calculating conservatively: That should be a savings of more than a billion dollars every year."

Other authors include Hiromi Tajima, Akhilesh Yadav, Javier Hidalgo Castellanos, Dawei Yan, Benjamin P. Brookbank and Eiji Nambara.

A patent application has been filed by the University of California and is pending. Bayer Crop Science and the UC Davis Will Lester Endowment have supported the research.



UC ANR team helps small farmers understand historic, decade-old groundwater law

Lack of awareness and action observed in response to Sustainable Groundwater Management Act



Building on the relationships cultivated by the Small Farms Network of the UC Sustainable Agriculture Research and Education Program, a new team of educators will help small farmers understand the Sustainable Groundwater Management Act. Photo by Elena Zhukova

By Michael Hsu

A landmark law – representing one of the most revolutionary changes to groundwater management in California history – was passed more than 10 years ago. But many farmers across the state still have not even heard of the Sustainable Groundwater Management Act, or SGMA.

Jarin Tasnim Anika started as a SGMA technical assistance community educator for small farms with University of California Agriculture and Natural Resources earlier this year. She said that of the dozens of small-scale farmers she has spoken with, "an extremely small fraction" of them had heard of SGMA.

"I've been driving around Merced, Stanislaus and San Joaquin counties - the counties I cover - and for almost all of the small farmers, I can honestly say that I was the first person who has talked about SGMA with them," Anika said.

After SGMA was passed in 2014, over 260 Groundwater Sustainability Agencies (GSAs) were formed and charged with creating locally focused plans for California's patchwork of basins and subbasins to achieve sustainability by 2040. Those Groundwater Sustainability Plans are submitted to the California Department of Water Resources for review and to ensure compliance with the law.

GSAs are making progress toward this goal. They're developing strategies to prevent overdraft of groundwater and are addressing a host of related problems for farmers, residents and the environment from wells running dry to poor water quality to land subsidence.

But while GSAs are required by law to consider all "beneficial users" in the implementation of SGMA, many of them overlooked a major subset of groundwater users: small farmers. Nearly 80% of farms in California can be categorized as small-scale farms, by the U.S. Department of Agriculture's definition of small farm (a farm with annual gross cash farm income between \$1,000 and \$350,000).

In 2022, UC ANR and a coalition of partners published a report,

"SGMA and Underrepresented Farmers," that analyzed, through the lens of small farmers and socially disadvantaged farmers, the **Groundwater Sustainability Plans** developed by the agencies.

"We reviewed these 20-year plans to see if small-scale farmers are incorporated into that planning, and the results were alarming," said Ngodoo Atume, one of the authors of the report. "We found that across all 14 plans we reviewed, none of those agencies were considering small-scale farmers."

The result is that many small farmers (predominantly tenant farmers) with whom Atume has met are wholly unfamiliar with SGMA.

"We asked many questions: 'Have you heard of SGMA? Have you heard of this groundwater regulation? Have you heard of the potential cutbacks? Has the landowner shown you any notice to attend a meeting?" Atume said.

"And we get 'no' across the board."

Because the impacts and benefits of SGMA for small farmers are not addressed in those plans, the 2022 report recommended more focused engagement of those stakeholders. So this year, UC ANR hired a dedicated team to provide technical assistance, education, policy analysis and outreach for small farmers.

Atume serves as the statewide coordinator, and Anika is one of five regionally based SGMA educators for small farms, part of the UC Sustainable Agriculture Research and Education Program.

The others are Erik Rodriguez (Fresno and Madera counties), Luis Paniagua (Tulare and Kings counties) and Sonia Rios (Riverside and San Bernardino counties). Another educator is currently being recruited for Santa Clara, San Benito and Monterey counties.

'Business as usual': Cooperative Extension specialist finds farmers' actions largely unchanged

A lack of awareness may be one reason California growers aren't taking more action in the wake of the historic law's passing. Despite the potential for future water regulation and reductions, one analysis indicates that SGMA is not yet affecting farmers' decision-making.

Economists studied farmland parcels along the borders of neighboring GSAs, some with greater baseline overdraft (and ostensibly subject to more stringent SGMA restrictions) than others. Parcels near the administrative borders experience similar hydrological, climactic and agronomic conditions - the only difference being the expectation of greater future regulation.

The researchers then compared the differences in the planting of new perennial crops and the drilling of new wells between neighboring parcels of farmland, at a time before SGMA passed in 2014 and after SGMA, in 2020 and 2021.

"We found that SGMA had no statistically significant effect on the differences," said Ellen Bruno, associate professor of Cooperative

See Small Farmers page 27



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Small Farmers

Extension in the Department of Agricultural and Resource Economics at UC Berkeley.

In other words, farmers didn't seem to be altering their practices in the face of impending regulation. Bruno and co-author Nick Hagerty concluded it appears that, in SGMA's early years, potential restrictions were perceived to be so far in the future that short-term considerations – like well-drilling in response to drought or planting due to favorable markets - were taking precedence.

"The implication of people continuing business as usual so far is that the groundwater will continue to be overdrafted," Bruno added. "And, of course, the point of SGMA is to try to correct that and bring the basins into sustainability."

She said that Atume's community education team can help small farmers learn more about groundwater management and take appro-

"There's a lot of variation in what people know; big farmers have many more resources to plug into changing regulations," Bruno said. "I think Ngodoo's team could be really instrumental in helping everybody stay informed – both on how they're going to be regulated and what they can do to respond to the regulation."

SGMA education team sees uneven implementation across agencies

Management actions outlined in the Groundwater Sustainability Plans include groundwater allocations, taxes or fees based on users' extraction, pumping restrictions, and efficiency incentives, among other policy instruments (see a database summarizing strategies in those plans).

And while the agencies have laid out their long-term plans and actions, implementation has been uneven and inconsistent.

"It's a very small percentage of GSAs that are actually implementing actions right now that might impact the stakeholders," Atume explained. "In that sense, SGMA is still at the very beginning stages, and so people are not worried about it."

Nevertheless, the team wants to begin a step-by-step education process. Piggybacking on personal networks and events established by their UC ANR peers, the regional educators are finding opportunities to introduce themselves and build trust with local farmers. They are planning workshops for later this year.

Eventually, they want farmers to see them as people to contact if they have questions about groundwater.

"If you have any questions related to a random fee that you're getting, or somebody came out and told you that you have to install this specific thing on your irrigation infrastructure, you can call me," said Rodriguez, the educator for Fresno and Madera counties. "I'll help you figure it out and explain it."

Some farmers are already reaching out, such as a small farmer in Merced County who recently experienced quite a shock. According to Anika, the local GSA sent an invoice to the farmer with a penalty of \$15,000 for overextraction of groundwater. She was referred to Anika, who explained that the notice was sent to make the farmer aware of her potential penalty.

Communication barriers a major challenge for small farmers Beyond the task of distilling the complex, technical wording of SGMA into an easy-to-understand format, language barriers are another challenge.

For example, the majority of small farmers Anika has met with are Hmong, and she expressed gratitude for the linguistic help of staff research associate Vong Moua. Other members of the UC ANR Small Farms Network who speak non-English languages have helped with outreach to speakers of Spanish, lu Mien, Punjabi and Cantonese.

A complicating factor is that GSAs will usually send flyers and mailings only to the owners of land - not the tenant farmers.

"Reaching tenant farmers is difficult because it requires very tar-

geted outreach in their language to engage them," Atume said. "Even for GSAs that have made a lot of progress with outreach, most times those materials still stop at the landowner, and then the responsibility then lies with the landowner to communicate that information to the small farmers."

On their end, the community educators are also struggling with a dearth of information for crops grown by their clientele. According to Anika, Hmong farmers, for example, cultivate herbs, spices and seasonal vegetables under mixed cropping systems that have not been studied extensively by California academics, in terms of crop

While growers of almonds have a lot of research-backed information about their crops' water requirements, small-scale farmers often lack those resources.

"As a scientific team, we always try to give data-based recommendations, but at this point, I can only provide theory in our discussions - not data - so that's another challenge I face all the time," Anika explained. "I think people are trying their best to gather more information, but there's just not a lot of research on these crops that are very culturally focused."

SGMA educators cultivate partnerships with GSAs

Another key task for the SGMA education team is engaging with the Groundwater Sustainability Agencies themselves. The team members regularly attend agency meetings to share feedback and farmer perspectives.

"For some of these GSAs, there is - for the first time - someone consistently attending the meetings and providing small-farmer input on agenda items," Atume explained. "That's a huge part of the team's work."

Rodriguez, in Fresno and Madera counties, said he is first familiarizing himself with the GSAs (and their respective Groundwater Sustainability Plans) before reaching out to small farmers to explain the nuances of SGMA. He wants to know the details of those plans and the exact scope of his role – and then prepare the most relevant and accessible resources for when he approaches the growers.

"We're finally at a point now where we're starting to consult with different GSAs on how their work is conveyed in the outreach materials," Rodriguez said. "We're trying to make these materials GSA- or subbasin-specific, and we want their seal of approval and logo on it."

Building and strengthening relationships with the GSAs is a high priority for the SGMA team members, as they get a better sense of the unique political pressures, legal situations or local interests that each agency must navigate. Anika noted that some GSAs have been eager to learn more about the needs of small farmers, and Rodriguez has found that agencies in his area are receptive to hearing from the community.

"They are open – they do answer questions, they do schedule meetings," he said.

As the team assists GSAs in communicating with under-engaged stakeholders, Atume believes small farmers can be incorporated more meaningfully in the implementation of SGMA. She hopes all groundwater users contribute to a future where water is available for communities, agriculture and ecological health.

"Personally, I think everyone should comply with SGMA; I don't think some stakeholders should comply and others shouldn't," she said. "But at the same time, I do think that there should not be disproportionate impact on any particular group of stakeholders. Overall, we all need to move towards sustainability."

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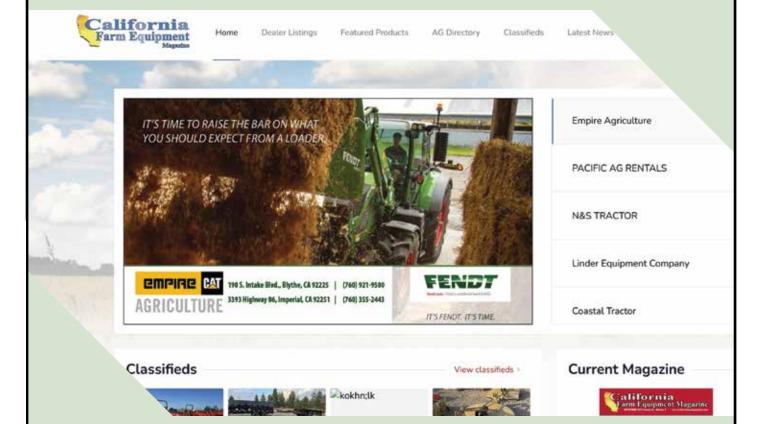
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