



## GROWN IN CALIFORNIA

### *Buy California Marketing Agreement*

*\$2,500,000*

#### **California Grown: Always in Season**

The Buy California Marketing Agreement will implement a multi-platform digital campaign including retail and foodservice promotions to create strong support from the retail and food service trade and increase consumer demand for California specialty crops and specialty crop products. The multiplatform digital campaign will utilize contextually relevant media placements, deliver rich and engaging experiences within impactful media, integrate multiple influencer marketing programs, and utilize social media to reach consumers in shareable environments. Retail trade outreach will be conducted, and promotional partnerships will be established with key California retailers to execute retail promotion programs both in-store and through digital extension.

The project's foodservice promotion component will support the reemergence of the foodservice industry in a post COVID-19 environment. Marketing includes participation in and execution of trade and consumer events. The social media, retail, and foodservice campaigns will be supported by participation in industry events and implementation of specialty crop agri-tours. The project will continue to include both in-person and digital consumer events. Promotions are designed to increase awareness and consumption of California grown specialty commodities to help consumers develop a better relationship with California grown agricultural products and enjoy the best of the California lifestyle. Promotions are also designed to increase the value of California agricultural products while helping to build strong communities and a thriving California economy.

Performance will primarily be measured through an increase in sales of California specialty crops and digital media impressions. Success will be measured through total sales performance and/or category lift for featured specialty crops during the promotional period. The Buy California Marketing Agreement's consumer database will also be utilized to survey target audience to measure intention to access/produce/preserve specialty crops because of campaign reach.

### *Wine Institute*

*\$500,000*

#### **Eureka! Guiding the Discovery of Sustainably Produced, Diverse, Appealing California Wines by United States Trade and Consumers**

Wine sales in bars and restaurants have plummeted in the United States, deeply impacting California winegrape producers who rely on this high-value sales channel. With COVID-19 shuttering 72,700 restaurants and bars in 2020 alone and many still recovering, restaurant industry sales in the United States dropped 8.7 percent in 2021



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versus 2019. Wine sales losses are projected to continue as on-premises buyers shift to beers, canned cocktails, and hard seltzers, perceived to be lower-cost and more convenient options. Efforts are needed to build back critical California wine sales. As such, Wine Institute will leverage over 88 years of marketing experience on behalf of California's 5,900 growers and 4,800 wineries to launch *Eureka!*, a marketing campaign sharing the value of California wine with trade and consumers through, 1) public relations, 2) social media and digital outreach, and 3) a unique immersive event. Project goal is a 5 percent increase in California wine sales by 2026; success will be measured by independent sales data.

*The Regents of the University of California, Riverside* *\$487,077*

**Avocado Extra Virgin Oil: Expanding Alternative Market Opportunities for California Avocado Growers**

California once dominated the avocado market in the United States, but this is no longer the case; most of the fruit now comes from Mexico, Peru, and Colombia. California has a rich varietal history, but this is underutilized, with the domination of the Hass variety. This University of California, Riverside, project explores developing an extra-virgin avocado oil industry that builds upon California's rich varietal heritage and California Hass that do not meet fresh market standards. Results will highlight market opportunities on the local, regional, and national level, allowing pairing of avocado oil with its documented health benefits. This project will interface with the existing extra-virgin olive oil industry since processing requirements are similar and seasons complementary. An active outreach program is planned to share the knowledge gained. Success will be measured by the introduction of California extra-virgin varietal avocado oil throughout the state and nationwide in farmers' markets, roadside stalls, retail, and online markets and through enhancing the long-term sustainability of the California avocado industry.

*Sunsweet Growers, Inc.* *\$500,000*

**Sharing Nutritional Benefits of California Prune and Plum Juices to Build Sales Among United States Families**

California prune prices are down 5.7 percent when comparing the most recent three-year average to the prior three-year average. These price declines come at a time when input costs are rising: the U.S. Department of Agriculture reported 2022 farm input costs rose 18.8 percent, nearly triple the general annual inflation rate. Selling more California prunes into high-value sales channels is needed for higher prices and grower viability, but markets must be expanded. Opportunity exists to achieve this by targeting United States millennial families (consumers aged 26-41 with one or more children; an audience of 39.5 million). Sunsweet Growers, Inc. will promote the convenience and nutritional benefits of California prune and plum juices to this audience via a national media campaign to drive domestic California prune product sales and shift more prunes



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to this high-value use. Project will increase high-value sales by 2.2 percent, measured through internal sales records. As a grower-owned cooperative, all earnings flow directly to California growers.

*Paso Robles Wine Country Alliance*

*\$378,677*

**A Roadmap for Paso Wine: Data-Driven Research, Strategic Marketing, and Increased Sales**

Marketing efforts of Paso Robles' vineyards, wineries, and the Wine Country Alliance have led to increased visitation to the region, new vineyards and wineries, and an increased perception of quality wines. But competition from import wines, hard seltzers, and ready-to-drink beverages are hurting overall wine sales. Data-driven research is needed to develop strategic marketing plans, increase wine sales, and increase the value of winegrapes. With this project, the Paso Robles Wine Country Alliance will, 1) initiate research studies of how much and where Paso wines are purchased in direct-to-consumer and wholesale channels; 2) track sales trends, identify current and future customer demographics, study local economic impact of winegrapes, and create metrics to support the industry; 3) identify new markets and younger consumers for California grown wines; 4) execute educational trips to the region, in-market tastings, and digital campaigns to a selected new market, and 5) share the results with trade partners and regional wine associations. Success will be measured by the creation of new benchmarks to review visitation and sales, tracking grape pricing, and increasing overall sales of winegrapes and wines from Paso Robles. This will be seen through surveys of growers and wineries, the District 8 crush report, and Nielsen sales data.



# EQUITY, OPPORTUNITY, AND EDUCATION FOR ALL CALIFORNIA SPECIALTY CROP FARMERS

*Napa Valley Farmworker Foundation*

*\$500,000*

## **Attracting and Building the Next Generation Workforce for Napa's Winegrape Industry**

The average farmworker age has risen seven years since 2006, with many retiring and the overall farm labor supply declining. Napa's winegrape growers are deeply impacted. To combat this alarming labor crisis, a younger, skilled, regional labor force must be attracted and training is needed to expand the current workforce's technical skills. Napa Valley Farmworker Foundation will leverage its strong reputation to introduce new workers to the industry and retain the existing workforce by, 1) expanding a high school student mentorship program and launching a year-round apprenticeship program and alumni program and 2) executing a workforce training program, including a leadership and management conference and train-the-trainer workshops for current farmworkers and supervisors. The project's goals are to educate and train 448 Napa students, resulting in higher wages for participants and new careers created, measured by surveys and economic analysis.

*The Regents of the University of California, Davis*

*\$497,335*

## **Growing Civic Urban Farmers**

Many urban farmers are new farmers, from historically underrepresented groups, and live in low-income areas that experience food insecurity. The Civic Urban Farmer Program is a hybrid program composed of 10 webinars and four in-person events covering food safety, production practices, soil management and composting, and accessing markets. The University of California, Davis, will expand upon a 2021 Specialty Crop Block Grant Program H.R. 133 project by working with urban farmers in California to, 1) conduct additional outreach; 2) conduct specialized sessions on food safety; 3) incorporate new content on apiculture and native pollinators; 4) partner with additional community organizations; 5) attend farm conferences to share the program outcomes; and 6) deliver presentations on urban farming, food safety, apiculture, and native pollinators to stakeholders. Success will be measured by tracking the number of participants during the program period, participant learning, and progress in meeting identified outcome measures.



*The Regents of the University of California, Davis*

**\$396,926**

**Development of Teaching Modules to Support California's Vegetable Crops Industry**

There is a critical need to develop and maintain a technically skilled and diverse workforce to keep California's specialty crops agricultural industry competitive. Those entering the workforce must receive state-of-the-art training that also anticipates the challenges that producers will face. This University of California, Davis, project will create a set of learning modules that will be used and rigorously evaluated at four universities and four community colleges that serve as key conduits for agricultural workers to the state's vegetable production regions. The role of agricultural colleges in delivering, via diverse modalities, both the theory and practice of agriculture is key today as California's population of farmers ages, shortages of suitably trained agricultural workers increase, and workers increasingly come from non-farming backgrounds. The learning modules will be developed by California State University and the University of California, with input from community college partners, and rigorously evaluated for effectiveness using pre- and post-activity assessments.

*California Bountiful Foundation*

**\$435,867**

**A Specialty Crop Beginning Farmer Mentoring Program to Support Equity, Education, and Agricultural Sustainability in California**

The California Bountiful Foundation (the Foundation), a non-profit of the California Farm Bureau, will support a farmer-to-farmer specialty crop mentoring and education program. This program will be limited to beginning specialty crop farmers in California, including, 1) socially disadvantaged; 2) Black, Indigenous, Multiracial, People of Color; and 3) lesbian, gay, bisexual, transgender, queer, and others. The Foundation has identified that one method of implementing an effective education program for beginning specialty crop farmers is to have them learn about the challenges and solutions to running an agricultural operation and doing business from existing specialty crop farmers with 10 years or more experience in California agriculture. The effort will focus on the following specialty crops grown in the state: almonds, grapes, berries, pistachios, citrus, lettuces, walnuts, tomatoes, broccoli, avocados, garlic, onion, celery, bell peppers, olives, cabbages, squashes, artichokes, green peas, and carrots. Success will be measured by ensuring 200 new farmers are mentored.

*Asian Business Institute and Resource Center*

**\$353,585**

**Creating Access for Asian Specialty Crop Producers Initiative**

Asian specialty crops such as bitter melon, bok choy, and jujube have historically been excluded from mainstream markets. This exclusion is due in part to Asian specialty crop producers lacking access to federal, local, and state resources; education programs; and training opportunities. Furthermore, Asian specialty crop producers also have



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unique cultural and linguistic backgrounds that are often overlooked by service providers. The Asian Business Institute and Resource Center offers a solution to these issues. This project proposes to create a two-year program for 60 Asian specialty crop producers who will receive culturally competent technical assistance and engage in a series of workshops and networking events to increase their capacity and market opportunities. The producers will specifically obtain their Produce Safety Alliance and Good Agricultural Practices certifications and strengthen their knowledge about business management techniques and efficient farming strategies. Success will be measured and evaluated via surveys, focus groups, and impact of technical assistance and workshops.

*The Regents of the University of California, Davis*

*\$496,116*

**California Frontline Supervisor Training Program**

Agricultural frontline supervisors play an important role in establishing a safe workplace culture. Frontline supervisors may be promoted based on their skills as a farmworker, but not necessarily based on their leadership or safety expertise. Despite this need, few trainings target this group and those that do are intensive and expensive. The University of California, Davis, proposes a robust, accessible frontline supervisor training program based on a previously piloted program. The program will enhance worker safety in California specialty crops, with emphasis on training supervisors to assist specialty crop growers with COVID-19 safety requirement compliance. The program will reach 2,000 frontline supervisors through, 1) the core training program and 2) a virtual learning network. Post-training assessments, follow-up phone calls with participants, session engagement, and online user metrics will be used to confirm that the project resulted in successful uptake and implementation of the training. Indicators of project success will include the level and diversity of participants engaged, the change in participants' knowledge, perceived value of the trainings, the change in behavior post-training, the reach of trainings, and the level of dissemination and adoption of safe practices.

*California Farmworker Foundation*

*\$499,715*

**Cultivating the Next Generation of Agricultural Workers in the South Central Valley**

Hundreds of specialty crop growing, packing, and processing operations in Southern San Joaquin Valley seek vocational and skill development of their employees. There is a lack of accessible, affordable, and applicable training opportunities that align with the unique characteristics of the farming industry. Most importantly, agricultural workers lack access and opportunity to pursue skill development on their own. The California Farmworker Foundation will bridge the gap between agricultural operations and regional community colleges in Kern and Tulare counties to address cultural, social, and economic barriers that exist for both employees and employers. The project will marry existing industry training needs with available educational assets and resources in the



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region. The effort will align specific skill-development with existing skills gaps by creating a customized eight-week cohort training. The customization is to meet the needs of the employer and interests of the employee by providing the training in a manner that is comfortable and familiar for the employee. Customization will be based on surveys (written and verbal) from agricultural workers to address the specific barriers that would limit or prevent their participation in the skill development program. Success will be measured based on pre- and post-surveys of participants and their knowledge gained. (This project participated in the Additional Assistance for Historically Underrepresented Organizations Program.)



# HEALTHY SPECIALTY CROPS FOR ALL CALIFORNIANS

*California Foundation for Agriculture in the Classroom* **\$499,371**  
**Increasing Awareness and Consumption of California Specialty Crops Among California Fourth-grade Students and Teachers**

Kids are not eating enough vegetables and fruits: 93 percent under-consume vegetables and 60 percent under-consume fruit, a serious issue. Increasing fruit and vegetable consumption in children could reduce risk of chronic diseases in adulthood and improve mental health. Engaging education on California specialty crop uses and benefits is needed to build consumption. As such, the California Foundation for Agriculture in the Classroom will increase specialty crop awareness and consumption among California fourth-grade students and teachers via, 1) an innovative web application with geo-specific crop information and kid-friendly recipes, 2) a teachers' guide aligned to California standards, and 3) social media outreach to ensure the developed tools reach this audience. The project goal is to reach 1,600 California fourth graders and teachers with knowledge about specialty crops, with 800 increasing consumption, measured by surveys; all California fourth graders and teachers will gain access to the developed materials. Efforts seek to boost California specialty crop consumption and demand, benefiting producers.

*Center for Ecoliteracy* **\$447,720**  
**Specialty Crop Resources for Early Childhood Education**

Research shows that students do not eat enough fruits and vegetables. Now is the time to inspire the next generation of specialty crop consumers and increase specialty crop sales to the multibillion-dollar school food industry. California is at the dawn of universal school meals and universal transitional kindergarten. The Center for Ecoliteracy will develop new teaching and learning resources for early childhood education focused on specialty crops, including approachable recipes, standards-connected activities, illustrated bilingual learning cards, and gardening kits. The Center for Ecoliteracy will engage educators, school nutrition professionals, and community partners in four professional development workshops, menu planning sessions, and a dissemination campaign. Project success will be evaluated and measured through analysis of school purchases of specialty crops and via surveys that track increased specialty crop knowledge and consumption among 2,990 students and 205 adults.





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*The Regents of the University of California,  
Agriculture and Natural Resources*

*\$487,755*

**Expanding Efforts to Increase Procurement of California Grown Specialty Crops in the California Corrections System**

The California Department of Corrections and Rehabilitation (CDCR) is the largest state purchaser of food in California, spending over \$150 million on meals annually for nearly 100,000 incarcerated residents. The CDCR can support California agriculture and improve the health of incarcerated people by procuring more California grown produce. The University of California, Agriculture and Natural Resources, will work with the CDCR to institutionalize and expand Harvest of the Month programming in nine or more facilities, promote local procurement for additional meals in corrections facilities, promote increased compliance with Assembly Bill 822, and work with community-based organizations to train formerly incarcerated people to deliver nutrition education workshops to formerly incarcerated individuals and their families on an on-going basis. Outcomes will be measured via a review of the CDCR purchase records, supplier sales records, surveys with nutrition education workshop participants, interviews with individuals recently released from facilities with Harvest of the Month programming, and interviews with food service staff, growers, and distributors supplying corrections facilities. Distributors and growers that are currently selling to CDCR will be tracked as well. Project success will be measured via interviews and surveys from individuals who are participating or have participated in this project.

*18 Reasons*

*\$450,000*

**Hands-On Cooking and Nutrition Education for Low-Income Families**

In a time of skyrocketing inflation, 20 percent of Bay Area families are at risk of food insecurity. Meanwhile, nearly 11 percent of adults are diabetic, 38 percent have prediabetes, and rates of type 2 diabetes (a preventable, diet-related disease) are surging, per the Centers for Disease Control and Prevention. Increasing access to food is not enough: data from a Rand study shows that bringing a grocery store to a food desert does not change consumption patterns. Instead, people need cooking education and motivation to cook on a daily basis to develop healthier eating habits. With this project, 18 Reasons will provide hands-on, cooking-based education to low-income families, particularly families of color who are disproportionately affected by food insecurity and diet-related nutrition disparities. As a result, 9,000 Bay Area residents will increase their awareness, consumption, and knowledge of how to prepare specialty crops, as evaluated through pre- and post-participation surveys that measure behavior change in specialty crop consumption and knowledge.



*Occidental College*

*\$500,000*

**Urban Agriculture at the Market: A Model for Urban Producers to Improve Fresh Food Access at Neighborhood Farmers' Markets**

Farmers' markets can reduce inequities in fresh food access, too common in low-income neighborhoods and communities of color in Los Angeles. Yet small, community-driven farmers' markets frequently struggle to recruit regional farmers (those from neighboring counties, and as far as the Central Valley, who travel to Los Angeles markets). Though urban farmers from the community often want to address food insecurity, they need support to build technical skills, navigate regulations, and coordinate plans to sell at their local markets. Occidental College, through the Urban Ag at the Market Project, will expand access to specialty crops in underserved communities by connecting urban producers to farmers' markets. The project will achieve this goal by, 1) identifying key training needs, 2) creating an Urban Agriculture Accelerator training program that prepares urban producers to partner with small-scale markets, and 3) conducting a pilot to establish best practices in which urban producer trainees grow for and sell at their local markets. The program evaluation will include focus groups, sales data, and evaluation surveys.

*Common Threads*

*\$251,455*

**Cooking Up Community: Culinary and Nutrition Education with California Specialty Crops for Los Angeles Students and Families**

Common Threads, a non-profit with a 15-year history of serving Los Angeles County, will increase nutrition knowledge, consumption, and preparation of California specialty crops among underserved communities by expanding family and youth nutrition and culinary education at Los Angeles Unified School District schools. Programs implemented will include, 1) Small Bites, an eight-lesson nutrition education curriculum for students in kindergarten through eighth grade, 2) a youth and family cooking class series focused on preparing specialty crops, 3) caregiver workshops focused on shopping and meal planning around specialty crops, and 4) farmers' market tours. The project's goal is to equip students and their families with the skills and knowledge necessary to recognize, choose, and prepare healthy meals centered around locally and regionally grown specialty crops, empowering them as agents of change for healthier families, schools, and communities. Evaluation will be conducted via pre- and post-surveys of participants.

*Sustainable Economic Enterprises of Los Angeles*

*\$499,982*

**Peak of Season Specialty Crop Nutrition Education and Culinary Program**

This program provides sixth through twelfth-grade students, adults, and caregivers with culturally relevant specialty crop education showcasing California's seasonal variety and



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specialty crop growers, focusing on underserved communities and Title I schools. Since 2002, Sustainable Economic Enterprises of Los Angeles has successfully partnered with hundreds of Los Angeles area schools and community sites annually. In response to ongoing diet-related disease health disparities in underserved communities, the program model incorporates evidence-based nutrition and behavior change practices to bolster impact in increasing specialty crop knowledge, awareness, preparation, and consumption through two school-based video series and bilingual child and adult community-based curricula that incorporate specialty crop tasting and hands-on culinary skill building. Participant surveys and qualitative assessment tools will be administered to individual participants before and after each lesson and the data collected from the surveys will be analyzed to measure a change in knowledge attainment, consumption, preparing, and accessing more specialty crops. Success will be measured by an increase in knowledge and consumption of specialty crops.

*The Regents of the University of California, Agriculture and Natural Resources* *\$402,221*

**Provide Research-Based Online Food Preservation Educational Events for Specialty Crops**

As a result of the COVID-19 pandemic, more people are preserving fresh produce and then preparing meals with their preserved food. Often home canners rely on internet recipes, blogs, old canning books, and family history for preservation recipes, many of which use out-of-date and potentially unsafe methods. The University of California, Agriculture and Natural Resources, will leverage a new online-only version of the University of California Master Food Preserver model to extend science-based preparation, storage, and preservation practices to anyone with an internet connection. It will build a network of online volunteer educators to provide online helplines, education materials distributed through social media and websites, and online classes addressing safe preparation and preservation methods with research-based recipes to promote awareness and consumption of specialty crops. Project success will be measured by the increase in specialty crop knowledge and consumption reported through pre- and post-event surveys.

*East Stanislaus Resource Conservation District* *\$232,552*

**Youth Engagement and Education on Specialty Crops Careers in the Central Valley**

The Student and Landowner Education and Watershed Stewardship program introduces youth to the specialty crop industry through education and internships. The East Stanislaus Resource Conservation District (ESRCD) will lead three cohorts, each consisting of two on-campus classes and a farm field trip, reaching a total of 105 students. The students will learn about soil health, water conservation, and other



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regenerative agriculture principles as related to specialty crops while also learning from speakers about pathways into the industry. All students will be surveyed and those that are interested will be connected by the ESRCD to a partner organization or specialty crop farmer who can plug them into an internship project having to do with producing, processing, or accessing specialty crops. The ESRCD will inform the student about trainings, certificates, and higher education opportunities while they work on their project, which they can feature in a college application or resume. ESRCD has run the Student and Landowner Education and Watershed Stewardship program for many years, but the connection to career and higher education opportunities for youth is a new feature.

*San Francisco Parks Alliance*

*\$151,710*

**Advancing Food Justice and Resilience in Low-Income, Black, Indigenous, and People of Color Communities**

San Francisco Parks Alliance will fiscally sponsor Urban Sprouts, which believes safe and beautiful outdoor environments are the best conduits for advancing healthy, economically thriving, and socially connected communities; they should be accessible to all. Urban Sprouts offers three programs: garden-based education, job training, and community health and nutrition education. The Community Sprouts program offers hands-on training in regenerative agriculture through a network of Certified California Production gardens and through one-on-one technical support for home gardeners. Community Sprouts focuses on growing specialty crops without chemical pesticides and fertilizers, prioritizing water conservation, and maximizing carbon sequestration. The Sprout Out program is an intensive agricultural job training program that focuses on strengthening transferable jobs skills, increasing financial capacity, farmers' market management, and earning the nationally accredited ServSafe Food Protection Manager Certification. The Community Health and Nutrition Education program provides hands-on classes and demonstrations that use culturally appropriate recipes and practices to promote the production and consumption of specialty crops. (This project participated in the Additional Assistance for Historically Underrepresented Organizations Program.)



# ENVIRONMENTAL STEWARDSHIP AND CONSERVATION

*The Regents of the University of California, Davis*

**\$499,953**

## **Understanding and Breeding for Yield Under Water and Heat Stress in Chili Pepper**

Peppers drive a \$1.4 billion salsa and \$2.8 billion hot sauce market in the United States, with increasing demand. California produces one third of the peppers grown in the United States. Extreme weather events of heat and water scarcity threaten this rich source of nutrients available to all cultures and incomes. The project leverages initial work on screening populations derived from landraces collected in semi-arid regions of the center of genetic diversity, Mexico. The University of California, Davis, will combine tolerance to heat and water stress with yield and quality traits in chili peppers and develop genotyping and phenotyping tools to define the physiological and genetic basis of traits. Information and germplasm will be extended to growers, industry, and public stakeholders while training the next generation of scientists. Success and outcomes, as measured by performance of tools, germplasm, and outreach, are stability in the industry, pepper yield, and quality under water and heat stress. The strategies will serve as models for other pepper and vegetable species.

*The Regents of the University of California, Riverside*

**\$499,921**

## **Designing Drought Tolerant Specialty Crops Using Metabolic Modeling**

The University of California, Riverside, has the long-term goal to improve the productivity and sustainability of California's specialty crops by using metabolic models to create drought tolerant varieties. Climate change has and will continue to cause problems for California agriculture, including those caused by droughts. There are currently no commercial citrus varieties shown to produce desirable fruit and be drought tolerant in California growing regions. In this project, the team will use metabolic models to identify drought tolerance mechanisms of two citrus rootstocks grown in Brazil. The project team expects this research will enable the design of solutions for growers. Short-term solutions will involve nutrient amendments that redirect metabolic pathways facilitating drought tolerance. Longer-term solutions will involve engineering varieties that utilize an in-depth, model-based understanding of drought tolerance. Success will be evaluated by determining if the team identifies drought tolerance mechanisms and designed solutions.



*The Regents of the University of California, Davis* **\$498,402**  
**Limited Irrigation Management and Smart Water Technologies for the Pistachio Orchard of the Future**

Water is cited as the number one concern of pistachio growers in the Central Valley. Climate change and regulation of groundwater use threaten the sustainability of pistachio production. Limited irrigation involves applying less than full crop water needs or applying full irrigation to smaller acreage to obtain economically viable yields. Also, water technologies such as stem water potential sensors, soil water potential sensors, and remote sensing imagery can be used to refine irrigation scheduling decisions. With this project, the University of California, Davis, will, 1) evaluate limited irrigation management strategies for pistachios, 2) evaluate the performance of stem water potential sensors and soil water potential sensors in various pistachio orchards, 3) validate the accuracy of satellite remote sensing of evapotranspiration, and 4) disseminate findings to growers. The project will be considered successful if limited irrigation and smart water technologies are widely adopted by pistachio growers dealing with limited water.

*The Regents of the University of California, Davis* **\$498,706**  
**Conversion of Almond and Walnut Shells to Prebiotic Oligosaccharides and Gluconic Acid**

The Regents of the University of California, Davis, aim to produce high-value prebiotic products, cellobiose and oligosaccharides, and an industrial chemical gluconic acid from almond and walnut shells to increase the economic return to farmers and processors and ensure sustainable management of these byproducts. Project objectives include producing cellobionic acid and cellobiose from the cellulose portion of the shells using fungal fermentation. Cellobiose will be one of the probiotic products. Cellobionic acid will be used as the hydrolysis agent to produce oligosaccharides as another probiotic product from the hemicellulose fraction of the nut shells, and the cellobionic acid will be hydrolyzed to glucose and gluconic acids during the process. Gluconic acid will be recovered as another product. Project success will be determined by the positive economic evaluation of the process and the farmers' and processors' willingness to adopt the new technology.

*The Regents of the University of California, Davis* **\$396,176**  
**Farmer Driven Drought Resilience Innovations for Soil Health, Environmental Stewardship, and Marketability of California Processing Tomatoes**

The California processing tomato industry is under intense pressure from the decades-long megadrought in the Central Valley. There is an urgent need to identify the suite of water, soil, and plant management practices which enable drought resilience and



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quantify their adaptive potential. The University of California, Davis, has developed a network of 25 fields with varied adoption of climate smart practices for over five years, leading to different water use, yields, soil health, and carbon statuses. This project proposes to work with this network to identify the socio-ecological drivers of drought resilience and quantify their relevance to cope with water shortage scenarios in field experiments. Results will be shared with stakeholders in a video, field tour, and web content to facilitate adoption of effective climate change adaptation strategies and provide policymakers with evidence-based knowledge to maintain the competitiveness of the processing tomato industry while meeting climate change adaptation and mitigation goals.

*The Regents of the University of California, Davis* **\$496,321**

**Appraising Uncertainties and Errors of Evapotranspiration of Micro-Irrigated Orchards and Vineyards Estimated with Satellite Remote Sensing Methods**

Evapotranspiration (ET) and water productivity information of California's perennial crops is limited and outdated, but crucial for water management decisions. In addition, many irrigation districts and groundwater management agencies recently adopted satellite remote sensing (SRS) methods to derive ET, which may lead to uncertain and highly inaccurate ET estimates, while the limits for acceptable ET inaccuracy are uncertain and unclear. With this project, the University of California, Davis, proposes to, 1) determine the acceptable levels of ET accuracy for orchards and vineyards by surveying main industry's stakeholders, 2) measure ET and yield in commercial nut orchards and wine-grape vineyards, and 3) quantify errors and room for improvements of SRS-ET tested against ground-ET measurements. The expected outcomes are updated information for increasing water management capacity of specialty crop growers and water stakeholders. The project's success will be evaluated by tracking the number of growers and water stakeholders gaining knowledge and expressing interest in the novel ET information.

*The Regents of the University of California, Davis* **\$497,865**

**Development of a New Integrated Drying and Aeration Method for Off-ground Harvested Almonds**

California annually produces 5 million tons of in-hull almonds, with \$5.6 billion economic value. The current harvesting method generates a large amount of dust, causing air pollution and making the industry unsustainable. The off-ground method has been considered as the most promising approach. The most critical challenge for this approach is to dry the almonds rapidly and efficiently and ensure product quality and food safety. Heated air drying is a promising method to dry a large volume of almonds in a short time. However, the moisture variation of products in different locations in a dryer may affect product quality and food safety. Also, it is not energy efficient at the later



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stage of drying. The University of California, Davis, will develop a new integrated drying and aeration method for off-ground harvested almonds to increase drying capacity, reduce energy use and cost, and ensure product quality and safety. Project success will be evaluated by developing the new integrated heated air drying and aeration method and quantifying its benefits on energy saving, quality, and safety improvement of dried almonds. The benefits will be disseminated to the industry. This will make the almond industry more sustainable and competitive.

*U.S. Department of Agriculture, Agricultural  
Research Service*

**\$492,999**

**Improving Irrigation Management in Specialty Crop Systems: The Case for Advancing Proximal Sensing Tools and Forecasting Evapotranspiration Using Satellite Remote Sensing and Machine Learning**

Acquiring accurate measurements of crop water use such as evapotranspiration (ET) is increasingly important in California. Farmers use various forms of ET to guide irrigation management. Some are based on crop coefficients, using reference ET from the California Irrigation Management Information System, while more sophisticated approaches use remote sensing. These new tools still require validation and refinement to ensure mass adoption. This project from the U.S. Department of Agriculture, Agricultural Research Service, aims to, 1) continue efforts to ground-truth remotely sensed ET models, 2) develop a 10-day forecasted actual ET product based on satellite data and machine learning, 3) improve stress detection using novel machine learning methods to determine optimal, site-specific crop water use with ground-based and remotely sensed data, and 4) create the structure required to ingest new tools into the cloud-based OpenET framework. Ultimately, the project's goal is to optimize irrigation management strategies for improved water use efficiency and crop health in a myriad of cropping systems.

*The Regents of the University of California, Davis*

**\$499,991**

**Wildfire Smoke Exposure Risk Assessment for Different Grape Varietals**

Wildfires will occur with greater frequency and intensity in California, with 2020 wildfires resulting in a \$3.5 billion loss in revenue in the wine and winegrape industry. During wildfires, large amounts of volatile phenols (VPs) are released into the air, absorb through the berry skin, and compromise fruit quality. Different grape varieties naturally contain different amounts of VPs and differ in their ability to absorb VPs; this has not been studied. This University of California, Davis, project will determine VP synthesis in different varietals and the impact of smoke exposure on VP metabolism, vine physiology, and grape and wine composition. Information gained will aid in the





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development of targeted mitigation actions, determine the best time for grape sampling for risk assessment, determine varietal differences regarding VP synthesis and impact of smoke exposure thereon, and provide metrics for smoke risk assessment. These metrics are essential to guide grape contracts and optimize harvest decisions. Success will be measured by adoption of these new metrics in decision-making, as indicated in surveys.

*University Corporation at Monterey Bay*

*\$490,048*

**Advancing Adoption of Decision Support Systems for Irrigation  
Management of Vegetable Crops**

California growers are under increased regulatory pressure to achieve groundwater sustainability due to the Sustainable Groundwater Management Act. Central Coast growers face added requirements under Agricultural Order 4.0, which focuses attention on irrigation practice efficiency and, among other things, mandates reporting of crop evapotranspiration (ET). Decision-support models can help irrigators quantify ET and apply water in alignment with crop demand. CropManage is a leading software tool operated by the University of California, Cooperative Extension, for guidance of ET-based irrigation and nutrient scheduling and now provides nearly 3,000 vegetable crop irrigation recommendations to approximately 200 farms annually. With this project, the University Corporation at Monterey Bay will perform additional validation work in commercial fields to broaden user acceptance through further refinement of CropManage and evaluation of a complementary satellite-based ET monitoring system. Project success will be evaluated primarily in terms of increased awareness and adoption of decision support tools.



## PLANT HEALTH AND PEST MANAGEMENT

*Cal Poly Corporation*

*\$192,721*

### **Control of Strawberry Pathogens by Nano-Encapsulated Oils Extracted from Citrus Fruit Waste**

California produces approximately 90 percent of the strawberries and 50 percent of the citrus grown in the United States. Strawberry yield and quality are affected by *Botrytis* Fruit Rot (BFR) and Powdery Mildew (PM), which can cause annual yield and postharvest losses greater than 15 percent. BFR and PM are controlled by multiple applications of conventional fungicides but have begun to develop resistance. Fungicide resistance frequency for strawberry BFR worldwide ranges from 18 to 86 percent. Organic waste from processing citrus is approximately 50 percent of the original fruit biomass; citrus oil has antimicrobial properties that, if applied effectively, could help control pathogens. With this project, Cal Poly Corporation proposes to close this loop using nanoencapsulated citrus fruit waste oil to control BFR and PM. Objectives are to, 1) extract and characterize oils from citrus fruit waste, 2) develop an encapsulation technique to apply citrus oils in a nanoemulsion as an antimicrobial delivery system (ADS), and 3) determine the impact of an ADS on BFR and PM control in vitro and in vivo.

*The Regents of the University of California, Riverside*

*\$492,391*

### **Rapid-Response Detection and Management of Emerging Outbreaks of Lettuce *Fusarium* Wilt in Coastal California**

*Fusarium* wilt of lettuce has recently become one of the top lettuce pests on California's Central Coast. Data on resistance of commercial cultivars to the pathogen is lacking, and rapid diagnostic tools for all races are not available. Preliminary data suggests a novel race may be present on the Central Coast as of August 2021. The Regents of the University of California, Riverside, plan in this project to, 1) evaluate commercial cultivars and breeding material against pathogen races, 2) investigate the source of resistance to the potential novel race, 3) determine the geographic distribution of races in California, and 4) complete and validate molecular assays to rapidly detect the novel race in plant material and soil. Anticipated outcomes are that growers will be able to rapidly identify the race present in their soil and make informed cultivar selections. Success of the project will be assessed based on extension of data to growers, shifts in cultivar use patterns, and commercial use of diagnostic assays.



*The Regents of the University of California, Davis* *\$446,190*

**Advancing Diagnostic and Management Tools that Mitigate Severe *Fusarium* Bulb Rot Pre- and Post-Harvest Losses in California's Allium Crops**

*Fusarium* bulb rot (FBR) is an emerging destructive disease of California garlic, onion, and leek production. In-field and post-harvest losses equal to or greater than 30 percent are common, with 60 percent or more garlic seed being contaminated. Rotten seed is not planted, resulting in hundreds of lost acres. Growers are desperate for effective management strategies. This project by the University of California, Davis, proposes to, 1) advance diagnosis and seed detection decision support tools; 2) evaluate epidemiological linkages between allium crops for rotation recommendations; 3) identify synthetic and biological chemistries effective against both pathogens; 4) develop in-field strategies for seed and fresh market FBR management in garlic; and 5) disseminate tools and recommendations via outreach presentations, trainings, publications, and diagnostic support. The project team will evaluate success based on the number of growers using testing services and recommendations, diagnosticians trained in new tools, accurate diagnoses, and attendance at meetings and in-service trainings.

*The Regents of the University of California, Riverside* *\$310,543*

**Molecular-Diagnostics-Ready Total Nucleic Acid Collection without a Laboratory**

Specialty crops are the mainstay of California's agriculture. However, various diseases, such as Huanglongbing and curly top, threaten the industry's long-term prosperity and sustainability. The University of California, Riverside, aims to develop a new tool for in-field total nucleic acid collection in order to improve disease and pathogen detection. The project team will validate the device with three distinct pathogen types, including bacteria, viruses, and viroids, and three different crops, including citrus, avocados, and grapes. The success of the developed device will be evaluated based on the accuracy and sensitivity of quantitative polymerase chain reaction (qPCR) tests using known infected samples in the lab and field. The project team will educate and train specialty crop stakeholders through presentations and hands-on training at regional events and a dedicated website. The success of the outreach will be measured by assessing the number of stakeholders trained with the device and their newly gained knowledge about the proposed technology.

*The Regents of the University of California, Riverside* *\$473,917*

**New Traps and Sensors for Regional Monitoring of Navel Orangeworm in Pistachios**

Navel orangeworm (*Pyralidae: Amyelois transitella*) (NOW) is the key pest of pistachios. Adults deposit eggs on nuts and larvae feed on kernels, reducing crop yield and quality,



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but only if hull integrity is low. As such, pesticide use for NOW is a function of pest abundance and hull integrity. Unfortunately, monitoring for this is time and labor intensive. The University of California, Riverside, will provide a decision-support tool to promote judicious pesticide use for NOW by integrating new automated traps and plant volatile sensors to track regional NOW abundance and changes in pistachio hull integrity. Data will feed into a new online map tool to help pistachio growers gauge risk of NOW damage. Project outcomes include new evaluation of automated traps and plant sensors, a regional monitoring network, an online mapping tool, and improved NOW risk-assessment for pistachio growers. Project success will be measured by adoption of new monitoring tools, website engagement, and changes in grower behavior and attitudes.

*The Regents of the University of California, Riverside*      **\$498,088**  
**Improved Nematode Thresholds Determination in Almond**

California almonds are produced in different agro-ecological environments and soil textures, with varying assemblages of plant-parasitic nematodes, including *Pratylenchus vulnus*, *Meloidogyne spp.*, and *Mesocriconema xenoplax*. To combat these threats at planting, producers select resistant rootstocks or use pre-plant soil fumigation with 1,3-dichloropropene. In Integrated Nematode Management, grower decisions are based on nematode numbers in the soil. These are determined by highly trained personnel in tedious, species-specific extraction and counting procedures, while species identification frequently requires molecular confirmation. In a wheat advisory system in Australia, amounts of soil pests and pathogens have been determined with real time quantitative polymerase chain reaction (rt qPCR) tests from soil DNA extracts, foregoing classical nematode procedures. This University of California, Riverside, project will use DNA methods and almond-pest-specific rt qPCR protocols to determine reproducible thresholds, guiding rootstock and fumigation decisions. Success will be measured by primers validated for accuracy, trials completed, data collected, and stakeholders that gain knowledge on improved pest control processes.

*The Regents of the University of California, Davis*      **\$497,672**  
**Reducing Chemical Use and Maintaining Product Quality Using Smart Technology for Early Detection and Notification of Insect Activities in Tree Nuts**

The University of California, Davis, believes that tree nuts are the most important specialty crops in California, with a value of \$9.5 billion as 20 percent share of the agriculture output of the state. At present, insect infestation during storage and handling is monitored by human inspection and cannot be discovered in a timely fashion, which causes a 3 to 4 percent product loss. Meanwhile, a frequent fumigation practice uses a large amount of chemicals. The project team at with the University of California, Davis, has successfully developed a smart wireless technology (SmartProbe) for early



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detection of insects and environmental monitoring. The insects were detected when they emerged, and temperature and relative humidity were simultaneously monitored in almond and walnut during storage, which made reducing chemical use and maintaining product quality achievable. This project will study the reduction of chemical use and preservation of product quality through the further development and implementation of this technology. Project success will be measured by developing the SmartProbe technology and quantifying its benefits on reducing chemical use and maintaining product quality. This project should make the tree nut industry more economically competitive and sustainable.

*The Regents of the University of California, Davis* **\$369,068**

**Loss of Susceptibility for Durable and Broad-Spectrum Resistance Against Root-Knot Nematodes in Tomato**

Root-knot nematodes are highly evolved obligate parasites that threaten global food security. These nematodes have a remarkable ability to modify host cells that serve as their only source of nutrients throughout their life cycle. Resistance to root-knot nematodes conferred by the single dominant gene Mi-1 is available in many varieties of fresh and processing tomatoes. However, reliance on Mi-1 has led to the emergence of resistance-breaking nematode populations in tomato fields in California and worldwide. Research over the last years has identified a number of plant susceptibility genes that are essential for development of root-knot nematodes. The University of California, Davis, has as the goals of this project to, 1) characterize tomato susceptibility genes that are essential for root-knot nematode development, 2) use clustered regularly interspaced short palindromic repeats (CRISPR)-associated protein 9 enzymes to mutate key susceptibility genes in tomato, and 3) demonstrate the efficacy of identified targets to control root-knot nematodes in greenhouse and field trials. The success of this project will be determined by the identification of at least one susceptibility gene in tomato plants and subsequently demonstrating its effectiveness in controlling nematodes through both greenhouse and field trials.

*The Regents of the University of California, Agricultural Research Service* **\$495,341**

**Testing Citrus Tristeza Virus Delivery of *Bacillus thuringiensis*-Pesticide Proteins in Cara Cara Navels and its Economic Benefits**

This project by the University of California, Agriculture and Natural Resources division, will support the California citrus industry in response to the threat of Huanglongbing (HLB) disease transmitted by the Asian citrus psyllid (ACP). ACP is endemic in parts of California and innovative tools are required for cost-effective control to prevent introduction of *Candidatus Liberibacter asiaticus* (the HLB-associated bacterium assumed to be the causal agent) into commercial citrus. A citrus tristeza virus (CTV)-



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based vector driving the production of engineered *Bacillus thuringiensis*-derived proteins (BtP) to manage ACP populations in citrus has shown promising results in Florida. A bioactive CTV-based vector from a California isolate that can be used to determine BtP's efficacy in growing conditions unique to California will be tested and its economic benefits assessed. The project team will meet throughout the course of this project to evaluate the efficacy of the technology for California as determined by the fecundity and mortality of ACP fed on trees protected by BtP-expressing CTV, make adjustments to ensure that the milestones are achieved as planned, and complete grower outreach. Outreach success will be measured via number of clientele reached and educated on BtP for ACP management.



## FOOD SAFETY

*The Center for Produce Safety*

**\$386,842**

### **Developing a User-Friendly Risk Assessment Tool to Assess the Food Safety Risks of Fresh Produce Production and Landscape Use**

The Center for Produce Safety will partner with the University of California, Davis, to help produce growers better manage the risk of contamination in their fields. Production of leafy greens and other fresh produce grown in California is a billion-dollar industry, concentrated in the Salinas Valley and Imperial Valley. Outbreaks of foodborne bacterial infections due to *Escherichia coli* (*E. coli*) O157:H7 have been traced back to produce grown in these regions, which have led to investigations on the origin of the bacterial contamination. Despite much scientific effort, it has been difficult to determine exact causes of *E. coli* O157:H7 contamination in fresh produce. This project will develop a risk assessment model that will consider knowledge from multiple sources and research studies to determine where and when the risk of a contamination event is increased. Input will be sought from the scientific literature as well as experts in the field. Data will be distilled into online risk maps that point out where and when to concentrate efforts to mitigate the known risks. The overall measure of success for this project will be the development of new risk-based metrics for landscape use and co-existence of livestock near produce production. The risk assessment developed will be useful to determine the risk associated with the contamination of fresh produce and identify high risk areas as well as areas with high uncertainty where further information should be collected.

*The Center for Produce Safety*

**\$456,713**

### **Development of a Risk Ranking Tool for Evaluating Hazards and Risks Related to Agricultural Water Subpart E**

The Center for Produce Safety will partner with the University of Arizona to develop a tool that ranks the risks posed by agricultural water. The U.S. Food and Drug Administration is proposing revisions to some preharvest agricultural water requirements in Subpart E of the Food Safety Modernization Act Produce Safety Rule, requiring a more risk-based approach to assess potential hazards to agricultural water. To enhance industry and regulatory confidence in making risk-based decisions on agricultural water and its use, this project will build a risk ranking tool, backed by quantitative microbial risk assessment (QMRA). This tool will allow users to identify hazards and practices that increase potential risk as well as mitigation strategies that reduce risk, applicable to their production system. The research team will use historical and newly generated laboratory and field data, coupled with QMRA to quantify the impact of microbiological risk due to growing practices outlined in the proposed Subpart E. The resources developed for industry by this project will improve evaluation of the impacts of specialty crop characteristics, among other factors, on risk posed by



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agricultural water use during production of covered produce and will provide scientific evidence to aid in risk reduction and support regulatory compliance. Results of this study will be summarized in project reports, presented at the annual Center for Produce Safety Research Symposium, and published in peer-reviewed journals.

*The Center for Produce Safety* *\$462,246*  
**Characterization and Mitigation of Food Safety Risks Associated with Waxing Roller Brushes**

The Center for Produce Safety will partner with the University of California, Davis, to optimize the cleaning and sanitizing protocols for waxing roller brushes used by fruit packinghouses. Waxing roller brushes play an important role during the application of waxes onto fruit and vegetable surfaces. However, food safety risks associated with waxing roller brushes have not been well characterized, and the cleaning and sanitizing of roller brushes have been challenging for the produce industry. To address the above knowledge gap and challenge, the team will first evaluate the impact of waxes and wax residues on the survival of pathogens on roller brushes made with different materials. Second, the team will conduct microbial sampling at operating packinghouses during peak packing season to generate first-hand information about the native microbial loads of commercially used waxing roller brushes. Third, the team will characterize the physical and chemical properties of wax residues and compare, optimize, and validate the efficacy of commonly used roller brush cleaning and sanitizing protocols. Optimized protocols will be validated at two pilot facilities for both clean-out-of-place and clean-in-place usages. Results of this study will be summarized in project reports, presented at the annual Center for Produce Safety Research Symposium, and published in peer-reviewed journals. Outcomes will directly assist the design, optimization, and validation of protocols used for removal of waxes, wax residues, and microorganisms from waxing roller brushes, thus mitigating microbial safety risks associated with produce waxing.

*The Center for Produce Safety* *\$254,196*  
**Evaluation of Sanitation Protocols for Non-Conventional Food-Contact Surface Materials used in Produce Packinghouses**

The Center for Produce Safety will partner with the University of Arkansas System, Division of Agriculture, to develop guidance for produce packinghouses on sanitizing hard-to-clean food-contact surfaces such as wood, vinyl, and foam. Data are lacking on the microbial risks associated with current cleaning and sanitizing practices for non-conventional, porous food-contact surfaces that may be found in very small to medium-sized and seasonal packing facilities. Also, there is a need for evidence-based sanitation standard operating procedures for these surfaces. This project will evaluate cleaning and sanitizing practices for porous food-contact surfaces and assess the risks of product contamination influenced by surface or equipment characteristics. Semi-structured interviews will be conducted with growers and Extension Specialists to





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characterize the most used porous food-contact surfaces and current cleaning and sanitizing practices. Based on these interviews, the research team will conduct laboratory experiments to assess the persistence and potential growth of bacterial pathogens and viruses on coupons of selected porous food-contact surfaces under a variety of conditions relevant to production environments and evaluate cleaning and sanitizing protocols for each of the surface materials. Data generated from this research will be used to help characterize the risks associated with porous food-contact surfaces and limit cross contamination during packing operations. Results of this study will be summarized in project reports, presented at the annual Center for Produce Safety Research Symposium, and published in peer-reviewed journals.

*The Center for Produce Safety*

**\$358,166**

**Improving Methods for the Assessment of Infectious Human Enteric Virus Survival in Produce**

The Center for Produce Safety will partner with the University of Barcelona to improve methods used to detect and measure infectious viruses in fresh produce. Detection of viruses in produce items is difficult, partly because contamination usually occurs at low levels, but also because the molecular tests currently used are time consuming, have low recovery efficiencies, and do not discriminate between infectious and inactivated viruses. This project will optimize current human norovirus (HuNoV) and hepatitis A virus (HAV) concentration and detection methods in leafy greens and berries, to increase efficiency, reduce turnaround time, and provide estimates of viral infectivity and risk of infection. Two alternative virus concentration methods based on rapid procedures will be tested and compared to the standard reference protocols currently available for virus analysis in foods. Also, the project will validate the use of a salivary gland-derived cell culture system to detect infectious HuNoV and adapt it as a novel method to determine HuNoV infectivity in produce. The optimized methods will be implemented at laboratory-scale experiments to fill critical knowledge gaps regarding detection and persistence of infectious viruses in leafy greens and berries during postharvest storage and disinfection scenarios. Results of this study will be summarized in project reports, presented at the annual Center for Produce Safety Research Symposium, and published in peer-reviewed journals.