

California Department of Food and Agriculture
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CALIFORNIA GROWN PROMOTION

California Grownifornians

\$1,539,100

The Buy California Marketing Agreement

This project will execute a multi-layered promotional program that promotes in-season California specialty crops and specialty crop products. To achieve this goal the project will integrate a digital media campaign, a retail promotion program, retail trade outreach, and an influencer event program called California Grownifornians Agritour 2020. The intended outcome of the project is an increased awareness and preference by premium paying consumers for California specialty crop products. Additionally, the project will invigorate the strong support of California specialty crops and specialty crop producers by the retail trade as well as realize a 25 percent increase in sales over the prior sales of \$4 million of California specialty crops in partnership with key California retailers.

California Food for California Kids® Culinary Academy: Enhancing Specialty Crop Preparation and Promotion in Schools

\$242,250

Center for Ecoliteracy

The Center for Ecoliteracy (CEL) will establish the California Food for California Kids® Culinary Academy to expand school markets for California specialty crops and promote student consumption of healthy fruits and vegetables. CEL will use a scalable and sustainable, train-the-trainer model in partnership with Frontier Energy to reach foodservice staff in the California Thursdays® Network, which represents 33 percent of the \$2.4 billion school meal industry. In seven workshops, foodservice staff will, 1) learn culinary techniques and plant-based recipes to enhance the flavor and student consumption of 10 specialty crops, 2) obtain new skills and resources to promote specialty crops to students, and 3) engage with marketing boards to optimize specialty crop promotion and preparation. Success in increasing awareness and consumption of specialty crops will be measured through sales in lead districts, workshop participant knowledge and intention to purchase, and taste tests with over 19,000 students.

Growing Awareness/Demand for California Grown Prunes in Prune Juice by Sharing Digestive Benefits With Consumers

\$450,000

Sunsweet Growers, Inc.

The percentage of households in the United States purchasing prune juice is only 3.5 percent [2018 Information Resources, Incorporated (IRI)] with most of those consumers 55-plus years of age; California prune growers feel the impact of this low demand. California grown juice is made largely from unpittable fruit and without juice demand this fruit must be disposed of, often at a cost. Penetration of households in the United States is low, yet there is a rise in digestive health ailments and digestive health beverage consumption by younger consumers (ages 25-45) that can be leveraged to grow sales. Sunsweet, representing 65 percent of prune sales in the United States and 200 California prune growers, seeks to boost awareness/demand for California grown prune juice by sharing value (healthy digestive traits) via a public

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relations/digital marketing campaign. The goal is to boost California grown prune juice sales 14.9 percent by 2022, by building new consumers for California prunes and demand for higher-value prune product. As a grower-owned cooperative, all earnings flow directly to California prune growers. Success will be measured by internal records and independent IRI data.

Sonoma Strong: Leveraging the California Grown Identity to Promote the Value and Quality of Sonoma Wine

\$449,444

Sonoma County Local District 3 Winegrape Commission

A decline in Sonoma County tasting room sales over the past five years has been exacerbated by consumer misconceptions and doubt about wine quality following the 2017 fires. Declines persisted in 2018. Tasting room sales are a significant portion of direct sales for most winegrape producers and wineries and low sales impact winegrape demand. Insufficient sales of recent vintages have caused cancellations of grower contracts for current grapes; vintners need to sell current inventory before making new wine. Efforts are needed now to grow new consumers and markets and combat misconceptions among existing consumers to build visits and sales. Representing all 1,800 Sonoma winegrape growers, Sonoma County Winegrape Commission will execute a campaign (ads, events, immersive experiences, and podcasts) to increase awareness of and demand for the value and quality of California grown Sonoma wine and grapes among consumers, media, and influencers. The goal is to benefit growers with an approximate 6 percent boost in winegrape sales as measured by crop reports.

Santa Barbara County Wine Retakes Los Angeles

\$380,780

Santa Barbara Vintners

California wine sales in the United States grew by 24.4 million bottles from 2014 to 2016. Yet California-produced wine is trending downward in our own backyard, California, with sales reduced by \$52.4 million or 4.3 million fewer bottles sold. Californians are buying from competitive states and countries. Santa Barbara Wine Country is impacted by this negative trend, with a 4.94 percent decline in direct sales since 2016 due to its reliance on the Los Angeles metro area only two hours away. Santa Barbara's grape growers and wineries, most of whom are family-owned businesses too small for a distributor's attention, are dependent on direct-to-consumer sales for their livelihood. A focused effort targeting the Los Angeles area is needed before California loses more ground in this large, influential market. This project will reach consumers, wine trade, and media with an integrated marketing plan concentrated over a short timeframe to maximum exposure and quickly reverse the downward trend.

Discovering California's Zinfandel Trail

\$259,113

Association of Zinfandel Advocates and Producers

Zinfandel's contribution to California's wine industry, lifestyle, and agricultural heritage is indisputable; however, Zinfandel growers and producers are struggling. As the only state-wide, single varietal trail, "Discovering California's Zinfandel Trail" guides enthusiasts to unique adventures and meaningful connections with Zinfandel growers and producers. Leveraging existing technologies, compelling storytelling, and real-world experiences, this project will improve the economics of growing and producing Zinfandel. By sharing positive attributes of

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Zinfandel winegrapes and wines (e.g., small family farms, food-pairings, and the high quality) through education, marketing, and agritourism, the project will boost direct to consumer Zinfandel wine sales by 8 percent and average bottle price by 4 percent. Benefits will translate to all California Zinfandel growers and vintners. Success will be measured using surveys and industry sales data.

Paso Robles Wine in the Big Cities

\$350,285

Paso Robles Wine Country Alliance

The United States is the largest global wine market and growing, making overseas competition fierce. To compete, California must maintain and grow market share by influencing the influencers. In the digital age, influencers are diverse (media, bloggers, retailers, sommeliers, friends, etc.) with some of the most influential located in New York, Chicago, and Washington D.C. These cities offer a huge economic opportunity for California's wine producers based on their size, consumption behavior, the concentration of wine's target audience, and growth potential. This project will reach influencers at every touch point: media, retail, restaurants, and directly through advertising and social media. By introducing and educating wine enthusiasts about the up-and-coming region of Paso Robles, California grown wine will be top-of-mind and wine sales will grow.

Expanding Access and Demand for Local Produce

\$218,254

Mandela Partners

Mandela Partners' (formerly known as Mandela MarketPlace) "Expanding Access and Demand for Local Produce" will increase food access points in underserved communities, strengthen specialty crop sales for small-scale farmers within a 250-mile radius of the communities served, and advance the competitiveness of California specialty crops in urban markets. The project will, 1) provide five Healthy Retail Network (HRN) program stores with in-depth technical assistance, support, and equipment to market and sell fresh, frozen, and lightly processed specialty crop products; 2) develop a cohesive and efficient inventory management system to expand product offerings of specialty crops that bolsters sales for 25 HRN farmers; 3) identify and train local stakeholders to lead community outreach to increase the visibility of specialty crops among select HRN corner stores; and 4) support nutrition education efforts to familiarize the surrounding community with health and wealth benefits of purchasing specialty crops from local, minority-operated farms.

California Grown Figs FIT the Needs of Product Developers

\$449,800

California Fig Advisory Board

Figs and fig products are gaining in popularity due to the fig's strong nutritional profile, functionality, and versatile flavor. In fact, Fermenich, a leading global flavor company, named fig the 2018 flavor of the year. This is a prime opportunity, and a critical one, for California fig farmers to ensure product developers are seeking out California grown figs. While California produces 100 percent of the figs sold commercially in the United States, a 57 percent increase in fig imports in 2017 versus 2016 threatens the economic viability of the California fig industry. To raise awareness and drive sales of California grown figs and fig ingredients, the California

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fig industry will run a campaign targeting food manufacturers, technologists, and chefs who influence the development of thousands of new food products each year. Success will be evaluated by increased farm gate value, actual sales, shipments, and surveys.

*California Grown Retail Promotions in Japan Featuring California
Fresh Cherries and Blueberries*

\$395,000

California Cherry Board

The California Cherry Board (CCB) and the California Blueberry Commission (CBC) propose conducting a series of California Grown retail promotions in Japan featuring fresh California cherries and blueberries. To meet price requirements, Japanese importers have shifted to purchasing lower quality fruit. This has negatively affected the reputation of California fresh fruit, leading to decreased demand and lower export volumes. By organizing large-scale promotions with Japanese retail outlets, the CBC and the CCB will increase consumer demand, demonstrating to importers the high quality and profitability of California fresh fruit. Leveraging the California Grown identity, the CCB and the CBC will highlight the availability of California cherries and blueberries as the first fresh imported fruit of the summer. Following the activity, the CCB and the CBC will collect sales data and survey importers on their perceptions of California fruit and interest in increasing purchase volumes in subsequent seasons.

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ENVIRONMENTAL STEWARDSHIP AND CONSERVATION

*Understanding the Role of Lettuce Leaf Lipid Composition in Salinity
Tolerance*

\$328,048

U. S. Department of Agriculture, Agricultural Research Service

Increasing salinity is a problem in all major lettuce growing districts in California. Lettuce is sensitive to salinity, causing reduction in yield and affecting profits. Reports in other plant species suggest phospholipids and/or fatty acid composition in leaves to be important for tolerating salinity. This project aims to perform deep lipidomic studies to analyze phospholipid and fatty acid composition in the leaves of 10 sensitive and tolerant lettuce varieties selected from a previous study. In addition, the project will screen lettuce germplasm and analyze fatty acid composition in leaves correlating with salinity tolerance and good seed germination under high salinity. An added advantage of this screen will be to identify lettuce varieties with high levels of healthy omega-3 fatty acids. The success of this project will be measured by the identification of phospholipid and fatty acid compositions ideal for tolerating salinity in lettuce, publications and citations, and outreach activities.

*Informing Vineyard Irrigation Practices Through Improved
Understanding of Grapevine Physiological Responses to Heat
Extremes*

\$427,763

The Regents of the University of California, Davis

Future climate will expose vineyards to heat events of greater frequency, intensity, and duration. Grapevine cultivars are adapted to specific growing climates, and thus, likely to respond differentially to increased heat. As growers primarily respond to extreme heat via irrigation, understanding cultivar-specific water demands will better inform grower decisions and increase water use efficiency. However, little information exists on current irrigation and cultivar-specific responses to extreme heat. Working with industry and agency partners, this project will identify current irrigation responses to heat events, model irrigation needs under future climate scenarios, and establish long-term field experiments to quantify cultivar-specific tolerances and physiological responses to heat extremes. Project outcomes will inform cultivar-specific irrigation recommendations and solicited stakeholder feedback will allow for project evaluation and co-production of future work.

*Refining Sustainable Navel Orangeworm Management in California
Almond*

\$115,230

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

Conventional and organic almond producers in California lack scientifically-based information regarding the effectiveness of spring insecticide sprays against navel orangeworm (NOW).

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This proposal addresses the question of whether targeting first-generation NOW with reduced-risk or organic insecticides, applied during spring and in conjunction with NOW mating disruption, significantly reduce damage to almond nutmeats. Research from the mid-1970s and late 1990s evaluated spring insecticide sprays. However, the development of conventional and organically-registered mating disruption, and improved monitoring tools, provide a new opportunity to develop more sustainable integrated pest management strategies for NOW. This project will conduct large-scale field trials in almond orchards under NOW mating disruption to evaluate spring applications of Intrepid (methoxyfenozide), Delegate (spinetoram), and the organically-registered insecticides, Bacillus thuringiensis (Bt) and Venerate (Heat-killed Burkholderia spp.).

Demonstration of a Pilot-Scale Sequential Direct Flame and Catalytic Infrared Dry-Peeling System for Fruits and Vegetables \$440,952

The Regents of the University of California, Davis

The need exists to develop a new peeling method for fruits and vegetables. It is needed to replace the current lye and steam peeling methods in order to improve sustainability by reducing water use and wastewater generation. An infrared dry-peeling technology based on electric emitters was successfully developed. To minimize the operation cost and improve the throughput, a lab-scale, sequential direct-flame and catalytic infrared peeling system was developed by using natural gas as an energy source and a new tomato conveying mechanism during heating. This project will further develop the technology for commercialization by demonstrating the benefits and adaptability of the new peeling technology for tomatoes through building a pilot-scale system and demonstration.

Optimizing Compost-Microbe Interactions to Enhance Drought Resilience and Nutritional Quality in Tomato Production \$397,442

The Regents of the University of California, Berkeley

Soil biology is an integral feature of soil health and has great potential to enhance resource use efficiency in specialty crop cropping systems. In tomato production, compost can improve soil health and, possibly, drought resistance. However, the effects on certain groups of beneficial soil biota depend on compost types. Tradeoffs between compost use and soil biological ecosystem services are rarely investigated. In a controlled field-trial and in participatory on-farm research, this project will study interactions of high- and low-phosphorus composts with native beneficial arbuscular mycorrhizal fungi (AMF) and commercial AMF inoculum under full and deficit irrigation. The project aims to identify practices that maximize combined benefits of compost and soil life for nutrient-use efficiency and water-use efficiency, crop quality, and soil health in tomato production. Results will be shared with growers, specialty crop stakeholders, and scientists through on-farm workshops, online media, and a bilingual information leaflet.

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*Irrigation and Nitrogen Management and Monitoring to Improve Nut
Production While Minimizing Groundwater Nitrate Leaching* \$449,675

The Regents of the University of California, Davis

Growers face new regulations to minimize nitrogen (N) fertilizer use and to monitor impacts on groundwater quality. This project addresses the issue by using high-frequency low-concentration (HFLC) fertigation in orchards and by performing an unprecedented whole orchard systems analysis of N dynamics. Three monitoring systems will be used to estimate nitrate loss to groundwater, 1) mass balance (nitrogen use efficiency); 2) water and nitrogen flux monitoring in the vadose zone; and 3) groundwater quality monitoring. Outcomes focus on developing improved systems for assessing groundwater impacts from specific practices, developing an in-field demonstration site, and outreach to at least 5,000 orchard growers, extension advisors, and regulatory and policy decision makers. Project success will be measured through model and field site documentation; N flux assessment from a fully-instrumented, commercial, 140-acre almond orchard; employing the model to demonstrate sustainability benefits of HFLC; and adoption of tools in the agricultural industry.

Improving Water Use Efficiency of Cool Season Vegetable Crops \$333,435

The Regents of the University of California, Monterey County Cooperative Extension

Water use efficiency is a key component of drought resilience and other agricultural water security aspects. This project will conduct a series of controlled, scientific experiments designed to quantify water efficiency in two high-value vegetable crops (artichoke and red cabbage). Replicated irrigation trials will be performed at the U.S. Department of Agriculture, Agricultural Research Service Salinas field station. Differing water amounts will be applied by drip irrigation as a percentage of crop water use (evapotranspiration) guided by the CropManage specialty-crop web application. Crop development, soil water content, and soil nitrate will be monitored. Aboveground biomass, marketable yield, water use efficiency, and nitrogen use efficiency will be derived. The study will improve knowledge regarding water requirements for these crops and serve to verify and further promote CropManage capability throughout the stakeholder community. Project success will be evaluated in terms of the number of growers adopting best practices.

*Water and Nitrogen Management Decision Support Tool for Asian
Vegetables (Bok Choy and Napa Cabbage) and Bell Peppers* \$320,472

**The Regents of the University of California, Santa Clara County
Cooperative Extension**

The majority of the vegetables grown in the Central Coast region of California are irrigated using ground water. Prolonged drought conditions and nitrate leaching have impacted the Central Coast groundwater aquifers. Growers now face reduced water allocations and stricter regulations to minimize nitrate leaching. Given the large number of crops produced and fields that must be managed, growers need a simple-to-use tool to guide both water and fertilizer management decisions. CropManage, an online decision support tool, is currently used by

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vegetable growers on the Central Coast to better manage water and nitrogen applications. This project will expand the capabilities of CropManage to include additional crops such as bok choy, napa cabbage, and bell peppers and enhance critical decision support algorithms. This project will also provide support to help growers integrate CropManage into their farming systems through trainings and workshops that will include evaluations to determine the adoption and benefits of CropManage.

Cover Crop Strategies to Tighten Nitrogen Cycling, Save Water, and Increase Soil Carbon in Walnut Orchards \$448,951

The Regents of the University of California, Davis

The use of cover crops increases soil carbon (C), nitrogen (N) fertility, and soil productivity, making it an appealing practice for climate change adaptation and sustainable land use. However, little information is available to walnut growers to reassess N inputs following implementation of cover cropping. The project goal is to develop management guidelines for walnut growers that use cover crops by providing information on the mineralization, distribution, and uptake of soil N, as well as water use and C sequestration. Such information is needed to predict seasonal N availability. This project will, 1) investigate the effect of cover crops on soil N transformations and water use; 2) quantify the N credits of cover crops in walnut orchards; and 3) evaluate the cost and returns of cover crop use. It is expected that N management guidelines will improve adoption of cover crops to address soil health. Extension products and education activities will inform stakeholders.

Grazing Winter Cover Crops With Sheep to Increase Adoption in Annual Vegetable Systems \$300,887

The Regents of the University of California, Davis

Despite the known benefits of winter cover crops (WCC) for improving soil health and decreasing the environmental footprint of tomato cropping systems, adoption remains low among California vegetable growers due to a lack of economic incentives. Re-integration of livestock into California vegetable systems represents an opportunity to increase adoption of WCC through the generation of income from WCC grazing while augmenting the benefits of WCCs to soil health and carbon storage, and reducing tillage. However, major knowledge barriers to grazing integration exist among California growers. This project will compare the effects of grazed WCC with ungrazed WCC and winter fallow on soil health indicators including soil organic matter, nutrient cycling, and biodiversity. It will also provide California tomato growers with information on benefits, tradeoffs, and the food safety risks of manure deposition associated with incorporating WCC and sheep graziers into tomato systems.

Optimizing Fertilization and Irrigation Recommendations in a Newly Planted Almond Orchard After Recycling \$439,570

U. S. Department of Agriculture, Agricultural Research Service

The recycling of tree biomass into the soil at the end of an orchard's life represents a sustainable alternative practice to burning or transporting debris to cogeneration plants.

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Growers may be reticent to implement whole orchard recycling (WOR) because it leads to decreased nitrogen (N) availability and negatively impacts young tree nutrition and growth. However, WOR also results in soil with enhanced moisture content and water retention, which should reduce irrigation demands and leaching loss. This project would optimize N fertilization and irrigation regimes in an experimental recycled orchard with the goal to provide growers with better guidance on managing tree nutrition and water usage and an estimate of the costs of implementing WOR. The findings will be disseminated to growers through field day events, talks, and publications. As a measure of project success, growers and orchard removal companies will be surveyed to gauge views on WOR and determine the extent of its adoption as a practice.

Development of New Walnut Drying Methods for Reduced Drying Time and Energy Usage

\$429,143

The Regents of the University of California, Davis

California produces about 690,000 tons of walnuts each year, contributing \$1.24 billion to the state's economy. However, about 3 percent of the walnuts are lost due to delayed drying. This is caused by insufficient drying facilities and the low drying efficiency of the conventional hot air-drying method of in-shell walnuts at 43°C. The low drying efficiency results from the resistance of walnut shells to moisture transfer, also leading to high drying costs. Preliminary test results have shown that when the kernels and cracked in-shell walnuts were dried by the same method, they had significantly reduced drying time (47 percent and 21 percent respectively) with corresponding amounts of energy savings, while still meeting the quality requirements of the industrial standard. The aim of this project is to develop and optimize new, efficient walnut drying methods using infrared pre-drying followed by hot air drying of walnut kernels or cracked walnuts. The technology will be disseminated for adoption.

Increasing Profitability of Fig Production in California by Increasing the Shelf Life of Fresh Figs

\$199,567

The Regents of the University of California, Merced

California ranks first in the nation in fig production. About 87 percent of the figs are processed and sold as dry figs. Selling figs as a fresh market product is desirable and profitable, but distribution is limited for growers because figs are highly perishable and have a short shelf life. Extending shelf life can increase the profitability of fig production. The preliminary studies show that application of ozone on freshly harvested figs can control weight loss and extend shelf life by an additional week. This additional time allows the growers greater flexibility in storage and shipping and could increase the market for fresh figs. The proposed method is environmentally-friendly, chemical-free, and low-cost. The project aims to develop an ozone generator that can be used in the field or in storage and to determine optimal application parameters, such as ozone concentration and application duration. Evaluation of this method will also include recording the shelf life of the sample in the following year.

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EQUIPPING CURRENT AND NEXT GENERATION SPECIALTY CROP FARMERS

*Southeast Asian Small Farmers/Businesses Capacity Building Project:
Building Networking and Training Opportunities* \$100,000

Asian Business Institute & Resource Center

The Asian Business Institute & Resource Center's (ABIRC) mission is to assist Southeast Asian (SEA) business owners through access to resources, business and financial plans, marketing assistance, non-traditional loans, workshops conducted in various languages, networking, advocacy for small businesses, certifications for various contractual opportunities, and other means of building capacity within the SEA Asian business community. ABIRC will convene three networking opportunities for SEA small specialty crop farmers with potential buyers, conduct an ethnic media outreach program, and perform community outreach and training activities. ABIRC will work directly with SEA, small specialty- crop farmers through a case management system to monitor the number of new careers created and, jobs maintained or created as a result of project efforts.

*Bee Where, Geographic Information System Technology to Protect
Pollinator Populations for Specialty Crops* \$90,000

California State Beekeepers Association

Many California specialty crops use pollinators; thus, bee health is important to these crops. Even with new regulations requiring beekeeper registration in order to track and monitor their locations, communication is limited and slow between beekeepers, pesticide applicators, pest control advisors, and county agricultural commissioners, which can lead to bees accidentally being sprayed by pesticides. A new tool called Bee Where, a web-based geographic information system, brings these groups together by electronically mapping hive locations across the state. Bee Where allows beekeepers to register and plot the location of their hives electronically thereby informing relevant pesticide applicators, pest control advisors, and agricultural commissioners. This project will implement extended education training programs with industry partners, creating awareness and usage of Bee Where among beekeepers and pesticide applicators with the goal of protecting specialty crops and their pollinators.

*Developing Orchard Crops and a Vineyard Management
Apprenticeship Program to Train Beginning Farmers and a Skilled
Workforce* \$421,873

Center for Land-Based Learning

The Orchard Crops and Vineyard Management Apprenticeship Program's goal is to create an effective, structured pathway to develop a skilled workforce and educate beginning farmers to replace aging farmers and farm managers. Through a combination of classroom instruction and on-the-job training, apprentices will get knowledge of crop production, processing,

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management, and marketing. Mentor farmers will host the apprentices and provide them with on-the-job training that will provide comprehensive field experience. Industry and grower associations will assist to identify needs and build a network of mentor farmers. The National Center for Appropriate Technology will develop Spanish language resources and workshops to encourage socially disadvantaged farm workers to take part in this program. A robust evaluation plan (pre- and post-surveys, interviews, and apprentice tracking) will be used to measure project success.

California Specialty Crop Small- and Medium-Scale Farm Food Safety

Technical Assistance Program

\$281,231

Community Alliance with Family Farmers

According to 2012 agricultural census data, 22,472 farms in California need to be in compliance with the Food Safety Modernization Act (FSMA). Of those, 75 percent are small- (less than \$250,000 in gross sales) and medium-scale (less than \$500,000 in gross sales) produce farms. There are another 2,300 farms in California that are qualified exempt under FSMA and also need assistance. Community Alliance with Family Farmers (CAFF) will provide 680 California specialty crop producers with direct FSMA technical assistance and provide all farmers access to helpful resources. CAFF will train growers through a suite of methods: in-person workshop trainings, farmer field days, webinars, podcasts, a six-week e-course, and creation of practical resources. CAFF will track milestones completed with a subset of farmers and evaluate increased farmer knowledge through pre- and post-evaluations. The project will be successful if it reaches 680 farmers through in-person and electronic training and at least 75 percent of them increase their food safety knowledge.

Technical and Leadership Training: Preserving Jobs and Maintaining

Winegrape Competitiveness

\$96,609

Lake County Winegrape Commission

The labor shortage in the winegrape specialty crop industry is one of the biggest challenges facing winegrape growers today, according to the 2018 Wine Business Monthly Vineyard Survey Report. Seasonality of work, immigration laws, and competition from other industries has increased pressure on vineyard labor. Investing in Spanish-language training is vital to retaining a technically skilled workforce and ensuring the competitiveness of winegrapes. This project will foster job retention with hands-on technical and leadership training for crew leaders, labor law and human resources training for vineyard supervisors, career awareness for high-school students, and a website portal featuring Spanish-language educational materials and training resources. The goals of this project are to retain skilled workers in the winegrape industry and to introduce career opportunities to the next generation. Success will be measured through participant surveys and employer surveys on training and job retention.

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*Investing in Conservation Practices through a Farmer Demonstration
Network to Make California Specialty Crops Thrive* \$306,541

California Association of Resource Conservation Districts

Conservation agriculture has been shown to increase crop yields and promote climate change resiliency, making it critical to the long-term agricultural sustainability, competitiveness, and marketability of California's 400 specialty crops. There is a need to increase the adoption rates of conservation practices among specialty crop growers statewide in order to further enhance the specialty crop industry. The project will promote greater adoption and information sharing of conservation practices by new and existing specialty crop producers and will enhance the competitiveness of specialty crops by increasing the adoption of practices that improve the quality of soil health, water, climate, and nutrient smart systems for California's specialty crop production. This will be achieved by supporting the number of statewide on-farm demonstration events about conservation tools and practices, creating an opportunity to convene and train farmers, technical assistance providers and researchers, and creation of a website to increase access to information about conservation tools for the specialty crop industry.

*Seeds of Success: Training Beginning California Organic Specialty
Crop Seed Producers in Business and Marketing Skills* \$266,521

Organic Seed Alliance

Organic specialty crop seed sales are projected to exceed \$1.5 billion by 2024. California is the leading vegetable seed producing state because of its ideal microclimates. California producers can satisfy a large part of the organic specialty crop seed market while also helping meet organic specialty crop producers' seed needs. This project will help beginning and potential organic seed producers overcome economic and business challenges by providing, 1) seed business and economics courses and tools and 2) training on how to market to seed buyers and how to build up-stream demand from chefs and consumers. Over 300 beginning producers will benefit, with a net benefit of over \$400,000. Project success will be assessed through feedback and increases in revenue and jobs as measured by pre- and post-survey tools.

*Scaling the Adoption of Environmentally Responsible Almond Farming
Through Data-Driven Outreach, Training, and Tools* \$286,770

Almond Board of California

Market demand for California almonds increasingly includes environmental sustainability in addition to price and quality. To address this need, the Almond Board of California (ABC) has established four environmentally responsible farming goals which include, 1) increase the adoption of environmentally friendly pest management tools, 2) increase water-use efficiency, 3) achieve zero waste in orchards, and 4) reduce harvest dust. This project will implement a coordinated set of formal, social, and experiential learning opportunities for growers through workshops, field-days, printed media, and digital tools focused on integrated pest management, water use efficiency, biomass and soil health, and harvest dust reduction. The

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success of outreach and training will be documented and evaluated through growers' in-person participation in events, use of the ABC's California Almond Sustainability Program online platform, and the number of completed orchard assessments of environmentally responsible management practices.

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SPECIALTY CROP ACCESS AND NUTRITION EDUCATION

Watch Us Grow

\$100,000

African American Farmers of California

The “Watch Us Grow” project will blend together, with a full ground-to-table approach, healthy eating and local farming through year-round curriculum lessons, activities, and food tastings for young people from underserved communities. This project will aim to improve access to, and knowledge and consumption of, specialty crops from locally sourced farms in Fresno, Madera, Alameda, and Kern counties. The planting of specialty crops will teach children and parents the benefits of consuming specialty crops such as black-eyed peas for addressing obesity, diabetes, and heart disease issues. Participants will plant and grow specialty crops through demonstration events on the African American Farmers of California 20-acre farm and smaller urban farms in Fresno County. Participants will also learn about the nutritional benefits of consuming the specialty crops that they helped grow through outreach events that include demonstrations and recipe development. The program will be provided to school districts, reaching 275 students and 50 adults. Project success will be measured by changes in knowledge of and interest in consuming more specialty crops, as measured by surveys of Watch Us Grow Project participants.

*Increasing Health Awareness within the Sacramento Regional Native
American Community of California Specialty Crops*

\$100,000

California Indian Manpower Consortium

The California Indian Manpower Consortium, Inc. (CIMC) was formally created in 1978 under state law as a nonprofit corporation for the purpose of working for the social welfare and educational and economic advancement of its member tribes, groups, organizations, and Indians and other Native Americans living in its service area. The goal of this project is to increase awareness and consumption of specialty crops within the Californian Native American community through culturally-appropriate events, workshops, and educational materials. By utilizing the Sacramento Native American Health Center and CIMC’s social and health programs and effective statewide communication network (social media and traditional), CIMC anticipates reaching 400 Native American community members during the one-year project. The plan for evaluating and measuring the success of the project will include tracking event registration and educational literature distribution, enrollment numbers, social media and membership articles accessed, sign-in sheets, pre- and post-surveys, meals prepared, and workshop evaluations.

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*Health Centers: Partners for Increasing Access to Fruits, Vegetables,
and Culinary Education* \$93,776

CommuniCare Health Centers

CommuniCare Health Centers (CCHC) is a Federally Qualified Health Center, a designation conferred by the U.S. Department of Health and Human Services on community-based organizations that provide comprehensive health care services regardless of ability to pay. As part of an ongoing effort to support patients' holistic health, CCHC conducts wellness initiatives that empower patients to prevent disease and to successfully manage existing conditions. The wellness team coordinates Group Medical Visits (GMVs) that bring together patients who share a chronic disease diagnosis, a medical provider, and health educators to inspire social support, develop knowledge and skills for disease management, and improve patient access to medical care. CCHC will increase the consumption of fruits and vegetables among low-income patients by incorporating culinary education into existing GMVs. The culinary education will include culturally-relevant weekly cooking classes offered in conjunction with GMVs at each of three clinic sites and at an outdoor classroom 40 weeks per year, and monthly food demonstrations in clinic waiting rooms to promote cooking class participation while introducing tasty dishes that emphasize fruits and vegetables. Waiting room food demos will be monitored via satisfaction surveys, and cooking class participants will complete assessments at their first and fourth GMV to measure changes in knowledge, attitudes, behaviors, and skills. Electronic Health Record data will provide clinical data.

*Building Bay Area Cooperation for Urban Specialty Crop Production,
Market Access, and Nutrition Equity* \$100,000

Acta Non Verba: Youth Urban Farm Project

This project will be conducted as a collaborative partnership between Acta Non Verba: Youth Urban Farm Project and the Multicultural Exchange for Sustainable Agriculture (MESA) to work together to serve socially disadvantaged and beginning urban specialty crop growers. MESA will add momentum to increase capacity for beginning specialty crop growers and availability of specialty crops in the target communities of Oakland, Berkeley, El Sobrante, and/or Richmond. A collaborative monitoring and evaluation process will include, 1) the initial needs assessments to develop the baselines for consumers and participants, 2) the production and supply of, and access to specialty crops, 3) the number of individuals (youth and adults) reached, and 4) the quality of reach with identified core competencies for the learning programs.

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*Promoting Specialty Crops by Training Retailers, Mobile Vendors,
and Educating Community Members* \$100,000

The Center at Sierra Health Foundation

The Center at Sierra Health Foundation is an independent 501(C)(3) nonprofit. The Center brings people, ideas and infrastructure together to create a collective impact that works to eradicate health inequities across the state and especially within the San Joaquin Valley. The Center at Sierra Health Foundation will serve as the fiscal agent for Cultiva La Salud, which is a public health advocacy organization based in Fresno, CA. Its mission is to engage, inform, and inspire residents of the San Joaquin Valley to become actively involved in promoting their health, the health of their families and the broader community through policy, system and environmental improvements that promote healthy eating and active living. The project will increase access to produce grown by local socially disadvantaged specialty crop farmers by making the produce available in underserved neighborhoods. The project will also provide education on specialty crops to disadvantaged community residents. These two goals will be accomplished by training mobile food vendors who will sell locally grown specialty crops and provide needed community education.

Growing a Vibrant East San José from its AgriCultural Roots \$98,927

Veggielution

Veggielution’s mission is to connect people from diverse backgrounds through food and farming to build community in East San José, CA. The programs expand opportunities for East San José residents to rebuild their local food system. Each year, Veggielution grows over 30,000 pounds of produce using pesticide-free and sustainable growing practices. All of the produce grown is distributed to local residents through channels that include a farm stand, cooking classes, middle school field trips, and Veggie Vouchers (veggie “prescriptions” issued by local pediatricians). Through the project Growing East San José from its AgriCultural Roots, Veggielution will increase consumption and raise awareness of the nutritional benefits of ethnic specialty crops among San José residents through various programs and marketing channels. Project success will be evaluated and measured through surveys, focus groups, and one-on-one conversations with adults and youth about the knowledge they have gained about specialty crops, their intention to eat them, and their reported consumption of these foods. Project success will also be measured by the number of additional ethnic crops added to the crop plan during the two-year grant period.

*Cooking Matters: Increasing Fruit and Vegetable Consumption Through
Cooking Classes and Market Tours* \$300,000

18 Reasons

This project will increase awareness and consumption of California-grown specialty crops through Cooking Matters cooking and nutrition education programs for low-income community

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residents. Cooking Matters includes one-time market tours as well as a six-week, cooking-focused nutrition education series. The project will reach 9,000 Cooking Matters participants over the grant duration. In each class, participants will prepare and eat healthy fruit- and vegetable-based recipes. Tours focus on how to purchase, prepare, and store specialty crops. Classes and tours are led by peer educators from the community who have completed a training series with 18 Reasons. Success of the program will be evaluated with matched pre- and post-surveys completed by each graduate that measure changes in fruit and vegetable consumption.

Enhancing Specialty Crops Through Farmer Training and School-Based Education

\$405,846

International Rescue Committee, Inc.

This project will provide on-the-job farmer training for beginning refugee farmers and increase access to, education about, and consumption of California specialty crops in Yolo County annually at twelve participating Yolo County schools' Kids Farmers' Markets. The project has three core activities, 1) providing advanced on-the-job farmer training to six refugee farmers to produce specific commercial quality specialty crops; 2) providing outreach and education on the health benefits, preparation methods, and how to access specialty crops to underserved children and families; and 3) teaching school-aged children about growing and consuming specialty crops via school gardens. The project will track consumption of specialty crops at participating schools.

Solano County Farm-to-Institution and Public Education Project

\$238,524

Sustainable Solano

Sustainable Solano is creating an environmentally and economically sustainable, value-driven, community-based, local food system to ensure the economic viability of farms and create a stronger market for specialty crops in Solano County. A key part of this vision is increasing awareness, consumption, and sales of specialty crops grown by Solano farmers. The project has four interrelated parts, 1) develop a comprehensive information hub of specialty crops, farmer profiles, and materials to promote Solano-grown specialty crops; 2) build a foundation for in-house hospital kitchens and culinary professionals (restaurants/caterers) to introduce 1-2 seasonal specialty crops per month; 3) expand the current local food public education program, "What's for Dinner?", to increase knowledge on health benefits, sourcing, and preparation of specialty crops; and 4) showcase local farms and crops through agritourism and Bounty of the County events.

Increasing Specialty Crop Access and Consumption in Low-Income and Low-Access Bay Area Communities

\$441,960

Fresh Approach

This project will create a healthier food environment to promote increased consumption of California specialty crops in San Francisco Bay Area communities defined as low-income/low-access by the U.S. Department of Agriculture (USDA). USDA Economic Research Service

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data for 2015 showed that 20 percent of census tracts in the cities that Fresh Approach serves are low-income/low-access. Fresh Approach will employ overlapping strategies to increase specialty crop consumption throughout the urban Bay Area. The project will offer low-income residents nutrition and cooking skills that reinforce ways to eat specialty crops on a tight budget; increase the locations that specialty crops can be purchased by adding mobile farmers' markets; and increase the number of traditional farmers' markets that provide nutrition incentives for low-income customers - creating new outlets for specialty crop farmers and increasing the number of customers who shop for specialty crops. Success will be measured by increased specialty crop sales and consumption.

*Eating Right From the Start - Increasing Consumption of Specialty
Crops in Low-Income Communities*

\$75,431

Sacramento Neighborhood Housing Services Inc.

NeighborWorks Sacramento will increase specialty crop sales and specialty crop consumption at two farmers' markets in Oak Park, a racially diverse community with high rates of poverty and health challenges. This project will reach low-income families that have not traditionally been farmers' market customers and encourage them to improve healthy eating habits to become lifetime specialty crop consumers. The "Eating Right From the Start" campaign will include fun, child-friendly, interactive education activities, including the popular "Passport Play" specialty crop nutrition education activities, family tours at local farms, and tours of the farmers' market. The project will also add new sales outlets for specialty crop farmers, link farmers with local grocery stores and restaurants, and provide training, resources, and support to help farmers be prepared and positioned to take advantage of these opportunities.

*Developing Sustainable Farm to Institution Market Coordination in
San Diego County*

\$342,429

Community Health Improvement Partners

Community Health Improvement Partners (CHIP) has cultivated strong relationships with San Diego County growers and institutional buyers. These farm to institution relationships were built through CHIP's food service collaborative groups that have catalyzed increased procurement of California-grown specialty crops. In the 2016-17 school year, San Diego County schools procured \$6 million of California-grown specialty crops. However, per the 2018 San Diego Grower Needs Assessment, farmers face major challenges to business viability due to a lack of farm business planning, regulatory, and crop planning support. CHIP will coordinate San Diego specialty crop supply with institutional demand to increase access and consumption, using CHIP's food service groups to specify product demand and local grower sessions to adjust supply. Intertwined with this, experts in farm business planning, regulations, and crop planning will support growers sustaining profitability.

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Expanding Education and Knowledge of Fermented Fruits and Vegetables

\$213,051

The Regents of the University of California, Davis

Consumer and food processor education is needed on the safe preparation of specialty-crop fermented foods and incorporation of these foods into healthy eating habits. The current lack of educational resources and information is detrimental to specialty crop market growth. This project will provide up-to-date, educational materials and trainings supported by new research on the nutritional and bioactive properties of live-culture, specialty-crop fermented fruits and vegetables. Project outcomes will be print and electronic materials, workshops for consumers, new or improved methods for fermented food processors, and new data on these foods. Success of this project will be measured by learning and behavior change among consumers and commercial processors. This project benefits specialty crop growers and processors by increasing consumption, access, and awareness of specialty-crop foods in the context of healthy diets.

Expansion of the Riverside Unified School District Food Distribution Hub

\$432,861

Riverside Unified School District

The Riverside Unified School District has leveraged their successful Farm-to-School program and established relationships with local growers to develop the Food Hub serving small school districts, childcare centers, and restaurants. The Food Hub has sold \$1.5 million of California grown produce to date and is well positioned to expand to new markets. This project will increase the Food Hub's long-term sustainability by expanding its customer base to additional buyers in Riverside and San Bernardino counties, including additional school districts, charter schools, colleges and universities (seeking to comply with the University of California's goal of procuring 20 percent of food from sustainable sources), childcare centers, and hospitals. This project will also evaluate and disseminate outcomes and lessons learned regarding expansion and replication of this model to other interested parties, including large school districts.

Stanislaus Grown's Farm-to-School-to-Community - Nutrition and Specialty Crop Education

\$200,931

East Stanislaus Resource Conservation District

The "Stanislaus Grown's - Nutrition and Specialty Crop Education" program will enhance marketability and consumption of specialty crops by connecting producers with schools, schools with educational programs, and educational programs with parents and the community to create an integrated farm-to-school-to-community system. The program will build upon existing outreach such as Harvest of the Month, Junior Chef at the Market, and the Regional Food and Nutrition Network by incorporating specialty crop specific curriculum and activities that reinforce the importance of eating fresh, locally grown fruits and vegetables. The program's integrated approach will include, 1) producer outreach to develop a procurement list

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for schools; 2) school outreach to develop farm-to-school implementation kits; 3) educational outreach to provide farmer profiles and cooking lessons for students; and 4) community outreach to provide community gardens for farmers, schools, students, parents, and educators to work together.

*Technological Innovations to Increase Specialty Crop Consumption
Among CalFresh Participants*

\$443,422

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

This project will increase demand for consumption of specialty crops among San Diego County's CalFresh participants by utilizing the County's new text messaging system to provide all CalFresh participants with information about, 1) the benefits of consuming specialty crops; 2) affordable, seasonal specialty crops; and 3) how to select, store, and prepare specialty crops. The project will reach tens of thousands of San Diego County CalFresh participants. The partnership between the University of California, San Diego Center for Community Health and the University of California, Division of Agriculture and Natural Resources Nutrition Policy Institute offers a unique opportunity to test and replicate an innovative technology-based model for promoting specialty crops and providing nutrition education statewide and beyond.

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PLANT HEALTH AND PEST MANAGEMENT

*Control of Overwintering Olive Fruit Fly Through Soil Applied Insect
Pathogenic Fungi*

\$142,645

The Regents of the University of California, Davis

Olive fruit fly (OLF) is the most important insect pest of California olives. Fruit infestation can reach 100 percent if not treated. An estimated 63 percent of olives grown in California are susceptible to OLF with potential losses of over \$120 million. OLF is primarily managed with a single product, GF-120 spinosad bait, for which resistance is well documented. Control costs are significant and increasing. Danitol, the alternative insecticide, causes secondary pest outbreaks. This project proposes to evaluate insect pathogenic fungi (IPF) that are commercially available and sustainable as a control for overwintering OLF. A similar strategy has shown promising results in Spain. The project will test, 1) the efficacy of IPF products in killing overwintering OLF in the field, 2) persistence of IPF in orchard soil, and 3) IPF compatibility with fungicides used to control olive knot. Project success will be evaluated by determining impact of IPF on OLF populations through lab studies and field trials in commercial orchards.

*Synergizing Biocontrol of Asian Citrus Psyllid and Other Sap Sucking
Citrus Pests*

\$416,183

The Regents of the University of California, Riverside

The Argentine ant (AA) has formed mutualisms with sap sucking pests (SSP) in citrus, including Asian citrus psyllid (ACP), the vector of *Candidatus Liberibacter asiaticus* (CLAs) that causes the lethal citrus disease Huanglongbing (HLB). HLB is not in commercial citrus. Ants protect more than 85 percent of SSP and over 55 percent of ACP from natural enemies (NE) and are rewarded with honeydew. AA exacerbates pest infestations. Sprays for AA and SSP kill NE which cause secondary pest outbreaks and increase resistance. Biocontrol of ACP and SSP can be synergized through three management practices, 1) monitoring AA activity with infra-red sensors (IRS), 2) controlling AA with biodegradable hydrogel beads (HGB) infused with 25 percent sucrose water and 0.0001 percent insecticide, and 3) floral resources that provide food to NE that attack SSP. This project proposes to evaluate the impacts of orchard-wide management of AA with IRS, HGB, and floral resources on biocontrol of ACP and SSP in citrus orchards.

*Landscape Engineering to Manage Beet Leafhoppers Vectoring Beet
Curly Top Virus in Tomato and Other Specialty Crops*

\$229,503

The Regents of the University of California, Davis

This project proposes innovative and sustainable management of beet curly top virus (BCTV), a major disease in specialty crops (including tomato), which is vectored by beet leafhoppers (BLH). This project will demonstrate that barley planted as a trap crop next to tomato fields can significantly decrease the risk of BCTV outbreaks. Barley is an ideal trap crop for BLH

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because, 1) there is strong preliminary data showing that barley is significantly more attractive to BLH than tomato, 2) BCTV cannot replicate in barley, and 3) barley is easy to plant and grow in plots or strips adjacent to tomato fields. Different barley planting strategies (when to plant, fertilize, and irrigate) will be experimentally tested to optimize the use of barley as a trap crop. A risk warning decision support tool will be developed based on modeling of immigration by BLH from overwintering sites into tomato fields. Project outcomes will be disseminated via hands-on presentations and contributions to University of California's Integrated Pest Management website.

Evaluation of Ribonucleic Acid Interference-Based Resistance in Almond and Walnut Rootstocks Against Phytophthora Pathogens \$388,377

U. S. Department of Agriculture, Agricultural Research Service

Phytophthora root and crown rots cause serious losses to California almond and walnut nurseries and nut producers, reduce the efficiency of soil and water use, and require costly prevention and remediation. Optimally adapted almond and walnut rootstocks with resistance to Phytophthora and other key pests are urgently needed, but it will be slow and challenging to develop them using only conventional breeding. This project's goal is to facilitate rootstock improvement for resistance to Phytophthora via ribonucleic acid interference-based, host-induced gene silencing (HIGS). HIGS resistance can be stacked with other traits and its effectiveness has been demonstrated against walnut crown gall disease and root-lesion nematodes. Over 80 transgenic walnut lines carrying HIGS constructs for Phytophthora have already been created and almond embryo lines suitable for HIGS insertion have already been developed. Success of this project will be measured by the number of Phytophthora-resistant walnut lines and HIGS-transformed almond lines it generates.

Mitigation of Huanglongbing Using Bioinoculants Developed With Strain Level Metagenomics of the Citrus Microbiome \$448,406

The Regents of the University of California, Riverside

Plant health is a function of the activities of its resident microbiome. This project's objective is to derive beneficial citrus bioinoculants (microbes) from the citrus microbiome as a sustainable management tool for Huanglongbing (HLB). The key for developing successful bioinoculants is to seek candidates in the same niche (host) as the pathogen. Studies of a phenomenon in Florida show that citrus groves with severely symptomatic trees also contain trees that have slower HLB progress, referred to as survivor trees. Microbes have been identified and found to be associated with these survivor trees. This project will infer comparisons between California and Florida citrus microbiomes with strain level specificity using a new metagenomic tool, ProxiMeta Hi-C Metagenome Deconvolution. This will guide development of specific strains as bioinoculants and allow for selection of microbes with a high likelihood of success in the ecological niche of California.

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Enhancing Diagnostics of Regulated Root-Knot Nematodes in Specialty Crops

\$63,761

California Department of Food and Agriculture

This project will develop and apply recombinase polymerase amplification (RPA) technology as a novel molecular tool for rapid diagnostics of root-knot nematodes (RKN) *Meloidogyne hapla*, *M. incognita*, *M. javanica* and *M. arenaria*, which are pests of many specialty crops in California. The RPA technique has some clear advantages over polymerase chain reaction (PCR), 1) it does not require any DNA extraction steps, 2) it does not require thermal cycling, and 3) amplification products may be detected at end-point or in real-time (15-20 minutes), even in field conditions. Molecular diagnostic protocols dealing with the technique will be available to the state, private nematology laboratories, and farm advisers. The method will provide substantial improvements in time and costs over existing diagnostics based on a PCR approach, does not require any training, and the tools developed will significantly enhance the accuracy and early detection of RKN.

Discovering Contributors to the Walnut Replant Problem Using Diverse Rootstock Genotypes Before Commercial Release

\$429,551

The Regents of the University of California, Riverside

California produces almost all of the walnuts in the United States with an annual farm gate value of approximately \$1.6 billion (2017). When orchards are replaced after 35 to 40 years, the replanted walnut trees often grow unevenly and lack vigor. These impediments can be caused by infestations from root lesion nematodes and poorly understood soil-borne microbes, resulting in the “replant problem” (RP). Methyl bromide was highly effective in mitigating this disorder. After Methyl bromide was banned in 2005, mixes of 1,3-D and chloropicrin provided some relief, but had use restrictions and included the risk of gassing-off of volatile organic compounds. A selection of *Juglans* rootstocks planted to non-fumigated and fumigated replant soil at two locations will be used to examine the following objectives, 1) test novel walnut rootstocks for their tolerance to RP and 2) decipher microbial components of RP-rootstock interactions. Determining the cause of RP will improve rootstock selection and design of mitigating tools.

Developing Innovative Detection Tools and Cultural Solutions to Minimize Economic Damage of Fusarium Wilt in Tomato

\$169,982

The Regents of the University of California, Davis

Fusarium wilt caused by *Fusarium oxysporum* f. sp. *lycopersici* race 3 (Fol3) is one of the most destructive diseases to the California tomato processing industry. Existing crop rotation practices provide ineffective control because, as revealed in recent studies, many crops cryptically host Fol3 and may allow pathogen persistence. Resistant cultivars have become available but with high soil pathogen loads, the risk of resistance-breaking strain emergence is high. To mitigate disease impacts the project proposes to develop, 1) soil testing tools to demystify inoculum loads in soil prior to planting and 2) Fol3-suppressive crop rotations. This project will transfer new technologies to private labs, provide diagnostic training, and promote

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adoption through outreach efforts. Success indicators include the number of companies offering soil testing, the number of first detectors trained, and the number of producers using soil testing and following recommendations.

*Detection, Biology, and Management of the Expanding Whitefly-
Transmitted Cucurbit Virus Disease Complex in California* \$192,228

U.S. Department of Agriculture, Agricultural Research Service

The whitefly- (*Bemisia tabaci*) transmitted virus (WTV) and the Cucurbit yellow stunting disorder virus (CYSDV) have impacted production of California melon and watermelon in the Imperial Valley and other desert regions since 2006. It has also eliminated fall cucurbit production due to high whitefly and virus pressure. Recently, CYSDV-resistant melon varieties have become commercially available and may allow the return of summer and fall melon production in these regions. However, in 2014, a new WTV, Squash vein yellowing virus (SqVYV), emerged which caused the collapse of watermelon vines. Further, in 2018, Cucurbit chlorotic yellows virus (CCYV) was identified with symptoms identical to those of CYSDV. Resistance to CYSDV is not effective against SqVYV or CCYV. This project will develop a universal detection system to rapidly differentiate all three viruses, add to the knowledge of virus biology, and lead to improved management. Information and tools will facilitate resistance breeding for these new WTVs.

Remote Sensing-Assisted Scouting of Virus Infections in Vineyards \$279,757

California State University, Fresno

With 880,000 acres, California has the most vineyards in the United States (80 percent). The cost of virus infections per acre, in vineyards with an average lifespan, ranges from \$10,000 to \$16,000. Early, accurate, and cost-effective detection and eradication of infected plants is crucial to manage pathogen spread and to limit the economic impact, as there is no cure for viruses in the field. Chemical control of insect vectors of viruses has limited efficacy and is often not an option in organic agriculture. Supported by preliminary data, this project seeks to demonstrate that remote sensing coupled with machine-learning can be used to detect major grapevine diseases (red blotch and leafroll) more efficiently than traditional methods. It is anticipated that the new tools will be adopted by commercial companies and be made readily available to growers or included in decision-support systems.

*Identifying the Basis of Lettuce Drop Resistance to Develop Cultivars
With Superior Resistance* \$430,677

U.S. Department of Agriculture, Agricultural Research Service

Lettuce drop is an economically important soil borne disease of lettuce. It is caused by two fungal pathogens, *Sclerotinia minor* and *S. sclerotiorum*, and results in the total collapse of the entire plant before harvest. Fungicides and cultural methods have traditionally been used for lettuce drop control with unsatisfactory results. The incorporation of genetic resistance in lettuce drop management would provide a sustainable approach to the loss of produce. To complement prior research, this project proposes to evaluate disease symptoms, quantitative

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phenotyping, and tissue composition to incorporate the findings in breeding. The success of the project will be measured by the number of new diagnostic techniques developed for detecting lettuce drop resistance.

Ground Cover Strips in Pistachio to Control Stink Bugs and Leaffooted Bugs Through Improved Bio-Controls and Monitoring \$289,073

The Regents of the University of California, Berkeley

Though once virtually pest free, pistachios are now attacked by a variety of insect pests including true bugs, commonly grouped as small and large bugs. Large bugs include stink bugs and leaffooted bugs that can use their large needle-like mouthparts to penetrate the pistachio shell throughout the season. Currently, pesticide applications are the most common control. The goal of this project is to test novel, irrigated strips of ground covers (shown to reduce weeds in organic farms) and determine if they can be employed to improve large bug monitoring, increase the abundance of natural enemies to large bugs, and/or hold large bugs away from the pistachio canopy to reduce damage. Field samples will be taken during the project to catalog large bug numbers, crop damage, and develop the monitoring and control programs. Measures of success include an accurate description of the pros and cons of the system, a reduction in pesticide sprays, and greater adoption by other stakeholders.

Characterization of Resistance to Verticillium Dahliae Races 1 and 2 for Improved Iceberg Germplasm Development \$262,518

U.S. Department of Agriculture, Agricultural Research Service

Verticillium dahliae is highly destructive to lettuce production and total losses of crisphead-types are high. Genetic resistance is the most economical and environmentally sound control method. Complete resistance to Race 1 isolates of V. dahliae is conferred by the single, dominant gene Vr1, but only partial resistance has been identified for Race 2 isolates of V. dahliae. The Vr1 gene is currently effective in many commercial fields but Race 2 isolates of V. dahliae are being introduced on spinach seed, a common rotation crop with lettuce. Therefore, characterization of resistance to Race 2 isolates of V. dahliae and development of improved lettuce germplasm is imperative. The project objectives are to, 1) combine Vr1 and resistance genes with Race 2 isolates of V. dahliae into a single genotype, 2) identify the most resistant lines from partially-resistant crosses, and 3) develop improved crisphead-type lettuce germplasm. Success will be indicated by releasing new lettuce germplasm, publications, citations, and requests for seeds and information.

Preemptive Development of Management Strategies for Branched Broomrape: An Emerging Threat to California Specialty Crops \$334,651

The Regents of the University of California, Davis

Re-emergence of branched broomrape (Phelipanche ramosa), an A-listed quarantine pest, is a threat to the California tomato industry and could threaten several other specialty crops. Yet California is lacking management solutions to cope with this difficult-to-control weed. The goal of this project is to develop preemptive solutions for detection, containment, management, and

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eradication of *P. ramosa* before it disrupts the viability of the tomato industry and other specialty crops. As broomrape is hidden underground for most of its life, this project will test hyperspectral remote sensing to discriminate broomrape infected and non-infected plants for rapid detection of infestation foci. To prevent seed dispersal, the project will test machinery sanitation methods and assess a sustainable fumigation practice, biosolarization, to eliminate soil seedbank. The project will recalibrate the Israeli-developed decision support system, called PICKIT, to equip California growers with the most effective *P. ramosa* management tool.

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FIXED AMOUNT AWARDS: 1) MEETING THE STANDARDS FOR THE U.S. FOOD AND DRUG ADMINISTRATION'S FOOD SAFETY MODERNIZATION ACT AND 2) PROVIDING TECHNICAL ASSISTANCE TO ADDRESS WORKFORCE CONCERNS THROUGHOUT THE SPECIALTY CROP SUPPLY CHAIN

Bridging Knowledge Gaps for the Control of Microbial Hazards on Dried Fruits During Food Safety Modernization Act Implementation \$149,955

The Regents of the University of California, Davis

The Produce Safety rule and the Preventive Controls for Human Food regulation have significant impacts on California specialty crops. California dried fruit producers, the leading dried fruit producers in the United States, are facing dramatic challenges due to the lack of literature about pathogen behaviors on dried fruits and the lack of standards used to conduct microbial studies to validate processing protocols. These knowledge gaps have hampered the development of food safety plans and there is an urgent need to address them. This project will bridge knowledge gaps by systematically evaluating the behavior of microbial hazards on dried fruits during storage and establishing reference protocols for the preparation of artificially contaminated fresh and dried fruit samples for validating different thermal and non-thermal treatments without impacting a products' chemical and physical properties. Outcomes will ensure the safety and enhance the competitiveness of California dried fruits.

Small-Holder Organic Produce-Growers Educated on Food Safety Modernization Act Requirements (SHOPER) Project \$149,999

Agriculture and Land-Based Training Association

Food Safety Modernization Act (FSMA) Produce Safety rule compliance requirements present a new and complex obstacle to start-up, small-holder Latino farm owners and agriculture professionals in a highly competitive specialty crop industry. Learning and adhering to these standards is key for small-scale farmers to survive and thrive in this new era of food safety regulations. Leveraging eight years of experience providing food safety assistance to beginning farmers, the Agriculture and Land-Based Training Association (ALBA) will address small-holder-farmers' urgent need for FSMA compliance assistance. Furthermore, the project will extend services to a greater number of specialty crop farmers and workforce participants.

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“Small-Holder Organic Produce-Growers Educated on Food Safety Modernization Act Requirements (SHOPER)” will provide intensive training and compliance assistance to 50 farmers on ALBA’s 100-acre organic berry and vegetable farm. The project will provide mandatory FSMA training to an additional 150 regional farmers and agriculture workers and distribute food safety tools and information to hundreds more statewide through ALBA and partner networks.

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FOOD SAFETY

*Verification and Validation of Environmental Monitoring Programs for
Biofilm Control in the Packinghouse*

\$190,789

The Center for Produce Safety

The Center for Produce Safety will partner with Clemson University to develop informational tools for environmental sampling and sanitation frequency in packinghouses. *Listeria monocytogenes* (Lm), an important foodborne pathogen, has been involved in foodborne outbreaks linked to the consumption of fresh produce and stone fruits. To avoid contamination events, the packing industry must rely on rigorous sanitation practices and environmental sampling plans. The project will grow biofilms formed by background microbiota collected in stone fruit packinghouses and by Lm under conditions simulating industry settings. The main findings regarding biofilm growth rate and transfer will then be validated in pilot plant studies in which background microbiota will be inoculated and allowed to develop as biofilms on selected surfaces. Growth of the biofilms over time, as well as transfer rates to the produce used in the trials, will be evaluated. Data from biofilm growth and transfer experiments will be used to build a mathematical model of biofilm development, and ultimately designed as a user-friendly Excel add-in. The add-in could be developed into a practical tool to predict microbial behavior in the packinghouse and anticipate optimal sampling time and sanitation intervals, and thus provide the scientific data for sanitation schedules and environmental monitoring programs. Overall, the findings from this project will improve packing operations and the safety of the products.

*Environmental Microbial Risks Associated with Vented Produce in
Distribution Centers*

\$358,218

The Center for Produce Safety

The Center for Produce Safety will partner with the University of Georgia to assess the contamination risk for fresh produce in vented packaging in distribution center (DC) environments. The Food and Drug Administration's (FDA) Preventive Controls for Human Food rule requires the establishment of environmental monitoring programs within FDA-registered facilities, including in distribution centers (DCs) that receive, hold, and ship fresh produce. Generally, in the DC environment, product arrives fully packaged and is shipped in the same packaging, with minimal to no handling. However, the FDA has determined that fresh produce entering these environments may be at risk for contamination due to the vented nature of the packaging materials used. Produce is typically shipped and stored in packaging that allows the accumulated postharvest gas and moisture to dissipate. The vented packaging also helps maintain product quality throughout the supply chain. This project will examine the risk of contamination in the DC environment by surveying DC managers and sampling their facilities, with a focus on potentially high-risk areas, practices, or equipment within the DCs. Knowledge gained from this project and guidance documents developed will assist DCs in evaluating the environmental microbial risks of vented produce as well as eliminating high-risk practices that may contribute to contamination events within DC environments.

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Post-Harvest Fresh Produce Wash Water Disinfection by Submerged Cold Plasma Non-Chemical Continuous Treatment System \$354,229

The Center for Produce Safety

The Center for Produce Safety will partner with Drexel University to optimize and test a novel energy-efficient wash water treatment system for fresh and fresh-cut produce, based on cold plasma technology. Cold plasma technology uses electricity and a carrier gas to inactivate pathogens in water and does not require antimicrobial chemical agents. The challenge with a plasma-based disinfection technology system is to provide sufficient mixing of the plasma-treated water with bulk water in the produce wash system. The goal of this project is to design a plasma-based wash water management system for minimally processed fresh produce to eliminate cross-contamination. The research team will optimize existing reverse vortex gliding arc plasmatron for the specifics of produce processing plants, validate this new system in lab-scale studies, and finalize this project by full validation of the plasma system prototype at an industry-scale testing facility.

Analysis of the Presence of Cyclospora in Waters of the Mid-Atlantic States and Evaluation of Removal and Inactivation by Filtration \$58,613

The Center for Produce Safety

The Center for Produce Safety will partner with the University of Delaware to evaluate a novel filtration method to remove and inactivate the protozoan parasite *Cyclospora cayetanensis* (*C. cayetanensis*) from water used for produce. *C. cayetanensis* presents a unique challenge to the scientific community in understanding its persistence, transfer, and detection in the environment. The first documented domestic *C. cayetanensis* outbreak, in 2018, was linked to produce grown in the United States. Previous outbreaks had often been associated with produce imported from countries where this organism is endemic. Zero valent iron (ZVI), an affordable by-product of the steel industry, has been shown to be effective in removing and neutralizing bacterial, viral, and chemical contaminants from water. The efficacy of ZVI on parasites has not been studied but shows great potential in filtration applications. This project will determine if *C. cayetanensis* is present in potential sources of irrigation water within the U.S. Mid-Atlantic Region and assess the effectiveness of ZVI filtration in removing and inactivating protozoan parasites like *C. cayetanensis* from irrigation water to ensure the safety of produce. Quantitative polymerase chain reaction (qPCR) detection of presumptive-positive *Cyclospora* in the waters will be correlated with sequencing data and location and climactic data associated with the water sample collection. Filtration parameters for successful removal of protozoa through ZVI filtration will be established; using two protozoa surrogates, *Cryptosporidium* and *Eimeria*, will be used to address the removal of *Cyclospora*.

Sources and Prevalence of Cyclospora Cayetanensis in Southeastern United States Water Sources and Growing Environments \$415,433

The Center for Produce Safety

The Center for Produce Safety will partner with the Centers for Disease Control and Prevention to assess the domestic prevalence of *Cyclospora cayetanensis* in agricultural

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environments in the Southeastern United States (U.S.). In 2018, a domestic produce–associated cyclosporiasis outbreak and the first Cyclospora detection on domestic produce demonstrated the need for a better understanding of Cyclospora prevalence in U.S. produce-growing environments. The Southeastern Coastal Plain growing region has several risk factors that warrant the evaluation of Cyclospora prevalence, including a farm worker population from Cyclospora-endemic areas, use of surface water for irrigation, and heavy rainfall that could transport Cyclospora into surface waters. This project will assess Cyclospora prevalence in this region through two Georgia industry partners representing growing practices across the Southeastern states. Human sewage samples from municipal wastewater influents and on-farm portable toilets will be tested to assess Cyclospora shedding in the region and on-farm, respectively. Cyclospora prevalence in the agricultural environment will be assessed in water and on produce (via a proxy measurement of packinghouse wash water). Using newly developed tools, Cyclospora contamination found will be traced through the produce-growing process by genetic typing to match detections between samples and by assessing the parasite’s maturation state to the approximate time since shedding. This project will add to the understanding of Cyclospora contamination in U.S. produce-growing environments and provide information about contamination routes to produce.

The Prevalence of Cyclospora in Water and Produce

\$245,118

The Center for Produce Safety

The Center for Produce Safety will partner with the University of Georgia to compare detection methods for Cyclospora cayetanensis (*C. cayetanensis*) in water and produce, and determine the prevalence and persistence of this parasite in selected regions in California and Florida. *C. cayetanensis* is an important enteric pathogen but its prevalence and persistence in the United States (U.S.) environment (water and soil) is unknown. Humans who become infected with *C. cayetanensis* by consuming contaminated food can develop an intestinal illness known as cyclosporiasis. Cyclosporiasis outbreaks in the U.S. have historically been associated with ingestion of produce imported from cyclosporiasis-endemic regions. In 2018, however, two large cyclosporiasis outbreaks were associated with fresh produce (romaine lettuce and shredded carrots) and vegetable trays (cauliflower, broccoli, and carrots), implicating vegetables produced in the U.S. This project will first examine the specificity and sensitivity of three molecular detection methods for Cyclospora in water and fresh produce to determine the most suitable approach to test for Cyclospora in agricultural settings. The research team will collect samples of river water in California and pond and canal water and fresh produce in Florida over two years, with sampling in seven months each year. The data provided will contribute to understanding the distribution, persistence, and prevalence of Cyclospora oocysts in the environment, which is the first step to address interventions to eliminate and/or prevent introduction of the parasite in produce at the farm level.