**Condition Change: UC ANR contributed to improved food safety**

**Issue**

California is a national and global leader in food production and agricultural export. The state faces social, regulatory, economic, and environmental challenges that affect our agricultural and food systems, our communities, and our public health. The Center for Disease Control and Prevention estimates that 1 in 6 people get sick from foodborne diseases each year, including 128,000 hospitalizations.

**Methods**

UC ANR conducts research about and delivers educational programs promoting improvement in individual and household food management practices as well as farm and food system food safety.

A UC ANR scientist located at the Kearney Agricultural Research and Extension Center conducted research that contributes to the safe commercial production of pistachios. A new strain of pistachio was evaluated and registered for use in California after finding the strain to be of high quality and safe from poisonous substances such as aflatoxins, which are produced by certain molds. Even though aflatoxin contamination occurs less frequently in pistachio and almond nuts compared to other crops, some nuts do become aflatoxin-contaminated in commercial orchards. Replacing or excluding strains of pistachios that produce aflatoxin can reduce contamination (Themis Michailides).

UC ANR statewide programs conducted extension activities about individual and household food safety. UC Cooperative Extension (UCCE) academics provided oversight, leadership, and guidance for the statewide implementation of the UC 4-H Youth Development Program, CalFresh Healthy Living, University of California program (CFHL, UC) and Expanded Food and Nutrition Education Program (EFNEP), and the UC Master Food Preserver statewide programs, which delivered the food safety extension (UC 4-H; CFHL, UC; EFNEP; UC Master Food Preserver). One UCCE academic’s research on food safety practices and food behaviors of seniors living with multiple chronic diseases in ten counties, led to the development and piloting of the curriculum Make Food Safe for Seniors. In 2019 that curriculum was delivered to 80 seniors in three low-income housing sites (Mary Blackburn and Katherine Uhde). Local UC Master Food Preserver programs delivered evidence-based education about food preservation and food safety (Dayna Ravalin and Katherine Soule; Hawau Bojuwon; Dustin Blakey).

UCCE scientists extended food safety research findings with agriculture clientele. Food safety outreach and technical assistance for 110 limited-resource small farmers in Santa Clara, San Benito, and Santa Cruz counties included six extension meetings and several one-on-one trainings that included presentations and hands-on demonstrations on Food Safety Modernization Act compliance and good agricultural practices (Aparna Gazula). In another project, two UCCE academics conducted a dairy manure pathogen risk assessment of applying untreated, solid bovine manure as a soil amendment to agricultural lands. Findings suggested that the presence of E. coli O157:H7 and Salmonella spp. in solid bovine manure may pose potential risks to public health, if untreated manure is applied as a biological soil amendment and accidentally consumed by the public. Additional findings showed that current manure compost strategies are sufficient to limit pathogens and successfully mitigate risk on some, but not all dairies (Jeffrey Stackhouse and Pramod Pandey).

Several projects worked to inform farm food safety decision-making and policy.One UCCE academic conducted research to provide scientific evidence to support regulations that require a minimum wait time between the use of untreated manure (i.e., raw and aged manure) and crop harvest in order to reduce microbial contamination of produce. Research findings characterize and identify risk mitigation strategies to reduce the risk of microbial contamination. Several foodborne pathogens are commonly associated with human illness such as E. Coli, Salmonella and Listeria in fresh produce organically grown with animal-based soil amendments. The majority of the research is collaborative, involving the participation of various stakeholders, including farmers, organic industry members, educators, researchers, and governmental agencies (Alda Pires).

Integrated crop-livestock growers diversify their production systems by including a rotation of livestock in crop fields (i.e. re-integrating animals back into cropland), which provides numerous benefits. However, potential food safety risks related to the interface of animals and crops are largely unknown. Furthermore, these systems face challenges, including potential food safety risks and compliance with the federal Food Safety Modernization Act Produce Safety Rule. Research is being conducted to apply epidemiological quantitative tools and microbiological methods to characterize these systems and identify mitigation strategies to reduce food safety risks, particularly for those farms that integrate animals and produce production (Alda Pires).

A major update to U.S. food safety regulations occurred in 2011, impacting growers and food processors of all sizes. UCCE academics contributed significant effort to developing industry-specific targeted supplemental materials and delivering a recognized, standardized curriculum to aid in implementation (Erin DiCaprio and Linda Harris).

The food industry must often validate processes that are used to control (reduce) pathogens. UCCE research efforts have provided the scientific basis for validation of various processes to control foodborne pathogens and verification activities to support food safety plans (Linda Harris).

In 2019 UCCE wrapped up its collaboration with the Bishop Paiute Tribe’s Food Sovereignty Program. UCCE provided the program with university information and training around produce safety with the goal of establishing a community safety resource person (Dustin Blakey).

As a result of UC ANR research and education, participants learned about and adopted farm, individual, and household food safety behaviors. Outcomes with specific indicators follow.

**Outcomes**

**Participants learned about home food safety practices.**

* Over 500 4-H youth statewide responded to the Healthy Living common measures survey and 78% of youth report knowing how to keep a cooking area clean in order to stop the spreading of germs, as a result of what they may have learned at 4-H. (UC 4-H)
* EFNEP surveyed over 4,200 youth participants and 55% of youth participants reported used safe food handling practices more often or gained knowledge such as washing fruit and vegetables before eating or putting foods back in the refrigerator within 2 hours, as a result of participating in the program. (EFNEP)
* Make Food Safe for Seniors participants reporting large increases between pre- and post-programs in knowing sources of harmful bacteria, recommended washing practices, and refrigeration practices. Notably, 71% knew raw food should be stored below ready-to-eat foods in the refrigerator, which increased from 14% at the start. (Mary Blackburn and Katherine Uhde)
* Local outcomes from UC Master Food Preserver programs:
	+ In Santa Barbara and San Luis Obispo Counties, 98.8% of 623 professionals, volunteers, and teen leaders reported in retrospective surveys increased knowledge of food safety as a result of participating in the program’s evidence-based educational workshops about safe food handling practices. Additionally, 68 workshop participants assessed through paired pre- and post-assessments demonstrated a statistically significant increase in gained knowledge. (Dayna Ravalin and Katherine Soule)
	+ Program participants in a Kern County Garden Club increased knowledge of food preservation tips, food safety practices, benefits, and recipes to try at home while learning about preserving lemons and repurposing canned goods. Intent to adopt dehydrating practices were observed as participants asked about where to obtain dehydrating equipment. (Hawau Bojuwon)

**Participants adopted home food safety practices.**

* EFNEP surveyed over 3,600 participants and 86% of adult participants showed improvement in one or more food safety practices, such as washing hands before preparing food or using a meat thermometer, as a result of participating in the program. (EFNEP)

**Science-based information applied to individual and household food safety decision-making.**

* Research conducted by one UCCE academic found that both the online and in-person food safety extension of the Make it Safe, Keep it Safe program resulted in positive and statistically significant change among clientele. These findings confirm that this existing, cost-effective practice of delivering federally-funded programs online is just as effective as in-person extension in reaching its goals. (Christine Bruhn and Katherine Soule)
* As a result of changing management to UC Master Food Preserver volunteers in Inyo-Mono Counties, the Tri-County Fair will now have judges trained in current standards and will only judge safe, approved products instead of previously followed dangerous procedures, such as open-kettle entries. (Dustin Blakey)

**Participants learned about farm food safety behaviors.**

* As a result of 44 farmers receiving one-on-one food safety training in Santa Clara, San Benito, and Santa Cruz counties, 37 small farmers increased their knowledge of safety and increased their awareness of Food Safety Modernization Act (FSMA) requirements and pending inspections for small-scale farms. As a result of the two Produce Safety Grower trainings, 30 farms in the region now have at least one staff on their farm that has completed the required FDA certified food safety training, which increased their knowledge of FSMA requirements for on-farm food safety compliance and pending inspections for small-scale farms, and increased their knowledge of recordkeeping requirements for FSMA inspections. (Aparna Gazula)

**Participants adopted farm food safety behaviors.**

* As a result of extending information about the risks associated with manure application to cropland, two of the high-risk dairies in this study immediately changed their compost strategies to reduce the potential public health risks of using untreated manure. (Jeffrey Stackhouse and Pramod Pandey)

**Science-based information applied to food system and farm food safety decision-making and policy.**

* Organic farm food safety research resulted in science-based recommendations to create new metrics for appropriate time-intervals used between untreated manure and harvest. It will inform ongoing Food & Drug Administration risk assessments and the organic and fresh produce industries. (Alda Pires)
* Integrated crop-livestock research evaluated existing food safety regulations and identified improvements for risk mitigation of foodborne pathogens and improvements for animal health on alternative agricultural systems. (Alda Pires)
* A standardized 1-day grower training curriculum recognized by the Food and Drug Administration was used to provide almond growers in Butte County information they need to comply with food safety regulations and as a result, 50 growers received certificates of completion. (Linda Harris)
* UCCE study findings provide data to support risk assessments and food safety plans for a range of foods including tree nut processors, milling of flour, home and food service cold brewing of coffee, and whole and fresh cut onions. (Linda Harris)
* As a result of the food sovereignty safety program, the Bishop Paiute Tribe now has a UC-trained technician knowledgeable about safety who can consult with the other tribes. In the winter, the Bishop tribe hosted a Produce Food Safety Alliance workshop for tribes and market vendors to further educate growers in good practices, even though this was not strictly required by the Food Safety Modernization Act for their operations. (Dustin Blakey)

These measured outcomes demonstrate improved knowledge and skills around individual and household and farm food safety practices that can lead to a decrease in foodborne illness. In this way, UC ANR contributes to the public value of safeguarding sufficient, safe, and healthy food for all Californians. For example, between the years that the UC Master Food Preserver food safety project started in San Luis Obispo county and the most recent data collected by the San Luis Obispo County Public Health Department, there was a 30% reduction in reported cases of foodborne illness in the county, toward which UCCE may have been a contributor.