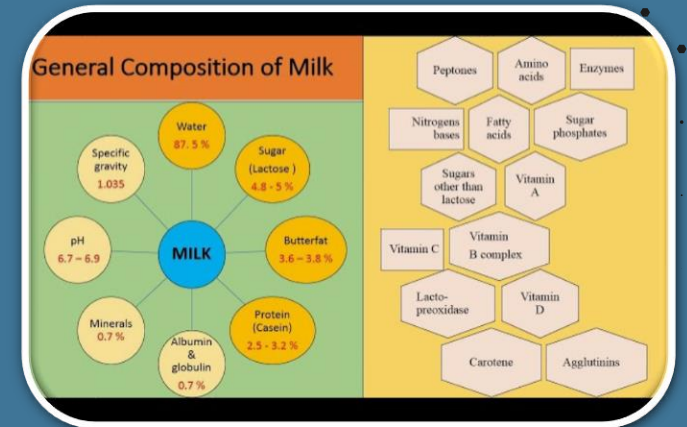


California Dairy Research Priorities and Projects

Kevin Comerford, PhD
Chief Science Officer



2024 Golden State Dairy
Management Conference



Who, What, Where, Why, When



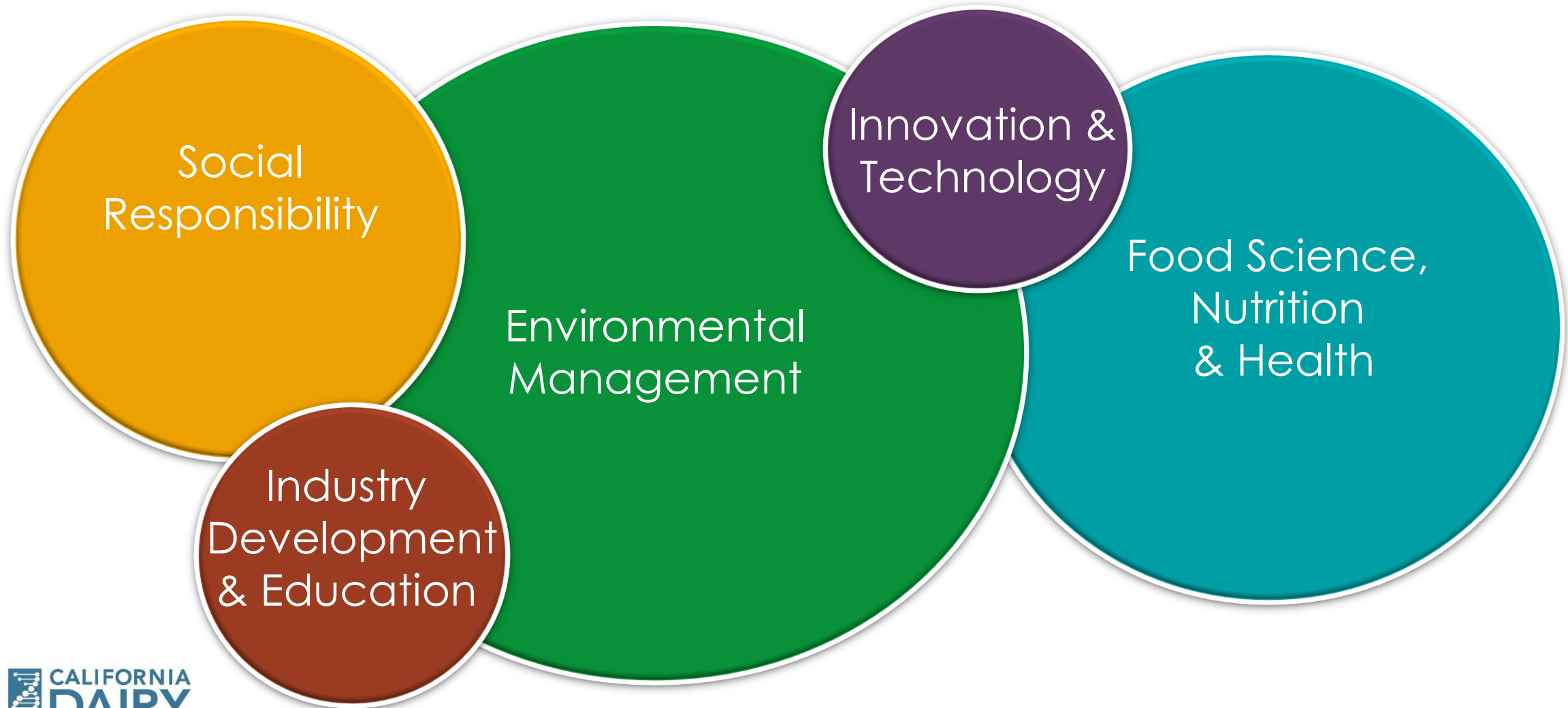
CDRF is a non-profit research organization that funds and manages research and education projects that benefit the CA dairy industry.



Supporting a Sustainable CA Dairy Industry

- ✓ Healthy people and animals
- ✓ Healthy environment
- ✓ Healthy industry economy

Focus Areas - Research and Education



Project Selection Strategies

- Prioritize projects unique to CA dairy
- Co-fund and collaborate wherever possible to leverage checkoff dollars
- Target short-term projects; 1-3 years
- Select projects that address multiple industry needs

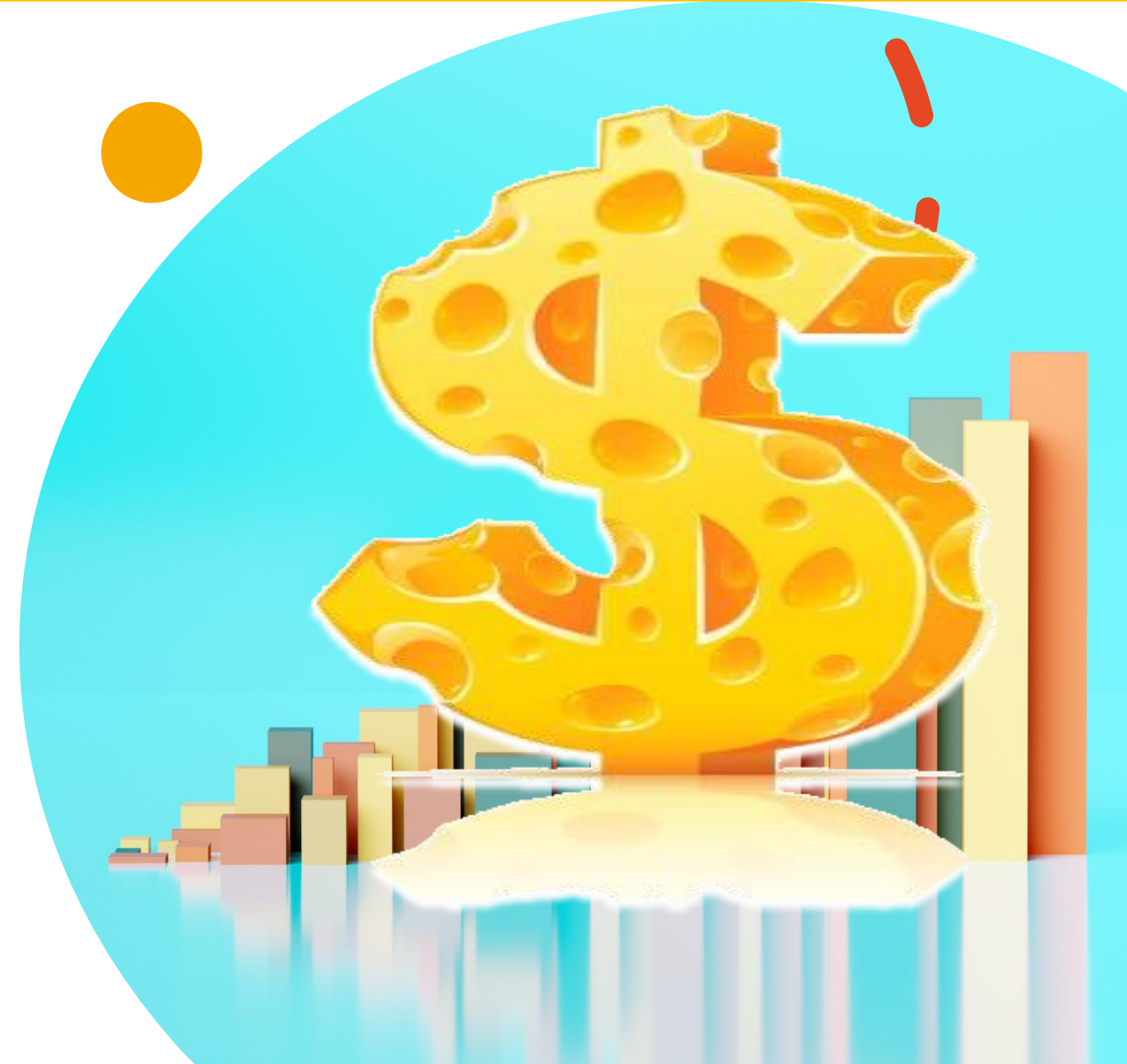


Funding Sources

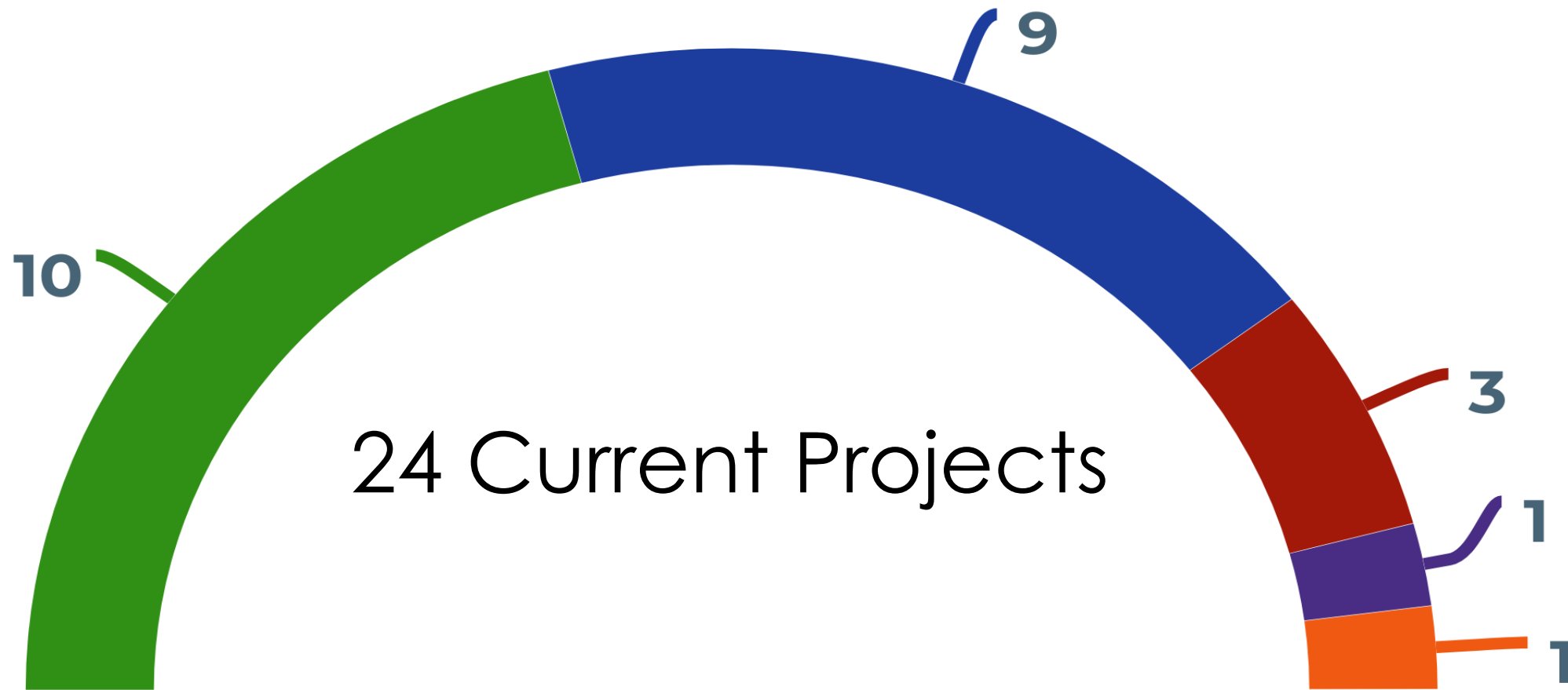
Checkoff Dollars!

And CDRF receives additional project funding from:

- Allied Dairy Orgs
- Milk Processors
- Food & Beverage Sector
- Other Ag Commodities
- Government Grants
- Philanthropies



Current Projects



- Environmental Management
- Food Science, Nutrition & Health
- Social Responsibility
- Industry Development & Educational Outreach
- Innovation and Technology

Environmental Management Projects

- California Dairy Quality Assurance Program (CDQAP) Environmental, Animal Care & Food Safety Outreach (Payne, Meyer, Mullinax) CDQAP.org
- Dairy Cares - Sustainability Communications & CDQAP Support (Boccadoro) DairyCares.com
- Benchmarking and Describing California Dairy Sustainability Metrics (Heguy, Meyer, Fulford, Clark, Bruno)



Environmental Management Projects

- Scoping the Environmental Feasibility of DairyMAR (Dahlke and Harter)
- Applying Manure Safely to Almonds Using Subsurface Drip Irrigation (SusCon)
- Reducing Water Use and N₂O Emissions with Subsurface Drip Irrigation (SusCon)



Environmental Management Projects

- Production of Pathogen-Free Products from Dairy Manure (Zhang, Pan, Pandey)
- Evaluation of Manure Treatment Technologies (Meyer, Clark, Heguy)
- Effects of Nanobubbles on Methane and other Gases Emissions from Dairy Manure (Mitloehner, El Mashad)



Food Science, Nutrition & Health Projects

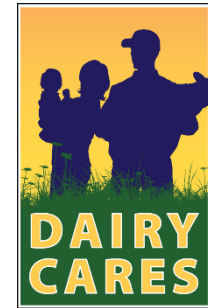
- Comparing Whole-Milk vs 1% Milk in Toddlers - Evaluation of the Microbiome (Ritchie, Patel) *(Co-funded with NIH and DCC)*
- Examining the Role of Dairy Co-Products on Brain Function (Taha and Barile) *(Co-funded with NDC)*
- Characterization of Health-Promoting Properties in Cow's Milk vs Plant-Based Alternatives (Barile and Bornhorst) *(Co-funded with NDC)*
- Effect of Yogurt on Gut Health and Immunity (Lemay and Marco) *(Co-funded with NDC)*



USDA Grant: CA Climate-Smart Dairy Project



\$85 Million to Invest in and Build Markets for California's Climate-Smart Dairy Producers



USDA Grant: CA Climate-Smart Dairy Project

Projects Update

- 14 projects starting soon
Totaling \$16,725,138 in awards.
- 49 new applications received.
Review process starts soon.

2024 DAIRY PLUS PROGRAM



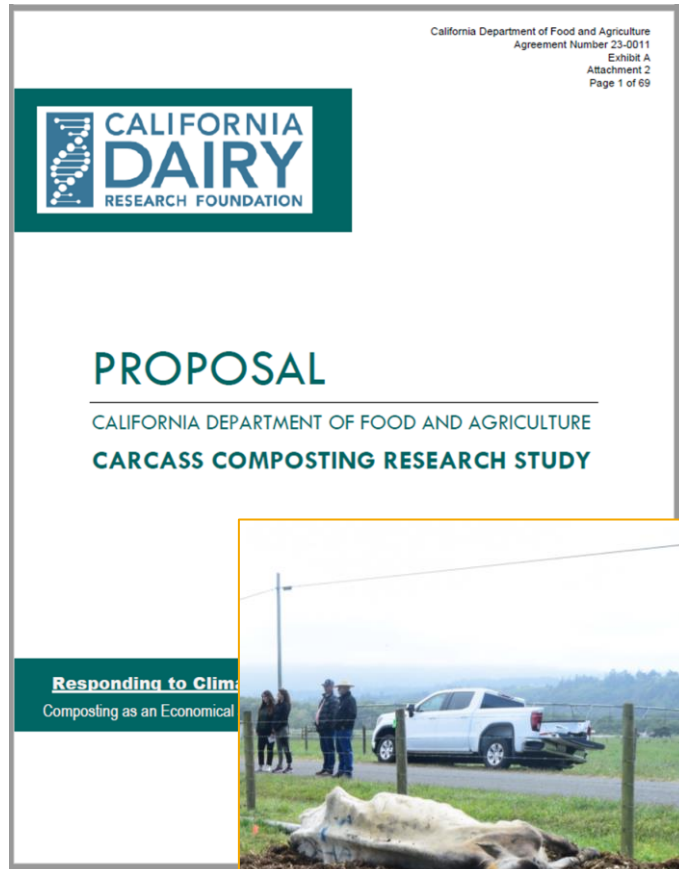
Request for Applications

Released Date: July 23, 2024
Applications Due: October 18, 2024 by 5:00 p.m. PT
Late submissions will not be accepted.



California Department of Food and Agriculture
Office of Environmental Farming and Innovation
1220 N Street, Sacramento, CA 95814
CDFA.OEFL_DairyPlus@cdfa.ca.gov

CDFA Carcass Composting Research Study



\$895,561 CDFA Grant Awarded to CDRF

Project Goals:

- Define environmental impacts of dairy and poultry composting
- Develop *Best Management Practices* for:
 - Emergency composting
 - Composting in areas not served by rendering
- Create online training for emergency composting



CDRF - Annual Report



ANNUAL PROJECTS REPORT



JULY 2023 - JUNE 2024

CDQAP ENTERS 25TH YEAR OF SERVICE TO THE CA DAIRY INDUSTRY

GRANT MONEY AVAILABLE

Program Leaders: Dr. Michael Payne and Dr. Deanne Meyer, UC Davis, and Denise Mullinax, CDQAP/CDRF

For more than 30 years, California has been the nation's number one dairy state. For the last 25 of those years, the California Dairy Quality Assurance Program (CDQAP) has worked with the California dairy industry to promote the health and safety of consumers, the environment, and California's dairy animals.

CDQAP was established in 1999 as a voluntary and collaborative partnership between the California dairy industry, academia, government agencies and other interested parties. Since its inception, CDQAP has had a tremendous impact on sustaining California dairy farm operations, supporting them in adhering to the highest standards for protecting the environment, optimizing animal care, and ensuring food safety.

In 2023, the CDQAP team continued to work to provide dairy producers with the education and tools needed to not only maintain regulatory compliance but to make ongoing improvements and demonstrate their commitment to sustainability and food safety, while maintaining economic viability for the long-term.

One-of-a-kind certification program reduces environmental impacts and saves money

CDQAP implemented the new online version for the Environmental Stewardship Short-Course (ESSC) and was utilized by producers starting in 2023. The program's third-party environmental stewardship certification evaluator performed 87 dairies certified in certifications. To date, there are 781 dairies certified in environmental stewardship through CDQAP, resulting in a cumulative savings to California dairy producers of over \$3M annually in State Water Board fees.

CDQAP's environmental curriculum in 2023 focused on the development of outreach related to the Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) program requirements and an anticipated new Central Valley Dairy General Order (DGO). With the goal of providing producers with as much infor-

CDQAP EFFORTS CONTINUE TO SAVE CA DAIRY PRODUCERS OVER \$3M IN FEES ANNUALLY

781 CALIFORNIA DAIRIES ARE CERTIFIED IN ENVIRONMENTAL STEWARDSHIP

6

- Strategic Goals
- Completed Projects
- Current Projects

EXPLORING SYNERGISTIC SOLUTIONS BETWEEN DAIRY AND WINE INDUSTRIES

FRESH GRAPE POMACE ADDED TO FEED REDUCES ENTERIC METHANE EMISSIONS ON DAIRIES

methane emissions while maintaining milk quality and milk coagery. Cows receiving the 10% GP and 15% GP treatments had 10.31% less enteric methane emissions than control cows, which is a stronger effect on methane reduction than previously reported.

There were no significant differences between the 10% and 15% GP treatments in reducing methane production.

Importantly, neither milk yield nor milk composition were negatively impacted by fresh grape pomace supplementation.

There was also no significant difference between treatment groups in milk fat, protein, lactose, solids not fat, or somatic cell count (SCC). However, milk urea nitrogen (MUN) was significantly lower in GP treatment cows compared with CON cows, which suggests that the GP supplementation may have increased the efficiency of rumen protein utilization and reduced the loss of excess nitrogen.

"I think the optimal (supplementation) is probably less than 10%, as there was no difference between the 10 and 15% (supplementation) in a future trial," said Kebreab.

Prior to this study, there was limited information regarding the effect of fresh grape and milk yield from dairy cows and its inclusion level in dairy rations. The results are promising and support the need for follow-up studies.

"The next step," explained Kebreab, "would be to do an on-farm experiment to see if what we observed under controlled conditions is repeatable."

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Non-CDRF Environmental Research

- Effectiveness of Alternative Manure Management Practices
 - Mitloehner, F. **Benchmarking of pre-AMMP dairy emissions** (completed 2019). Funded by California Department of Food and Agriculture (CDFA), UC Davis study, \$580,000.
 - Mitloehner, F. **Post-AMMP Dairy Emissions of GHG, Ammonia and Hydrogen Sulfide from a Pastured Dairy and Compost-Bedded Pack Barn Project** (2021). California Air Resources Board (CARB)-funded UC Davis study, \$385,000
 - CARB used in-house eddy covariance monitoring equipment to assess real-time, long-term methane emissions on three study dairies.



Non-CDRF Environmental Research

- Digestate Land Application emissions
 - Horwath, W. ***Liquid and Soil Sample Collection and Analysis of Dairy Digestate and Lagoon Effluent during Storage and Land Application Phases*** (in progress). CARB-funded UC Davis study, \$446,062.
 - Zondlo, M. ***Eddy Covariance Monitoring of Nitrogenous Emissions from Land Application of Manure and Digester Effluent*** (in progress). CARB-funded Princeton study, \$556,142.
- Research on Biomethane Constituents
 - Kleeman, M. ***Evaluation and Identification of Constituents Found in Common Carrier Pipeline Natural Gas, Biogas, and Upgraded Biomethane in California*** (in progress). CARB-funded UC Davis study, \$1.02 million (not all to dairy).

Non-CDRF Environmental Research

- Literature Reviews on Dairy and Livestock Manure Methane Reduction Strategies
 - Kaffka, S. ***Evaluation of Dairy Manure Management Practices for Greenhouse Gas Emissions Mitigation in California (2016)***. CARB-funded, UC Davis.
 - Kaffka, S. ***Research and Technical Analysis to Support and Improve the Alternative Manure Management Program Quantification Methodology (2020)***. CARB-funded UC Davis/California Biomass Collaborative., \$130,446



Non-CDRF Environmental Research

- Literature Reviews on Enteric Methane Reduction Strategies
 - Appuhamy, R. and Kebreab, E. **Characterizing California-Specific Cattle Feed Rations and Improve Modeling of Enteric Fermentation for California's Greenhouse Gas Inventory (2018)**. CARB Contract 16RD001.
 - Kebreab, E. and Feng, Xiaoyu. **Strategies to Reduce Methane Emissions from Enteric and Lagoon Sources (2021)**. CARB-funded UC Davis literature review, \$115,000



Non-CDRF Environmental Research

- Onsite, Mobile, Flyover, and Satellite-based Emissions Measurement
 - Amini, S., et al. ***Evaluating California Dairy Emission Factors Using Short-term Ground-Level and Airborne Measurements*** (2022). Partially CARB-funded mobile emissions monitoring.
 - Duren, R. et al. ***California Institute of Technology Jet Propulsion Laboratory (JPL) The California Methane Survey*** (2020). Partially CARB-funded JPL flyover-based monitoring campaign, \$700,000.
 - California Satellite Partnership. Public-private partnership to deploy satellites to pinpoint and quantify large sources of methane, carbon dioxide, and other environmental indicators. The partnership planned to launch two satellites in 2024.
 - Satellite Data Purchase Program. State Budget Act of 2022 allocated \$100 million for the purchase of methane plume data from a commercial satellite company.

Non-CDRF Environmental Research

- Onsite, Mobile, Flyover, and Satellite-based Emissions Measurement
 - Hopkins, F. et al. **Climate Impact of Manure Management from California Dairies** (funded 2017, ongoing). Multi-component study measuring methane from dairies using multiple methods and isotopic testing. \$4 million in funding from the University of California Office of the President.



Non-CDRF Environmental Research

- Onsite, Mobile, Flyover, and Satellite-based Emissions Measurement
 - Arndt, C. et al. ***Short-term methane emissions from two California dairy farms estimated by different measurement techniques and U.S. EPA inventory methodology: A case study*** (2018). Funded by Environmental Defense Fund with support from Dairy Cares.
 - Hopkins, F. and Meyer, D. ~\$1 million project funded in 2020 by the California Energy Commission to verify effectiveness of digesters through field measurements of methane, nitrous oxide and ammonia. Ongoing through 2024.
 - Conley, S. ***Airborne Methane Emissions Measurement Survey***. Funded by CARB, \$100,000.

Non-CDRF Environmental Research

- California Dairy Emissions Model (CADEM)
 - Kebreab, E. **Development of the California Dairy Emissions Model (2022)**. CARB-funded UC Davis model development, \$300,000
- Enteric Testing Standard Development and Calibration
 - Kebreab, E. **Development of a Testing Standard and a Mechanistic Model for Enteric Fermentation Methane Emissions (in progress)**. CARB-funded UC Davis model development, \$595,252



Non-CDRF Environmental Research

- Verification of Methane-Reduction Strategies
 - Bubbleology, Inc., **Measuring the climate and environmental air emissions footprint of improved management practices** (awarded 2023, ongoing). CDFRA-funded, \$1.6 million
- Alternative Methane Reduction Strategies
 - Mooteric, LLC., **Feeding seaweed to accelerate enteric methane emissions reductions in Central Valley Dairies** (awarded 2023, ongoing). CDFRA-funded for \$500,000 with \$83,900 matching/in-kind.
- Manure Recycling and Innovative Products Development
 - FYTO, **Aquatic Crop Production as a Nutrient-to-Feed Solution for California Dairies** (awarded 2023, ongoing). CDFRA-funded for \$2 million with \$1.32 million in in-kind/matching funding.

Non-CDRF Environmental Research

- Enteric Methane Emission Reduction Research Program (LEMER-RP)
 - Mitloehner, F. ***An evaluation of long-term feeding 3-NOP to reduce methane in California Dairy Cows*** (funded 2023, ongoing). UC Davis research funded by CDFA, \$2.5 million.
 - Silva-del-Rio, N. ***Evaluating the Impact of Methanogenic Inhibitors Co-fed with Alternative Feed Additives on Lactating Dairy Cows and Dairy Cow Manure under California Dairy Management Practices*** (funded 2023, ongoing). UC Davis research funded by CDFA, \$1.5 million.
 - McFadden et al. ***Interactions between dietary fatty acids, *Aspargopsis taxiformis*, and bromoform on enteric and manure methane emissions and energetic conversion in lactating dairy cows*** (funded 2023, ongoing). Cornell University research funded by CDFA, \$1.5 million.
 - Engle, T & Place, S. ***A bromoform safety study for California dairy and beef cattle*** (2023, ongoing). Colorado State University research funded by CDFA, \$1.25 million.

Non-CDRF Environmental Research

- Dairy Carbon Sequestration, Soil Health & Water Quality Research
 - Soil Health Institute project to study soil carbon sequestration and soil health, environmental benefits of field manure use and soil health practices. Multiple research institutions including UC Davis, involves dairies in CA, TX, Idaho, WI, NY. \$23 million in funding from Foundation for Food & Agriculture Research, with \$3.2 million in California.
- Manure Management
 - Zhang, R. et al. ***Effect of Solid Separation on Mitigation of Methane Emission in Dairy Manure Lagoons*** (2019). UC Davis research funded by CDFA/dairy industry, \$237,000.
 - Meyer, D. ***Characterize physical and chemical properties of manure in California dairy systems to improve emissions estimates.*** UC Davis research funded by CARB, \$151,423.



THANK YOU



QUESTIONS ?
