**Condition Change: UC ANR contributed to improved animal management, productivity and efficiency**

**Issue**

California ranks fourth in the nation in total livestock receipts, with over $11 billion (2017). It remains the largest dairy-producing state, providing over 18% of the nation’s milk supply (2017), and dairy is the state’s top producing commodity. Ranchers and dairy producers face many management and production challenges, like drought, water and air quality regulations, and invasive species, as they strive to maintain their competitive edge. Forage crops linked to the livestock industry is an important economic driver in California’s food-producing system. Although livestock are a high value commodity, at the ranch level it can be difficult to be profitable. In fact, ranchers or their family members often need to work off the ranch in order to make ends meet and keep the ranch running. At the same time, there is the need to improve the ecological viability of these animal production systems.

**Methods**

UC ANR partners with public, non-profit, and private groups to create and extend new knowledge about animal systems management for dairies and livestock operations.

As part of the UC Agricultural Experiment Station, one researcher located at UC Davis is working on a multistate effort focused on animal behavior and welfare. To be sustainable in the long term, food systems must continue to meet the various criteria of social acceptability, nowhere more apparent and pressing than in the world of livestock production. This applied research on pain perception in dairy calves in response to horn disbudding has changed industry perceptions of the practice. Together with research into current husbandry methods, the research team is leading the development of new approaches for measuring animal welfare that will guide animal production systems towards even higher welfare standards in future.  The important findings from this research are being delivered to stakeholder audiences from peer scientists, to industry groups, and welfare auditors (Cassandra Tucker).

A couple dairy production projects led by a UC Cooperative Extension (UCCE) academic in the Central Valley addressed milk quality and labor skills, challenges which dairy farms always face. Two milking schools on two dairies in Fresno County were held, working with a veterinarian, to provide hands-on experience with procedures and protocols to milk cows and identify diseases. In addition, the UCCE academic helped resolve an increase in mastitis cases on a dairy. The outbreak investigation identified the source of the problem and developed recommended responses (Daniela Bruno).

One study focused on identifying dairy calf management strategies to reduce bovine respiratory disease (BRD) on organic and conventional dairies. This multi-year study involving ten scientists and graduate students identified the prevalence of BRD in Humboldt and Del Norte Counties to be nearly 11%, and that calves in group pens had a higher BRD prevalence (Jeffrey Stackhouse).

Another UCCE collaboration conducted a dairy manure pathogen risk assessment, which is particularly crucial for organic fields that are fertilized almost exclusively by bovine waste. The findings determined that current manure compost strategies are sufficient to limit pathogens and successfully mitigate risk on some but not all dairies. These results do not preclude any dairies from utilizing manure, but suggest care be taken to mitigate risks. Individual dairy-level results were sent to dairy managers, and the data were presented for the scientific community in Letters of Applied Microbiology (Jeffrey Stackhouse and Pramod Pandey).

Another UCCE dairy project focused on evaluating the impact of two recent regulatory changes: the amended Veterinary Feed Directive and the California Senate Bill (SB) 27, which jointly increased veterinary oversight and involvement in the distribution and use of medically important antimicrobial drugs for livestock. Ten dairies enrolled for the surveillance study. The findings were disseminated to the dairies involved in the study and through two extension meetings (Emmanuel Okello).

A UCCE Livestock Waste Specialist worked with Watershed and Dairy Advisors and the USDA Natural Resources Conservation Service Agronomists to provide science-based information during modifications to the regulatory requirements for the North Coast (Regional Water Quality Control Board 1) and stepwise implementation of the San Francisco Bay Board (Regional Water Quality Control Board 2). In particular, intensive input was provided to Region Board 1 during their Waste Discharge Requirements adoption process. In addition, the UCCE Specialist developed an improved solid manure sampling protocol based on research, and disseminated the information through workshops for dairy professionals in California (Deanne Meyer).

UCCE has been an integral partner during the more than 20 years of the California Dairy Quality Assurance Program. Workshops inform dairy producers about management practices to improve environmental stewardship, in particular to reduce their impact on water resources, primarily groundwater resources. Through the partnership, agencies, industry, and academia meet quarterly to address and identify ways to work through air and water concerns. The goals of the program are to achieve environmental compliance through education by providing sufficient information for producers to do their actual work, when allowable (Deanne Meyer).

Two UCCE academics conducting livestock management research evaluated ranch-level mineral programs and determined the status of manganese in beef-cattle operations by taking blood samples from four herds in Humboldt County. Individual level ranch results were provided to the ranches, and the findings were published for the scientific community in the Translational Animal Science journal (Jeffrey Stackhouse and Josh Davy).

A collaborative livestock and natural resources program conducted outreach and education on a livestock protection tool: five producer-focused field days with 129 ranchers and two agency-focused field days with 46 agency and NGO staff. The agencies involved included California Department of Fish and Wildlife, U.S. Fish and Wildlife Service, USDA Wildlife Services, US Forest Service, Bureau of Land Management, USDA Natural Resources Conservation Service, local resource conservation districts, and local land trusts (Dan Macon, David Lile, Laura Snell, and Tracy Schohr).

Forage production is part of livestock systems. UCCE continues to work on improvement of alfalfa, the second largest acreage crop in California and third most important economic crop in the nation. UCCE scientists have organized the Western Alfalfa Symposium for the past 49 years. This meeting is held cooperatively with 11 western state Cooperative Extension Services. It is the largest alfalfa outreach meeting in the nation, with over 600 participants each year (Dan Putnam, Rachael Long, Nick Clark, Michelle Leinfelder-Miles, and Mike Rethwitsch).

Another UCCE forage project worked with the University of Wisconsin Madison to conduct research on the impacts of field traffic from farm equipment on alfalfa production. It was determined that the traffic results in 25-30% yield declines, both from crushing new regrowth and from soil compaction; that latter also impacts water infiltration, reducing water use efficiency. The scientists discussed these findings with designers at two world equipment manufacturers, namely John Deere and New Holland (Dan Putnam).

Last but not least, a UCCE aquaculture project interacts with California’s sturgeon and steelhead producers to discuss modern technologies that can be applied to the handling and slaughter of fish. The scientist is also conducting on farm research to optimize farm practices and the use of the technologies to increase aquatic animal welfare as well as labor efficiencies. The findings are communicated to international welfare organizations, national aquaculture associations, and through on-farm demonstrations (Jackson Gross).

As a result of UC ANR research and extension, participants made changes that improve animal production systems. Outcomes with specific indicators follow.

**Outcomes**

**Participants learned practices for more productive and sustainable animal management.**

* Seventy percent of participants (90 ranchers and 32 agency staff) in the livestock protection tool field days reported that they gained knowledge, and 52% said they gained new skills. As a result, there is greater agency understanding of the cost and efficacy of specific tools, as well as increased knowledge about the appropriateness of specific tools at the ranch level. More specifically, several agencies learned new ways to install electric fence more effectively, and others gained a better understanding about how livestock guardian dogs work and where they may be more or less successful. (Dan Macon, David Lile, Laura Snell, and Tracy Schohr)

**Participants adopted practices for more productive and sustainable animal management.**

* Recommended practices were implemented in response to the mastitis outbreak on a farm in the Central Valley. As a result, the levels of mastitis decreased to normal levels similar to before the outbreak and milk quality remained high. Since the issue was addressed in a timely manner there was no negative economic impact. (Daniela Bruno)
* As a result of the study on bovine respiratory disease prevalence in Humboldt and Del Norte counties, local dairymen have created additional single-housing units for calves, and clientele are discussing changing bedding types. (Jeffrey Stackhouse)
* Manganese results from the blood samples were shared with ranches, and two ranches made immediate changes to their mineral programs as a result. (Jeffrey Stackhouse and Josh Davy)
* Knowledge of existing manure composting practices and understanding the pathogen risks associated with manure application to cropland has been applied to decision-making. Two high-risk dairies in the study immediately changed their compost strategies, and at least five dairies have transitioned from liquid manure to compost piles during the winter months to reduce the risk of surface water contamination. (Jeffrey Stackhouse)
* 93% of participants in the Western Alfalfa Symposium reported that that the information they gathered at this meeting positively impacted their farming or business operations and improved profitability. After a symposium workshop in 2015 and again in 2019, which presented innovative irrigation methods, farmers modified their systems to become more efficient. Several farmers using center pivots in Intermountain California started using Low Elevation Low Pressure systems and Mobile Drip Irrigation on Center Pivots. Other participants implemented sub-surface drip irrigation techniques on their farms. The adaptation of improved technology and monitoring of irrigation has the potential to save 20% of the water used for California’s second most water-using crop. This reduces use of water resources, as well as impacts on-farm yields and profitability. (Dan Putnam)
* Three farms adopted aquaculture technology and improved welfare of thousands of finfish. These technologies applied to the handling and slaughter of fish continue to be adopted as more aquaculture farms understand the value. (Jackson Gross)

**Science-based information applied to animal production systems policy and decision-making.**

* Results from the dairy surveillance study were included in the 2019 report to the state legislature: the Antimicrobial Use and Stewardship Program report by the California Department of Food and Agriculture. (Emmanuel Okello)
* Research-based information was incorporated into the non-profit Central Valley Dairy Representative Monitoring Program's recommendations. The implementation of the improved protocol and the greater accuracy in measuring nutrient uptake by harvested plants will improve nitrogen management and reduce nitrate impacts to groundwater. (Deanne Meyer)
* The trust developed through the California Dairy Quality Assurance Program was instrumental in creating an effective collaboration with Regional Water Quality Control Boards when new regulations were adopted and producers were required to change.The novel approach for nutrient budget calculations was adopted for nutrient management in Region 2 dairies and will be used in the year ahead for Region 1 dairies. (Deanne Meyer)

**Change in condition**

* **Improved milk quality:** After the trainings, two dairies improved their procedures for their milking routine. The milk quality on the dairies greatly improved, measured by decreases in total bacteria and coliform counts. There was also improvement in the identification of sick cows. (Daniela Bruno)
* **Improved yield:** Equipment manufacturers used the science-based information on the impacts of field traffic on alfalfa production to develop innovative machinery that saves one additional trip for each harvest. Research showed that field traffic in alfalfa forage results in 25-30% yield declines, depending upon the situation.  Saving one trip greatly reduces the negative effects of equipment traffic on re-growth, and thus improves yield and sustainability. (Dan Putnam)

These measured outcomes demonstrate farm or ranch-level advances, which help the state’s overall improvement in animal management and production. California’s total livestock and livestock products cash receipts went up nearly 7% and the cash receipts for dairy products increased slightly over 8%, from 2016 to 2017. In addition, because of dairy producers doing a better job at managing manure, there is less impact to surface or ground waters. Thus, UC ANR contributes to the public value of promoting economic prosperity in California, as well as the ecological viability of the livestock industry.