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# Dairies team with technology experts to save water

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Dominic Rossini, Netafim Agronomic Relationship manager, points to the subsurface drip irrigation system at DeJager Farms. The system is unique, with an automatic mixing valve controlled by an electrical conductivity sensor.
Photo/Cecilia Parsons

Michael McRee describes his experience with the system within his silage corn field. The system is able to deliver blended dairy lagoon water and fresh water a quarter mile away from the filtration station to an irregular-shaped field.
Photo/Cecilia Parsons

Resource challenges for dairy operators are being overcome with practical solutions.

The proof is in high yielding silage corn and forage crops using less water and commercial fertilizer.

One innovative approach on two Central California dairies is the use of subsurface drip irrigation to deliver a precise blend of nutrient-rich lagoon water and fresh water to their forage crops. This practice is aimed at more efficient water use and delivering nutrients to the crop in a more consistent manner.

Dairy managers Nate Ray and Rich Mayo at De Jager Farms and Mike McRee at McRee Dairy confirmed that the practice of using dairy wastewater collected in a lagoon and applied via drip irrigation lines to their crop has evolved during the past several years with better filtration and delivery systems, and is proving to be a sound economic and environmental choice.

The dairies partnered with San Francisco-based nonprofit Sustainable Conservation and drip irrigation technology company Netafim to improve their irrigation systems and help them farm with less water and commercial fertilizers—and stay in business while doing so.

California dairies have a long history of recycling water. Dairy waste and wash water are flushed from barns and milking parlors and are moved to a separator where solids are screened out and, when dried, are composted or used for dairy bedding. The liquid waste is stored in lagoons. This liquid is added to fresh water and used to irrigate forage crops, which are harvested and fed to the cows. Flood irrigation is common on dairies, but water and nutrient application can be difficult to assess.

Mandatory nutrient management plans for dairies require that nutrients be applied at the rate they are harvested with the crop. The approach being used at De Jager and McRee dairies allows for more measured application of nutrients, delivering only what the crops need to thrive.

During the drought years, Ray said he and other dairy managers began looking at the subsurface approach to save water. One of the challenges was designing a filtration system that did not require frequent back flushing, which added to energy costs for operating the system. Fresh water delivery via drip irrigation is a common practice, but using only fresh water would require use of commercial fertilizer for the crop at an added production expense and without making use of the dairy nutrients.

Sustainable Conservation and Netafim worked with Ray and McRee to address their filtration challenges, improving the systems to cut down on back flushing. Ray said backflushing the system is now done at two-week

intervals, followed by running fresh water through the system. The Netafim-designed system uses electrical conductivity sensors to automatically balance the mix of fresh and lagoon water to maintain consistent water quality for the crop.

Dominic Rossini with Netafim USA said the goal was to develop a practical solution that can be easily applied and operated at a dairy, and requires minimum labor and oversight. The elaborate filtering and sensing systems are not cheap, Rossini said, but they are affordable.

He said the plan was to design a turnkey system that could be integrated with the dairy and cropland layout to achieve crop production goals.

At De Jager Farms, the effluent from the dairy is delivered to one end of the tertiary lagoon. The pipe at the other end of the lagoon takes the liquid into the filtering and mixing system adjacent to the lagoon. The pipe, Rossini pointed out, is positioned about 20 inches below the water line to avoid the solids that collect at the bottom of the lagoon. This dairy also has the option to utilize fresh water from the irrigation district, delivered via an adjacent ditch, or well water.

The fully automated system meters the amount of lagoon and fresh water entering and a sensor notes the nutrient levels of the lagoon water and adjusts the blend. The adjustment is done, Rossini said, because the potency of the lagoon water can change and it is important to not only deliver a consistent supply of nutrients to the crop, but to also record the amount applied. The system can be operated efficiently at a 60% lagoon water to 40% fresh water ratio.

Sensors in the subsurface irrigated fields where the lagoon/fresh water blend is being applied are part of the research and development of the system. The sensors provide the project team information on performance.

The subsurface drip lines are buried about 12 inches deep and are on 40-inch rows in corn silage and wheat crops. One of the advantages of the subsurface drip is the elimination of "gassing off" of the nitrogen from the lagoon water. Instead, the nutrients are directed at the crop.

Eric Lee with Sustainable Conservation said water savings last season at De Jager Farms totaled 11½ inches less water for the silage crop and yields were in the 32½ ton per range. McRee Dairy used 5½ inches less water on a silage crop that yielded 35 tons per acre.

Sustainable Conservation program manager John Cardoza said the key to an effective SDI (subsurface drip irrigation) system is a settling basin where more of the solids in the dairy effluent can settle out and the quality of the lagoon water is consistent. A pressurized delivery system is also necessary. There has not been much of a need for a change in field tillage practices when the subsurface is used, Cardoza said.

Ray said it took a few years of experimentation, trial and error to achieve the fully automated system now in place at the dairy. The goal, he said, was to make operation of the system as simple as possible to save time and labor.

The dairy uses minimum tillage on forage crop ground, a practice that has been guided by Sustainable Conservation. Minimum tillage uses fewer passes through the field with equipment to prepare ground for planting. The forage crops are planted into dry ground and sprinkled up. Ray said his corn silage crop took 5½ inches of lagoon water per acre during the growing season.

McRee is in his second year with a similar SDI system. His dairy faced challenges with longer distances to move lagoon water, but he said the advantages were notable.

Cardoza said there has been a learning curve on the dairies, but the SDI is a viable system that helps use wastewater in a uniform and efficient manner.

"Our manure subsurface drip trials have demonstrated multiple promising wins. First, the system allows a dairy to apply nutrient-rich lagoon water in precise amounts, which reduces the chance of those nitrates leaching into the ground. Also, compared to neighboring fields that utilize flood irrigation, crop trials with the manure subsurface drip irrigation have proven to use up to 35% less water, get nearly 40% more crop per drop and even increase yields slightly," Cardoza said.

Sustainable Conservation and partners are overseeing the lagoon-SDI systems on three other dairies to demonstrate the operation and track results of the system under different soil types and management practices. A total of 212 acres in Kern, Madera and Merced counties are being irrigated with dairy lagoon water blends in a subsurface drip system.

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