Western Dairy News
for the West, about the West, from the West
May 2009
Vol. 9, No. 4

Making the most from manure

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Sustainability requires a balance of economic viability, environmental impact, and societal needs. No doubt, economic viability is always at the forefront of the decision making process on dairy operations.

Over the last few years, environmental compliance and analysis of environmental impact have opened a new language for many in the dairy business. In addition to ever-changing regulatory requirements, producers are faced with ever-increasing pressures from an expanding urban society and a global marketplace.

The volatility in production input prices (feed and fuel), combined with sinking prices received for milk and a particularly unstable banking market, make most dairy operators (and processors) very nervous. Financially, dairy operators are trying to figure out how to cut costs. Yet, various industries and food processors continue to initiate programs and/or respond to consumer groups' concerns in order to inch toward greater sustainability for their supply chain and market outlets.

Table 1: Analysis of waste stream inputs to identify management/infrastructure options to reduce waste stream volume.

Source of input into waste stream	Evaluate this source to reduce contribution to waste stream	Alternative management needs
• Water used for milk cooling	• Is water reused before entering the waste stream (used for drinking water, udder hygiene, etc.)? Does milk cooling efficiently utilize water?	• Modify milk transfer through plate cooler to maximize efficiency of heat transfer; modify plumbing to deliver plate cooler water to water storage system.
• Water used for udder hygiene.	• Can water use be reduced or eliminated?	• Increase management of animal housing area; alter bedding use.
• Water used to sanitize milking equipment.	• Can water use be reduced?	
• Fresh water used to flush any animal lanes.	• Can fresh water used for flushing be eliminated?	• Re-plumb flush system to recycle liquid manure; modify manure collection to slurry or solid system.
• Footbaths.	• Are other products available for use? Would a pre-footbath wash increase effectiveness of footbath (extend footbath duration; reduce number of changes per month).	• Install pre-footbath wash.Identify if other products are available and if used monitor foot health closely to be sure new products are acceptable. Potentially switch between products over time.
• Rainfall and potential runoff from buildings.	• Is runoff a significant contributor to liquid storage needs?	• Install and maintain gutters to divert roof runoff from liquid storage structure.
• Bedding	• Are alternative materials available for bedding (potentially ones that have larger particle size, are less damaging to pumps, have lower nutrient composition, are more or less degradable)? Can less bedding be used?	• Modify management of corrals and roofed housing areas to minimize need for bedding; modify bedding material storage area to minimize losses of useful material; modify animal surfaces to minimize need for bedding.
• Wasted/spoiled feed.	• Can feed be managed to reduce waste and spoilage?	• Manage wet feeds (especially during extreme weather conditions).
• Earthen material.	• Does equipment used to collect solid manure capture soil?	• Modify solid manure collection equipment/methods (use box scraper instead of tractor bucket).
• Feed management.	• Are diets formulated, mixed, and delivered to get desired production?	• Use feed capture system to collect feed data and compare to anticipated ingredient uses; feed supplements only when accounted for in dietary formulations.

Evaluate your system

Managing manure to minimize costs and maximize revenue is important. Critically evaluate existing manure collection, storage, treatment, and utilization systems to determine if and/or where improvements are possible to reduce costs or increase revenue. Be sure that any alterations in manure management are acceptable to local and state regulatory agencies.

Step 1. Analyze the inputs to the waste stream.

There are numerous inputs into liquid/slurry/solid manure waste streams. It's important to identify if simple management changes can reduce costs associated with handling waste (typically by reducing volume). Common sources of inputs to the waste streams are identified with suggested areas to consider in Table 1.

Step 2. Analyze alternative outlets for manure if the waste stream is modified.

Most operators are governed by a nutrient management plan of one form or another. It becomes increasingly important to

minimize atmospheric losses of nitrogen from manure. This is important since atmospheric losses reduce the amount of plant available nitrogen in the manure. Nutrient excesses exist when manure nutrients exceed the capacity of the land application area to receive nutrients.

Address potential options for alternative composition to existing manure sources (Table 2) and determine if it is feasible to modify current manure collection/treatment practices to yield different compositional outputs (drier, higher N, etc.) and potentially increase income with the new product.

Step 3. Identify practice(s) or technology(ies) to achieve desired outcomes identified in Step 2 (establish a job description or goal).

Potential investment in technologies may be helpful if the desired modification to manure composition isn't achieved through alternative management practices. As identified in previous Western Dairy Management Conferences (2003) it is best to identify the job description before selecting the technology. Once a job description is identified it is potentially possible to identify one or more technologies to achieve the desired outcome. Identification of technologies that have no cross media impacts may be needed for producers in areas where air, water and county regulatory requirements potentially conflict with one another.

There is no perfect technology to manage dairy manure and address both water and air quality concerns. A review of submitted technologies in 2005 by interested stakeholders in California identified that most technology providers were unable to provide data collected by an impartial third party to identify technology effectiveness. Technologies have a higher probability of being successful when the job description required is specific and simplistic.

It is easy for a vendor to imply that a technology will resolve all problems associated with manure management. Be sure you review actual data from research projects done with the technology on dairy farms. It's critical that the testing process occur on a facility with similar management practices to your facility if you are interested in transferring findings to your operation. Contact the dairy operator where the research was conducted. Ask specific questions to find out if they are satisfied with the technology, if they're still using it, and find out if they paid for it or received it at minimal cost. Point blank ask if they would do it again, and if they recommend that others pay full price for it.

The value in writing down your job description needs and comparing it to the potential technology is to save you from installing something that will not accomplish what you need. As an example, the standard anaerobic digestion methodology remains effective to reduce organic fraction in materials. However, it does nothing to salts or P and it potentially increases plant available form of Nitrogen (ammonium form) while reducing the organic fraction of N. If the biogas is burned through a combustion engine to generate electricity you should reduce methane emissions. Depending on your air district and your engine, you may violate emissions of NOx, and potentially emit small amounts N2O (a very potent greenhouse gas).

Table 2: Potential modification of existing manure to find if alternative markets exist for manure.

Desired outcome for manure.	Potential methods to assist in achieving objective.
• Increased quantify of manure in solid form.	• Scrape manure onto surface for air drying (instead of flushing).
• Increase N, P, and/or K in manure.	• Collect as slurry instead of liquid; collect more frequently to reduce N losses.
• Modify solid manure characteristics (drier, weed seed 'free', or has a reduced pathogen load).	• Dewater; heat treat via compost to reduce weed seeds and pathogens; use anaerobic digestion as pathogen reduction treatment.
• Specific particle sizes or density.	• Select mechanical separation screen to meet requirements; improve separation of sand or earthen components.
• If liquid manure has more/less solids.	• Use processing centers to concentrate nutrients; reduce water inclusion in stream.

Cash in on new sources of revenue

Cap and trade systems for water and air emissions will provide new opportunities for new revenue on dairies. Depending on the location of a dairy, credits for reductions in phosphorus, nitrogen or sediment (erosion) may be available. In other locations, attention to criteria pollutants (particulate matter, NOx) or select greenhouse gases (methane, nitrous oxide, carbon dioxide) may have value. There are market opportunities to obtain greenhouse gas emissions credits for use by companies in the U.S. or abroad.

In areas where air quality is poor there may also be opportunities to implement management practices/technologies to reduce emissions, thereby allowing a business to sell, bank or trade emissions credits. In such airsheds, new or expanding dairy operations must comply with new source review analysis and implement best available control technology and purchase offsets.

Emissions Reduction Credits. An existing emissions source can implement management/technology practices to reduce these emissions. These credits have value in the open market. Another emissions source interested in increasing emissions is not able to do so absent the opportunity to offset these emissions. The sum of the reduction and increase must not exceed zero.

One of the challenges is to validate the actual emissions reductions. Reductions must be real, quantifiable, and permanent. Reductions must be proven to have occurred. This requires a third party analysis to confirm reductions and must be completed per the regulatory and/or emission credit agency specifications. Accepted methodology must be available and employed when measuring emission reductions. Reductions are intended to be permanent. *(Note: It is probable that offsets would need to be purchased if in the future one would no longer generate the reductions.)*

The more commonly identified compounds for emission credits are criteria pollutants regulated through the Clean Air Act – NOx, ROC, SOx, and CO. Alternatively, one may seek to participate in carbon credits. As part of many local and regional Climate Action Initiatives there will be great pressure to reduce carbon footprint from dairy operations. As an example, the Western Regional Climate Action Initiative aims to reduce aggregate emissions 15 percent below 2005 levels by 2020. In California, AB32 is well on its way to inventory greenhouse gas emissions and identify ways to implement emission reductions.

One is going to hire a firm familiar with completing the required documentation and working on your behalf to receive high returns in the market for your reductions. Be sure you do your homework first. Be sure they know how to get through your specific emission source, understand and are able to document emission reductions, are familiar with county, regional and state regulatory obligations and emission credit options, and have a solid track record.

Renewable energy credits. After last summer's incredibly volatile fuel prices it is a given there will be more incentives available for federal and potentially state renewable energy credits. These programs are associated with "green" or "environmentally friendly" practices. They produce two products. The first is a tradable renewable credit, the second is electricity. Again, consulting firms are available to identify market opportunities, identify useful technologies, and assist in obtaining low cost financing.

Reasons to invest in "green" power include improving image, satisfy regulatory need, or controlling costs of energy use. The potential investment now in reducing energy costs in the future may be a viable option. In some areas this will include generating energy from solar, wind or methane. Depending upon the technology installed, market demand of local electric supplier, and potential payments for electricity, it may or may not be more desirable to sell electricity off-farm or utilize it on-farm.

This article is excerpted from a presentation at the 2009 Western Dairy Management Conference in Reno, Nevada.

Western Dairy News is published as a service to people interested in the health and welfare of the Western dairy industry. Archives of this publication may be found at:
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