

Milk production linked to water quality, quantity

by Hugh Maynard

Rule number one: if the cows don't drink, they don't milk. Rule number two: even if they do drink, they'll milk more if the water's right.

There are a whole host of things that effect the quality of water quality. What those problems are and what a dairy farmer can do about them was the focus of the presentation by Dr. Richard Adams at the Quebec Farmers' Association's annual Dairy Days, held at the end of February at McGill University and the Lennoxville Research Centre of Agriculture Canada.

Adams, from Penn State University, has spent his career studying the relationship between dairy production and water quality. He says that nearly a third of dairy herds that encounter some kind of production problem have a water problem.

"There are not a lot of problems with water, but when they do occur they can be serious. Most of the problems on farms are not caused by contamination but from what a farmer has control over," he said.

Cows need approximately 5 units of water for every unit of milk produced, which means that top producing cows should be able to consume up to 50 gallons per day. With less than 10% of water requirements coming from the ration, Adams says that failure of the watering system to deliver or give access to an adequate supply of water is the most frequent cause of low intake. This is followed by poor water quality due to microbial or bacterial contamination and problems associated with excessive (or deficient) mineral content.

Access

Water delivery problems can be as simple as no water facilities in pastures and exercise paddocks, or as complicated as stray voltage originating from a neighbouring farm. Adams noted one case where a submerged pump at one farm was giving off electricity which travelled over a mile via the aquifer to another.

More commonly, however, failure to keep watering bowls clean, or inadequate watering facilities, are the types of situations that Adams finds when milk production in herds declines inexplicably. He says that some of the new types of watering bowl valves block easily, with only a few baler twine hairs in the pipes being all that is needed.

"Cows are social beings; when one drinks water, they all want to drink. If they don't get it straight away, they forget about it. Rather than dehydrate, they reduce milk production," he said, adding that cows need water most right after milking and feeding.

To few waterers in free stall barns means that some cows get squeezed out in the the crush to drink within a short period of time. Even if watering bowls are clean, an improperly adjusted pump or clogged pipes results in inadequate water pressure, which should be a minimum of 20 psi at the furthest reaches of the watering system.

Adams suggests the installation of an in-line water meter to monitor water consumption and flow; at less than \$100 per unit, it's a small investment with a potentially large pay-back.

Bacteria

Even though cows have a greater tolerance of high bacteria counts, excessive bacteria levels can interfere with rumen metabolism by competing with the normal flora essential for forage digestion; reduced feed intake can result, leading to ketosis. Severe bacterial or microbial contamination can result in infections such as diarrhea, abscesses, ulcers, mastitis and salmonella poisoning.

Farmers who suspect bacterial contamination should obtain more than just coliform counts, says Adams. "You need to know the different types of bacteria in order to determine a solution, whether they are soil-born or pathogenic. You need to have a look at the total picture."

He pointed out that "iron loving" bacteria produce a slime that plugs up pipes and affects the taste of the water; since cattle "don't like a metal taste of any kind," according to Adams, removing iron from the water is more important to improving water intake than treating the bacteria alone.

On the other hand, high coliform levels can be deadly for calves; determining the type of bacteria can often point to the source of contamination and provide a short-cut to solving the problem. Most coliforms are soil-born but most incidents of infection come from fecal coliforms; these are divided into animal and human sources, identified by streptococci and coliforms respectively.

Adams says that between 65-80% of coliform contamination in farm water supplies comes from human sources, with septic tanks and weeping tiles the common causes. Keeping wells located away from possible sources of contamination is the only sure way to ensure clean water.

Hiring a hydrologist is the best way to locate clean water sources according to Adams. They will use aerial photos to identify fractures in the land that will provide water but which don't cross or draw from possible sources of contamination. Even though such a survey will cost several hundred dollars, he maintains the procedure is a lot cheaper

than having to drill three or four wells guided by a "water witcher"; the witcher will find water, but will it be clean?

Other biological contaminants are blue-green algae, the scum often found covering stagnant ponds and in uncleaned water bowls; Adams says the algae will produce toxins that will kill cats and dogs. "Cleaning waterers once a week is the only way you can keep the bacteria load to cows down," he said.

Giardia, a single cell organism that is often the cause of municipal water systems shutdowns, is another contaminant that farmers want to avoid at all costs; heavy chlorination, often at considerable expense, is the only solution.

Minerals & Metals

So, the waterers are cleaned twice weekly and the new well is nowhere near the septic tank, everything should be alright? Maybe, maybe not.

A variety of minerals (see table) can cause a mix of dairy herd management problems, the most significant of which are iron, manganese and melibdinium. These can contribute to induced copper deficiency, resulting in lower milk production, along with an oxidized or "cardboardy" flavour, and hoof problems.

Signs are cows with coats turning grey, black droppings and a general poor state of health; he pointed out that blood tests won't show anything until the problem is quite severe, and that even recommended levels of copper in the mineral mix is not always a guarantee of prevention.

He suggested that any water tests showing less than 0.6 ppm of copper would be a marginal situation requiring additional copper in the ration, boosting the normal 10-12 ppm to 15-30 ppm, depending on the copper deficiency in the water.

Conversely, highly acidic water can cause copper toxicity, with the water corroding the copper pipes. Green stains at joints and faucets is a good indicator and some farms have had to convert to plastic pipes.

Adams says that organic contaminants such as nitrates and pesticides have so far proved to be of little concern to well water quality. He cites surveys from across the U.S. that show only 2.6% of tested wells had nitrate levels of any significance, despite the fact that 54% had some nitrates present; he believes that nitrates have always been naturally present in water to some degree.

Of significant cases of contamination, only 14% were in excess of 100 ppm, which were still too low to affect cattle, or even adult humans. He noted that in the worst cases there might be some concern for infants, especially if they were being fed formula.

Pesticides and other industrial solvents have also shown only minor levels of contamination in surveys; less than 2% of samples had any contamination, and less than 1% had levels that might pose some problems to humans or livestock. He said that farm wells located next to a fertilizer plant could expect problems, but as a general rule, farms were witnessing few problems in this area.

Improvements in regulations for landfill sites since the 1980s have reduced problems as far as water contamination is concerned. Adams cites the use of liners for new landfills, as well as prohibition of establishment on gravel soils, in old mines, sinkholes and away from water supplies as being the major reasons.

He warned however, that illegal dumping still posed a threat, especially from industrial waste; having approved and supervised landfill sites was a much better solution, in his view, than not having any and increasing the risk of illegal dumping.

"Protection (of water supplies) is only as good as the enforcement. If we put everybody who was violating regulations into jail, the jails wouldn't be big enough and we could pay off the national debt just by fines. But they don't like to do that because it's called government interference," Adams concluded.

Minerals and metals in water

Iron

Causes maintenance problems with equipment and stimulates bacteria growth in pipes, producing slime that clogs pipes and gives water off-taste.

Manganese

Can effect butterfat tests at 0.1 ppm; can affect cow health through reduced water consumption at 1-3 ppm.

Calcium

Excessive levels can cause retained placenta, adjustment should be made through the ration.

Magnesium

Has an effect like Epsom salts, quickly shows up in thinner cows.

Sodium

Cows will tolerate up to 1,000 ppm, usually comes from water softener treatments; using chlorine and passing through sand filter is better solution than ion exchange with salt.

Sulfur

Rotten egg smell at 0.1 ppm gives poor taste and results in lower water intake; greater than 10 ppm can cause anemia and reduced fertility.

Nitrate iron

Cows will tolerate 200-300 ppm, but greater levels will reduce growth in young stock and cause infertility and reproductive problems in cows.

pH

Range should be pH 6.0-8.0; unless iron or manganese present, can dip to pH 5.0 before problems occur for low end of scale. Veal are more susceptible to low pH, which must be kept above 6.0.

For alkaline water, pH levels that exceed 8.5-9.0 can cause problems, depending on the diet.

Lead

Comes from sinkholes used to bury old batteries, or in farms hooked up to public water systems where pH has been raised to as much as 10.0 in order to neutralize the lead. Results in lower feed intake and ketosis.

"There are some farms that never amounted to anything in the dairy business due to water problems. Never buy a farm where they never had good luck with cows until you test the water supply. That's kept a lot of people out of trouble."

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