Water supply and Intake for Dairy Cattle

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Water, like energy, protein, vitamins and minerals, is essential for the "high producing dairy herd". A lactating cow can drink from 30 to 50 gallons per day (1) depending on age, lactation and environmental conditions. Most farmers assume that if they provide some water sources in the barn, their cattle will self regulate the intake of water to support her production. But that assumption might just be incorrect.

Water Intake

The social structure of cattle, the moisture content of the ration, the physical environment inside the barn, location of water in the pen, day to day human intervention all will influence the amount any particular cow might drink on a given day. If water intake is limited then feed intake can be limited (2). If maximizing milk production is the goal. Then maximizing water consumption is a priority. In research done with tie stall cows at Michigan State University cows drank a high of 1.59 gallons per drinking bout at a rate of 1.29 gallons per minute. These cows drank 16.1 times per day for a total of 16.7 minutes per day. With about 38% of the cow's daily water requirement coming from moisture in the feed and 62% from water consumed at a drinking fountain (3). For an "theoretical 100-cow group" this indicates that there would be 1.16 cows drinking at any one moment during the day.

But we need to apply some reality to the picture. The cows in your herd are perhaps not as organized as the "100-cow average group". Within that same 24 hour period there will be times when cows will be resting, eating, ruminating or in the holding pen or milking parlor which all keep them away from opportunities for drinking. The manager's job is then to counter act those barriers to water consumption, and provide incentives for the cows to drink more.

Location Location, Location.

Just as in Real Estate the location (of water sources) can mean increased satisfaction for the client (the cows). A commonly quoted recommendation calls for one watering spot (or 2ft. of space per cow) for each 15-20 cows (4). This suggests 15% of the herd should be able to access water at the same time (5). But space alone is not enough. Location of water in the pen can influence use. Research from Kansas State University (5) reported that 72.5% of water was consumed at troughs located in the exit half of the pen and in pens with three crossovers 39% of the water was consumed at the center crossover. The addition of temporary water tanks on outer walls between crossovers adjusted the water tank use throughout the barn, even at the end tank. This reduced cow crowding and stress by spreading cattle over a larger area of the barn. Of the water consumed at the crossovers, 60% was consumed from the water tank nearest the feed bunk (5), which indicates that water should be placed near the feed bunk. The other important place for water availability is at the parlor exits, in the research example above, cattle exiting the parlor consumed 3 to 5 gallons per day at water tanks in the return alleys during the summer months.

Water Quality is Job One

Consideration needs to be given to the chemical and bacterial qualities of the dairy herd water supply. There are several properties of water that are considered in both humans and animals when examining water quality. These include; smell and taste, salinity (Total Dissolved Solids and Total Soluble Salts), chemical properties (ph, hardness, dissolved oxygen and solids), Excess minerals, Toxic compounds and Bacteria. While these problems are described in more detail elsewhere a short synopsis of water quality measures is in order.

The determination commonly used when measuring salinity is Total Dissolved Solids (TDS). With the exception of the potential for some diarrhea, a TDS of up to 5000ppm is acceptable in most cases, though the lower the TDS level the better. Water hardness generally does not adversely affect cows (6). Nitrates can, in certain circumstances, constitute a health risk issue. The general safe concentration of nitrates in water is less than 44 ppm and less than 10 ppm of nitrate-nitrogen. Be aware that nitrates in feed and nitrates in water are additive in the cows diet. This can become important when considering potential nitrate poisoning effects (7).

Sulfur or Sulfates in well water is a significant issue in parts of Michigan. And when sulfur exceeds 500ppm, determination of the specific salt form should be made to determine potential toxicity (7). Hydrogen Sulfide, the most toxic form, of sulfur can decrease water intake at levels as low as 0.1 milligrams per liter (7). Toxic compounds and Bacteria in water need to be monitored as well. A maximum level for a number of contaminants and toxins is provided in figure 1 (7). But bacterial contamination is perhaps the most common contaminant of farm water sources.

Though the Michigan Department of Agriculture tests water on dairy farms annually, it is still important to consider bacterial contamination in water destined for cattle consumption. . For animal consumption, especially young calves, total and fecal coliform counts should be less than 1 per 100 milliliters. For adult animals total and fecal coliform counts should be under 15 and 10 per 100 milliliters, respectively. It is also recommended that fecal streptococci counts not exceed 3 or 30 per 100 milliliters for calves and adult cattle, respectively (7).

General cleanliness of drinking facilities is important as well. What is often considered somewhat acceptable is the presence of algae growth in the water or decaying plant material dropped into the water by the cows. These organic materials can produce off-flavors and even add nitrates to the water. Regular cleaning of water sources in the barn can help maintain water intake particularly in hot weather when temperatures encourage water quality problems. While clean water tanks may not add more milk production it can lead to less production loss, by making the water more desirable to drink.

Facility Usage and Demand

A hidden management hurdle in maximizing water intake is supplying enough at the right time. Planning for adequate gallons per minute for the entire facility is important. The water supply system must be able to supply enough gallons per minute to meet the maximum draw on the system during peak water use periods. As an example, cattle often head for the water tank following milking. For a 100-cow group there may be 10 or more animals attempting to drink at various water tanks simultaneously. Using the 1.5 gallons per minute drinking rate established above (3) and multiply that by 10 cows equals a 15 gallon per minute requirement. Keep in

mind this is only for one pen. There could be other simultaneous water requirements to fill as well. Some water might be used in the parlor during this time. A plate cooling system uses about 3 gallons of water for each gallon of milk cooled and some water might be used for watering heifers or cattle in other pens or even animal cooling. All this water adds up quickly. In practical terms, if the flow rate or water demand for the entire water supply system cannot be met, some animals cannot drink as much water as they would desire when they want it, robbing them of potential production. Maximum milk production requires maximum water availability.

In order to meet demand, both current and future, estimates of daily usage and demand will need to be made to determine issues such as well capacity and/or number of wells needed. The main line from the well or storage tank area needs to be sized properly. On farms planning for future expansion the main line must meet the demand for all water uses on the dairy current and future. Water distribution problems will occur in the future when this line is sized only for current use.

The distribution lines branching off the main water line is routed to a specific building or use. An example would be the line to the freestall barn. This line should be sized to supply the drinking needs of the cows and for current and future animal cooling purposes. These lines are often too small. Branch water lines carry water from the distribution lines to it end use, such as a water tank. The water movement capacity of these lines can become a problem if the branch lines are utilized as distribution lines for other water uses. Usually they cannot carry enough water to work well (1). A final consideration for water system planning is the loss of pressure in a piping system due to friction losses as water flows through the system. This pressure loss is due to friction in the pipe, elevation differences between the pump and the end use and velocity losses. Friction losses are due to water flowing through pipes, fittings, and valves. If these losses are too great then the system will not be able to move enough water to the end use points to meet water requirements (1). The mechanical and hydraulic engineering requirements of a complicated watering system such as commonly that used on U. S. dairy operations call for careful consideration the needs of the farm and cows, particularly before construction or renovation.

On a practical basis, what does this mean for most producers? First, look around the cattle facilities during times of both peak and non-peak water use. If the cows appear to need to wait for their turn at the water tank then perhaps there are not enough water sources in the pen. If the cows need to wait for the water tank to fill before drinking or the tanks are all but dry then there is a water supply problem. Another test of the system might entail opening all the water sources to run simultaneously for a short period and see how long it takes to fill the water tank farthest from the well. There are, no doubt, other simple tests that can be devised on the farm to challenge or determine the capacity of the water supply system on almost any farm. The question remaining is, does your water supply meet the needs of your cows?

Table 1. Generally considered safe concentrations of some potentially toxic nutrients and contaminants in water for cattle

Aluminum	0.50
Arsenic	0.05
Barium	10.00
Boron	5.00
Cadmium	0.01
Chromium	0.10
Cobalt	1.00
Copper	1.00
Fluoride	2.00
Iron	2.00
Lead	0.02
Manganese	0.05
Mercury	0.01
Nickel	0.25
Selenium	0.05
Vanadium	0.10
Zinc	5.00
ppm = Parts per Million	

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