



Never cut corners on water availability

WATER is the most vital and overlooked nutrient for dairy cattle. Too often we neglect an assessment of water resources when conducting a herd walk-through. But an adequate supply of clean water is important for such basic functions as urination, respiration, and heat dissipation. On planet Earth, all cellular activity has adapted entirely to the chemical and physical properties of water.

For the dairy cow, water comprises about 87% of milk, and body water content ranges between 56% and 81% of body weight. In fact, the water requirement for the high-producing dairy cow, per unit of body weight, is reported to be greater than for any other land mammal.

Ensuring adequate water availability needs to be a top priority for any dairy herd. There are two primary sources of water for the dairy cow:

1. Drinking water that supplies 60% to 80% of needs.
2. Water or moisture in the feed that supplies 25% to 35% of needs.

More than space per cow

Water availability is a function of four main components shown in Figure 1. We often focus primarily on monitoring space per cow when assessing water availability, but we also need to consider flow rate, placement of the water resource in the pen, and water quality. Taken together, these four factors determine whether cows can satisfy their water requirements on any dairy farm.

For instance, even if there are adequate linear inches of water space in a pen, a slow rate of flow into a waterer means that some cows will need to wait in order to drink or they may not get to drink at all during that visit to the waterer. Likewise, a poorly placed but properly sized water tank, perhaps in a narrow crossover alley, can be more easily guarded by a dominant cow.

What drives water intake?

The main factors affecting water consumption are dry matter intake, milk production, dry matter content of the ration, environmental temperature, and sodium intake. Most water intake prediction equations use some combination of these key factors.

The most accurate water intake equations available were developed recently by researchers at the University of California-Davis and University of Nebraska-Lincoln. Two equations were proposed: one for use when dry matter intake is known, and another for use when intake is not available. Having these two equations

markedly improves our ability to accurately predict water needs on a dairy farm because many farms do not have measured dry matter intakes.

Accurately quantifying drinking water needs is critical when attempting to match water system capacity to the number and type of cows in a facility. Anyone wishing to use these equations will find them in the reference mentioned at the end of this article.

Natural drinking behavior

Research shows that cows in tie stall barns drink about 14 times daily, while cows in loose housing only drink seven times or so in a day. Altogether, a dairy cow will typically spend between 10 and 60 minutes per day drinking. In one study, water intake per drink averaged 3.3 gallons with a range of 0.6 to 13 gallons.

Most water is consumed during daylight hours — one study reported that 73% of water was consumed between 6 a.m. and 7 p.m. Rate of water intake varies between 8 and 33 pounds per minute, with the slower rates usually associated with water bowls frequently found in tie stall barns.

We need to remember that cows drink a lot of water quickly! If we envision 6 cows drinking at one time at a water tank, each drinking 2 to 4 gallons per minute, then in total they will consume about 12 to 24 gallons in just one minute. So, the best water systems are often designed to provide about 30 gallons per minute flow rate into the tank to ensure that water does not become limited at active drinking times.

Flow rate into water bowls is also important. Decades ago, a European study tested flow rates of 0.5, 1.8, or 3.2 gallons per minute. As flow rate increased, time spent drinking fell from 37 to 7 minutes per day and overall water intake climbed from 20 to 23 gallons daily. We should never underestimate the potential for slow refill rate in a water bowl to negatively affect cows within the herd, especially when we consider how easily a single water bowl can be guarded by a dominant cow.

Space recommendations

Most commonly, water tank perimeter space is recommended to be at least 2 inches per cow and preferably 4 inches. Other important recommendations include providing at least two watering locations within a pen to mitigate the potential negative effects of dominance and competition for water. A good rule of thumb is to provide sufficient water so that 20% of cows in the group are able to drink at the same time.

Exit lane waterers are important, especially on larger dairies where cows need to walk 200

The author is president of the William H. Miner Agricultural Research Institute, Chazy, N.Y.

or more feet back to their pens. Research shows that cows can consume up to 10% of their total daily water intake after parlor exit during the hot summer months.

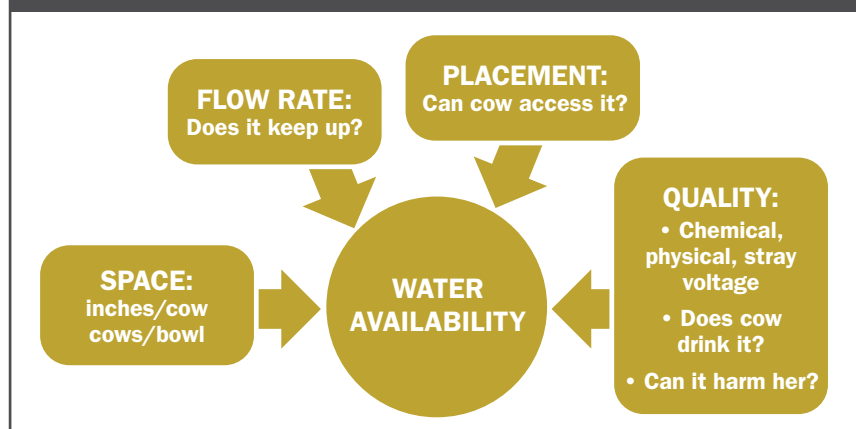
Researchers at the University of Guelph measured the relationship between water tank space and milk production on commercial dairy farms and found that milk yield improved by 2.1 pounds per day for every 1 inch per cow of water trough space within the observed range of

locate and size water resources and crossover alleys.

In four-row barns with minimal overcrowding and three times a day (3x) milking frequency, they found that pen water usage was greatest for the middle crossover and lowest for the end crossover water trough. The water trough located at the pen exit to the parlor was intermediate in water usage.

This information tells us that we should never cut corners for cross-

Figure 1. Four factors that affect water availability.



1.5 to 5 inches per cow. This relationship is useful when attempting to quantify the economic impact of inadequate water space per cow.

One final note: Cows drink 30% to 50% of their total daily water within the first hour or so after milking, which coincides with major periods of feeding. Feed and water intake are always positively related. The time right after milking is also a peak time for water use for cleaning the parlor and milking equipment.

We need to be sure that water pressure is adequate to supply water tanks and waterers during this time of peak use. Water flow rates ought to be measured during these times of heavy water use. Cows should never have to wait for the tank or bowl to fill!

Location of water resources

Important general guidelines for waterer placement include:

1. Providing the ability to eat and drink at the same time boosts dry matter intake and milk yield.
2. Recognizing that cows prefer to see while drinking to avoid being butted or displaced.
3. Understanding that cows should travel no more than 15 to 20 stalls to access a water source.

Alley width where water tanks are located needs to be designed to allow for cows to actively drink at the tank and also for unhindered one- or two-way travel of cows behind those that are drinking. Using the typical dimensions of a Holstein cow, this means that a crossover alley needs to be wide enough to accommodate the water tank, plus 7 feet for a cow drinking at the tank, and either 4 or 8 feet additional width for one- or two-way traffic.

Kansas State dairy scientists have also evaluated what water troughs in a typical freestall pen are most heavily used. This is useful information to know when deciding where to

over alley width in the middle of a pen since the most water intake occurs here. Assuming that all water tanks within a pen are used equally may result in limited water availability.

Monitor water quality often

Routinely monitoring water quality and composition is critical for every dairy farm. Water quality entails chemical and physical aspects of the water such as minerals, nitrate-nitrogen, total dissolved solids, and bacteria content. Good quality water doesn't contain undesirable flavors or odors. Quality could also include factors such as the presence of stray voltage, which thankfully is uncommon but can be devastating to a herd.

The bottom line questions are: Does the cow drink the water in needed quantities? Can it harm her?

Water quality is not the focus for this article, but an outstanding resource is a chapter titled "Drinking water for dairy cattle" by Kononoff et al. in the 2017 e-book, *Large Dairy Herd Management, Third edition*, published by the American Dairy Science Association. This publication also contains the water intake equations mentioned earlier and how to best use them on-farm.

Previous National Research Council publications — widely considered the authoritative guides on feeding dairy cattle — have emphasized that water is the most important nutrient for dairy cattle. They suffer more quickly and severely from inadequate water availability than any other nutrient. So, ensuring ample access to water should top everyone's list of management priorities.

Water availability depends on adequate space per cow, flow rate into the tank or bowl, water placement, and quality. A problem with any one of these components will impair water intake and limit herd performance. 🐄