Dairy Research Summary

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Water Use and Conservation on a Free-Stall Dairy Farm

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Why is this important?

As our human population grows, the demands placed on agriculture grow as well, creating pressure on water resources. Water is a vital agricultural resource and its effective and efficient use improves the environmental sustainability of the dairy sector. In the past 100 years, agricultural production has accounted for 80% of global freshwater consumption. Water is one of the most important factors on a dairy farm, as it is essential to support milk production and is heavily used to wash, clean, and cool the dairy facility. Total agricultural blue water (fresh surface/groundwater) use in Canada is estimated between 1.7 and 2.3 billion m^3 per year. Approximately 5-10% of this water use is related to livestock, with the remainder used mostly for irrigation. The total water footprint of the dairy industry makes up 19% of global water use for animal production, second only to the beef industry at 33%. Despite water in Canada being a fairly abundant resource, there have been water supply issues in the past. It is likely that the industry will see more active regulation and monitoring of water use in all agricultural sectors, placing a greater need on producers to conserve water where possible. The question is, how much water does an average dairy farm use right now (the farm's water footprint), and what is that water used for? Are there ways producers can conserve water that will also provide savings?

What did we do?

A large, free-stall dairy operation in Ontario was monitored for a 1-year period. Information was collected on environmental conditions (temperature/humidity), herd management and milk production (through CanWest DHI), and water use across the farm. The operation included 419 lactating Holstein cows (milked 3x/d), 54 dry cows, 60 transition cows, 240 heifers, and 200 calves. Water was used for: drinking water, milk parlour sanitization, milk pre-cooling, cow misting, and general farm cleaning. All on-farm water was drawn from two wells and 10 in-line flow meters were installed in strategic locations to monitor and partition whole-farm water use. A water footprint scaled by milk production was calculated (L of water required for 1 kg of milk).

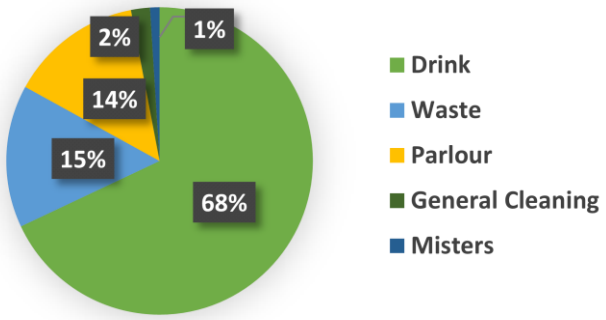

Figure 1. Breakdown of total water use (%) including drinking, waste (water not recovered from plate cooler return and pasture bowl spillage), parlour (foot baths, parlour floor cleaning, cow cleaning, line sanitization), general cleaning (barn floor, farm equipment), and mister water use.

What did we find?

The average total daily water use for the farm was 90,253 L ± 15,203 L and the annual water use was 33,032 m^3. Predictably, water intake was higher in the warmer summer months compared to cooler and less humid months. Approximately 12,160 L of water was used daily to clean the parlour. Plate cooler flow discharged into the primary reservoir on the farm and while in use, the plate cooler flow exceeded drinking water consumption and exceeded the reservoir capacity. As a result, 12,702 L overflowed from the primary reservoir into wastewater daily and entered the manure storage. Interestingly, during the period of monitoring on this farm, there was a plumbing change that resulted in an increase in daily plate cooler waste from 3,801 L to 15,604 L! The change caused a reduction in the capacity to reuse the plate cooler return water as drinking water and demonstrated the fact that plumbing changes can have unintended effects on water components elsewhere on the farm.

Table 1. Allocation of total on-farm water uses.

Component	Annual Water Use (m^3/year)	Daily Water Use (m^3/d)
Drinking Water	22,101	60.4
Plate Cooler Waste	4,649	12.7
Milk Parlour	4,451	12.2
Barn Cleaning	702	1.9
Misters	481	1.3
TMR	474	1.3
Pasture Waste	175	0.48
Total	33,032	90.3

The water footprint scaled by milk production was 6.19 L/kg milk, including contributions from all animal groups and 5.34 L/kg milk when excluding the water intake of replacement animals and dry cows.

Milking System Comparisons

In a separate study, water use was measured on 17 dairy farms, including tie-stall and free-stall, both automated milking ("robots") and parlour systems, over a 2-year period.

- Free-stall parlour – used 134.6 L/d per cow
- Free-stall robot – used 168.8 L/d per cow
- Tie-stall – used 101.3 L/d per cow

Source: A.D. Robinson, R.J. Gordon, A.C. VanderZaag, T.J. Rennie, and V.R. Osborne. "*Usage and attitudes of water conservation on Ontario dairy farms*"

What does it mean?

Dairy farms in Alberta continue to grow, causing increased pressure on water resources. The researchers suggested a couple scenarios for water conservation that producers can consider. If strategies such as lower stocking density or improved ventilation were used to maintain the average barn temperature at 2 °C lower, 351 m^3 of water could be saved annually and the water footprint would drop to 6.12 L/kg milk. If the plate cooler water and other water losses were fully recycled instead of wasted to manure storage, 4,882 m^3 of water could be conserved and the water footprint would drop to 5.29 L/kg milk. Water reuse is currently the most common water saving strategy used on-farm. That said, 55% of farms in a Canadian survey did not use water reuse strategies, suggesting that this is a major area that could be improved. Producers should proactively examine their operations and current plumbing from the perspective of water conservation. Small changes can sometimes make an enormous difference in water conservation and allow the dairy industry to retain its status as a leader in environmental sustainability.

Summary Points

- Dairy farms use a significant amount of water; the largest portions are used for drinking water, cooling, and cleaning
- Producers should consider ways to reduce water consumption on farm to improve environmental sustainability

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