



Usage and attitudes of water conservation on Ontario dairy farms

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ABSTRACT

Water use on 17 Ontario dairy farms was studied over 20 mo using continuous-flow water meters to measure cow consumption and milk-house and parlor usage with the goal of quantifying and assessing the amount of water used on dairy farms. The farmers were also interviewed regarding their perspectives on water use on their operations as well as throughout the industry. The goal was to gauge producers' opinions and motivations behind water use as well as future environmental and industrial sustainability. Average water use for a free-stall automated milking operation was greater ($P < 0.01$) than the average usage for a free-stall parlor and a tie-stall operation. Overall, water use was found to be greater ($P < 0.05$) during the summer (June–August) than the winter months (December–February). Producers of free-stall operations were found to implement sustainable water-use strategies on their farms even without government incentive.

Key words: dairy, water use, sustainability, efficiency, agriculture

INTRODUCTION

The production demand on the agricultural industry is constantly increasing with the growth of the human population. This is creating pressure on water resources, which then leads to a need for coordinated management considerations (Wall and Marzall, 2006). Water is a vital agricultural resource; therefore, its effective use provides a means to improve the environmental sustainability of the sector. Water is one of the most important factors on a dairy farm because it is essential for cow consumption to support milk production and is heavily used to wash, clean, and cool the dairy facility.

The total water footprint of the dairy industry makes up 19% of the global water use of all animal production, second only to the beef industry at 33% (Mekonnen and Hoekstra, 2012). There are considerations that go into the water footprint calculation that are not wholly controllable by

the farmer, including processes such as feed production. However, it has been estimated that the overall water footprint of milk production is 1 m³/kg of milk (Mekonnen and Hoekstra, 2012). This represents a substantial amount of water that could be partially conserved throughout the production system on farm, which can have a significant effect (House et al., 2014). Water is used in many aspects of dairy production within the dairy barn, including cow consumption, washing of the milking equipment and milking parlor, cleaning of the pipelines, washing down of the holding area, cooling of the milk, and heat abatement (Brugger, 2007).

With the agricultural industry as one of the leading freshwater consumers in Canada, and dairy operations as significant users, it is important to improve dairy farmers' awareness of their direct and indirect water usage (Hoekstra and Chapagain, 2007). Water is abundant throughout Canada, making it seem like an inexhaustible resource. Yet, there have been issues with supply in the past, and it will certainly become a bigger issue in

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Table 1. Operational information for 17 Ontario dairy farms used

Farm	Location in Ontario	Herd size	Milking herd size	Housing style ¹	Milking system ²	Conservation practices employed ³
A	East	141	126	Free	Rotary	Yes
B	West	160	80	Free	Robot	Yes
C	North	52	40	Tie	Tie	No
D	East	72	65	Free	Parallel	Yes
E	North	44	36	Tie	Tie	Yes
F	North	177	146	Tie	Tie	Yes
G	East	181	155	Free	Robot	Yes
H	South	116	98	Free	Parallel	Yes
I	South	145	125	Free	Parallel	Yes
J	East	85	78	Tie	Tie	No
K	North	47	43	Tie	Tie	No
L	South	125	108	Free	Robot	Yes
M	East	135	118	Free	Swingover	Yes
N	North	151	122	Free	Parallel	Yes
O	East	71	65	Tie	Tie	Yes
P	West	116	104	Free	Parallel	Yes
Q	East	226	187	Free	Rotary	Yes

¹Free = facilities where cows are free to roam around the stall area, Tie = facilities where cows are constrained to a particular stall.

²Rotary, Parallel, and Swingover are particular styles of free-stall parlors, where the cows are milked in a separate parlor area at particular times of the day, and Robot is a method in which the cows choose to go to the robotic milker on their own.

³Each producer's response to whether they practiced any water conservation on their farm of their own accord before this study began.

the future (de Loë et al., 2001). This trend may lead to more active regulation and monitoring of water use in all agricultural sectors, which puts a great amount of pressure, especially financially, on farmers.

Agricultural water conservation is an extremely important issue because of greater scrutiny being placed on more effective water resource management (Robinson, 2006). Water is essential for agricultural production; however, monitoring of Ontario's agricultural sector water use has been limited. Increasing our understanding of agricultural water use in Ontario would be a great asset for the industry, individual producers, and provincial water technicians (de Loë et al., 2001). With enhanced awareness of water conservation comes knowledge and, in turn, positive action.

The goal of this study was to quantify the amount of water used on Ontario-based dairy operations and assess current attitudes around on-farm water conservation. Specific objectives included the following:

- identifying water use for a range of Ontario-based dairy operations and assessing the extent of seasonal and system variations and
- identifying current attitudes of Ontario-based dairy producers around water conservation.

MATERIALS AND METHODS

Study Population and Measurements

This research was carried out over 2 yr, from May 2013 to December 2014 (20 mo), and included 17 dairy farms with details provided in Table 1. Initially, 25 Ontario-based dairy operations were preselected for this study from a previous Ontario Ministry of Agriculture, Food and Rural Affairs; and Dairy Farmers of Ontario project (OMAFRA, 2013). Of these, 8 were excluded because of the farmer's choice not to participate or because the facility's water systems were not able to support the water meters.

Continuous-water-flow meters (Jer-man Co. DLJ Water Meters, Hackensack, NJ) were installed on each dairy operation. These meters were purchased with a calibration guarantee, and samples were selected for validation both before installation as well as near the end of the trial. Monthly after the May 2013 installation through December 2014, the farms were contacted to provide the most recent continuous-flow water meter readings. Besides the total water-use values, the rest of the readings were converted into a liters per cow on a daily basis. Total herd size was used to calculate the per cow basis for total water use, and milking herd size was used to calculate the per cow basis for robotic, parlor, or milk-house water-use values. The farms that specifically measured total facility water use were grouped into 3 categories of milking systems: (1) free-stall parlor, (2) free-stall robotic, and (3) tie-stall facilities. "Free-stall," or cubicles, indicates facilities where cows are free to roam around the stall area ["parlor" (in-

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