

Evaluation of water usage and water conservation strategies in the swine industry

Yaomin Jin

Prairie Swine Centre Inc. P.O. Box 21057, 2105-8th Street East, Saskatoon, SK S7H 5N9

Bernardo Predicala

Prairie Swine Centre Inc. P.O. Box 21057, 2105-8th Street East, Saskatoon, SK S7H 5N9

Eleonor Navia-Richards

Prairie Swine Centre Inc. P.O. Box 21057, 2105-8th Street East, Saskatoon, SK S7H 5N9

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ABSTRACT Water is a critical input in swine operations but often neglected because of the prevailing notion that water will always be available in unlimited quantity. However, excessive use of water can have negative impact on the environment and cause depletion of water resources. In swine operations, water is used for animal drinking, cooling, cleaning, and domestic consumption. The rate of water use from different stages of swine production has impact on the overall production cost. Poor production practices may lead to higher water consumption and increased manure slurry volume which needs further handling and treatment, representing added cost. The objectives of this study are to assess the water usage in different stages of pig production and to compile the available water conservation management practices. The applicability of these conservation measures in swine production operations in terms of technical viability, economic costs for implementation, and benefits to the overall operation will be assessed. Preliminary results from this work included calculation of the current rate of water usage to produce each pig based on the literature review and survey of swine producers in Saskatchewan. Furthermore, the different technologically-feasible water conservation practices that pork producers can implement in their operations to reduce their water usage were ranked.

Keywords: cooling, drinking, pressure washing, swine, water conservation

INTRODUCTION

Water is an important input in swine operations. On one hand, water is a critical nutrient that is required in the largest quantity for pig growth. Most of metabolic functions, body temperature adjustments, nutrient transport in tissues, maintenance of mineral homeostasis, and discharge of metabolic end products all require water. At birth, water accounts for 82% of the pig's empty body weight and 51% of the market hog weight (about 240 pounds) (Shields Jr. et al., 1983). On the other hand, the volume of water used in a production operation will determine the size of the manure storage system and the land base required for effluent disposal. However, many pig producers have no knowledge of the exact amount and cost of water consumed in their operations because water is generally available freely and in many cases a water meter is not even installed in the barns.

In swine operations, water is utilized mainly for animal drinking, cooling, cleaning, and domestic chores. The rate of water use in different stages of swine production has impact on the overall production cost and on the environment. However, very little effort has been made to document the actual quantity of water used in different production stages and in different types of production units. Many existing standards have been developed over twenty years ago and may not offer an accurate account of water use on modern farms. Most of the published work only cover animal drinking, and fail to supply the information on usages for washing, cooling, and other functions within a modern swine production. Thus, this study was aimed to quantify current water usage in swine operations and to evaluate existing water conservation measures and practices that can be adopted in swine production.

METHODOLOGY

The overall approach of this study was to conduct a comprehensive search of available information on various water conservation practices for livestock operations, to conduct a benchmark survey on actual water use in different types/sizes of swine operations, and to evaluate selected water conservation measures in an actual barn facility.

The extensive literature review was aimed to gather specific information about existing water conservation practices including their description and effectiveness in reducing water use, economic cost and benefits, and their viability for application to swine production operations in Saskatchewan. Following the literature search was the benchmarking survey of different swine operations across Saskatchewan. The survey was aimed to gather information on water usage, water expenses, and production data for the past three years and consequently to determine the average yearly water expense per pig sold (\$/pig sold) and per 100-kg sold (\$/100-kg pig sold).

RESULTS

A. Highlights of literature review

Previous research conducted in Manitoba swine barns showed that animal drinking represented about 80% of the total water consumption in the barn (Froese, 2003). The rest was contributed by other activities, namely, animal cooling (10-15%), cleaning (5-10%) and domestic use (1%). In terms of production stages, farrowing stage consumed the greatest amount of water on a per head basis, followed by gestation, grow/finish, and nursery phases. However, due to the large number of animals involved, combined water use in grow-finish units comprised 64% of the barn's total water use (Froese, 2003). The different water conservation strategies implemented in swine barns that were gathered from published literature are listed in Table 1.

Table 1. Water conservation strategies for swine barns compiled from published literature.

Category	Water conservation practices
Animal drinking	<ol style="list-style-type: none"> 1. use of bowl drinkers (push-lever and float types) 2. use of nipple drinker (swinging and ball-bite) 3. use of water trough 4. use of wet/dry feeder
Cooling pigs/sows	<ol style="list-style-type: none"> 1. use of evaporative cooling pads 2. use of intermittent sprayer/mister
Cleaning	<ol style="list-style-type: none"> 1. use of hot water 2. use of soap 3. pre-soaking rooms
Management practices	<ol style="list-style-type: none"> 1. wastewater recycle for reuse (i.e. pig's drinking water or flushing manure) 2. adjustment of drinker's height

B. Highlights of the survey

Information on 29 participating swine barns in Saskatchewan was collected. The common source of water for the participating barns was barn-owned groundwater well (22 barns), dugout (6 barns) and municipal water system (1 barn). Summarized in Table 2 are the volume of water used per pig sold and the corresponding water expenses, which showed a wide range of values thus presenting an opportunity for savings in terms of reducing water use and spillage. In addition, savings in manure management costs (i.e. hauling/storage/application of manure) can also be achieved.

Table 2. Water usage, water expenses and production data of the 29 participating swine barns.

Operation		No. of participating barns	Volume of water use		Water expenses	
Type	Size		gallons per pig sold	gallons per 100-kg pig sold	\$ per pig sold	\$ per 100-kg pig sold
farrow-to-finish	12 - 1250 sows	18	67 - 2070	58 - 1558	0.05 - 2.70	0.10 - 3.19
farrow-to-wean	1300 - 6000 sows	3	1907 - 4641	867 - 1856	1.15*	0.46*
grow-finish	4500 - 55000 feeders/weanlings	6	164 - 509	207 - 432	NA**	NA
nursery	23360 - 24000 feeders/weanlings	2	1018 - 1684	3588 - 6122	NA	NA

*data from one barn only

**data not available

Table 3 shows the list of conservation measures and the percentage of barns participating in the survey that employed such measures. Almost all barns had pressure washer with straight nozzle attachment. Only few used soap or warm water for cleaning and 76% of the barns pre-soaked the rooms before cleaning. More than half of the participating barns used wet and dry feeder. Few barns used drippers to cool pigs/sows and 45% used spray/mist. Among the drinkers, nipple

drinkers were used by most barns; only few used bowls, troughs and ball-bite drinkers. Less than half of the survey participants adjusted their nipple drinkers as the pigs grow and about 69% regularly inspected pipelines and drinkers for leaks. The rest of the barns fixed any leaks as the problems occur.

Table 3. List of existing water conservation practices employed in the participating barns.

Water conservation practices	Percentage of participating barns that employed the measure
<i>Drinker</i>	
1. Use of nipple drinker (regular standard drinker)	97
2. Use of water trough	34
3. Use of ball-bite drinker	14
4. Use of wet/dry feeder	59
5. Use of bowls/cup drinker	10
<i>Cooling</i>	
1. Use of spray/mist for cooling pigs	45
2. Use of drippers	10
<i>Cleaning (pressure washing)</i>	
1. Use of soap	31
2. Use of warm or hot water	52
3. Pre-soaking rooms	76
<i>Management Practices</i>	
1. Adjustment of nipple drinker's height	41
2. Regular inspection of leaks	69

CONCLUSION

Current work demonstrated that there are various opportunities to improve water use in swine operations by carefully choosing the right combination of conservation measures and applying these to the areas where highest savings can be achieved. Results from the literature review indicated that animal drinking represented the largest contribution (80%) to total water consumption among all activities in the barn. Very little information was available on the water consumption for pressure washing the barn facility and equipment. More work could be done on optimization of the pressure washing procedure, quantification of water consumption amount, and new design of the washing tool and drinking equipment. The benchmarking survey also showed that a large percentage of producers currently do not closely monitor the volume of water consumed and the corresponding cost of water used in their production operations. Tracking the water consumption in each stage of production would allow producers to establish their baseline water usage and help to detect potential problems associated with water wastage.

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