Water Conservation in the Swine Industry

FACTS

WATER℠

Pork Producers: *Committed to Environmental Sustainability*

PORK'S 4 PILLARS OF SUSTAINABILITY℠

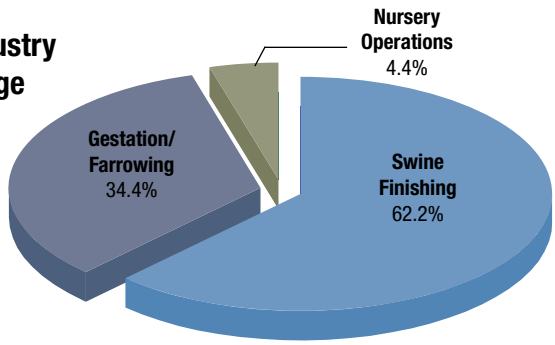
Safeguarding the environment comes naturally to America's pork producers because they understand their inherent responsibility to preserve natural resources for future generations. Today, under the umbrella of environmental sustainability, producers have taken this public trust to the next level with their Checkoff investments in research into the four pillars of environmental sustainability—CARBON FOOTPRINT, WATER FOOTPRINT, AIR FOOTPRINT AND LAND FOOTPRINT. The insights and innovations found from this research will help producers maintain their role as leaders in protecting the natural resources they manage on their farms—one of the ethical principles of the pork industry's We Care initiative they are committed to achieving.

Conserving water in swine production is not only environmentally responsible and important for sustainable agriculture, it can result in a considerable reduction in input costs. It may also have other input reduction benefits in addition to manure. For example, purchasing less water from outside sources (rural water and city systems) and running pumps less. Cost-avoidance logic in manure slurry handling and land application could be used to help determine the direct cost of excess water usage on the farm. Swine finishing in the United States uses 62.2% of an estimated 41.3 billion gallons of water annually for all of swine production. Gestation/farrowing and nursery operations use the remaining 33.4% and 4.4%, respectively. Within swine production, animal-drinking water consumption is approximately 80% of total water usage. For these reasons, the greatest potential reduction in water use would be realized through water conservation technologies and practices applied to finishing-swine drinking systems. Many of these technologies and practices are easily applicable to gestation/farrowing and nurseries as well. In a recent study funded by the National Pork Board, Iowa State University determined the most effective water conservation technologies and practices to be water auditing, facility maintenance, and pig drinker selection and management.

Water Audit and Facility Maintenance

An effective water audit involves water metering. Metering total-site water usage allows the operator/producer to establish water-use baselines. Once a water-use baseline is established, any deviation from the baseline could be identified and addressed. It is important to monitor the performance of water delivery systems as they age and require maintenance. If system leakage occurs, monitoring the deviation from baseline consumption would reveal the leak and expedite its resolution. Metering also allows the operator to monitor water consumption when no pigs are in the facility to check for non-visible leaks.

Swine Industry Water Usage



Cost Analysis Example 1

A valve or fitting (like a nipple drinker) that leaks one drop per second will add approximately 6 gallons of water to the manure storage per day. That could add up to 2,190 gallons in a year from one leaking nipple drinker. A 1,000-head finisher may have 80 nipple drinkers. If 25% of these nipples leak at the rate of one drip per second, 43,800 gallons of water will be added to the manure storage per year. At a manure slurry handling cost of $0.012/gallon, that represents a cost of $526 to land apply the leaked water as manure slurry. If that leaked water is administering medicine, it is even more costly. A producer could spend approximately $26/leaking nipple to repair the leaks in this barn to equal the extra amount that would be spent on land applying that water as part of the manure slurry, not to mention medication cost savings.

Pig Drinker Selection and Management*

Studies have shown that pig drinking systems are responsible for approximately 80% of total-site water usage. That means practices like intensely managing nipple drinker height and flow rate or using drinking systems like cup drinkers or wet/dry feeders can significantly reduce total-site water usage (Figure 1). Table 1 shows the results of a producer survey representing 319 swine production facilities; the table illustrates the difference in whole site water usage and manure slurry production between similar facilities with different pig drinking systems.

Figure 1 a and b. ;

a) Shallow cup drinker
(Vittetoe, 2010)

b) Shelf style wet/dry feeder
(Vaucluse, 2010)

Studies reported in literature have shown pig performance is not negatively affected by drinker type, assuming proper drinker and water supply management. Therefore it is assumed the difference in total water usage between the sites in Table 1 is due to wastage associated with each drinker type.

**Pork Checkoff does not endorse any specific brand or product. Products used are for example only.*

Table 1: Swine facility water usage and manure slurry production for 319 survey facilities.

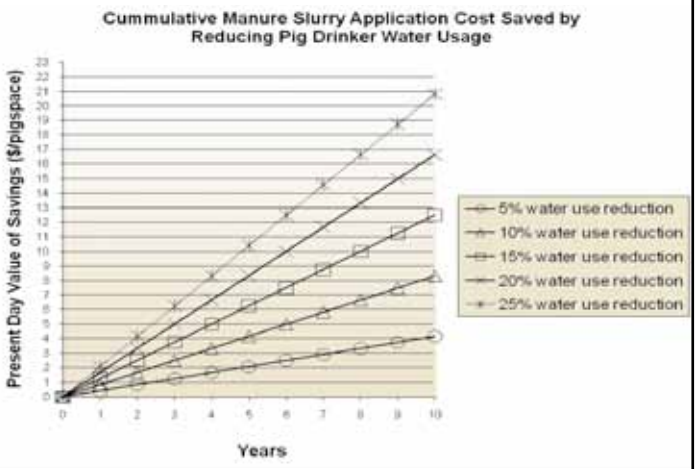
Production phase, feed/water type	Number of sites surveyed	Average total site water consumption (gal/pigspace/day) (range)	Average manure slurry volume (gal/pigspace/day) (range)
Wean-Finish, dry feed/nipple	4	1.36 (1.10-1.53)	0.96 (0.79-1.11)
Dry, Arid Climate grow-finish, dry feed/nipple	33	2.46 (1.61-3.63)	NR
Grow-Finish, dry feed/ nipple	7	2.33 (2.06-3.04)	1.50 (0.82-2.13)
Wean-Finish, dry feed/cup	29	1.48 (1.10-2.36)	0.88 (0.64-1.07)
Grow-Finish, dry feed/cup	3	1.15 (1.02-1.34)	0.71 (0.66-0.74)
Wean-Finish wet/dry	116	1.02 (0.76-1.92)	0.65 (0.40-1.60)
Grow-Finish wet/dry	17	1.25 (086-1.93)	0.75 (0.47-1.03)
Wean-Finish wet/dry and cup	42	1.37 (0.94-2.38)	NR
Grow Finish wet/dry and cup	4	1.44 (1.31-1.61)	NR
Nursery, dry/nipple	6	1.49 (0.73-2.39)	NR
Dry, arid climate Nursery dry/nipple	14	1.18 (0.71-2.19)	NR
Gestation (wet/dry trough), Farrowing (dry feed/nipple)	21	5.67 (3.20-8.19)	5.39 (3.42-9.32)
Dry, arid climate Gestation (wet/dry trough), Farrowing (dry feed/nipple)	17	10.16 (7.61-14.94)	NR
Gilt Development, wet/dry trough	6	1.43 (0.63-2.84)	NR

Pigspace defined as site design capacity. For gestation/farrowing, pigspace refers to sows.
NR = Not reported

Cost Analysis Example 2

A cost analysis on the impact of reducing water usage in a grow-finish facility with dry feeders and nipple drinkers is shown in Figure 2. A pig drinking water usage rate of 1.9 gallons/pigspace/day was assumed as the baseline (0% water reduction) based on the results of the survey in Table 1 and other published studies. An analysis was performed to find manure slurry application cost savings as the manure volume was reduced by reducing pig drinker water usage. Manure slurry application cost was assumed to be $0.012/gallon. The results of this analysis can be seen in Figure 2.

Figure 2: Cumulative manure slurry application savings as total manure slurry applied is reduced.



Baseline (0% reduction) manure slurry production is assumed to be 1.9 gal/pigspace/day for a grow-finish facility with dry feeders and nipple drinkers.

Figure 2 shows the savings possible by applying water conservation technology or practices to a swine finisher with nipple drinkers. A 5% to 25% reduction in water use in a 1,000-head finisher with dry feeders and nipple waters averaging 1.9 gal/pigspace/day can save 35,000 to 173,000 gallons of water annually. Using the assumed manure application rate, that represents $420 to $2,076 saved per year, or approximately $0.40 to $2.00/pigspace as seen in Figure 2. Table 2 gives examples of technologies or practices that are proven to reduce water consumption in the swine industry and the percent reduction they can provide.

Using Table 2 and Figure 2 it is possible to see the cost recovery time and/or required lifespan associated with various water conservation technologies and practices. The cost recovery time ranges from approximately one year for swinging nipple drinkers to approximately six to seven years for wet/dry feeders.

Table 2: Various technologies and practices that reduce water consumption in swine facilities.

Technology or Practice	Percent reduction in water use versus conventional nipple drinkers	Reference	Price[1]
Swinging nipple drinkers	11%	Brumm (2000)	< $1.00/pigspace2
Managing nipple height and flowrate	16-26%	Li (2005)	Variable3
Bite style or Arato style nipple drinkers	8-22%	Rath (2000), Almond (2002)	$0.50-$0.60
Cup or bowl drinkers	9-31%	Magowen (2007), Brumm (1999), Energy (2001), producer survey	$2.50-$4.50/pigspace
Wet/dry feeders	104-34%	Rantanen (1994), Brumm (1999), Christiansen (2002), Amornthewaphat (2003), producer survey	$8.00-$10.00/pigspace

1. Price estimated from results of producer survey, pigspace refers to finishing pigspace with 20-25 pigs per drinker
2. It is assumed solid mounted nipple drinkers can be converted to swinging nipple drinkers at a relatively low cost. Price will vary with procedure and materials used for conversion.
3. Variable depending on the amount of labor devoted to drinker management
4. Only Christiansen (2002) reported a reduction of 10% for grower pigs, the same study reported 34% reduction for finishing pigs, all other references reported reductions of 17-30%

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We Care is an overarching philosophy and set of ethical principles that guides America's pork producers to do what comes naturally to them – ***demonstrating their commitment to maintaining a high standard for safe food, animal well-being, public health, natural resources, employee care and community.***

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