Water in Swine Nutrition

Water is the most essential of all nutrients and is the most consumed nutrient in terms of amounts throughout its lifetime. Consequently, it seems to be of utmost importance to provide water in enough quantity and adequate quality to swine in all stages of production. The most relevant topics regarding water in swine production are discussed in this fact sheet.

Water requirements

Water accounts for as much as 80% of body weight at birth and declines to approximately 50% in a finished market pig. Water requirements are primarily associated with body weight and feed intake. Suckling piglets drink around 1.5 oz of water per day on the first days after birth and gradually increase consumption to around 1.5 cups daily by weaning at 28 days (Fraser et al., 1988; Nagai et al., 1994). Water intake during the nursing period may prevent dehydration and promote survival of piglets with low milk intake (Fraser et al., 1988). After weaning, water requirements are highly variable. In general, water requirements are commonly based on water to feed ratios, with normal ratios of 2:1 to 3:1 for nursery and grow-finish pigs, declining as pigs grow (Shaw et al., 2006).

In gestation, restricted-fed sows consume most of the water between meals and there is no relation between water and feed intake. Water requirements for gestating sows range from 3 to 6 gallons of water per day (Brumm, 2010). In lactation, sows have the greatest water requirement attributed to meeting the demands of milk production. Also, water consumption is important to encourage feed consumption in lactation. Water requirements for lactating sows range from 5 to 10 gallons per day (Kruse et al., 2011).

Factors affecting water usage

Water usage by the pigs is influenced by different factors, including environment, management, facilities, and diet. Understanding the factors affecting water usage is important to provide water to meet the requirements while controlling water wastage.

Water flow rate

Low water flow rate increases the time spent at the drinker and discourages optimal water consumption by the pigs. In contrast, high water flow rate increases water wastage. The recommended water flow rates are presented in **Table 1**.

Water pressure also influences the activation of water delivery devices by the pigs and the amount of water wastage. The recommended water pressure to facilitate activation while controlling water spilling is 20 psi.

Table 1. Recommendations for water flow rate

	Nursery	Grow-finish	Sows
Flow rate, cups/min	1-2	2-4	4
Time to fill a 16 oz bottle, sec	60-120	30-60	30

Adapted from Brumm (2006; 2010).

Waterer to pig ratio

Waterer to pig ratio of 1:25 is typical for nursery and grow-finishers in the industry. The general recommendation is to have a single waterer for every 10 to 15 pigs, typically in a 1:12 waterer to pig ratio. Providing access to water at the recommendation may improve growth performance of nursery (Sadler et al., 2008) and grow-finish pigs (Vier et al., 2018).

Waterer type and adjustment

Waterer types for pigs are generally categorized as nipples or cups. Both are designed to provide *ad libitum* water to pigs and there is no evidence that growth or reproductive performance is influenced by waterer type. Yet, waterer adjustments to the proper height for consumption is important to encourage water consumption as pigs grow. Cups and nipples mounted at a 90° angle should be adjusted at shoulder height, whereas nipples mounted at a 45° degree angle should be set at 2 to 3 inches over shoulder height.

There is a wide variation in the amount of water wastage due to waterer type and management. Nipple drinkers are more prone to water wastage than cup

drinkers. With nipple drinkers, water spilling goes directly into the manure pit and pigs easily activate the nipple for recreation or by unintentionally leaning on the nipple. Nipple drinkers may require more management of waterer height and water flow to minimize water wastage. With cup drinkers, water spilling flows into a bowl placed beneath the water delivery devices and is available for pigs to drink. However, cup drinkers may also accumulate feed, urine, and feces in the bowl, whereas nipples provide a continuous supply of fresh water for pigs.

Feed form and feeder type

Water consumption is greater for pigs fed meal diets compared to pellet diets, resulting in a similar water to feed ratio when accounting for differences in feed efficiency between the feed forms (Laitat et al., 1999). The use of wet-dry feeders reduces water wastage compared to the use dry feeders and waterers (Brumm et al., 2000).

Diet composition

Water consumption is greater when dietary composition increases the need to eliminate metabolites or surplus nutrients. The increase in water consumption is noticeable when pigs are fed diets with excess salt, proteins, or minerals (Shaw et al., 2006).

Environmental conditions

The amount of water consumption by pigs varies greatly with temperature, humidity, ventilation, stocking density, flow rate, health status, and stress level. Knowledge of the daily patterns of water consumption by the pigs can serve as an indicator of unfavorable environmental conditions and a predictor of the onset of health challenges (Brumm, 2006).

Water quality

Water quality generally refers to the mineral composition, pH, and bacterial contamination of drinking water. Minerals most commonly found in ground and surface waters are sulfates, chlorides, bicarbonates, and nitrates, which form salts with calcium, magnesium, or sodium. The combined concentrations of these minerals are called total dissolved solids (Patience, 2012). The potential for water quality issues increases with heavy applications of fertilizers to fields, contamination of run-off water by animal wastes, and severe drought. Pigs are typically adaptive to a wide range of water quality, but concerns arise with elevated levels of sulfate, nitrate and nitrite in the water source.

Sulfates

Sulfates are a common cause of water quality problems. Sulfates are of special concern because of laxative effects. As a result, pigs consuming water with high levels of sulfates typically have diarrhea. Growth and reproductive performance do not seem to be adversely affected unless extreme levels of sulfates are present in drinking water. Recommended maximum sulfate level in water is 1,000 ppm (NRC, 2012).

Nitrates and Nitrites

In water, nitrates are converted to the toxic compound, nitrites. Nitrites impair the oxygen-carrying capacity of the blood by reducing hemoglobin to methemoglobin. As a result, nitrites toxicity causes low oxygenation of tissues and results in signs of cyanosis and difficulty breathing. Recommended maximum level in water is 100 ppm of nitrates plus nitrites nitrogen (NRC, 2012).

Total Dissolved Solids

Total dissolved solids (TDS) is a measure of the total minerals dissolved in a water, which is also referred to as water salinity. As many elements contribute to TDS, further analyses need to be conducted to determine specific mineral contaminants in the water. Pigs consuming water with high levels of TDS have transitory diarrhea, but health, growth and reproductive performances are not usually affected. Recommended maximum TDS level in water is 3,000 ppm (NRC, 2012).

Hardness

Hardness is the level of calcium and magnesium in the water. Water hardness contributes to the formation of scale deposits that can lead to accumulation of scale in the water system, causing nipple drinkers to become blocked. Water is considered soft if the concentration of calcium and magnesium is below 60 ppm and hard if above 120 ppm (NRC, 2012).

pH

pH is the measure of water acidity or alkalinity. Most water sources are within the acceptable pH range of 6.5 to 8.5 (NRC, 2012). Acidic water (pH lower than 5) can create corrosion and cause damage to water lines. Basic water (pH above 9) can form scale deposits and block the nipple drinkers. Moreover, water pH influences the dispersion of medications used via water application and influences proliferation and survivability of pathogens. Basic water (pH above 7) is considered a risk factor for *E. coli* diarrhea and water pH should be controlled if diarrhea is a problem.

Coliforms

Water contamination by bacteria is estimated by measuring the level of coliforms per milliliter of water. Recommended maximum level of coliforms in the water is 50 CFU/ml (NRC, 2012).

Water test and treatment

It is recommended to test water quality annually. A regular water test allows for detection of changes in water suitability for pigs. Water tests typically assess TDS, hardness, pH, and coliform count. Water samples should be collected at the beginning and at the end of water lines for analysis.

It is important to clean water lines regularly. Water lines form a biofilm and a buildup with solids over time, which increases the pathogen load, reduces the volume of water, and decreases the efficiency of chemicals and medications used via water. Water lines should undergo a treatment with hydrogen peroxide and organic acids to flush out the buildup and then a chlorine-based disinfectant should be used to reduce the pathogen load. It is worth noting that disinfectants have little to no effect on microorganisms contained in biofilms or in the presence of organic matter. After cleaning, all nipples should be checked for flow rate as biofilm and solids can reduce or plug water flow through nipples.

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