Water Concerns And Strategies To Deciphering Them In Commercial Pig Production - A Review

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Abstract: Water is one of the fundamental nutrients required for the optimization of swine production. Water plays very important functions in the life of the pig. Pig does not just require water but good quality water as to be able to perform optimally. In most swine production areas access to good quality water is increasingly becoming difficult. Poor quality water impedes performance and health of the pig. Poor quality water leads to excessive water consumption resulting in difficulties in manure management principally due to increased slurry volume. Mineral ionization and solubility are also the problems leading to the formation of phytate-mineral-complexes which is the leading cause of high levels of minerals in the pig manure. This also compromises the pig health/welfare and causing eutrophication. This review focuses on water concerns experienced on pig farms and provides the means of managing them.

Key words: Production, Strategies, Swine and Water Quality

1 Introduction

Water is a key nutrient in swine production. Pigs require water for its many functions, such as growth and other physiological functions. The nature of diets that are served also determines feed intake. For pigs to perform optimally, they should be provided with adequate good quality water [3]. To this point therefore, any factor that influences the provision of good quality water to the pig will no doubt affect pig production. It is also important to identify other factors that affect water intake, such as nature of feed being consumed [7]. As an important nutrient required in adequate amount just as in other nutrients care must be taken in its management. This comes to the fore because access to good quality water in swine producing areas is gradually becoming difficult [3], [11]. Poor quality water usually compromises pig performance in addition to encouraging pigs to drink excessively resulting in the difficulties of managing such slurries just because of the intake of excessive water. Disposal of such slurries are also very time-consuming resulting in delay in the time it takes for re-stocking in the commercial setting [5], [8]. This paper dwells on water concerns that are often experienced on swine farms and also decipher strategies that can be adopted in managing them.

The Importance of Water in the Pig

As previously stated, the pig requires water for its various biological needs. Water is required for the regulation of the pig’s body temperature, nutrient digestion/absorption as well as for the elimination of waste products of digestion and metabolism [7]. Water is also a major component of saliva and milk. From nutrition standpoint, it is difficult to truly quantified water requirements by the pig because of the many factors involved. Nevertheless, the amount of water required by pigs is driven mainly by the amount required to maintain the body water pool. Body water pool appears to remain constant throughout the various physiological phases of growth [10]. On the other hand, the pig loses water through various ways. These include respiration, evaporation, urination and faeces. However, the main route of water losses is by urination [7].

Water Intake by Different Physiological Groups of Pigs

Water intake by pigs is highly dependent on its physiological status. The estimates of water intake by these different groups of pigs are presented in Table 1.

Table 1. Estimated water intake of physiological classes of the pig

<table>
<thead>
<tr>
<th>Physiological Class</th>
<th>Water Intake (kg/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gestating sows</td>
<td>11.5 – 20</td>
</tr>
<tr>
<td>Lactating sows</td>
<td>12 – 40</td>
</tr>
<tr>
<td>Suckling pigs</td>
<td>0 – 0.2</td>
</tr>
<tr>
<td>Weaned pigs</td>
<td>0.5 – 1.5</td>
</tr>
<tr>
<td>Growing-finishing pigs (fed ad libitum)</td>
<td>5 – 7.5</td>
</tr>
<tr>
<td>Growing-finishing pigs (fed restricted)</td>
<td>6 - 9</td>
</tr>
</tbody>
</table>

Source: [7].

Gestating Sows

Water requirements in the gestating sow is more influenced by its physiological needs [7]. Gestating sows are normally fed restricted and as such tend to consume more water as to feel satiated and full. Additionally, if sows are housed individually they may suffer from boredom which often makes them to drink excessively as to offset such boredom. Hence in practical terms gestating sows should be provided with ad libitum water intake. This also comes with additional advantage of meeting the animal welfare from the animal rights standpoint [4].

Lactating Sows

These are sows that are milking to feed the young piglets. Therefore, their water intake is more than the other categories of pigs. Generally, it is recommended that lactating sows should be given between 15 to 20 litres of drinking water per day depending on size and level of milk production levels [7]. However, the level of water intake by sows is seriously influenced by the salt dietary content. For
instance, if the salt dietary intake is high more water will be consumed by the lactating sow; this observation was confirmed by the study of [9]. In that study, it was shown that the feeding of a diet containing 0.4% salt during a 4-week lactation period resulted in a significant more water consumption than sows with lower dietary salt content of 0.1% (14 versus 12.4 litres).

**Suckling Pigs**
Water is one of the major nutrients required by the suckling pig for optimum performance. Thus, it is critical that suckling pigs have access to drinking water. However, much water consumption may likely negatively impact on milk intakes [10]. Generally, these pigs should be provided water ad libitum. This is particularly important in situations where milk intake is limited and thus helps prevent the pigs from dehydrating and in this case aid in the survival of the piglets with low milk intake [7].

**Weaned Pigs**
This is one of the most critical periods in the life of the pig. Following weaning, water intake becomes reduced as the weaned starts to learn how to seek, identify and drink water from the water nipples. This is highly undesirable as it can lead to impeding digestion and absorption thereby resulting in increased incidences of diarrhea in the young animals [7]. However, as they become familiar and accustomed to how to access their drinking points, water intake is increased. This is of special importance as feed intake at this stage is relatively low. Therefore, weaned pigs increased water drinking tendency helps to offset the low feed intake problem as the water gives them satiety and the fullness they desired [7].

**Growing-Finishing Pigs**
At this stage water intake is at full blown levels as water is very important in lean muscle accretion. Here, it is also important to state that the water content of lean muscle is about 72% [2]. This also justifies the ad libitum access of these pigs to their drinking water. However, if the feeding program of the pig is ad libitum the pig water consumption will be about 2.5 kg per kg of feed whereas if the pigs are fed restricted they will consume about 3.7 kg of water per kg of feed [7]. The second group uses water intake for satiety and fullness as pigs always enjoy being full during feed ingestion [7].

**Main Water Concerns in Swine Production**
There are many factors affecting water intake in the pig. These factors are also involved with concerns of water intake in the pig. However, the main fundamental factors only will be covered in this review. They include: water quality, diet composition, the physiological state of the pig, environmental factors and equipment design/placement. In brief, Table 2 sheds light on the usually factors that increase or decrease water intake by the pig.

<table>
<thead>
<tr>
<th>Factors affecting increase water intake</th>
<th>Factors affecting decrease water intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hunger</td>
<td>Cold stress</td>
</tr>
<tr>
<td>Boredom</td>
<td></td>
</tr>
<tr>
<td>Heat stress</td>
<td></td>
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<tr>
<td>High dietary mineral contents</td>
<td></td>
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<tr>
<td>Moderate dietary mineral contents</td>
<td></td>
</tr>
<tr>
<td>Pelleted feed</td>
<td></td>
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</tbody>
</table>

**Table 2: Factors that increase or decrease water intake**

**Water Quality**
Two main factors affecting water quality are its chemical element composition and bacterial contents of the water. The concentration of dissolved mineral water consumed by pigs is of major concern in the health/welfare of the pig as well as mineral digestion and absorption [1]. When the concentrations of the dissolved minerals are beyond the recommended levels they aid in the inability of the acidic environment of the stomach to dissociate phytate inherent in cereal grains that constitute the bulk of the animal feed [1]. Non-dissociation of phytate in the stomach results in the formation of phytate-mineral-complexes, leading to high levels of minerals in the pig manure causing eutrophication [3]. Overall, pigs should be provided with good quality water for optimal performance as poor quality water impacts pigs negatively. To this point, poor quality water makes pigs to have excessive water usage which in turn results to problems of slurry handling and management as a result of increased water volume of the slurries [4]. Additionally, it is a must that pigs will eliminate excess water consumed from their system can negatively impact productivity as energy for growth and other useful purposes are diverted for water elimination from their bodies. On the other hand, insufficient water intake as a result of poor quality can impact feed intake in addition to pigs being dehydrated with its attendant negative impacts on productivity. Specifically, sulfate contents of pig drinking water present a unique problem. Like humans, pigs’ posses high smell sensor and therefore, palatability is always of concern in pig nutrition [7]. High levels of sulfates give water a “rotten egg” odour; this results in water refusal by the pig thereby affecting performance negatively [2]. To this point therefore, it is recommended that water with 3500 ppm of sulfate should not be served to pigs, especially sows and water with more than 4500 ppm is unfit to be used for any livestock [6].

**Bacterial Contamination and Water Quality**
Bacterial contamination of water served to pigs is a serious problem of concern. The bacteria of importance here are cryptosporidium, enterotoxigenic E. coli, salmonella and leptospira [10]. Other microbes of concern are the protozoa, eggs and cysts of enteric worms that are found in the water which ultimately affect such water quality for pigs. As a general guide, the degree of water pollution by bacteria is customarily estimated by measuring the level of coliforms which usually represents the group of pathogenic bacteria as an indicator of the degree of pollution of the water [7]. Therefore, a count of 5000 total coliform per 100 milliliters is usually regarded as a guideline for maximal levels in water for pig production [7]. Nevertheless, it should also be known that the actual level that can impact water quality will highly be dependent on the degree of virulence of specific bacteria present.

**Strategies of Managing Water Concerns in Swine Production**
As the swine industry continue to expand its frontiers, the issue of pigs having access to good quality water will continue to be a source of concern in swine production, especially as the commercial level. Therefore, it is important...
that water quality of pigs should be monitored regularly or at least once a year. In doing this, the levels of coliform particularly must be measured since it is the best available yardstick in determining water quality for the pig [6]. Additionally, the feed formulator should always request for results of water quality tests as to ascertain the mineral levels of the pig drinking water as to incorporate such data in his formation as to avoid excessive mineral intake by the pigs [1]. In this way, mineral levels in the water will be used to balance their dietary sources thereby ensuring that ingested minerals are solubilized and absorbed by the pigs whilst working to better improve the water quality without compromising production and performance. Again, the degree of water contamination or pollution at which pig performance is negatively affected varies from location to location. This supports the fact that water contamination factor alone cannot be used to justify incurring high cost for water treatment with its attendant effect of increasing the cost of production; especially if there are no obvious signs that water source is not the cause of the problem experienced on the farm [7]. Nevertheless, when confirmed that the degree of water pollution is the cause of compromised or reduced performance, it is economically important to deal with the situation as to improve animal health and performance. The strategies in managing such conditions whatever may be the source of the contamination are identified here. The standard procedure is that the source/cause of contamination should first be determined. Once the source is known then the appropriate strategy is adopted in dealing with the situation. To this point, the developed strategies in dealing with water quality for swine include: chlorination, coagulation, filtration and pH adjustment (Table 3).

### Table 3. Strategies of managing specific water contamination for the swine industry.

<table>
<thead>
<tr>
<th>Contamination Type</th>
<th>Strategy to Manage it</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coliform count</td>
<td>Chlorinate the water</td>
</tr>
<tr>
<td>Water hardness</td>
<td>Install a water softener</td>
</tr>
<tr>
<td>High nitrates or other minerals/suspensions</td>
<td>Employ ion exchange or reverse osmosis treatment systems</td>
</tr>
<tr>
<td>Iron</td>
<td>Filtrate the water</td>
</tr>
<tr>
<td>High water pH</td>
<td>Acidify the water</td>
</tr>
</tbody>
</table>

Source: [12].

**Chlorinating the water**

This simply involves adding chlorine to the water to deal with the coliform in the water. However, amount to be added is solely dependent on the coliform counts in order to turn the water quality for the better for pigs. This is also guided by the kinds of the coliform identified in the water as some species have been shown to be resistant to treatment when adequate amounts of chlorine were not applied; otherwise chlorinating contaminated water by coliform is an effective strategy in managing coliform contaminations [8].

**High nitrates or other minerals**

Water with high contents of suspended particles (high turbidity) is not safe for pig consumption as it causes reduction in performance. Here, the chlorination strategy is not suitable for use because the suspended particles form a barrier layer between microbes and the active treatment agent. Therefore, by coagulating which primarily involves the lumping together the suspended into large particles resulting in their being settled that helped their removal via filtration. In this way the water high turbidity is eliminated thereby rendering such water safe for consumption without any detrimental effect on pig health and performance [7]. This strategy is very suitable in treating surface water known to contain high levels of suspended particles due to surface run-offs [7]. Additional suitable strategies for treating water contamination for swine are the use of ion exchange or reverse osmosis systems. However, these systems are typically very expensive and thus the cost of their uses becomes the major drawback in their application in the commercial setting. To this point, it is highly recommended as it has been demonstrated that it is beneficial to mix water of good quality with that of water of low contamination level in handling situations that will induce increase in cost of production [12].

**Water hardness**

The pH of water for pigs’ optimum performance should be at neutral pH or a slightly basic pH. However, when the water pH increases to high basic pH is an indication of high carbonates presence in the water. Intake of high levels of carbonated water interferes with the normal process of digestion leading to poor pig performance. Thus at high water pH there is a need to acidify to reduce to neutral or slightly basic pH for pig consumption for optimal performance [7]. Overall, it should be known that poor water quality works synergistically with disease causing factors to negatively impact production. Therefore, it is always important to keep the pig stressful factors to the barest minimum as to avoid reducing the pigs’ quality of life, welfare and productivity [7].

**2 Conclusions**

Water is an important nutrient to the pig just like other nutrients. Therefore, its importance in the health and productivity of the pig should no longer be taken for granted. Water contamination often occurs in most swine production areas because of the use of surface water in swine production. Therefore, there is always a need to closely monitor water quality during production as surface water is highly susceptible to contamination. It is noteworthy to be pro-active in dealing with water concern. This begins with the basic concepts of ensuring regular cleaning of the pig water source and environment and also maintaining the water supply system. This guarantees a steady supply of good water quality to the animal at all times, since water is provided ad libitum in pig production operations.
3 References


