The importance of water quality in turkey production

In contrast to turkey feed where fine-tuning of feed formulations is based on years of research, the quality of the water as the most important nutrient for the birds is often overlooked.

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Water is involved in every aspect of the bird's metabolism. It has a role in virtually every physiological function in the body, for example regulating body temperature, digesting food, and eliminating body wastes. It is a major component of blood, and a necessary medium for many chemical reactions that help to form muscles and eggs.

At normal temperatures turkeys consume approximately twice as much water as feed and in hot environmental conditions, water consumption can double or even quadruple.

A safe and adequate supply of water with acceptable physical, chemical, and microbiological parameters is therefore essential for efficient turkey production as these parameters can influence the performance of birds. This is why it is important to avoid substandard water quality.

The role of water and the impact of water quality

Water is the most single important nutrient in its own right and 68-75% of the body mass consists of water. It is an ideal transport medium with great solvent qualities and can pass through biological membranes freely resulting in rapid liquid and material exchange.

Water acts as a reagent in the process of digestion, hence feed and water intake are linked.

Water can be used for the transport and dissipation of heat as it has a high heat capacity and high evaporative heat. It must be consumed to maximise the genetic potential for feed consumption, feed utilisation, and ultimately feed conversion.

Reduced water intake, for example due to it being tainted, will negatively impact on flock performance. As many birds have access to the same water source quality problems will consequently affect a great number of animals. Some of the most common poultry diseases are transmitted by water.

Therefore, important factors in preventing waterborne diseases in turkey production are the protection of supply sources, water disinfection, and the quality control of microbiological, chemical, and physical characteristics.

There is a trend that farms with consistently poor performance tend to have higher microbial levels in their water systems, and there is a trend that farm performance improves after thorough and effective water line cleaning, provided management and environment are also good.

Water needs to be available (physically accessible at the right quantities with a suitable flow rate and pressure), palatable (flavour), and safe to drink (free of or low in nitrates, nitrites, micro-organisms like E. coli, Pseudomonas, acid levels, and heavy metals for example lead).

Water should not contain micro-organisms which predispose to disease such as viruses, bacteria, yeast, mould, and protozoa. Pathogens can be easily introduced and rapidly spread through a flock via contaminated drinking water supplies.

Difficulties of water management

Poultry houses are ideal environments for growing micro-organism: it is a warm environment; has relatively low flow rates of water through the lines at certain times of the production cycle, particularly during the early rear and at night facilitating sedimentation and colonisation. It also provides substrates microbes can thrive on like probiotics, citric acid, vitamins, organic acids, and vaccines.

A symbiotic relationship between bacteria, yeasts, and moulds leads to the formation of a biofilm. The complexity of water supply systems makes effective cleaning and disinfection (C&D) challenging; and delivery systems can be old and poorly/incorrectly maintained. Furthermore, the turkey growing cycle is long with lots of opportunities for waterlines to become contaminated.

Flow rates have to be considered particularly at the start of the rearing period of the birds when turkeys are only drinking small amounts of water resulting in very low flow rates. In a larger house with multiple brood rings, the brood rings at the far end of the house will be supplied with water which has travelled the length of the shed. With low flow rates, the water will be as warm as the ambient house temperature and any bacteria will have had time to multiply and form biofilms.

Biofilms are not just bacterial layers embedded within a slimy extracellular matrix, but biological systems. Micro-

organism organise themselves into a coordinated three-dimensional functional community ('cities for microbes'); and they can be a single species or a diverse group of micro-organism. The biofilm micro-organism are able to share nutrients, and are sheltered from harmful factors in the environment, such as antibiotics or disinfectants.

Biofilms are the product of a microbial developmental process. The process is summarised by five major stages of biofilm development: Initial attachment, Irreversible attachment, Maturation I, Maturation II, and Dispersion.

During the dispersion stage, huge numbers of bacteria can be released into the drinking water which can have a sudden and significant impact on flock health.

Water sampling

Laboratory testing of the birds' drinking water is undoubtedly necessary as sensory perception is not sensitive enough. Water has to be tested for the presence of bacteria and other microbes, for the levels of minerals that occur naturally in the water, and for other chemical and physical factors.

Water quality requires regular monitoring and this should be part of the routine farm operating procedures. A good starting point for identifying weaknesses in the system is the sampling of water for TVC testing at different points on the farm including at source and at the end of the line.

TVC stands for 'Total Viable Count' and is the measure of the total number of live bacterial organisms. Measurements are given in CFU 'Colony Forming Units' per ml. This does not identify non-bacterial organisms or bacteria hidden in the biofilm; it does not identify the type of bacteria nor does it differentiate probiotics. TVCs may underestimate bacterial numbers due to clumping or chain of cells. Two different types of water sampling methods can be employed: The most common method is the 'Standard' method where a sterile pot is used to collect water at various locations.

This is a quick, easy, and cheap method; however, the existing biofilm may not be releasing organisms when taking a standard water sample not reflecting the true situation.

Another option is the 'Swab' method where a sterile sponge saturated in Butterfield's Phosphate Diluent solution is inserted into the line and tested for Aerobic Plate Count (APC), E. coli/coliform, yeast, and mold.

A comparison of 'Standard' versus 'Swab' method samples for evaluating water lines on a farm showed considerable differences between these two methods employed. Five tests were performed in which results taken under the 'Standard' method ranged between 0-4 CFU/ml and 5,900-191,000 CFU/ml for the 'Swab' method.

Some literature state that 'Standard method' samples should have results of <100 CFU/ml and 'Swab method' samples of <10,000 CFU/ml. Others believe that "a TVC <300 CFU/ml should help support production, and a TVC <750 CFU/ml should support better liveability."

Keeping water lines clean

A clean water system is the starting point: The terminal C&D must remove the biofilm as any remaining organisms can multiply and start building a new biofilm.

However, as water will not be sterile efforts need to focus on minimising the multiplication of already existing micro-organisms and slowing the re-colonisation of the water systems. Once birds are in the house only a limited amount of C&D is possible. It is important to understand the limitations of treatments used during a flock's life. Monitoring water quality (TVC testing) and conducting ORP (see below) testing will help to understand what is going on and if necessary the terminal C&D needs to be modified accordingly.

A lot of different products and systems are in use for water sanitation. If systems are relying on chlorine than it is vitally important that the pH value of the water is considered due to the dissociation of the product.

An effective chlorination requires a pH of <7.0 as hypochlorous acid is 80-300 times more effective as a sanitiser than a hypochlorite ion. Free chlorine is not considered to be effective unless it is 85% hypochlorous acid. However, a pH of <5.9 can lead to poor performance as birds are less keen to drink due to poor palatability.

Conclusions

Water is the most important single nutrient and offering good quality, safe, potable fresh water with sufficient availability is an essential tool in maximising production, welfare, and profitability.

Minimising micro-organism contamination of water lines is vital to this process. Hence a regular water sanitation programme on the farm is absolutely necessary to ensure a good flock performance.

Water lines require a targeted and tailored cleaning regime at terminal disinfection; they require regular monitoring and may require cleaning through flock life.

Furthermore, if systems rely on chlorine products for water sanitation, than it is vitally important that the pH is considered due to the dissociation of the product. ■

References are available from the author on request