



## Optimizing Water Quality for Organic Bird Production

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Water is the last frontier in animal production. Significant time and money have been invested in creating the right production environment and with the premium price of organic feed; no stone is left unturned for ingredient and feed quality assurance programs. Yet in spite of the resources invested into these inputs, many producers spend little time and effort on water quality, the nutrient birds consume twice as much as feed. The first step in developing a successful water program that benefits production is acknowledging that water quality can be significantly impacted by the natural contaminants present as well as the products often used in water supplies. The next step is to do a critical assessment of the water system to identify the areas which need improvement. Proven to maximize water quality is cleaning the system between flocks and this involves choosing the best products for line cleaning and then utilizing them at the appropriate rate while the barns are empty. Finally, implementing a sound daily water sanitation program when birds are present and minimizing the use of products that could be feeding or promoting pathogens is how to keep water as a production tool. Taking water quality seriously could pay dividends with healthier birds, better feed conversions and reduced production costs.

One of the biggest challenges with poultry farm water supplies is the slow, sometimes stagnant flow and during parts of the grow-out cycle, it can undergo temperature variations from warm to cold which can actually make some pathogens even tougher. These factors along with naturally occurring iron, manganese and sulfur as well as utilizing products such as probiotics, citric acid, vitamins, organic acids, vaccines and milk replacers can lead to the development of microbial growth known as biofilm, a protected and hardy mixture of bacteria. Once established, biofilms hide pathogens and make water systems as much as 1000 times harder to clean. Drip and swab samples pulled from water lines can help identify if contamination is a problem. I recommend conducting a total plate count bacteria test as well as yeast and mold. Counts should be less than 1000 colony forming units/milliliter (cfu/ml) for drip samples and if a swab is used to evaluate how much is living in a water line, it is recommended that the swab results should be no greater than 10,000 cfu/ml. The University of Arkansas has a video available to demonstrate the sampling procedure: <http://youtu.be/BWDdcg22Wug>. If a mineral and pH analysis has not been done for a water supply, it is highly recommended. Knowing the natural contaminant levels of minerals such as iron, manganese or sulfur provides a great starting point for addressing the food supply for harmful waterborne pathogens such as E. coli, pseudomonas, klebsiella, strep, and others. Below is a chart that explains each contaminant typically found in water, what levels are acceptable and what options are available to correct the issues if levels are out of compliance.

Cleaning water systems between flocks is the single most important step for optimizing the quality of water. Some of the best products available for line cleaning are stabilized hydrogen peroxides used at the manufacturer's recommended rates (2-3%). It is important to note that injecting products with a medicator set at a 1:128 rate only gives a 0.78% solution which has been proven to be not nearly as effective as the 2-3 % solutions. Pumps such as the Qwik Blend will pump in the correct

concentration and can be hooked in at the same location as a medicator. Also submersible or transfer pumps can be used and solutions mixed into trash cans. (1 gallon of concentrate mixed with 33 gallons of water is an ~ 3% solution.) The next most important step is leaving the products in the lines long enough to do the job which for most is at least 24-7 hours. Before using any cleaner, check with the manufacturer for their recommendation. The last step in successful line cleaning is flushing the lines with water that contains a sanitizer level that is acceptable for the birds to drink. This helps to assure that if any biofilm was not eliminated by the line cleaning, it will not have an opportunity to re-establish or pass to the birds. I am often asked how much of the system should be cleaned. We have learned that as much of the water distribution system as possible should be cleaned, even underground distribution lines running from well rooms to the barns. These areas have proven to be sources of health challenges flock after flock. It may take line cleaning several times between flocks before all challenges are eliminated so don't get discouraged if immediate benefits are not achieved after the first line cleaning.

The last step is to minimize the use of water additives and focus as much as possible on maintaining a good daily water sanitation program with the birds present. Products such as citric acid or vitamins can promote microbial growth leading to health issues. If using these products is an important part of your operation, take time to check for bacteria and mold growth in water after these are used so you will know if the products are helping or hurting your performance. There are several products which can be used for daily water sanitation including hydrogen peroxide which should be mixed and injected at a level that provides 25-50 ppm of residual to the birds. Silver Bullet uses the Advanced Oxidation procedure and breaks down to water, oxygen and low levels of hydrogen peroxide. Best use of this system is infusion into a holding tank or well aquifer. Products such as citric acid or vitamins can actually promote microbial growth so if using products With the cost of production on the rise, don't throw away performance because of lack of attention to water.

Table 1. Water Quality Standards for Poultry

Contaminant	Levels considered average	Maximum Acceptable Level	Comments
Bacteria			
Total Bacteria (TPC)	0 CFU/ml	1000 CFU/ml	Total Bacteria is used as an indicator of system cleanliness, high numbers do not necessarily mean the bacteria present is harmful but it does mean that the system is capable of harboring pathogenic organisms. High bacteria levels can impact taste of water resulting in reduced consumption by birds  Presence of any fecal coliform means water is unfit for consumption by poultry or humans
CFU/ml	0 CFU/ml	50 CFU/ml	
Total Coliforms	0CFU/ml	0 CFU/ml	
Fecal Coliforms			

Table 2. Water Quality Standards for Poultry

Contaminant	Levels considered average	Maximum Acceptable Level	Comments
pH	6.5-7.8	5-8	pH below 5 can be harmful to drinker equipment-causing corrosion to metal components with long term exposure pH above 8- impacts effectiveness of most water sanitizers and if high pH is also associated with high alkalinity, may result in reduced water consumption in poultry due to “bitter” taste
Total Hardness	60-180 mg/l	110 mg/l	Hardness can also be determined by adding the Calcium and Magnesium content, Hardness causes scale which can reduce pipe volume and cause drinkers to be hard to trigger or leak
Natural Elements			
Calcium (Ca)	60 mg/l		No upper limit for calcium, birds very tolerant of calcium but if values above 110 mg/l may require water softener, polyphosphates or acidifier to prevent scaling.
Magnesium (Mg)	14 mg/l	125 mg/l	Higher levels of Mg may cause flushing due to laxative effect particularly if high sulfate present
Iron (Fe)	.2 mg/l	.3 mg/l	Birds tolerant of iron metallic taste but high iron causes leaking drinkers and promotes the growth of E coli and pseudomonas , Treatment includes oxidation with chlorine, chlorine dioxide or ozone and then filtration
Manganese (Mn)	.01 mg/l	.05 mg/l	Can result in black grainy residue on filters and in drinkers, Treatment includes oxidation with chlorine, chlorine dioxide or ozone then filtration, green sand filtration
Chloride (Cl)	50 mg/l	150 mg/l	When combined with high sodium levels, creates salty water that can act as a laxative causing flushing, also, salty water can promote the growth of enterococci organisms that can lead to enteric issues Treatment- Reverse Osmosis, lower dietary salt level, blend with non-saline water, Keep water clean and use daily sanitizers such as hydrogen peroxide or iodine to prevent microbial growth
Sodium	50 mg/l	150 mg/l	When combined with high chloride levels, creates salty water that can act as a laxative

(Na)			causing flushing, also, salty water can promote the growth of enterococci organisms that can lead to enteric issues Treatment- Reverse Osmosis, lower dietary salt level, blend with non-saline water, Keep water clean and use daily sanitizers such as hydrogen peroxide or iodine to prevent microbial growth
Sulfates	15-40 mg/l	200 mg/l	Sulfates can cause flushing in birds. If rotten egg odor present, then bacteria producing hydrogen sulfide are present and system will require shock chlorination plus establishment of good daily water sanitation program, sulfates can be removed by aerating water into a holding tank, treatment with sanitizers then filtration
Nitrates	1-5 mg/l	25 mg/l	High nitrate levels can result in poor growth and feed conversions. Plus presence of nitrates may indicate fecal contamination so also test for bacteria Can be removed with Reverse Osmosis
Lead	0 mg/l	.014 mg/l	Long term exposure can cause weak bones and fertility problems in breeders and turkeys
Copper	.002 mg/l	0.6 mg/l	
Zinc		1.5 mg/l	Higher levels may make water bitter causing a drop in consumption

mg/l is the same as parts per million (ppm)