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Avian Advice

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Water: The Most Important Nutrient for Your Birds

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Has it been more than 2-3 years since you checked the quality of the water your birds are consuming? Are you confident enough in your current water program to go to the end of the waterline and take a drink? Do your water filters become "dirty" each flock? Maybe they turn reddish/brownish, black, or grey? Does your water smell like rotten eggs? Do you have high mortality issues? Do you have performance issues? If you answered "yes" to any of these questions you could have a water quality issue affecting the performance of the birds. However, don't assume if your water is clear that the water is acceptable. Water that looks clear can also have bacteria challenges, if not more, than discolored water.

Picture 1: Various water filter with mineral and bacterial challenges.

Water is an essential nutrient for poultry production. Ensuring chicks have good quality water at placement can set the stage for a successful flock. Modern broilers and breeders have been selected for efficiency in meat and egg production with the least amount of feed. These highly sustainable traits are compromised by the birds reduced ability to manage stressors which means factors like poor water quality can result in lost performance. Just as important as providing the right temperature and good quality feed, clean sanitized water can have a tremendous impact on helping birds achieve their potential.

Poultry drinking water systems are at risk for contamination from things like bacteria and mold due to the water being slow moving and warmed during brooding. There is also many various pinch points in the water system that hide and protect microbes, like filters, regulators, and hoses. As birds continually drink water they risk introducing bacteria into the waterline by triggering the water nipple with beaks that have been pecking around the floor of the barn. Then if products such as organic acids, vitamins or electrolytes are added, the bacteria in the water can reach levels that cause a disturbance in the gut or respiratory health of the birds. The birds might overcome the challenge, but not without lost performance. So don't be fooled into believing that just because your home is on the same water supply that the water your birds are drinking is just as good. The best water recipe is clean and sanitized. Implementing, sustaining, and monitoring a water quality program is vital to eliminating and prevent bacterial growth in the water system.

The Watkins Water Quality Lab within the Center of Excellence for Poultry Science at the Division of Agriculture within the University of Arkansas provides key testing for evaluating poultry farm water quality. This lab runs various microbial analysis including, an aerobic plate count (total bacteria count), yeast, mold, E. coli, and coliform test. Testing for aerobic or total bacteria, yeast and mold gives a general idea

Picture 2: A water test kit that can be purchased through Watkins' Water Quality Laboratory. All the necessary supplies are included to properly take a water sample.

of the amount of "stuff" or biofilm living in the water system. Biofilms build-up along the sides of the water pipes and can provide a home for harmful bacteria, such as E.coli, staph and pseudomonas. In addition to performing a variety of microbial test, the Watkins' Water Quality lab can provide all the necessary supplies to take water samples. In addition the Division of Agriculture Leland Tollett Diagnostic Lab can provide even further detailed bacterial analysis for a reasonable fee.

A drip sample and a swab sample are two types of water sampling procedures. A drip sample can be sampled from the storage tanks, the control rooms, or the end of the water lines, which is the most common location to sample because it gives the best evaluation of what the birds are actually drinking. Taking samples at different points in the water system helps identify where contamination is occurring and helps to identify if a specific area needs more thorough cleaning between flocks. For example, taking a sample directly from the well could show if the source of contamination is coming from the well. In this case, a grower might consider shock chlorinating the well. In other instances the well, storage tanks, and underground lines (control room sample) may be free of bacteria but the end of water line sample shows an unacceptable amount of bacteria. This indicates that the focus needs to be on treating the waterlines inside the barns.

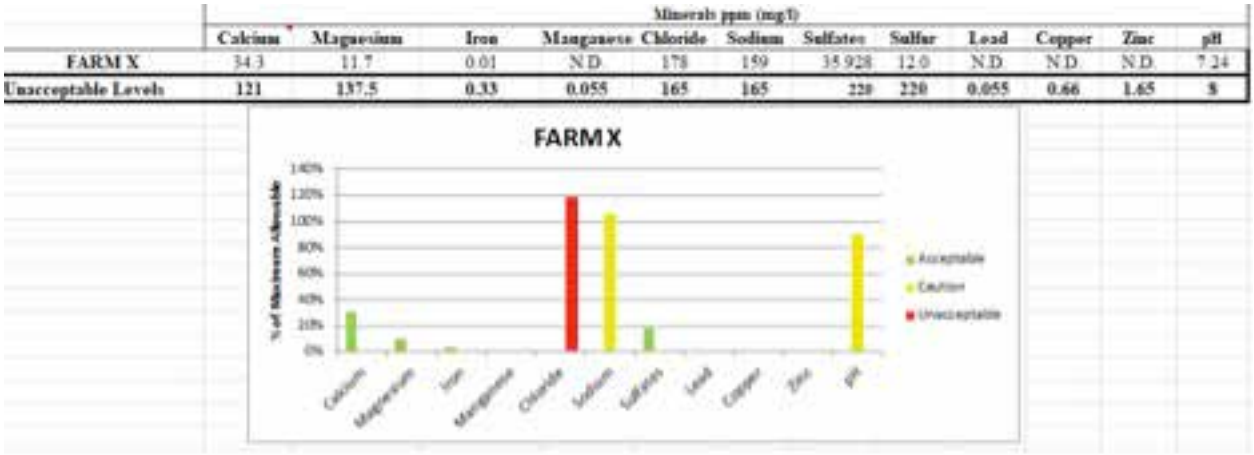
Farm Name	Source	Sample #	Drip/Swab	APC (aerobic)	Yeast	Mold	E. Coli	Coliforms
				(CFU/ml)				
X	Well 1	650	Drip	161	0	0	0	0
X	Tank	651	Drip	896	0	0	0	0
X	House 1 Control Room	650	Drip	1,254	0	0	0	0
X	House 1 End of Line	651	Drip	5,298	0	1	0	0
X	House 1 End of Line Swab	650	Swab	156,000	25	30	0	0
X	House 6 Control Room	651	Drip	1,698	0	0	0	0
X	House 6 End of Line	651	Drip	11,200	0	0	0	0
X	House 6 End of Line Swab	650	Swab	188,000	32	36	0	0

Picture 3: A microbial water analysis performed at the Watkins' Water Quality Laboratory

Swab samples use a sterile cellulose sponge soaked in sterile water to wipe the inside of water lines and gather any build-up that may be present. Swab samples tend to show yeast and mold counts more than drip samples do because they can be used to successfully wipe off the biofilm where these live. The swab method can be useful for determining if water line cleaning is effective. Recently, a service technician took off the site tube of the regulator and swabbed as close as possible to the regulator and the results showed a biofilm buildup, even after the waterlines were flushed with a sanitizer. These results helped to pinpoint that water line cleaning needed more attention.

Excessive amounts of certain minerals are also an issue that can affect bird performance. For instance sulfur can affect feed absorption while high sodium and chlorides can cause diarrhea. Water with low pH (below4) and almost no mineral content is called acid water and can have a very detrimental effect on weight gain and feed conversion. The Central Analytical Lab within The Center of Excellence for Poultry Science can perform a mineral analysis to determine the concentration of 22 different mineral as well as pH. Once a mineral analysis is completed, the results can be compared to the chart below to determine what is acceptable or out of compliance. The chart also shows best options for correcting the challenges.

Acknowledging that water can have a huge impact on bird health and performance is the first step in helping your bottom line as a poultry grower. Contact the Watkins Water Lab at 479-575-8428 or go online to Watkins Water Lab at https://poultry-science.uark.edu/watkins-water-quality-lab.php for more information about how to collect and submit samples.



Picture 4: Mineral analysis performed at the Central Analytical Laboratory. Watkins' Water Lab receives the analysis from the Central Analytical lab and inserts the values into this graph format to help us better understand what the values mean.

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
CFU/ml	0 CFU/ml	50 CFU/ml	
Total Coliforms	0CFU/ml	0 CFU/ml	
Fecal Coliforms			Presence of any fecal coliform means water is unfit for consumption by poultry or humans

Table 2. Water Quality Standards for Poultry

Contaminant	Levels considered average	Maximum Acceptable Level	Comments
pH	6.5-7.8	5-8	pH below 4 can be harmful to drinker equipment causing corrosion to metal components with long term exposure pH above 8- impacts effectiveness of water sanitizers and if high pH is also associated with high alkalinity, may result in reduced water consumption in poultry due to "bitter" taste. Low pH with no natural alkalinity can lead to water refusal
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, Also manganese is a food for pathogens. 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, saline water can damage reproductive tract in breeder birds causing shell quality 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 (Na)	50 mg/l	150 mg/l	When combined with high chloride levels, creates salty water that can act as a laxative causing flushing, also, salty water can promote the growth of enterococci organisms that can contribute to enteric issues, saline water can damage reproductive tract in breeder birds causing shell quality 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	If nitrates convert to nitrites, this 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	Continuous exposure to elevated copper levels could results inflammation of the proventriculus
Zinc		1.5 mg/l	No known issues

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