Drinking Water Quality for Poultry

Kathy Bunton
Area Specialized Agent, Poultry
North Carolina Cooperative Extension Service
Iredell, Wilkes, Alexander

In the last several years we in the poultry industry have become so accustom to associating water quality with waste management issues that we have sometimes forgotten water quality as it applies to the water that our birds consume. As of late though, it seems we have turned the corner and everywhere you go drinking water quality for poultry is the topic. Whole companies have been started whose sole purpose is to address how to correct water quality issues. I'm not saying this is bad, actually it is a good thing.

It is a good thing because water is a vital dietary requirement and an easy one to take for granted. It is a critical component for successful poultry production. In a non-stress situation, under normal conditions, healthy birds will take in twice as much water as food - two pounds of water (about a quart) for each pound of food they eat. Factors do exist that cause variances in water intake. Water intake is determined by the age, genetics, production and growth rate of the birds. Young birds will take in proportionally more water than feed. There is also the seasonal variance as in the summer when their body temperature goes up and they consume more water.

In addition to being a vital nutrient, water is involved in every aspect of poultry's metabolism. Water softens the feed in the crop and forms a carrier for feed during its passage through the digestive track. It aids digestion and absorption. Water helps birds remove waste, lubricates their joints and cools body temperature as it evaporates through the lungs and air sacs. Furthermore, water is used as a medium through which medications and vitamins are administered to birds. Water can also be a useful tool in monitoring the health of a flock. Since feed and water consumption are so closely related, a sudden drop in one is a good indicator of a drop in the consumption of the other and is often the first indication of a problem in a flock.

Quality and quantity of water must be maintained to ensure birds reach their maximum growth potential. Quantity of water is a major consideration. Baby chicks are 85 percent water, adults are 55 to 60 percent and eggs are 66 percent water. Even a 10 percent loss of water can cause serious physiological disorders and a 20 percent loss can lead to death. Thus, maintaining an adequate supply of quality drinking water to the birds at all times is essential. There must be enough water available to at least satisfy the demands of the birds at extremely high temperatures. Quality is a consideration because if they are consuming large quantities of poor quality water, then they are consuming large quantities of contaminants. The characteristics of safe, good-quality drinking water for poultry is often complex. Water can be and should be tested on a regular basis. It can be tested for bacteria and other microbes, for naturally occurring minerals, and for other chemical and physical properties. The following table can be helpful in determining

poultry drinking water quality. They are the most commonly used standards (evaluation.

Table 1. Drinking Water Quality for Poultry

Contaminant or characteristic	Level considered average	Maximum acceptable level
Bacteria		
Total bacteria	0/ml	100/ml
Coliform bacteria	0/ml	50/ml
Nitrogen Compounds		
Nitrate	10mg/l	25mg/l
Nitrite	0.4mg/l	4mg/l
Acidity and hardness		
pH	6.8-7.5	6.0-8.0
total hardness	60-180 ppm	110 ppm
Natural Occurring Chemicals		
Calcium (Ca)	60 mg/l	
Chloride (Cl)	14 mg/l	250 mg/l
Copper (Cu)	0.002 mg/l	0.6 mg/l
Iron (Fe)	0.2 mg/l	0.3 mg/l
Lead (Pb)	0	0.02 mg/l
Magnesium (Mg)	14.mg/l	125 mg/l
Sodium (Na)	32 mg/l	50 mg/l
Sulfate (SO_4)	125 mg/l	250 mg/l

The most telling affects of poor water quality are generally caused by the presence of bacteria. Thus, high concentrations of bacteria or toxic elements in the water affect the normal physiological process of the bird, resulting in inferior performance. Well water is usually tested for total bacteria level, coliform bacteria level, and occasionally for fecal coliform bacteria. Coliform bacteria are the organisms normally found in the digestive tracts of livestock, humans, and birds. Standards for animal drinking water indicate that there should be fewer than 100 bacteria of all types per milliliter (ml) of water and fewer that 50 coliform bacteria per ml.

Microorganisms can be a problem even when bacteria levels are low. Chlorination, iodine-based disinfectants, and proper cleaning of the waters are effective ways of controlling bacteria and microbial levels. Any chemicals added to the watering system should be approved and added only at the recommended rates. Chlorine and disinfectants can interact with vaccines and medications. Chlorine should be removed from the watering system 24 to 48 hours before vaccines are administered or a neutralizing agent used. If bacteria is a reoccurring problem, find and eliminate the source of contamination.

High levels of bacteria can often be traced back to the well servicing the poultry house. Wells may become contaminated by poorly designed sewage treatment fields that are improperly constructed, failing or simply located too closely to the well. The well itself may be poorly constructed or not properly protected from surface drainage water.

Nitrates in the drinking water may also be attributed to the well. They are produced in the final stage of decomposition of organic matter. Their presence in water usually indicates contamination by runoff water containing fertilizer or human and/or animal waste. Nitrates are very soluble and may travel with surface water runoff or leach through the soil into the groundwater and travel considerable distances. Nitrite (NO_2) is another byproduct of organic matter decomposition found in water known to affect bird performance.

Stage of growth seems to play a role in how affected birds are by elevated nitrate levels with younger birds being more sensitive. In laboratory trials levels in excess of 50 mg/ml for chickens and 75 mg/l for turkeys have proven harmful. It has been shown that nitrate levels at 20 mg/l have adversely affected weight, feed conversion and performance in broilers. It is suspected that nitrate levels as low as 3 mg/l may affect performance. Nitrites have been found to be toxic and much lower level than nitrates. Levels as low as 1 mg/l can be toxic.

You may be able to eliminate the source of contamination. Several things should be looked at. Does the well cap have a leak? Does the septic tank need pumping or the lines extended? Contaminated surface water may need to be diverted from the well head. The well may need to be moved or replaced. If drilling a new well is an option, proper well placement and construction is important. Site the new well 100 feet from septic fields, animal facilities and crop land. The well should be cased and grouted to a depth of at least 20 feet. Above ground casing should be 12 inches above land surface. The land surface should be sloped away from the well head and a concrete pad or well house floor poured.

The acidity or alkalinity of water is expressed as its pH level. Neutral water (that which is neither acid nor alkaline) has a pH of 7. Acidic water has a pH lower than 7 and alkaline water has a pH greater than 7. Well water normally has a pH in the range from 6.8 to 7.8, although it is not uncommon for the pH to be either higher or lower. The greatest debate going on is what pH is too low. Acid drinking water has been believed to affect digestion, corrode watering equipment, and be incompatible with medicines and vaccines. Older field research indicates that drinking water with a pH lower than 6 can impair broiler performance.

It has been felt for a while that acidic water, lower than 6, was beneficial in keeping water lines clean and free of build up as well as enhanced the performance of selected sanitation products. Chlorination of water to control bacteria and other contaminants is a common practice of poultry growers. Chlorine has been found to be most effective when pH levels are in the range of 4 -7. Chlorine at this pH level is in the form of hypochlorus acid is much more bactericidal than solutions with pH values greater than 7.

Now we are seeing pH levels of 3.5 - 4. Acidic water is being used to aid in the suppression of Salmonella in the gut at the time of slaughter decreasing contamination of processed birds. It is being used in the management and control of clostridial diseases. acidic water is now being hailed as a growth performance enhancer and aiding digestion by increasing microflore in the digestive tract of young birds.

Although hard water may cause stains, leave residues, or cause other physical problems in water-handling equipment, hard water has not been demonstrated to have either a positive or negative impact on poultry performance. In treating hard water that is to be used as drinking water for poultry, however, care should be taken not to increase any existing chemical imbalance in the water.

A large number of chemicals occur naturally in well water. They are usually present in amounts that do not interfere with the metabolism or digestive functions of chickens or turkeys. When the levels of certain chemicals are out of balance they can, by themselves or in combination with other chemicals, affect poultry performance.

Sodium (Na) in excessive levels has a diuretic effect. The normal sodium level in water is about 32 mg/l. Studies indicate that a sodium level of 50 mg/l is detrimental to broiler performance if the sulfate level is also 50 mg/l or higher and the chloride level is 14 mg/l or higher.

Consuming too much chloride (Cl) has a detrimental effect on metabolism. A chloridelevel of 14 mg/l is considered normal for well water. Studies have shown that a level of 14 mg/l in drinking water can be detrimental to broilers if combined with 50 mg/l of sodium. Chloride levels as high as 25 mg/l are not a problem if the sodium level is in the normal range.

High sulfate (SO_4) levels have a laxative effect. Levels of about 125 mg/l are regarded as normal for well water, but levels as low as 50 mg/l can have a negative effect on performance if either the sodium or magnesium level is 50 mg/l or more.

A symptom of a high magnesium (Mg) level is loose droppings. The normal level of magnesium in well water is about 14 mg/l. This chemical may interact with sulfate. Studies indicate that magnesium alone at 68 mg/l does not adversely affect broiler performance, but a level of 50 mg/l can be detrimental if the sulfate level is also 50 mg/l or greater.

Excessively high or low concentrations of other chemicals can produce recognizable symptoms. Excessive amounts of manganese (Mn) can produce a flavor problem. Too much copper (Cu) can give the water a bitter taste and may cause liver damage. High phosphate (PO_4) levels may indicate contamination from sewage. Calcium (Ca) does not seem to have any negative effect at levels as high as 400 mg/l, and it appears that a level of 35 mg/l or more may be desirable. High levels of iron (Fe), up to 25 mg/l, have not been shown to be detrimental to broiler performance, although staining of waterers is evident at much lower levels.

Water is an effective, efficient, and quick way to administer medications to the poultry flock if done properly. Medications can be initiated immediately when the need is recognized and stopped quickly to insure proper withdrawal and minimize cost. Changes in the medication or adjustments in the dosage can be made rapidly and easily. However, certain water properties can negatively impact widely used drugs in the poultry industry. Water hardness will interact with all tetracyclines. Penicillin will adversely react in a low water pH and sulfa drugs react with chlorine and low pH.

There are many different water treatment systems available to treat water quality issues on the poultry farm. Chlorination systems have become popular for treatment of bacteria and general sanitation of the watering system. Aboveground filters for de-ironing, nitrate removal, and water softeners are available. Oxygen is being added to the water through oxygenation and minerals are being taken out through reverse-osmosis. UV light and ozone treatments have been introduced to kill harmful organisms and to reduce the presence of specific chemical elements. If there is a water quality issue on a poultry farm, it can be addressed.

The first step is to have the water tested to determine if there is an issue. But, the results of the test will only be reliable if the samples are taken correctly. Often county or state health departments will help in obtaining samples and having them tested for bacteria and chemicals. There are many commercial laboratories that test water for a fee. Tests should be requested for the chemicals and other factors that can be detrimental to the growth performance of the poultry flock as well as for microorganisms.

When collecting water samples for testing, remember to run the water for several minutes to flush the water line. The outlet should then be sterilized by flaming or other suitable methods. The sample should be placed in a sterilized container often provided by the commercial company that will run tests. The sample should arrive at the testing laboratory with in 24 hours if bacteria tests are to be accurate.

Poor water quality can retard growth, curtail egg production, and lower egg quality even before it is readily apparent. Growers merely assume the security and quality of their water supply. We can no longer do that. Water quality is an issue that can be, and should be, addressed on every poultry farm.