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Nutrition News and Information Update

Water Quality For Poultry

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Water is the most important nutrient in poultry production. Depending on the age, a bird's body can contain between 60 and 85% water. Eggs contain about 65% water. A bird can survive for weeks without feed, but can only survive a few days without water. Water intake of birds is about twice the weight of feed intake. During periods of extreme heat stress, water requirements can easily quadruple. Therefore, a safe and adequate supply of water is essential for efficient poultry production.

Factors, such as bacteria, pH level, hardness or total dissolved solids, nitrate levels and high naturally occurring elements (sodium, magnesium, etc.) can affect water quality. These, in turn, can affect poultry health and performance. Water quality guidelines for poultry are hard to find due to limited research. Thus, many values have been obtained from human and other livestock guidelines. The values given in Table 1 should only be used as a guideline as many factors can contribute to water quality being a problem for poultry.

Water Sample Collection

Water sources should be checked on an annual basis for bacterial and mineral content. Wells can be contaminated by surface or run-off water, and thus should be tested after a heavy rainfall and in the spring of each year. The results of your water analysis can be affected if the sample is taken incorrectly. Interpretation of your water analysis should be conducted by an experienced person in order for the correct course of action to be taken. Shur-Gain producers can send their water samples to the St. Marys Laboratory for analysis. Your Territory Manager can assist you in determining the correct action to take if there is a quality issue.

Colour, Odour and Taste

Ideally drinking water should be colourless, odourless and tasteless. A reddish brown colour indicates the presence of iron, while blue indicates the presence of copper. Hydrogen sulfide produces a rotten egg odour. Taste can be affected by the presence of salts. A bitter taste is usually associated with the presence of iron and manganese sulfates.

pH

The acidity or alkalinity of water is measured by pH. A pH of 7 is neutral, acidity is indicated by a pH lower than 7 and alkalinity is indicated by a pH higher than 7. A high pH level indicates high calcium and magnesium levels, which can, over time, block the water system. Highly alkaline water may also cause digestive upsets, diarrhea, poor feed conversion and reduced water/feed intake. It can also lead to the build-up of lime scale in pipelines resulting in leaky nipples, reduced effectiveness of antibiotics and reduced activity of chlorine and other sanitizing agents. Low pH levels can be unpalatable, corrosive to equipment and may affect poultry performance.

Table 1. Suggested water quality guidelines for poultry (Weltzien, 2000).

CRITERIA	CONCENTRATION (ppm)	COMMENTS
Bacteria	0 cfu/ml	Ideal
Coliforms	0 cfu/ml	Ideal; levels above this indicate possible fecal contamination.
pH	< 6.0	Performnace issues; corrosion of water system.
	6.0 - 6.4	Possible issues.
	6.5 - 8.5	Recommended for poultry.
	> 10.0	Unsuitable.
		Note: High or low pH levels can be detrimental to water soluble medications as well as precipitation of some minerals.
Hardness	< 100 (soft)	No problem.
	> 110 (hard)	No health issues with poultry; may interfere with effectiveness of soap, disinfectants and some medications administered through water.
	1500	Maximum level.
Chloride	250	Maximum desirable level; levels as low as 14ppm may cause loose droppings if sulphate >50ppm or if chloride >14ppm
	> 500	laxative; wet droppings; reduced feed intake; increased water intake.
Calcium	600	Maximum desirable level.
		>600ppm excessive deposit and scale formation.
Fluoride	2	Maximum.
	> 40	Causes soft bones.
Iron	> 3.0	May encourage bacterial growth; causes odour, bad taste, precipitation.
Magnesium (Mg)	50 - 125	No issue unless sulphates >50ppm (forms magnesium sulphate which has a laxative effect)
	> 125	Laxative effect, especially if sulphates >50ppm.
Nitrate Nitrogen	10	Maximum desirable level.
Nitrites	trace	>Trace may indicate organic material contamination (i.e. fecal).
Sodium (Na)	50 - 300	May cause wet droppings if chloride>14ppm or sulphates>50ppm.
Sulphates	50 - 200	May cause alxative efffect if Na or Mg >50ppm
	200 - 250	Maximum desirable level.
	250 - 500	May cause laxative effect.
	500 - 1000	Poor; laxative effect, but birds may adjust; may interfere with copper absorption; additive laxative effect with chlorides.
	> 1000	Unsatisfactory; increased water intake, wet droppings; health hazard to young birds.
Total Dissolved Solids (TDS)	0 - 1000	Good.
	1000 - 3000	Satisfactory; may cause wet droppings; performance or health unaffected
	3000 - 5000	Poor; laxative effect; increased mortality
	> 5000	Unsatisfactory

Hardness

Hardness applies to the amount of dissolved minerals in the water. Hard water generally does not affect poultry health and performance, but it can cause build-up of mineral deposits and the formation of scale, leading to clogging of the water system and drinkers. Excessive hardness can interfere with water-administered medications, disinfectants and cleaning agents.

Total Dissolved Solids

Total dissolved solids (TDS) are a measure of the inorganic salts dissolved in water. Calcium, magnesium and sodium salts are the primary components of TDS. High TDS levels can cause harmful effects in poultry production including loose droppings.

Bacteria

The presence of bacteria is usually the result of surface contamination by organic materials, which can result in poor performance. Well water is normally tested for the total bacterial level and the coliform bacteria level. Coliform bacteria, such as *E. coli*, are organisms found in the digestive tracts of livestock, humans and birds. Their presence is generally related to fecal contamination of water due to run-off to surface or ground water. Ideally, bacterial content should not be present in drinking water and the measurable levels should be zero.

The best method in dealing with high bacterial levels is to eliminate the source of contamination. Extended use of disinfectants in highly contaminated wells is unadvisable because of the chance of it failing and exposing poultry to high bacterial levels.

Mineral Contaminants

Nitrates are by-products of the biological decay of animal and plant matter, chemical fertilizers or animal wastes. Their presence frequently indicates bacterial contamination, since it is often due to the seepage of surface water from surrounding fertilized fields. Nitrate is not toxic on its own, but becomes toxic when it is converted into nitrite by intestinal microorganisms. This conversion does not generally occur in poultry and thus is usually not an issue in poultry.

Moderate levels of sulphates can cause wet litter and dirty eggs due to loose droppings, but levels must be extremely high before they can cause adverse effects on growth and egg production. Proper barn ventilation to keep the litter and manure dry will offset sulphate drinking water problems. High levels may also interfere with other mineral intestinal absorption, such as copper.

High magnesium levels are only an issue if sulphate levels are also high, since the two combine to form Epson salt. High magnesium and calcium levels can contribute to the formation of scale in the water lines, resulting in restricted water flow.

High levels of iron encourage bacterial growth, which can lead to diarrhea. When iron is exposed to air it is converted to ferric hydroxide, which is commonly known as rusty water. Ferric hydroxide can clog water systems.

Excessive sodium levels increase water consumption, which results in wet litter. Sodium reduction in the feed can address high sodium levels in the water. Caution should always be stressed when making dietary changes and should be performed by a qualified nutritionist. Poultry are sensitive to overdoses of sodium, as well as deficiencies of sodium and chloride.

Water Treatments

Various methods are available that can reduce or eliminate the impurities in poultry watering systems. Shur-Gain highly recommends using **Combiacid** and **Proxy-Clean** for improving water quality for your poultry, and these are discussed below:

1. **Chlorination**. Chlorination is the most commonly used water treatment method for eliminating bacterial contamination. Chlorine can be administered by shock treatment or through an in-line proportioner. Chlorine reacts with organic compounds and thus its effectiveness as an antimicrobial agent is reduced in the presence of high levels of organic matter. General recommendations are to use a level of 2 to 3 ppm (2 to 3 mg/litre) at the drinker located farthest from the proportioner. Chlorine levels can be easily monitored with the use of a pool test kit. Guidelines for chlorination use are indicated below:

- Do not chlorinate market age birds under extreme heat stress
- Measure residual chlorine (Cl) at the waterer to maintain a minimum level of 1.0 ppm (1.0 mg Cl/litre) at the drinker mid-house.
- Use caution when using as chlorine solutions are acidic and often oxidize soft rubber over time.

2. **Softeners**. Water softeners reduce the hardness in water by replacing calcium and magnesium with sodium. However, this does not reduce TDS and may increase the sodium content to unacceptable levels. It is not recommended to use softeners if your water contains high levels of sodium. Poultry are also extremely sensitive to excess sodium, so it is not recommended to use water softeners.

3. **Acidification**. Acidification lowers the water pH level to improve water quality and thus enhance poultry health and performance. The benefits of adding acids to poultry water systems includes:

- Lowers the gastrointestinal tract (GIT) pH and increases the activity of GIT enzymes.
- Lower GIT pH reduces the growth of pathogenic bacteria.
- Improves the utilization of oral antibiotics.
- Prevents the buildup of lime scale in waterlines.
- Improves the availability of chlorine and thus lowers the cost of chlorination.

Combiacid is a water acidifier designed by Nutreco Canada Agresearch. Combiacid improves the water quality by reducing the pH level by 1.5 to 3 units. Maintaining the water pH between 5.5 and 6.5 can prevent the formation of biofilm in water lines, which is an attractive environment for pathogens, such as *E. coli*, *Campylobacter*, *Clostridium perfringens,* and *Salmonella*.

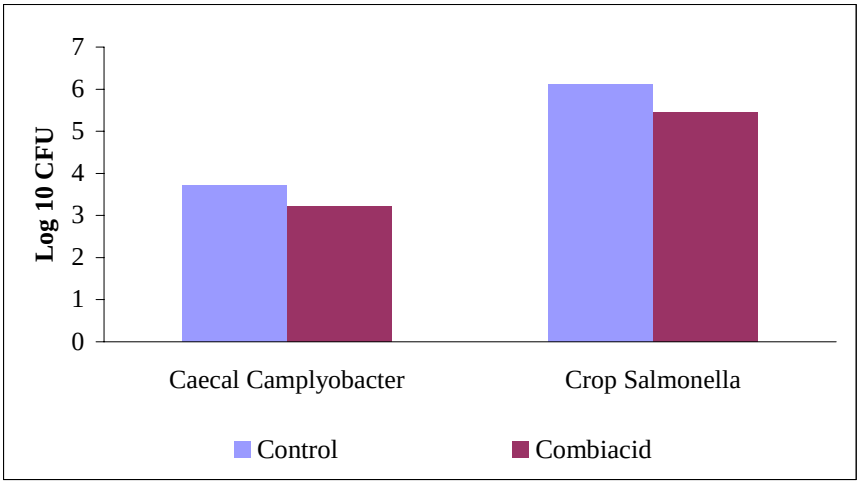
Agresearch identified the need to develop alternative products to control pathogens that affect poultry production. Combiacid was initially designed as an alternative program for antibiotic growth promotants for antibiotic-reduced poultry production. Broilers challenged with *Clostridium perfringens*-related Necrotic Enteritis (NE) at 16 days of age and offered Combiacid in the water had unaffected body weights, improved feed conversion and reduced NE mortality in orally challenged birds (Agresearch Trial #216, Table 2). In the Agresearch Trial ZB1109,

after 12 hours of access to water containing Combiacid, caecal *Campylobacter* was reduced by 76% and crop *Salmonella* by 69% in slaughtered broilers (Graph 1). Today Combiacid is widely used as a successful water acidifier for all livestock and poultry facilities.

Table 2. The impact of Combiacid on NE challenged broilers (Trial #216).

	Control	**Combiacid**	**P value**
Average bodyweight *(22 days of age) kg/bird*	0.719	0.748	0.092
Feed Conversion *(0 - 22 days)*	1.632	1.502	0.029
NE Mortality *(0 - 22 days) %*	9.583	4.167	0.053

Graph 1. The effect of Combiacid on pathogenic intestinal populations in slaughtered broilers (Trial ZB1109).



4. **Sanitizers**. Sanitizers are used to clean the water lines between flocks (shocking) or with birds present. Chlorination is one method of sanitation that was previously mentioned. Proper maintenance of water systems ensures the prevention of build-up over time of scale deposits, rust, algae or dirt in the water lines. If these substances are allowed to build-up in the water lines, they can provide nutrients for growth and multiplication of microorganisms, such as *E. coli*.

Shur-Gain is the exclusive supplier of **Proxy-Clean**, our number one water line cleaner. It uses 50% hydrogen peroxide enriched with a special silver complex, which work together to clean drinking systems. The longer it is allowed to sit within the water system, the better it works at removing the biofilm layer. The benefits of using Proxy-Clean in your water system include its non-corrosive and biodegradable properties, the removal and prevention of organic deposits and biofilm, and the creation of an undesirable environment for bacterial growth. It is more effective than chlorine at reducing the bacterial levels and removing the biofilm in your water lines (Figure 1).

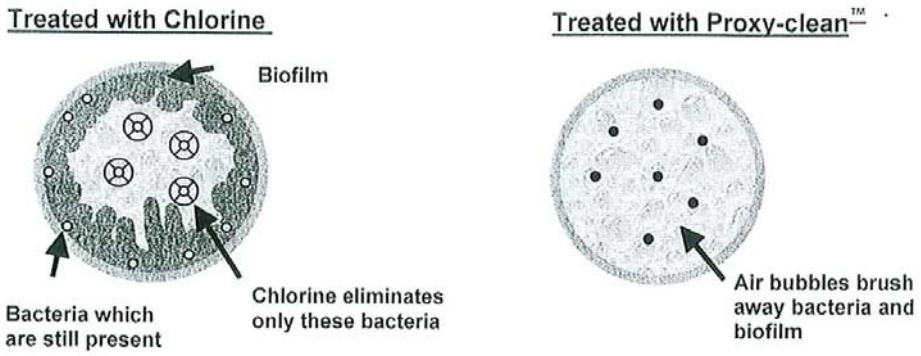


Figure 1. Cross section of a water line and the treatment effects of Chlorine versus Proxy-Clean.