



*The University of Georgia*

**Cooperative Extension Service**

*College of Agricultural and Environmental Sciences / Athens, Georgia 30602-4356*

JULY 2003



## ***BROILER TIP . . .***

### **IRON CONCENTRATION IN BROILER DRINKING WATER: DOES IT AFFECT BIRD PERFORMANCE?**

Iron is one of the most common elements found in nature and is a problem for many households. The question is whether iron is an issue for broiler operations. If iron concentrations are high in water, the symptoms may include yellow, red or orange color, slime buildup in water lines, buckets or tanks and an odor that resembles fuel oil, cucumbers or sewage. The presence of an odor may only be apparent after the extended periods of no water usage. Another symptom of high iron concentration is the presence of iron bacteria which is manifested as a reddish slime build up in water lines and equipment.

The National Research Council indicates that 4,500 ppm of iron in the feed is toxic to chickens and can cause rickets (NRC, 1994). Many recommendations for poultry are derived from human drinking water standards. This follows the general husbandry rule of not providing water to livestock unless you would drink it yourself. Human water quality standards list 0.3 ppm as the maximum desired level in drinking water. However, there is a misconception that levels above 0.3 ppm may have negative impact on flock health and performance. This is because at levels above 0.3 ppm an odor, metallic taste or staining problem may occur. For poultry the literature suggests that iron levels above 0.3 ppm could result in decreased water consumption that will be associated with decreased feed consumption. However, there is no documented case that confirms this. A recent study using Leghorn hens examined iron concentrations in water ranging from 0.5 to 500 ppm. Below 100 ppm there was no effect on performance. Water consumption was significantly reduced by 16% when iron levels were 100 ppm or greater. However, even though water consumption decreased, there were no differences in body weight or feed conversion. In the treatments above 100 ppm, egg production was more variable, but did not differ from the controls statistically (Damron and Eldred, 2002).

What is the likelihood of water iron concentrations being about 100 ppm? A summary of well testing in Georgia is presented in Table 1. A water quality study of 50 Northeast Georgia poultry farms in 1988 found iron concentrations that ranged from 0 to 1.45 ppm (French et al., 1988). A review of well water analysis in GA was performed for records over the last 10 years. Out of 21,800 samples submitted to the Agriculture Service Laboratory at the University of Georgia, 0.07% (16) were found to have iron levels above 20 ppm and 0.02% (4) had iron levels above 100 ppm. From this information it can be seen that iron levels rarely reach levels above 100 ppm.

#### **PUTTING KNOWLEDGE TO WORK**

The University of Georgia and Ft. Valley State College, the U.S. Department of Agriculture and counties of the state cooperating.  
The Cooperative Extension service officers educational programs, assistance and materials to all people without regard to race, color, national origin, age, sex or disability  
An equal opportunity/affirmative action organization committed to a diverse work force..

Table 1. Results from water quality surveys

| Year      | No. of wells tested | Range of Iron (ppm) | Reference           |
|-----------|---------------------|---------------------|---------------------|
| 1988      | 50                  | 0 - 1.45            | French et al., 1988 |
| 1990-2003 | 21,800              | 0 - 400             | UGA Ag Service Lab  |

Though iron rarely reaches levels to directly affect broiler performance, this does not mean that it does not have significant indirect consequences. The most common problems with iron levels above 0.3ppm is the growth of iron bacteria are organisms that use iron in the water, pipes, tanks, and well casings as a nutrient source. They can proliferate in water containing iron as low as 0.1 ppm, however to function properly these bacteria need at least 0.3 ppm of dissolved oxygen in the water. There is no research literature that suggests iron bacteria are associated with health problems. These bacteria are not even considered a health risk to humans. At most these bacteria present some management problems that will need to be addressed to maintain adequate water supply for bird consumption at the nipple of enclosed water systems. The presence of iron bacteria is normally associated with a slime buildup. As the iron precipitant (the red substance that accumulates in the bottom of water containers) and slime build up, they can clog water filters, pipes and drinkers. In the previous paragraph the iron levels found in Georgia well water samples were reported. Even though only 0.07 % had levels above 20 ppm and therefore of no threat to broiler health, they could present equipment problems.

If your well has excessive iron concentration according to the water analysis, it is probably based on human water quality standards. Unless the concentration exceeds 100 ppm there will be no effects on bird health. However, equipment problems could arise that will affect performance long before bird health becomes an issue. Iron levels as low as 0.3 ppm can support iron bacteria that may result in equipment problems. If water lines clog to the point that water flow is restricted the birds may not get enough water. Water restriction would result in lower feed consumption, increase feed conversion and possible dehydration if it was restricted over a significant time period. The slime and precipitate formation could also affect water flow through evaporative cooling systems causing house temperature to rise and have a negative impact on broiler performance.

In most cases these buildups can be avoided by preventative maintenance that involves regular back flushing of the water system. For more severe iron bacteria problems a simple treatment like chlorination may need to be used. Some people can get by with chlorinating in between flocks, but farms with excessive iron problems may need to use continuous chlorination. Chlorine not only kills the bacteria, but is an oxidizing agent as well. This means it can cause iron to combine with oxygen which causes the mineral to come out of solution and form a precipitant. In cases where chlorine is used, a filter system will be needed to remove the solids from the water. Other methods of iron removal may be required (See Dorman, 1996 for more information). You can get more information on iron removal systems by contacting your county extension agent or a water treatment professional.

**References:**

Damron, B. L. and A. R. Eldred, 2002. Tolerance of white leghorn hens to iron in drinking water. *J. Appl. Res.* 11:406-409.  
 Dorman, D. (1996). *Home Water Treatment Systems*. Athens, GA: University of Georgia, Cooperative Extension Service.  
 French, D, M. Lacy, and N. Dale, 1988. Georgia poultry farms water quality surveyed. *Poult. Dig.* 47(Jan.):44-49.  
 National Research Council, 1994. Nutrient requirements of poultry. 9<sup>th</sup> rev. ed. National Academy Press, Washington, DC.

  
 Brian D. Fairchild  
 Extension Poultry Scientist

Extension County Coordinator/Agent

  
 Mike Czarick  
 Extension Engineer