The ***Poultry Engineering, Economics & Management***
NEWSLETTER

Critical information for Improved Bird Performance Through Better House and Ventilation System Design, Operation and Management

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Feature article

Treating Poultry House Floors to Improve Poor Performance

In field observations with scientific and laboratory supporting documentation it has long been noted that some poultry farms show good flock performance for a significant period of time following construction, but then start showing persistent sub-par flock performance. This has happened with no sign of what the problem might be, even after a thorough evaluation of the farms' husbandry and management practices. In cases where excessive condemnation and mortality rates have been seen on farms where husbandry and management were apparently excellent, indications have been that the probable cause was high populations of disease-causing microorganisms such as coliform bacteria (including *E. coli*) in the growing environment.

Many university and industry representatives believe that both situations, poor flock performance on previously successful and well managed farms, and high condemnations or mortalities from disease occurring on otherwise well-managed farms, have root causes in poultry house floor and bedding management.

In the United States virtually 100% of broiler and turkey production is in houses with dirt pad floors. The practice of cleaning bedding and manure out of houses after each flock has been replaced with a variety of production practices that range from cleaning out only once per year to cleaning out only when the volume of manure and bedding dictates material removal. In other words, we are growing on more built up litter than we ever have in the past. And there is likelihood that on too many farms, high levels of bacteria, viruses, yeast, and molds are allowed to build up in house floors and litter.

In some cases the disease problems that result may have only what are called "subclinical" symptoms, in which the birds show no obvious signs of disease but are using too much feed energy in fighting off illness. Thus the appearance of poor flock performance numbers with no apparent cause. In other cases, it is obvious there is a health problem, but the source of infection is not easily identifiable.

There are indications that the root causes of these problems are not located simply in the litter but in the dirt floor, and can survive even after the litter is removed and the house has been cleaned and disinfected. The problem of poor flock performance without an obvious cause often persists even after old litter is replaced with fresh bedding.

Based upon the reasonable supposition that the dirt pad is where the problem originates, many field trials across the poultry belt have been conducted in an attempt to correct the problem by using some kind of pad treatment. Usually, litter and manure are cleaned out, and the dirt floor is given a super-strength "shock" acidification treatment using one of the common litter treatment materials normally used to help control ammonia release from litter. These trials have shown success in many instances, although not in all cases.

The purpose of this newsletter is to answer some of the most frequently asked questions about this practice and present some examples of field data on its value to the grower from an economic standpoint.

1. How does litter treatment or the shock acidification treatment of the poultry house dirt pad floor affect disease-causing microorganisms in the growing environment?

Certain types of microorganisms, such as viruses, bacteria, yeast and molds, can affect how well birds do. For the last three of these, there is an optimum range of acidity (measured in terms of pH) within which they can survive and/or flourish if they have proper temperatures and moistures:

Optimum pH ranges	
Bacteria	5.5 to 8.5
Yeast	2.5 to 8.0
Molds	1.5 to 8.5

An optimum pH range for viruses has not been demonstrated, but it is known that survivability of some is affected by low pH. For example, some of the earliest shock acidification floor treatments on poultry farms were found to alleviate problems resulting from infectious bursal disease, which is caused by a virus.

In many houses that have been in production for some time, pad pH is often found to be alkaline (pH approximately 7.1-8.5). This pH range provides a good environment for many disease-causing microorganisms to survive. Acidification treatment basically lowers the pH of the dirt floor. Treatment for ammonia control may lower the pH of the litter to around 4 (acid). Using the same materials at a higher application rate to treat the dirt pads often results in a pH of around 2 (very acid). The treatment may or may not kill disease-causing microorganisms directly. It does, however, result in a pH environment that most of these organisms cannot survive in.

2. Is there any scientific evidence to show what happens to the organisms in the dirt pad of the poultry house after the pH has been altered?

Yes. In recently completed scientific studies, acid treatments were used to reduce the pH of the floor to 3 or less. This treatment greatly reduced microbial levels. Bacteria, which commonly may cause serious disease problems, were completely suppressed. See cited publication on page 4. Table 2 on facing page shows effect of pH on selected poultry pathogens.

3. How should a grower decide whether his farm needs pad shock treatment?

Poor performance on any farm may be caused by many factors. Before making the decision to spend money on acidification treatment, growers should carefully evaluate all other possible reasons for poor performance. Problems, starting with chick quality and including feed, heating and ventilation, water delivery and quality, sanitation procedures, and other sources through which diseases might be entering the house, should be carefully checked and eliminated before ordering shock treatment. Problems with bio-films or other microbial contamination in water systems should be especially suspected and eliminated. Growers should be aware that pad shock treatment has not been 100% successful, and other causes may account for at least some of our “mystery” flock failures.

4. How are pads shock treated, how much does it cost?

In the early days many pads were shock treated with bulk acid to lower the pH. This is not a very safe or convenient way for the average grower to accomplish pH reduction of soil. However, a limited number of companies in the USA do offer custom bulk acid treatment service. In most locations in the broiler belt pH adjustment to pads has been accomplished by heavy dosing of the pad (after all manure and litter are cleaned out of the house) with one of the commonly available litter treatments at a rate of 100 pounds per 1000 square feet of dry treatment or 25 gallons per 1000 square feet of liquid treatment. Cost of treatments varies based on cost of application but at the present time treatment and application in a 40 x 400 house is about $400 and for a 40 x 500 ft house about $500.

5. What are the potential benefits to the grower of reducing pad pH?

In field studies conducted by major integrators (see examples in Table 1), pH shocking of the pads with sodium bisulfate on farms that were chosen often showed a very marked change in performance. Overall, response to the treatment was usually related to how bad the problem was prior to treatment. Field test results indicate an average settlement improvement of $0.0075/lb possible on farms that meet the criteria for treatment; i.e. continued poor performance with no obvious cause. With 20,000 4-pound birds in a 400-foot house that would be a $600 increase in pay per flock; with 25,000 4-pound birds in a 500-foot house it would be a $750 increase in pay per flock. On average, then, the potential benefits would outweigh the costs with the first flock (see #4 above). This of course does not mean that positive returns will be gained in every case. Growers must balance the costs of application with the potential returns from improved flock performance.

6. How long can good effects of a successful pad shock treatment be expected to last?

There is little definitive evidence answering this question. Most likely there will continue to be some benefit for a

TABLE 1. EXAMPLE SETTLEMENTS BEFORE AND AFTER SHOCK ACIDIFICATION TREATMENT TO HOUSE FLOORS

(40 x 400 ft Houses 20,000 birds adjusted to 4 lbs.)

FARM A

Date Sold	Grower $/lb pay above or below AVG	Gross $ Above or below AVG
6/28/01	+ 0.0030 $/lb	+240
8/16/01	+ 0.0020 $/lb	+160
10/13/01	- 0.0005 $/lb	-40
- - - - - - Shock treatment of pad ph - - - - - -		
12/4/01	+ 0.0106 $/lb	+848
1/19/02	+ 0.0126 $/lb	+1008
3/16/02	+ 0.0045 $/lb	+360

FARM B

Date Sold	Grower $/lb pay above or below AVG	Gross $ Above or below AVG
4/7/01	- 0.0041 $/lb	-328
5/26/01	- 0.0066 $/lb	-528
7/14/01	- 0.0078 $/lb	-624
- - - - - - Shock treatment of pad ph - - - - - -		
9/1/01	+ 0.0032 $/lb	+256
10/20/01	- 0.0008 $/lb	-64
12/15/01	+ 0.0009 $/lb	+72

Data above is taken from field studies in cooperation with three integrators covering four complexes, 23 farms, 100 houses during 2001-2003. Thanks is extended to those companies and Jones-Hamilton Co.

TABLE 2. EFFECTS OF pH ON BACTERIA GROWTH

pH	E. coli	Clostridium	Salmonella	Pasteurella
7.4	Heavy	Heavy	Heavy	Heavy
7.0	Heavy	Heavy	Heavy	Heavy
6.8	Heavy	Heavy	Heavy	Moderate
6.5	Heavy	Heavy	Heavy	Light
6.4	Heavy	Heavy	Heavy	Light +
6.3	Heavy	Heavy	Heavy	Very light
6.2	Moderate	Heavy	Heavy	Very light
6.0	Moderate	Heavy	Moderate	Very light
5.8	Light	Heavy	Light	Very light
5.7	Light	Heavy	Very light	None
5.4	Very light	Moderate	Very light	None
5.2	Very light	Moderate	Very light	None
5.0	None	Light	Very light	None
4.8	None	Light	None	None
4.5	None	Very light	None	None
4.3	None	None	None	None

(incubation 24 hours, soy agar medium)

Source: *Effects of pH on Selected Poultry Bacterial Pathogens*, Boyd E. Hardin and C.S. Roney, Alabama Department of Agriculture and Industries State Diagnostic Lab.

number of successive flocks. However, pH in the pad and litter starts to rise even during the first flock following treatment. Field observations suggest that shock pad treatments may be needed once a year.

7. If reducing pH in the litter suppresses disease, should a grower consider acidifying the water supply?

Mild water acidification to a pH of 6.0 to 6.5 will improve the effectiveness of water sanitizers such as chlorine, household bleach, and hydrogen peroxide. However, in University studies now available, significantly lowering the pH of the water to 3.5 to 4.0 has been shown to suppress bacterial growth. Producers should use care and consult their service technicians when selecting water acidifiers. At present time, there is insufficient information on how some water acidifiers will affect the taste and bird acceptance of water from different water sources (wells, etc).

8. Are there other sanitation procedures to be considered along with possible pad shock treatment?

Yes. When cleaning a house out, pressure-wash the inside before removing litter and manure. This allows much of the wash-down water and the pathogens in it to be removed by the cleanout instead of being absorbed by the dirt floor. If possible, allow the pad to dry completely before putting down fresh litter. Also, use an approved insecticide and other procedures to keep down darkling bugs and other disease-spreading pests.

The Bottom Line

Altering pH of poultry house dirt pads may be a valuable tool for helping correct performance problems on chronically poor performing farms. In extensive field trials, average performance benefits for the first flock after shock acidification treatment have been seen to exceed costs by $200 (400-foot house) or $250 (500-foot house). Growers must realize that these are averaged results, and shock pad treatment has not been successful in some individual cases. However, performance improvements much higher than average have been noted. As further field studies and research data become available we will report these results in future newsletters.

By Professor Jim Donald, Extension Engineer, Auburn University, and Dr. Susan Watkins, Extension Poultry Specialist, University of Arkansas. Appreciation is expressed to the many industry personnel who shared information and experiences with shock acidification treatment of poultry house floors.

Reference: *Proceedings, 2003 Virginia Poultry Health and Management Seminar*, Roanoke, VA, April 15-16, 2003. "Evaluating the Effectiveness of Poultry House Sanitation programs," S. E. Watkins, J.B. Payne, E.C. Kroger, M. Wilson and J. Cornelson, pages 64-67.

U.S. Poultry & Egg ASSOCIATION

***The Poultry Engineering, Economics and Management Newsletter* is now being produced in cooperation with the U.S. Poultry & Egg Association, as part of their commitment to poultry industry education. We are proud of this new association, and know it will help to improve our continuing efforts to bring you the critical information you need to know about poultry engineering, economics and management.**

ALABAMA COOPERATIVE Extension SYSTEM

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Jim Donald, Extension Engineer, Auburn University
Mike Eckman, Extension Poultry Scientist, Auburn University
Gene Simpson, Extension Economist, Auburn University