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The Link Between Brooding Management and Airsacculitis

There are many misconceptions about respiratory disease in poultry. All too often vaccine application, chick or poult quality, and a host of other factors are blamed for respiratory disease when the problem is actually caused by a failure to follow the guidelines set in the brooding management program. And since the effects of mismanagement are most evident later in a flock's life, early management is often overlooked as the source for the flock's later respiratory disease and performance declines.

Major Management Factors that Contribute to Respiratory Diseases

While there are many factors that will affect respiratory disease incidence and severity, the vast majority of losses are caused by two major management factors that, when followed conscientiously, will keep respiratory problems to a minimum—air and litter temperature, and ammonia levels. Only strict adherence to these basic proper management techniques will result in birds reaching their maximum genetic potential for flock profitability, and the prevention of respiratory diseases. Without proper management of these critical factors, even the highest quality birds will have respiratory problems, be less profitable and fail to be fully protected by the vaccine program.

Proper Temperature Control

Proper temperature control requires producers to avoid brooding birds at temperatures outside their thermoneutral zone and also avoid temperature fluctuations.

Modern high efficiency birds are acutely sensitive to small temperature fluctuations. If birds are chilled, they will huddle together to conserve body temperature instead of using energy to develop meat. The result is an unevenly sized flock, birds with greater susceptibility to respiratory diseases and an ultimate loss of revenue. Fluctuations throughout the day are a primary cause for greater susceptibility of a flock to respiratory disease; improper temperatures are a severe stress to birds and will result in a weakened immune system, higher incidence of respiratory disease, more severe respiratory conditions, harder vaccination reactions and rolling vaccination reactions.

Vital Role of Litter Temperature

While the air is the most commonly monitored area for temperature, it's the deep litter temperature that is most critical. If litter core temperature is low (even one or two degrees too cool about two inches below the litter surface) and air temperature is adequate, then the flock will still suffer from being out of their thermoneutral zone.

Litter temperature must be monitored and houses must be properly preheated prior to bird placement, NOT immediately prior to placement. Two days prior to bird placement the air temperature must be raised allowing sufficient time for the air temperature and deep litter temperature to increase to a minimum of 90°F.

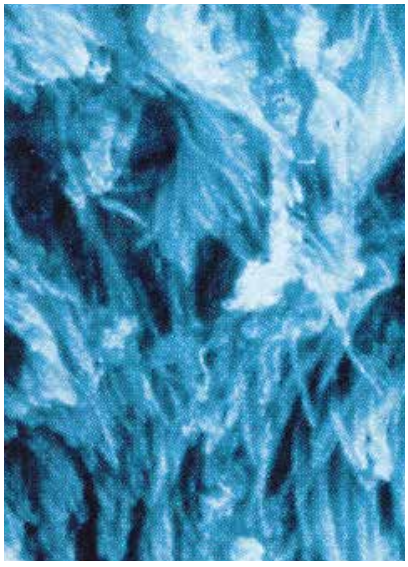
Also, as litter is heated it releases deep moisture and ammonia, a process known as litter curing. The preheating period should be long enough to allow curing to complete before bird placement so that moisture and ammonia are not fluxing off the litter surface when birds are present. In most farms, this process takes a minimum of 48 hours. Keep in mind that temperature fluctuations can occur if a house is not tight and air is being drawn in through cracks creating drafts, so routinely check every house for leaks.

Ammonia Damage Allows Entrance to Respiratory Invaders

Air quality is directly related to your birds' ability to respond to respiratory disease challenges. Ammonia is an often underestimated stress to birds, and actually causes the first breach of their respiratory defenses that then allows viral and bacterial invaders entrance into the respiratory system.

The mucociliary elevator of the trachea is birds' first line of defense against respiratory challenges. Upon inhalation, bacteria, viruses and other particles become trapped in the mucus that covers the cilia in the trachea. The cilia are small fibers that beat upward, in effect forming an elevator that lifts the trapped particles in the mucus out of the trachea where they can be either slung out or swallowed. Proper cilial function depends on the integrity of the tracheal lining. Any insult to the mucociliary elevator will impair the bird's ability to clear particles and disease organisms from the respiratory tract, resulting in airsacculitis.

Normal trachea with lush, uniform cilia



Ammonia damaged trachea showing stunted, irregular, patchy cilia

The most common cause of damage to the mucociliary elevator is ammonia. With levels as low as 20 ppm (barely detectable by the human nose), paralysis of the cilia can be seen which results in bacteria and viruses being trapped by the mucus without the ability to be removed. The trapped particles then fall deeper into the bird's respiratory tract causing disease. Higher ammonia levels can cause deciliation or a sloughing of cilia, giving viruses (including vaccine viruses) and bacteria immediate access to the respiratory system and bloodstream. Small particles (dust, bacteria and viruses) cannot be cleared adequately from the respiratory system and are able to make their way into the air sacs where airsacculitis will most likely develop.

The Development of Airsacculitis

Ammonia damages trachea →Respiratory virus causes further damage →E. coli enter → Airsacculitis develops

Chickens and turkeys are most susceptible to ammonia insults during brooding and when boosting respiratory vaccines in the field. Excessive moisture or improper decaking, litter tilling and windrowing will encourage excess ammonia production, therefore proper litter management and ventilation to maintain ammonia levels below 20 ppm should be followed at all times.

Effects of Ammonia on Respiratory Health

In one study Terzich et al looked at the effect of PLT® litter acidifier on the impact of development of respiratory disease lesions in broilers. Birds were raised on either untreated litter or litter that was treated with PLT®, and were then vaccinated with their normal respiratory disease vaccine program. Ammonia levels in untreated houses ranged from 53-115 ppm. In houses treated with the litter acidifier, ammonia levels were reduced to 5 ppm at placement and never rose to more than 22 ppm throughout the four week study (Table 1). Because of this reduction in ammonia, body weights and gross airsac lesions were greatly reduced in the birds raised on the PLT-treated litter.

Ammonia levels following litter treatment		
Days after treament[b]	None	PLT®
-1	96[c]	88
0	95	5*[.d]
7	72	14*
14	115	20*
22	115	22*
48	53	19*

Table 1. Mean atmospheric ammonia levels (ppm) in pens where litter was or was not treated with PLT®[a]

[a]Poultry Litter Treatment®.

[b]Treatment was immediately prior to chick placement at 1-day-old.

[c]Mean ammonia levels are parts per million. In the present study, ammonia levels in excess of 25 ppm were considered to be excessive.

[d]Asterisk indicates a significant (P<0.001) difference between treatments.

Improvements in respiratory health were also noted at the microscopic level. The application of live respiratory virus vaccines must cause a mild inflammatory response in the birds in order to be effective. The cilia of the bird must be functioning well at the time of vaccine application in order for the damage from the vaccine to be kept at a healthy minimum. The cilia that make up the mucociliary elevator were more intact and had milder inflammation in the birds raised in the lower ammonia environment compared to the other birds in the study.

Number of chickens with these injury magnitudes							
Lesion	Litter Treatment	Histopathology score[b]	Minimal	Mild	Moderate	Marked	*P* value[4]
Loss of cilia	Non	4.00*	0	0	2	20	<0.001
	PLT	3.25	0	1	13	6	
Hypertrophy and hyperplasia	None	6.00*	0	0	0	20	<0.001
	PLT	5.10	0	18	0	2	
Inflammation	None	6.00*	0	0	20	0	<0.001
	PLT	5.20	0	16	4	0	
Necrosis	None	4.60*	0	9	12	0	<0.001
	PLT	3.65	10	9	2	0	

Table 2. Histopathological findings in the mucosa of tracheas of 23-day-old broiler chickens raised in pens that were treated or not treated with PLT®[a]

[a]Poultry Litter Treatment
[b]See text for scoring method. Numbers are mean scores. A t-test was used to analyse these data, and an asterisk indicates a significant (P<0.001) difference between treatments.
[c]Twenty chickens in each group.

Reference: Terzich, M. , Quarles, C. , Goodwin, M. A. and Brown, J.(1998) 'Effect of Poultry Litter Treatment® (PLT®) on the development of respiratory tract lesions in broilers', Avian Pathology, 27: 6, 566 — 569