pH Matters
by JONES-HAMILTON CO.

JH Ag
WE KNOW pH MATTERS

FALL 2016

Comparison of Different Litter Amendments With Multiple Application During Broiler Growout

By Hong Li
Department of Animal and Food Sciences
University of Delaware

Control ammonia for brooding chicks

Poultry producers have recognized the need to provide an environment for birds that minimizes stress. Environmental stress is known to increase the susceptibility of broilers to diseases such as necrotic enteritis, botulism, gangrenous dermatitis, air sacculitis, and cellulitis. One important stressor is ammonia in the air, which is generated by bacterial degradation of nitrogenous compounds in the litter. Growers can limit the generation and volatilization of ammonia by applying acid-based litter amendments. These acidifiers reduce the pH of the litter to levels less conducive to ammonia volatilization. In addition to their influence on ammonia, these acid amendments in litter can also inhibit the growth of bacteria that break down uric acid and generate bacterial foodborne pathogens transmissible to humans through poultry products. Commercially available acidifying litter amendments, including PLT (sodium bisulfate), Klasp (ferric sulfate) and Al+ Clear (aluminum sulfate), are the most commonly used amendments for broilers in the brooding period.

Control ammonia after brooding with PLT

The ammonia emission reduction efficacy diminishes by the accumulation of litter and manure after 3 to 4 weeks because most of the ammonia is emitted from the top surface (less than 5 cm; 2 inches) of the manure within the first 48 hours after excretion (Li and Xin, 2010). Burns et al. (2007) found the majority (more than 4/5) of total ammonia emission was from birds older than 21 days of age. In current practice, most litter amendments are only applied into the broiler houses prior to chick delivery, due to potential bird toxicity and hazardous exposure. Li et al. at University of Delaware conducted studies on multiple PLT applications during grow-out and have shown it to be effective at further reducing ammonia in broiler houses by over 50%, improving the litter quality, the production, and health of the birds (Li et al., 2013). Improving litter quality alleviates foot and leg abnormalities and decreases the number of carcasses condemned at processing (Weaver and Meijerhof, 1991).

How about other litter amendments compared to PLT® on multiple application during grow-out?

A study was designed to determine the safety of the birds when various amendments were applied multiple times through the growout of broilers. This study was conducted under controlled laboratory conditions to mimic commercial production settings. Female Ross 708 broiler chicks were kept at a stocking density of 1.1 ft^2/bird raised over seven weeks. Al+ Clear, PLT, and Klasp, which are already widely used by broiler and turkey operations for the brooding period, were tested. Two rates were used: 50 lb/1000 ft^2 and 200 lb/1000 ft^2. The amendments were applied once per week starting at week 3. Amendments were also added to the corresponding feeders following each application at different rates (0.35 g/bird added for 50 lb/1000 ft^2 and 1.4 g/bird added for 200 lb/1000 ft^2) to mimic the spillage of amendment granules into feeders under commercial production at 0.85 ft^2/bird. The amendments were broadcast-applied in a manner meant to simulate the application in a commercial house. During the trial, performance data was collected and recorded. The data set included feed consumption, body weight, and feed efficiency. Poultry health and welfare indicators associated with exposure to different levels of ammonia were recorded. These were recorded as a function of different types and application rates of the selected litter amendments and included determinations of adverse cutaneous reactions (skin and eyes) to direct contact with acid-based litter amendments and intestinal lesions associated with ingestion of litter amendments. At the end of the trials all living birds were humanely euthanized and necropsied. Health and welfare parameters were measured between treatment groups. Lung, kidney, trachea, duodenum and intestine samples were collected for histopathology analysis.

Results

The production performance and health of the broilers were not affected by the three different amendments at either of the two rates when they were used weekly. The results showed no adverse effects on bird performance ($P = 0.24$) and health ($P = 0.7$) in regards to the amendment applied to the litter weekly from 3-wk of age.

The results clearly indicated that all litter amendments lowered ammonia concentration after litter amendments were applied on days 21, 28, 35, and 42, while ammonia concentration of the control birds gradually increased from 21 to 49-d ($P < 0.01$). Ammonia emission rates were also compared among the six treatments and the control. There was no difference between the two rates (50 vs. 200 lb/1000 ft^2) for the three different amendments. However, the birds with PLT had the lowest ammonia emission rate (0.09 g/bird-d) ($P < 0.01$) when compared to Al+Clear (0.13 g/bird-d) and Klasp (0.12 g/bird-d). The results suggested that PLT provided higher ammonia emission rate reduction (62%) than Klasp and Al+ Clear (48% and 49%).

The birds with PLT had the lowest NH^3 emission rate when compared to Al+Clear and Klasp. The results suggested that PLT provided higher NH^3 emission rate reduction than Klasp and Al+ Clear.

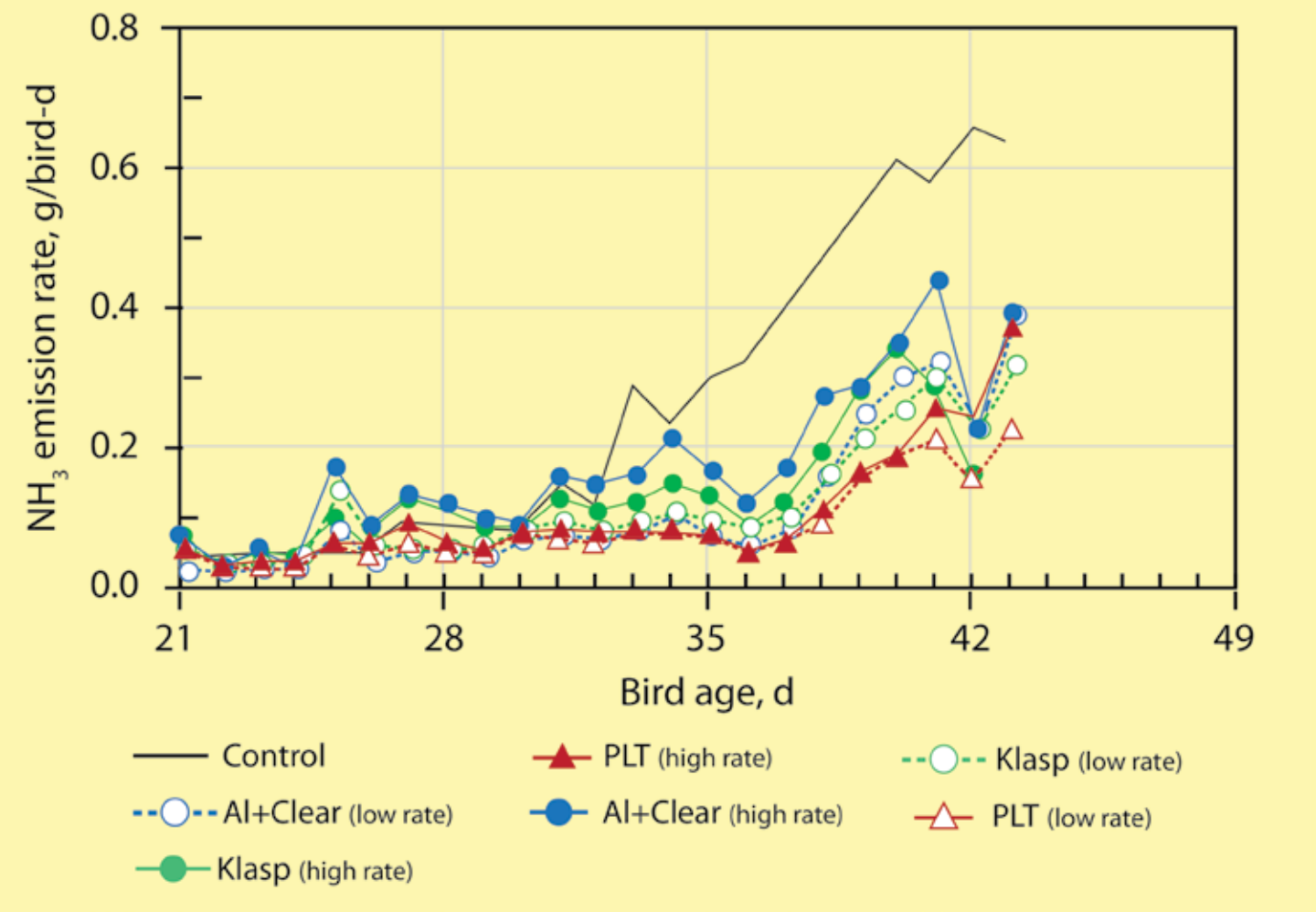

Figure 1. Daily mean ammonia emission rates of birds with three different litter amendments and rates (A_H: Al+Clear high rate, A_L: Al+Clear low rate, K_H: Klasp high rate, K_L: Klasp low rate, P_H: PLT high rate, P_L: PLT low rate)

Summary and Implications

Mid-flock and multiple litter amendment application showed promising results on Ammonia control and emission reduction throughout the broiler growout. The practice offers a viable option to control ammonia emission and elevated ammonia concentration during cold season while ventilation is limited for energy saving. The application of PLT with 50 lb/1000ft^2 every one or two weeks was the most cost effective practice for ammonia control (63% of reduction).

References

Burns, R.T., H. Xin, R.S. Gates, H. Li, D.G. Overhults, L. Moody, and J.E. Earnest. 2007. Ammonia emissions from poultry broiler systems in the southeastern United States. Proceedings of International Symposium on Air Quality and Waste Management for Agriculture. September 16-19. Broomfield CO. ASABE: St. Joseph, MI

Li, H., Lin, C., Collier, S., Brown, W., & White-Hansen, S. 2013. Assessment of frequent litter amendment application on ammonia emission from broilers operations. J. Air Waste Mgmt. Assoc., 63 (4), 442-452. http://dx.doi.org/10.1080/10962247.2012.762814

Li, H., and H. Xin. 2010. Lab-scale assessment of gaseous emissions from laying-hen manure storage as affected by physical and environmental factors. Trans. ASABE 53:593-604

Weaver, William D., Jr. and R. Meijerhof. 1991. The Effect of Different Levels of Relative Humidity and Air Movement on Litter Conditions, ammonia Levels, Growth and Carcass Quality for Broiler Chickens. Poult. Sci. 70:746-755.