Monday, November 3, 2008

Inhouse composting shows promise

D. Bautista, J. Ruano, G. Malone, K. Phillips & S. Fitz-Coy
Special to Poultry Times

OCEAN CITY, Md. -- Litter material shortages and escalating bedding costs have forced the Delmarva poultry industry to change litter use practices in recent years. Many have postponed clean outs and prolonged the reuse of litter in poultry houses.

Others have been transporting new litter material to Delmarva at distances up to 250 miles in order to schedule annual clean outs. Extended clean outs and reuse of litter have resulted in the emergence of disease problems and reduced flock performance. As consecutive flocks are raised on the same litter, accumulation of microbial pathogens in the built-up litter seems to impact flock performance and even food safety programs.

On the other hand, more frequent clean outs and use of new litter could generate a nutrient and waste management concern as the growers have to deal with the disposal of an increased amount of organic matter.

During the past five years, in various parts of the U.S., there has been renewed interest in the "in-house composting" of litter. One of the beneficial effects of this process might be correlated with the reduction or elimination of many litter pathogens due to thermal inactivation or high ammonia exposure, as the litter gets stockpiled and subjected to biochemical and temperature changes. Some other beneficial effects that have been noticed include reduction or elimination of cake, reduction of darkling beetle population, improved bird health and suggestions that it may alter the release rate of nutrients from litter.

Preliminary field trials using commercially available windrowing equipment is suggesting that this process has a great effect in reducing numerous pathogens. Laryngotracheitis virus was inactivated in the litter after in-house windrow composting and heating of the house at 100 degrees F (37.8 degrees C) for 120 hours. Aerobic, anaerobic and enteric bacteria was also significantly reduced from initial levels. Counts of aerobic and anaerobic bacteria from windrowed litter were significantly lower than those from untreated samples. Preliminary reports have also shown a significant reduction of spikes salmonella, campylobacter and C. perfringens.

Methods

- **Bacterial inactivation**

Several bacterial strains used as indicators of poultry health and food safety (Escherichia coli, salmonella, Kentucky/Typhimurium/enteritidis cocktail), Staphylococcus aureus and Clostridium perfringens were inoculated in brain-heart infusion agar slants (15 ml screw-cap tubes) and incubated at 37 degrees C for 16 hours.

One set of these tubes was sealed with screw caps, while the other was sealed with gauze to determine the effect of the temperature and the combined effect of the temperature and ammonia, respectively. These tubes were buried inside the windrowed pile at 1-foot deep. Replicates were removed at 4.5 days post-windrowing before the pile was turned. The remaining replicates were removed from the pile at 6.5 days post-windrowing. The slants were then swabbed and cultured for viable bacteria. Litter samples were also taken within an hour of windrowing and at the end of the process before the windrow pile was broken and spread out.

- **Virus inactivation**

Polypropylene screw-cap tubes were used to carry the following infective materials: reconstituted ILT chicken embryo-origin vaccine, intestine homogenates collected from runting-stunting-enteropathy cases and known to contain reovirus, liver homogenates collected from inclusion in body hepatitis cases and known to contain adenovirus, bursal homogenates from experimentally infected chickens with infectious bursal disease virus. Sets of tubes were also buried in the windrow pile at 1-foot depth. One set was removed from the pile at 3.5 days post-windrowing and the second at 6.5 days post-windrowing. Virus isolation was done in 11-day old SPF (specific pathogen free) embryonated chicken eggs.

- **Coccidiosis inactivation**

A 10 ml cocktail of mixed species sporulated oocysts (E. maxima, E. tenella, E. mivati) suspended in 2.5 percent potassium dichromate solution at 100,000 oocysts/ml, was aliquoted in screw-cup polypropylene tubes. Sets of tubes were placed in the windrow surface, buried at a 1-foot depth, and kept at room temperature inside the poultry house as non-treated controls.

One set of tubes was removed from the pile at 3.5 days post-windrowing (during turning) at the second set at seven days post-windrow. SPF birds (four 6-week-old birds) were inoculated with 1 ml of the treatment and control tubes, and necropsied for cocci lesions and oocyst counts at six days post-inoculation.

Results

Temperature inside the windrows reached 130 degrees F (54.4 degrees C) at the end of the first day of windrowing and peaked at 147 degrees F (63.9 degrees C) by the second day. The litter moisture ranged from 24 percent to 29 percent.

The analysis of the pathogen carrying samples showed no viable bacteria of E. coli or S. Kentucky/Typhimurium/enteritidis from both sets taken at 3.5 and 6.5 days post-windrowing. Although S. aureus was partially inactivated, it was recovered from most tubes taken at 3.5 days post-windrowing. There was also a reduction of viable C. perfringens at 3.5 days post-windrowing. No C. perfringens was cultured from tubes at 6.5 days. There was no viable coliform in tubes taken at 6.5 days post-windrowing. Total aerobic plate counts were also decreased.

The CEO-ILT vaccine virus was not recovered after litter composting but reovirus, adenovirus, and IBD virus were still viable. The cocci oocysts were inactivated by the composting treatment inside the compost pile (1-foot depth) but not on the surface of the windrowed pile or at room temperature in the house. Samples from both surface and room temperature sets caused severe coccidia lesions and very high oocyst counts when inoculated in susceptible birds.

Based on these preliminary results, there was a significant reduction-inactivation of pathogens, as previously reported. Records analysis of trial farms showed reduced mortality (up to 50 percent on farms with a history of dermatitis and RSS). In some farms, it takes two consecutive flocks of windrowing to break the disease cycle. The darkling beetle population has also been reduced up to 75 percent in some treated houses compared to control.

Broiler flocks raised on composted litter showed a consistent improvement in body weight and feed conversion. From the environmental standpoint, the Delaware Natural Resources Conservation Service is considering sharing the cost of this practice based on preliminary results and the Waste Treatment Standard No. 629.

Overall, in-house composting may be useful as a practical tool to reduce the incidence of food safety pathogens and poultry respiratory viruses such as ILT.

Daniel A. Bautista, Jose Miguel Ruano, George W. Malone and Kathy Phillips are all with the University of Delaware