The Poultry Engineering, Economics & Management
NEWSLETTER
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Windrow Composting of Litter to Control Disease-Causing Pathogens

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Reusing litter after a disease outbreak is never something that you want to do. However, the cost of new shavings and its general lack of availability, as well as the cost of full cleanout and restrictions on land application of litter, make salvaging this contaminated litter an attractive alternative. The problem with reusing contaminated litter is that the pathogenic organisms (bacterial, fungal, parasitic, or viral) that caused the disease in the first place are still present. So the question becomes, What should be done to clean up the litter for reuse?

There are several possible ways to do this. The first and easiest alternative is to allow the poultry house to "rest" for a couple of months. Of course, the obvious problem with this is that the cost (loss of income) of having a house or a group of houses idle for that long is very high. Another alternative is the use of litter amendments. Most of the commercially sold litter amendments work by acidifying the litter, which will kill many microorganisms. An important fact that is too often overlooked when using a litter amendment is that it should be tilled into the litter in order to be effective. If not tilled in, there is risk of not getting the acid spread throughout the litter, which means that the kill might not be high enough to ensure that there will not be another disease outbreak.

The third method is in-house windrow composting, which is what this newsletter is about. In-house windrow composting is a reliable and cost effective way to greatly reduce pathogen load. Some people would like to use the term "pasteurization" instead of calling the process composting. Why use the term pasteurization? Simply put, calling the process pasteurization is technically correct, since the process uses heating to kill microbial disease organisms. The pasteurization accomplished in windrow composting is typically not quite as thorough as traditional composting in killing disease organisms. The difference between the two is that in-house composting is generally only performed for 5-10 days, while traditional composting is performed for several weeks or even months. However, research studies conducted at Auburn University

Windrow composting heats the litter enough to accomplish pasteurization, killing almost all disease organisms. After the litter has been spread back out and allowed to cool for a day you are left with dry litter that is ready for the next flock.

have shown that when properly done, in-house windrowing can eliminate almost all of the pathogens that are present in litter.

Why does this process selectively kill these pathogens? The answer is fairly simple. Most pathogens that affect chickens (or for that matter people, too) grow most effectively at a certain temperature. In the case of chickens this is in the range of their body temperature, which is 105-107°F. If the temperature goes up just a few degrees the pathogen's growth will be inhibited, and if it is higher by 20-30 degrees the microorganism will be killed. That is why when we are sick we have a fever; it is a way for our body to slow down the pathogen growth so that our immune system will have time to catch up and destroy whatever made us sick.

After chickens have been caught, dust and cobwebs should be blown down onto the litter before windrow composting is started. This should minimize the amount of carry over contamination from one flock to another.

Typically the target temperature inside these windrow compost piles is 135°F; however, we have seen them as high as 170°F. At these temperatures there are very few pathogens that can survive. Even at fairly low internal temperatures like 130°F, there is substantial pathogen reduction.

Besides heat, windrow composting kills pathogens in two other ways. The other two methods that composting can kill microorganisms are by ammonia and by other microorganisms, chiefly beneficial bacteria. In this newsletter we will not go into detail about these two other methods other than to say that ammonia is a well known disinfectant and that bacteria are continuously waging war against each other for nutrients and space.

As mentioned, research performed at Auburn University has shown that the simple act of windrow composting can greatly reduce pathogens. In some trials performed at AU it has been shown that making a static windrow pile (one that isn't turned) for five days can significantly reduce overall bacterial numbers even when the internal temperature reaches only 130°F.

In this picture an adjustable blade is being used to pile the litter into a windrow pile. Notice that the litter is being scraped down to the hard packed dirt pad.

One surprising finding from this research is that the bacteria *Clostridium perfringens* was affected. This bacteria is the causative agent for two very devastating diseases in poultry, necrotic enteritis and gangrenous dermatitis. Why was the destruction of this organism so surprising? Simply put, this bacterium is known as a spore former. When a spore former detects that the environment is unfavorable it will form a spore. This spore is resistant to virtually all disinfectants, heat, cold, and desiccation. From this observation it has been conjectured that the temperature change in windrow composting is rather sudden and it may catch *Clostridium* unprepared to form a spore. In these studies it was shown that this particular bacterium is reduced by more

A windrow compost pile being spread out using a blade. Notice the steam rising from the litter as it is being spread out.

A "Brown Bear" attached to a BobCat, while not essential, can speed up windrowing. The Brown Bear works by throwing the litter in one direction, very similar to how a snow blower works.

Photo at left shows the steam coming off the composted litter as it is being spread out, indicating the litter is still hot.

After litter has dried, a new flock can safely be placed on the windrow composted litter. Entire process takes as little as 5-10 days.

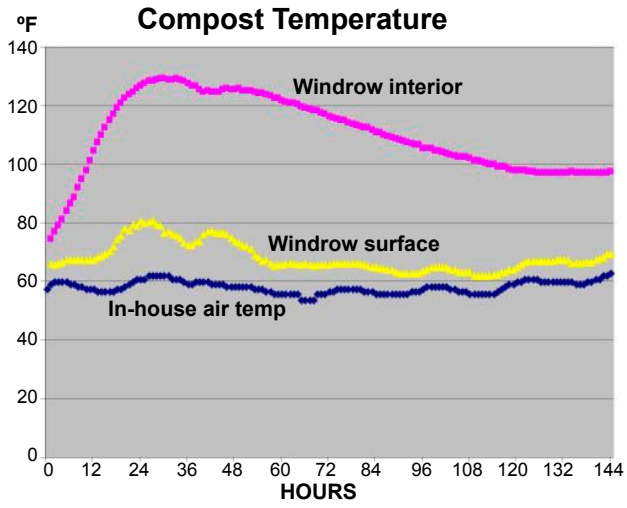

Chart shows temperatures reached in an unturned windrow compost pile in research at Auburn University. The interior of the composting litter reached about 130ºF by the second day, which is hot enough to destroy most of the disease-causing pathogens in chicken litter.

than 99.99% compared to litter that was not windrow composted.

In addition to bacteria, in-house windrow composting affects viruses as well. One such virus that has had a significant impact on poultry production is infectious laryngotracheitis virus (ILTV). ILTV is highly contagious, pathogenic, and results in serious economic losses. Work done at AU, as well as in field trials, has shown that windrow composting effectively eliminates all of the ILTV in contaminated litter after 5 days. ILTV, like many viruses, is very susceptible to high temperatures. Using built up litter, a typical windrow compost pile will reach an internal temperature of 140°F in about 24 hours, which is hot enough to destroy this virus.

No research has been performed for windrow composting effects on fungal and parasitic pathogens; however, the heat is high enough where all but the hardiest organisms are expected to be destroyed.

If you are planning on doing in-house composting it is important to wash or blow down the dust inside the house, since that dust is a potential hiding place for pathogens. While dedicated in-house windrow composting equipment such as a Brown Bear (see photo on page 3) is available, it is relatively expensive. However, most growers already have a tractor and the necessary equipment to do the job.

Many growers have successfully undertaken windrow composting by first de-caking, then using a litter pulverizer, and finally using an adjustable blade to create the in-house windrow. If a temperature probe is available, readings should be performed to verify that the windrow attains a minimal internal temperature of 135°F. After 5-10 days the blade used to create the windrow can then be used to level out the litter.

The Bottom Line

When properly managed, in-house windrow composting is a cost-effective method of disease control and prevention which will increase the useful in-house life of litter.

Check out our newly re-designed website with more up-to-date, practical information for growers and industry personnel: www.poultryhouse.com

U.S. Poultry & Egg ASSOCIATION

This newsletter is produced in cooperation with the U.S. Poultry & Egg and Alabama Poultry & Egg Associations, as part of their commitment to poultry industry education. We appreciate their support and are proud of our relationships with these organizations.

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