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In-House Windrow Composting of Poultry Litter

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It is very expensive for commercial producers to completely clean out and replace litter in poultry houses. In-house windrow composting, or IWC, is a cost-effective alternative that producers can use to extend the useful life of litter without damaging bird performance. IWC is a litter management technique that uses heat to eliminate harmful organisms in poultry litter between broiler or turkey flocks.

The IWC method involves creating long windrows of litter down the length of a poultry house after removing the flock (Fig.1). The goal is to use the heat generated in the windrows to kill pathogenic microorganisms. Because this method uses heat to reduce microbial growth, IWC is also referred to as litter pasteurization.

Once the windrows are formed, naturally occurring microbes start to decompose the litter material. This decomposition generates heat similar to that of conventional waste and biosolid composting. The goal, however, is not to create a humus-like soil amendment but to kill pathogens by rapidly heating the litter for a short time. Once the litter is pasteurized, it can be reused as bedding for the next flock. Research trials show that IWC can significantly reduce pathogenic bacteria and viruses in the litter. As well, some producers report that flocks raised on IWC litter suffered less disease than flocks raised on untreated litter.

The process

Soon after removing the birds, form the litter into windrows so they can generate internal heat. A target temperature of at least 130°F in the core of the windrows gives maximum pathogen

Figure 1. Poultry litter windrows and litter cleanout.

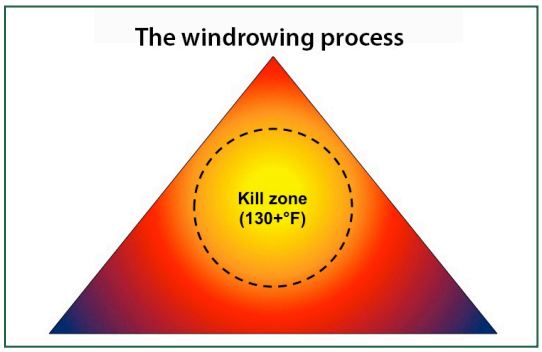

Figure 2. Target temperature in windrow core.

reduction (Fig. 2). The outer layers of the windrow will not reach temperatures high enough to kill pathogens, so the windrows must be turned after 3 or 4 days. This involves reforming the windrow so that litter from the outer edges of the pile moves into the center allowing the maximum amount of the litter to reach the target temperature. This also aerates the litter; aeration encourages heating in the reformed windrow.

Figure 3 shows temperatures recorded in the core of litter windrows during a Texas broiler farm trial. Windrows of the right size and moisture will typically heat to over 130°F in 24 to 36 hours. After 12 to 24 hours at peak temperature (often as high as 150°F) windrow temperatures will slowly decrease. Once they begin to cool, turn them. The sudden drop in temperature on day 4 is when the data loggers were removed and the windrows turned. Figure 3 also shows that the internal temperature of the windrows can vary greatly. This variability is influence by moisture, the amount of oxygen available in the windrow, its shape and size, and the placement of the temperature probes.

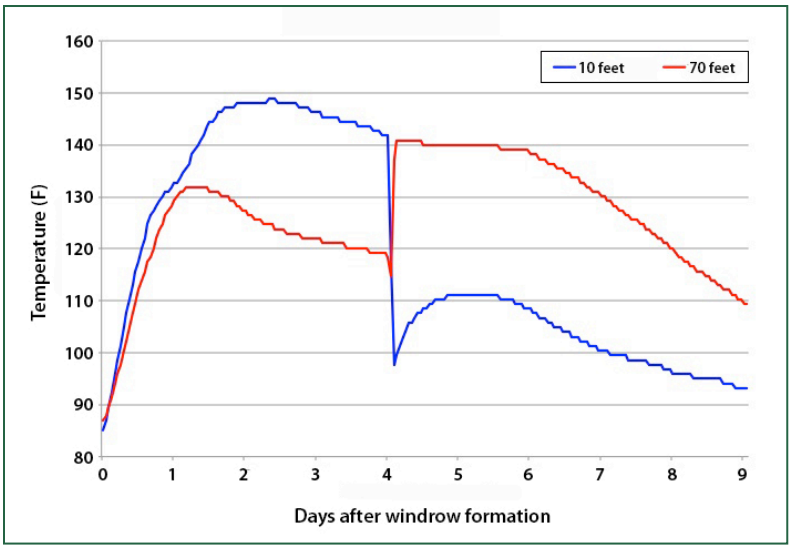

Figure 3. Core windrow temperatures recorded by data loggers at 10 feet and 70 feet from the end of a litter windrow on the cool pad end of a broiler house. Data loggers removed during turning on day 4.

Procedure

The following are generally accepted procedures for IWC in poultry houses. For optimum results, customize these operations according to litter conditions, scheduling, and operator experience.

1. Construct windrows within 2 days of removing the birds. Run the windrows the length of the house at 18 to 24 inches tall. If caked litter is excessive, remove some (e.g., from under the drinker lines) before forming the windrows. This will reduce excess moisture and possible ammonia problems when the litter is spread for chick placement.
2. Monitor windrow temperatures. Temperature can be measured with any type of thermometer as long as the stem or probe can reach the center of the pile—approximate 12 inches. If 130°F is not reached within 48 hours, successful composting is not likely. Try again by turning litter or level it out.
3. Turn the windrows 3 or 4 days after first forming them. Work the rows so that litter moves from the outside to the inside of the newly formed windrow. If there is enough time between flocks and the litter is sufficiently moist, turn the litter a second time and take advantage of a 3rd heat cycle.
4. Level the litter out 3 or 4 days after reforming windrows. Level the litter bed at least 4 days before placing the next flock to give moisture and ammonia enough time to purge from the litter.

IWC considerations

Equipment: Producers have been most successful with equipment that is specially designed for IWC. This equipment does the job more quickly and gives the windrows a more consistent size and shape. However, windrows can be formed with standard equipment such as a 3-point mounted angle blade or skid loader with a bucket.

Litter moisture: IWC is a microbial-driven process. For it to work, the litter must be moist enough to support microbial growth. The minimum recommended moisture content is approximately 25 percent. The optimum moisture content is 30 to 35 percent. If there is too little moisture (less than 25 percent) core windrow temperatures will likely not reach 130°F. If the litter is too moist (more than 35 percent) leveled litter will not be dry enough to avoid volatilizing excessive ammonia at chick placement.

Layout time: Proper IWC and litter purging takes at least 12 days, especially if initial litter moisture is high. IWC is not recommended if the layout time between flocks is less than 12 days. Trying to treat litter in windrows too quickly will likely not reduce microbes sufficiently. As well, purging litter for too short a time after windrow leveling will result in ammonia problems from litter that is not dry enough.

Litter depth: Keep the litter in the houses between 4 and 6 inches thick. Litter that is too deep takes longer to work and is more difficult, if not impossible, to form into windrows. Four to 6 inches of litter in a typical broiler house makes 2 windrows per house. Litter that is more than 6 inches deep will likely require 3 windrows.

Cost: The cost of implementing IWC depends on whether to work is done in house or contracted out. Rates vary by region and house size, but contractor rates of $125 to $300 per house have been reported. IWC using on-farm labor and equipment requires 1 to 1.5 hours forming the windrows, 0.5 to 1 hour turning the windrows, and 1 to 2 hours leveling the litter back out for a total of 3 to 4 hours per house. This is comparable to the time it takes to decake an entire house with a traditional decaking machine.

Ammonia concerns: Some producers have observed high ammonia volatilization after the litter is leveled out, particularly after the first time litter is windrowed. Managing litter moisture before forming windrows is essential to preventing this problem. After the windrows are leveled out and before placing new chicks, ventilate the house completely to remove ammonia and moisture from the litter. Producers have reported fewer ammonia problems after performing IWC for several consecutive flocks.

IWC as litter treatment for land application

When planning a partial house cleanout, it can be beneficial to use IWC before removing the litter. Traditional composting reduces pathogens and offensive odors and stabilizes the decomposition of organic materials. Texas A&M University and USDA-ARS have evaluated IWC for treating litter before applying it to land. The project showed that treatment reduced offensive odors without changing the nutrient content of the litter. In addition, the litter that remained in a partial cleanout benefitted from the pasteurization effects of IWC.

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