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# Are You Composting Right?

**Key Points:**

- Reduces viral pathogens
- Extends litter use
- Temperature should be 133º F for 3-4 days
- Moisture levels are best at 40-50%

## In-House Windrow Composting of Broiler Chicken Litter

By piling litter and organic bedding materials into long rows (windrows), many producers create compost valuable for use in planting operations. Bacterial decomposition turns the organic matter into usable compost, resulting in a product that is much more environmentally acceptable than raw litter for land application and disposal.

## Advantages of In-House Composting of Litter

Composting broiler litter in-house by the windrow method is both an art and a science so it may take some practice to do it successfully. The windrows are created to generate heat, but oxygen is needed to feed aerobic bacteria that help break down the waste materials into usable compost. To add oxygen, the materials need to be turned over. Larger operations may utilize special equipment just for this purpose.

In addition to composting, by raising the heat, it is possible to create sterilization within the bedding, allowing it to be reused.

## Benefits

There are several benefits for in-house windrow composting and reuse of broiler litter:

- Postpones the need for new litter (allows reuse of litter for an extended period of time)
- Reduces bacterial, fungal, and viral pathogens
- Reduces parasite loads (coccidia and intestinal worms)
- Kills fly eggs and weed seeds
- Can be used to reduce darkling beetle numbers in combination with insecticides
- Improves characteristics for land application (compost vs. raw litter)
- Hastens degradation of dietary antibiotics and coccidiostats as well asveterinary drugs
- Improves broiler performance

## Conditions Favorable for Composting

Composting is a biological process in which organic wastes are stabilized and converted into a product to be used as a soil conditioner and organic fertilizer. This process depends on the activity of microorganisms. It is very similar to the natural decay of organic matter but is faster due to more optimal conditions. Factors that influence the litter composting process are: aeration (oxygen), moisture content, carbon/nitrogen (C:N) ratio, temperature, time, particle characteristics (porosity, structure, texture, and size), and pH (acidity or alkalinity).

## Composting Creates Organically Bound Nutrients

When litter is composted, volume decreases and nutrient density and acceptability for land application increases. It has been demonstrated that compost nitrogen has a slower release than raw manure or litter cake. Good compost applied at the correct rate will generally outperform a similar level of nutrients supplied by synthetic fertilizer.

## Windrowing Litter In-House

In most cases, broiler growers use a box blade or compost turner to create two long windrows in each house to allow the litter to create heat. Creating windrows requires several hours of work per house, so it is time consuming and “dirty” work. Respreading litter after composting takes a similar amount of time. Although the windrow composting process reduces the quantity of broiler litter by about 25-50% in the pile, because of the high ash content of most used litter to be composted fresh litter (such as new pine shavings, sawdust, grain straw, or non-legume hay) will need to be added to increase the carbon content prior to composting.

## Evaluating Moisture Content

The litter cake (packed wet spots) may be removed or may be left to provide enough moisture for the bacteria to proliferate if litter moisture is low. Having at least 30% moisture in litter is necessary

for best results. But most litter in broiler houses range from about 20-25% moisture, so some water addition by spraying may be necessary. Preferably, broiler litter should have about 40-50% moisture at the beginning of composting. At less than 40% moisture, there is the risk of spontaneous combustion and reduced microbial activity.

When litter moisture content is greater than 65%, poor aeration results in anaerobic microbial activity. If anaerobic composting begins, the process will continue and temperatures will rise, but the process will take much longer. Litter must be allowed to dry adequately (and to release ammonia) after respreading and prior to receiving chicks for placement because litter caking and foot pad problems have been associated with wet litter (Harms and Simpson, 1977; Martland, 1984).

## Assessing and Correcting Carbon: Nitrogen Ratio

Nitrogen content of litter is influenced by several factors including moisture content and number of flocks since the last clean out. The nitrogen content of broiler litter ranged from 3.2 to 3.9% with an average of about 3.6% in composting trials. A C:N ratio of 39:3.6 or 10.83 will not compost properly because a range of 15 to 25 is needed. Having a C:N ratio that is too low will result in:

- Excessive ammonia emission during composting
- Failure to reach high (150° F) composting temperatures
- Reversion to less efficient anaerobic digestion (sticky compost piles)
- The end product readily caking and producing high ammonia levels during the next flock

## Internal Heat

Maximum temperatures (130-140° F) are reached within 36 hours of windrowing, and temperatures typically begin decreasing after about 48 hours, which is long enough to kill many pathogenic bacteria and viruses and reduce the overall microbial load. A live production manager for a U.S. broiler company uses the "thumb rule" of 100° F for 100 hours as being sufficient.

## Adding Beneficial Bacteria Involved in Composting

The direct-fed microbial product Q-Biotic® product Series from QTI contains viable spores of a mesophilic bacteria, *Bacillus subtilis*, thrives in organic matter such as animal manure or litter. When supplemented in the diets of poultry or pigs, for example, the beneficial bacteria pass through the digestive tract and out in the excreta where they can then contribute substantially to the composting process when conditions become suitable for them to grow and proliferate.

## Composting During Downtime

A 3-to-5-day in-house composting program between flocks is a useful way to reduce viral and bacterial organisms, and to improve broiler performance. Downtime between flocks needs to be 10-14 days to allow growers to complete composting and still have time to prepare for chick delivery. A period of a 5-7 days following respreading of the litter after in-house composting allows the litter to cool down and to release ammonia (and have it cleared from the air) prior to arrival of the next batch of chicks.

## Pathogen Reduction

Windrow composting of litter can be a way to control disease-causing pathogens. In-house composting is generally only performed for 5-10 days, whereas traditional composting is performed in larger piles over several weeks or months. In-house windrow composting involves self-pasteurization (reduction to complete elimination of pathogens) due to high temperatures (thermal kill), ammonia (chemical kill; a well known disinfectant), and microbial competition (biological kill—especially by beneficial bacteria which compete with pathogens for nutrients and space). Although the target temperature inside windrow compost piles is 135° F, they sometimes spike up to 170° F. Even in a static windrow (not turned), and at fairly low internal temperatures like 130° F, there is substantial pathogen reduction.

A finding from Auburn University research was that *Clostridium perfringens* counts were diminished by 99.99% through windrow composting. This bacterium is known to be a spore former and the causative agent for two very devastating broiler diseases—necrotic enteritis and gangrenous dermatitis. The spores are resistant to virtually all disinfectants, heat, cold, and desiccation. Infectious *laryngotracheitis* virus was completely eliminated from contaminated litter after 5 days of composting due to the high internal temperatures within the windrows but was still present in the dust within the house. Additionally, other studies show *Salmonella* species can also be reduced with windrow composting.

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qtitechnology.com | 847-649-9300
1707 N. Randall Rd, Suite 300, Elgin, IL 60123