Guidelines for poultry waste composting

This fact sheet summarises the requirements for composting and the methods to achieve the best results. Additional information is available from the Mass disposal preparedness for the poultry industries (PDF, 7MB) final report prepared for AgriFutures Australia and Australian Eggs.

Depending on the size and location of the poultry operation, on-farm composting may require an environmental permit. During an emergency animal disease response such as avian influenza, farms may also be permitted to compost poultry waste and carcasses to control biosecurity risks. Permission from the environmental management authority will still need to be given in this circumstance.

Composting is the controlled biological decomposition of organic materials such as litter, layer manure, eggs, waste feed and carcasses. The composting process transforms organic materials into a safe, reusable product called compost.

For composting to be done properly, it relies on thermophilic decomposition. This means that the temperature of the composting material must be between 45 °C to 55 °C for extended periods of time to eliminate pathogens and weed seeds. If the temperature rises above 65 °C, the microorganisms needed for the composting process begin to die off and decomposition rates start to decline.

Important factors for composting successfully

Composting requires several physical and chemical factors to be within optimum ranges to achieve best results whille mitigating adverse environmental affects (e.g., odour). These are summarised in the table.

Microorganisms require optimum nutrients levels to maintain decomposition rates. This includes maintaining the carbon-to-nitrogen ratio and ensuring an adequate supply of phosphorous, sulphur, potassium and trace elements. Moisture content below the optimum range can severely restrict microbiological activity, and high moisture makes the conditions more anaerobic and odorous.

Ensuring oxygen concentration is above the optimum level is vital to maintain the aerobic conditions.

Characteristics	Optimal range	Reasonable range
Carbon-to-nitrogen ratio	25–30:1	20–40:1
Moisture content	50–60% (wet basis)	40–60% (wet basis)
Porosity*	35–45%	30–50%
Oxygen concentration	>10%	
Bulk density	–	<640 kg/m^3
pH	6.5–8.0	5.5–9.0

* The amount of air-filled space in the compost

Composting set-up

Composting poultry farm waste is usually conducted in windrows or piles out in the open or in purpose-built undercover bays in two separate stages.

Stage 1 involves covering and letting the poultry waste decompose for 10–14 days to reduce health and biosecurity risks. The edges of the fully constructed pile should reach temperatures greater than 45 °C within the first 2–3 days. The core should reach these temperatures after 7–10 days. The six key steps in Stage 1 are:

1. Place a base layer of clean high-carbon co-compost material (poultry litter, sawdust, wood shavings or green waste) in the desired location (300 mm if undercover, 450 mm if exposed).
2. Place a 200 mm layer of poultry waste on top.
3. Cap the pile with 300 mm of clean co-compost material.
4. Lightly moisten the capping layer.
5. When a new layer of poultry waste is added, scrape away 100 mm of the capping and place waste on top.
6. Place excess capping on top of the new layer, topping with clean co-compost to a depth of 300 mm.

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Stage 2 begins when the pile is initially turned and ends when the compost is ready for curing (four weeks). Additional clean co-compost material is mixed in with the rest of the compost during the first turn. After this, the piles and windrows can be handled like traditional compost. Small amounts of animal tissue remaining in the compost is considered safe due to the extended exposure to high temperature.

The dimensions of a typical windrow are 1.5–2 m high and 3.5–5 m wide at the base. The windrow length will depend on available space. These dimensions are important, as excessively large heaps are more likely to overheat and become dry, and produce odour. Turning windrows ensures that all parts of the composting matter are exposed to the conditions necessary to eliminate pathogens.

Windrows should be turned when temperatures reach 65 °C or when they drop below 45 °C unless compost has reached the curing stage (once a week for the first 4–6 weeks). Turning windrows is the most critical activity that may contribute to odour emissions and should be scheduled when wind is moderate, steady and away from sensitive receptors. The diagram below shows how turning compost redistributes temperature in the pile to previously unaffected matter.

Temperature monitoring

Insert temperature probes into the pile at half height at three locations (more if pile exceeds 10 m in length). Take three readings at 40, 70 and 100 mm depth to get a temperature profile throughout the pile. Monitor temperatures every two days at the beginning to ensure thermophilic conditions are achieved, followed by bi-weekly readings. Measure moisture content along with temperature to avoid misleading results.

Curing

The curing phase is an integral part of the composting process, especially for those wanting to make quality composts. Curing begins when temperatures are sustained below 45 °C even after turning, and is complete when temperatures decline to within 5 °C of ambient temperature. A 3–6 week curing phase is required to mitigate any potential toxic affects; however, if the intention is to dispose the compost, only 3–4 weeks of curing is required. Curing should occur in a separate functional area of the composting facility to avoid recontamination. The pile can then be left undisturbed if aerobic conditions are maintained. This is aided by limiting the pile size to 2.5 m high and 6 m wide.

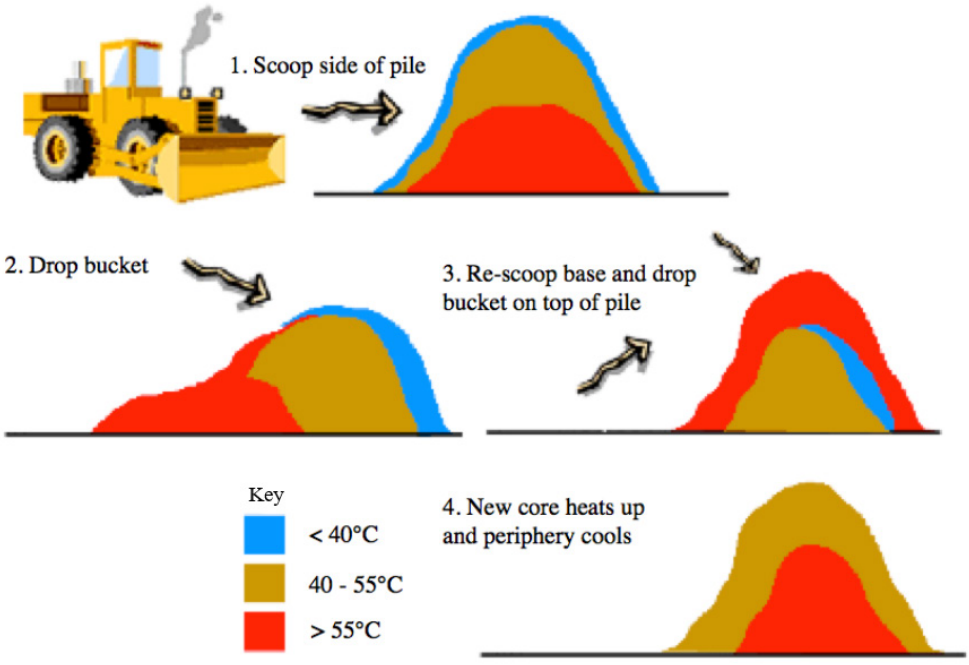

Figure 1: Process for turning a pile or windrow to ensure the whole mass is exposed to thermophilic conditions, from Information Sheet No. 2-7 Composting, Recycled Organics Unit, The University of New South Wales (2003).

Machinery

- Clean down trucks, loaders and trailers hauling bio-hazardous material from the production area before leaving the site.
- Bund the washdown area to prevent wash water reaching other areas of the compost site.
- Use a high-pressure hose with minimal use of disinfectant when cleaning vehicles and machinery.

Disposal of carcasses and other poultry wastes

Composting and burial are likely the most suitable options for large-scale poultry producers in Australia. However, on-farm burial is difficult as it needs technical expertise, specialised equipment, an understanding of the soil and groundwater implications and, in many cases, an environmental permit from the relevant government department.

Summary

There are many things to consider when planning poultry waste composting. Careful planning and process monitoring are the keys to success. Avoid technology suppliers that promote solutions that appear too good to be true. Composting does not need to be a complex process, however taking too many short cuts can have serious consequences to biosecurity and your licence to operate. Talk to your local regulatory agency and local government to identify regulations that may apply to composting in your area.

More information

Download the full report Mass disposal preparedness for the poultry industries (PDF, 7MB).

Read the Poultry waste composting guidelines available online.

Use the online Poultry legislation search tool to find relevant laws relating to biosecurity, animal welfare and food safety for the Australian chicken meat industry.

Download the Planning and environmental guideline for establishing meat chicken farms – Applicant guide and Assessment guide.

Figure 2: Turned windrows or piles. Photo courtesy of J. Biala, The University of Queensland

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