DEVELOPMENT OF A COMPOSTING CHAMBER FOR THE REDUCTION OF NITROGEN LOSS IN POULTRY LITTER

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ABSTRACT

The study was undertaken to develop a chicken litter composting chamber and investigate the effects of turning frequency (TF) and carbon to nitrogen (C:N) ratio on the loss of nitrogen (N) in chicken litter piles. This was with a view to producing good quality compost.

The experimental set up was a 3 x 3 factorial design with turning frequencies at every 2, 4 and 6 days, and C:N ratios at 20:1, 25:1 and 30:1. The organic materials were composted in a chamber of size 1.2 m ^{x} 1.2 m square base and a height of 0.3 m. Each treatment was replicated thrice and turned manually using a hand shovel. During the composting process, the moisture content in the piles was periodically replenished to 55%. The temperature, moisture content (MC), pH, ash, total nitrogen (N), total carbon (C) and C:N ratio of the chicken litter were periodically monitored. The total phosphorus (P) and total potassium (K) contents were determined at the end of composting. Cumulative losses of N and C were quantified to determine actual losses during composting. The data obtained were analyzed using inferential statistics.

The results showed that the developed chamber was effective for composting as indicated by the attainment of thermophilic temperatures during the 87 days of composting. It also showed that 'TF and C:N ratio had significant effect ($p < 0.05$) on moisture loss ($F_{2, 24} = 55.24$ and 44.32), C ($F_{2, 24} = 68.51$ and 35.86), N ($F_{2, 24} = 90.23$ and 99.57) and C:N ratio ($F_{2, 24} = 215.35$ and 184.94) while temperature was only affected by the C:N ratio ($F_{2, 24} = 7.57$, $p < 0.05$) and pH affected by the TF ($F2, 24 = 4.63$, $p < 0.05$).

Losses of N, which were attributed to volatilization of ammonia (NH_3), were highest during the period when the litter temperatures were above 33 °C and the pH values above 7.7. The losses of C were attributed to organic matter (OM) degradation. At the end of composting, TF of 4 days with C:N ratio 25:1 (T_4R_{25}) gave the minimum N loss (45.77% of the initial N) resulting in the lowest C:N ratio (24:1) as required of good quality compost while TF of 6 days with C:N ratio 20:1 (T_6R_{20}) gave the minimum C loss (41.40% of the initial C).

In conclusion, the study showed that good quality compost could be produced using the chamber developed with 4 days TF and initial C:N ratio of 25:1.