Composting of separated animal wastes

Introduction

One solution to the problem of dealing with solid organic wastes from livestock is composting. Composting is not only environmentally friendly but is also a means of generating extra income from the farm.

Composting is the decomposition of organic waste to a stable/sanitised product. The process involves a complex interaction between the waste and its inherent micro-organisms. The effectiveness of the process is determined by the material's moisture content, temperature, oxygen concentration, and Carbon to Nitrogen ratio amongst other factors.

Composting is possible with the wastes from a number of farming enterprises including pig, poultry, dairy and vegetable production. It should also be possible to use sewage sludge in the process.

Existing Composting Methods

Natural Aeration

If a heap of organic material is left to compost by means of natural ventilation the process will take around eight weeks to complete. This process requires no supervision once started but does result in some nutrient loss due to lack of temperature control.

Forced Aeration

This involves stacking the material on a ventilated floor and forcibly aerating it as required. When the optimum composting temperature is reached, any excess heat produced is removed by ventilating the heap. This process also maintains aerobic conditions in the material. The technique provides good temperature control and aeration of the heap, with low running costs and labour demand. A finished compost can be produced in 5 to 6 weeks using this method.

Mechanical Windrows

Windrowing consists of placing the material in rows and mechanically turning it regularly (usually every other day), to maintain aerobic conditions and structure in the heap. This involves a high labour input but produces an even textured compost. Temperature control is difficult to exert with this method. The entire process is completed in 6 to 7 weeks.

The National Agricultural Centre Composting Trial

The system based on the forced aeration technique has been developed and tested at the NAC. The material being composted is a mixture of straw and solids from slurry separation. The method was chosen as it had the potential to produce a consistent compost quickly, whilst involving the minimum of management.

The bays are 3.34m in length by 2.14m wide and 1.7m high. Aeration is provided by one low volume fan per bay controlled by a timer and a thermostat. The timer operates the fan for 3 minutes in every hour to keep the heap aerobic. When the temperature of the heap reaches the set point of the thermostat, the fan operates to stop the temperature rising further.

Two designs of bay have been used. The first has a fan which simply uses ambient temperature air to cool the material. The second more complex design incorporates a recirculation system which mixes ambient air with warm air drawn from the space

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above the heap. To facilitate recirculation an insulated lid and a recirculation chamber are used. This method helps to maintain an even temperature profile in the material.

The material itself is a 60/40 mixture of shredded straw and separated waste. This gives a well structured heap that can be aerated easily. The mixture also provides favourable Carbon to Nitrogen ratio, pH and moisture content values.

The material is stacked to a depth of 1.5m.

Design Details

Bay Length	3.34m
Bay Width	2.14m
Bay Height	1.70m
Airflow	8m³/minute
Pressure	2" water gauge
Oxygen Concentration	10 to 18%
Heap Depth	1.50m
Optimum Temperature	55°c
Moisture Content	60 to 70%
pH Value	5.5 to 8
Carbon/Nitrogen Ratio	25:1

The amount of area required for the aerated bays is 0.63m² per cow on a dairy farm. This figure changes to 0.13m² for a liquid fed pig and 0.07m² for a dry fed pig.

Results of Trail to Date

The batches of compost that have been completed have taken six weeks to stabilise in normal running, and up to eight weeks in Winter running. The composting process maintains and concentrates the nutrients in the dry matter of the material.

Sample Analysis (prior to storage)

Dry Matter of which	28%
Nitrogen (N)	3.2%
Phosphorous (P)	1.4%
Potassium (K)	2.6%
Carbon (C)	36%
Carbon: Nitrogen ratio	11:1
pH	7

The trial has showed the value of using a recirculation system to even out temperature profiles in the heap. This has been especially true for Winter running. The need to use the correct mixture of well-shredded straw to waste has also proved important in allowing adequate airflow through the heap. This ultimately controls the time taken to compost fully and the consistency of the end product.