

**EFFECTIVENESS OF HOME COMPOSTING FOR THE
DIVERSION OF THE ORGANIC FRACTION OF HOUSEHOLD
WASTE FROM LANDFILL**

by

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ABSTRACT

Increasing composting activity will be an integral part of meeting the obligations of EU Directives, however, the extent to which composting at home can play its part still remains poorly defined. Reliable and comprehensive statistics on home composting are very difficult to obtain as the activity cannot be monitored effectively. It is an activity that is entirely in the hands of the people, and it is the voluntary behaviours of those people, that will ultimately determine the success of home composting within any waste management strategy. Understanding home composting means understanding the people that compost. To date, most waste management strategies have concentrated on recycling with relatively little attention being paid to home composting.

According to requirements of EU Directives and legislation on landfilling of waste sustainable waste management practices need to be developed.

Composting of organic waste provides a viable alternative to landfill at the present time. Although home composting is rated highly on the hierarchy of control, little has been achieved in Ireland to develop home composting as an effective means of diverting the organic fraction of waste from landfill.

While other EU countries have developed home composting strategies, Ireland has no formal programme in place for the development of home composting. Home composting as a waste management strategy is currently being promoted by local authorities.

Home composting if developed and managed effectively could prove to be a viable means of diverting organic waste from Ireland's currently overloaded waste stream.

Some of the main results from this survey which aimed to determine the effectiveness of home composting and the diversion of the organic fraction of household waste from landfill indicate that this statement is true

The main findings from the report are as follows, further details in how these findings were obtained and detailed analysis of the results can be read throughout this report

- The majority of respondents 87% regularly make compost and 72% participate in Leitrim County Council's Home Composting Scheme.
- 64% of respondents were happy with their home composting units.

- 62% of respondents had heard of the council's home composting scheme through the newspaper or radio.
- 54% of respondents believed that their soil had been improved as a result of Home Composting
- The main problems noted were that the composting process is too slow and that insects such as fruit flies are attracted to the unit.
- The main materials put into the composting units were vegetable peelings, annual weeds, grass mowings, plant debris e.g. leaves, potted plants and newspaper. Other material that was composted included egg shells, egg boxes, tea bags and turf mould.
- 89% of respondents said that they put material into the composting units throughout the year.
- 72% of respondents stated the approximate quantity of waste they place in the compost bin per week. 44 households highlighted a total of 351.5kgs of waste being placed in their bin per week. This totals 18 tonnes of waste for 44 households per year.

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APPENDIX 1 EFFECTIVENESS OF HOME COMPOSTING - QUESTIONNAIRE

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APPENDIX 4 COMMENTS MADE BY DIS-SATISFIED RESPONDENTS

1.0 INTRODUCTION

Composting is highlighted in national waste strategies in Ireland and will form an important option in helping Ireland meet the targets set out in the policy statement 'Changing our Ways'.

Based on the EU Landfill Directive, recycling and recovery targets were developed for achievement until 2012.

- A diversion of 50% of household waste away from landfill
- A minimum 65% reduction in biodegradable waste consigned to landfill
- The development of waste recovery facilities
- Recycling of 35% of municipal waste

Ireland has now published regional waste management plans in order to develop more sustainable waste management practices in which home composting is highlighted as a method for dealing with household organic waste.

The National Strategy on Biodegradable Waste – Draft Report April 2004 views home composting amongst other waste management strategies as a key waste stream for diversion for organic waste from landfill.

One reason for the increased attention to composting at this level is related to the adoption of the waste hierarchy. This is a framework which the most desirable waste management options are set out with the most sustainable at the top and the least sustainable at the bottom

The Waste Hierarchy

Prevention

Minimisation

Re-use (Composting)

Recycling

Energy Recovery

Disposal

Composting is a higher priority than other treatment and disposal options such as landfill or incineration

This study examines the issues affecting the effectiveness of home composting for the diversion of organic household waste from landfill.

As part of this study a survey was conducted in conjunction with Leitrim County Council (Co. Co.), who initiated a home composting scheme in 2000, to determine its overall effectiveness in diverting household organic waste from landfill and to examine the views of householders affecting its successful operation.

2.0 LITERATURE REVIEW

2.1 WASTE MANAGEMENT IN IRELAND

The plan for dealing with waste in Ireland is to reduce the amount produced, maximise the amount recycled, minimise the amount landfilled and convert the rest into energy in properly managed and monitored incinerators.

This plan will minimise the impact that the waste produced has on the environment. It is an integrated approach to waste management and is the result of adopting the European Waste Hierarchy.

Waste management is one of the most problematic and challenging environmental issues in Ireland at the present time. Historically, Ireland has had no proper waste management planning and was almost completely dependent on poorly designed and cheap landfill. The public had little or no awareness that they should take responsibility for their own waste. When Ireland was ignoring the waste issue, European countries were developing and implementing sustainable integrated waste management practices. These practices have used a variety of waste solutions and achieved very high levels of recycling.

The adoption of the Waste Management Act in 1996 provided the turning point for waste management in Ireland considering that previous legislation governing waste management dated back to the Public Health Act 1878 and the Sanitary Services Act 1948 as well as a number of waste regulations arising from EU Directives since the mid 1970s. Following the Waste Management Act 1996, new regulations were developed. These have helped set the agenda for the modernisation of all aspects of waste management.

Ireland's delay in relation to some of its European counterparts in developing modern waste management techniques had its advantages. Before the Waste Management Plans were introduced, Ireland had the opportunity to explore the best waste management practices that existed throughout Europe. The adoption of the Regional Waste Management Plans was a major leap forward in that regard, as they established the framework to bring waste management in Ireland in line with the objectives of EU Policy, legislation and best practice.

What the Regional Waste Management Plans demand is substantial in terms of the facilities they require, the changes in management practices and most importantly, they demand a whole new approach to waste management at an individual and a collective level.

The Waste Management Plans are in place however it is apparent that change is not coming fast enough. The latest figures clearly show that waste quantities are continuing to rise. Almost 2.3 million tonnes of household and commercial waste were generated in Ireland in 2001 - representing an increase of almost 31 per cent in three years (EPA, 2001). This increase places severe pressures on the environment and on the existing waste management services and infrastructure. Landfill remains the main disposal route but this is unsustainable as Ireland is running out of landfill space.

There are some fundamental difficulties preventing real change - waste quantities continue to increase; recycling levels remain disappointingly low, the issue of domestic waste charges is still hugely contentious and landfill space is at a premium. All of this is compounded by the fact that there is widespread lack of awareness, understanding and appreciation of the integrated waste management approach and there is formidable opposition to the siting of waste management facilities.

As a result of awareness campaigns managed by the Department of the Environment, Heritage and Local Government, Local Authorities, NGO's and organisations opposed to aspects of the current waste management strategy, there is clear evidence that Irish society needs to appreciate the waste problem and that recycling needs to be a priority. However, there is considerable reluctance to turn this awareness into action.

The National Waste Database 2001 estimates that 1,468,834 tonnes of household waste was generated in 2001. 423,910 tonnes of this was organic waste, 404,064 tonnes was disposed to landfill (EPA, 2001)

Home composting is a panacea to address these challenges in Ireland as a whole since Home Composting has the **potential** to:

- Significantly decrease the amount of waste for collection going into the waste stream
- Decrease the amount of waste so as to reduce the amount of landfill space required, thus extending the life of existing landfill sites.

- Decrease the amount of potentially toxic leachate produced in landfill sites and therefore reduce the potential for pollution of rivers, surface and ground waters.
- Decrease the amount of 'greenhouse gas' methane (a highly explosive gas) produced in landfill sites and therefore decrease the possibility of migration explosions in uncontrolled sites.
- Reduces vermin (birds, rodents & insects) associated with scavenging organic waste at landfills
- Reduces odours from landfills resulting from the decomposition process.
- Produce fuel and energy savings by reducing the total amount of waste transported.
- Indirectly reduce the cost to the environment in terms of vehicle pollution, by reducing the total amount of waste transported
- Raise public awareness of the concept of waste minimisation and therefore home composting itself can be educational.
- Provide the user with a useable, free product for the garden
- Give householders an alternative to buying expensive compost which is often extracted from a natural peat or soil resource, causing destruction of finite resources in a particular area.

Figure 1 below provides information on recycling, composting, energy recovery and landfill rates within Europe. Ireland is not represented in Figure 1 but approximately 90% of waste goes to landfill with 10% being recycled, composted or recovered (EPA, 2003).

Waste Management In Europe

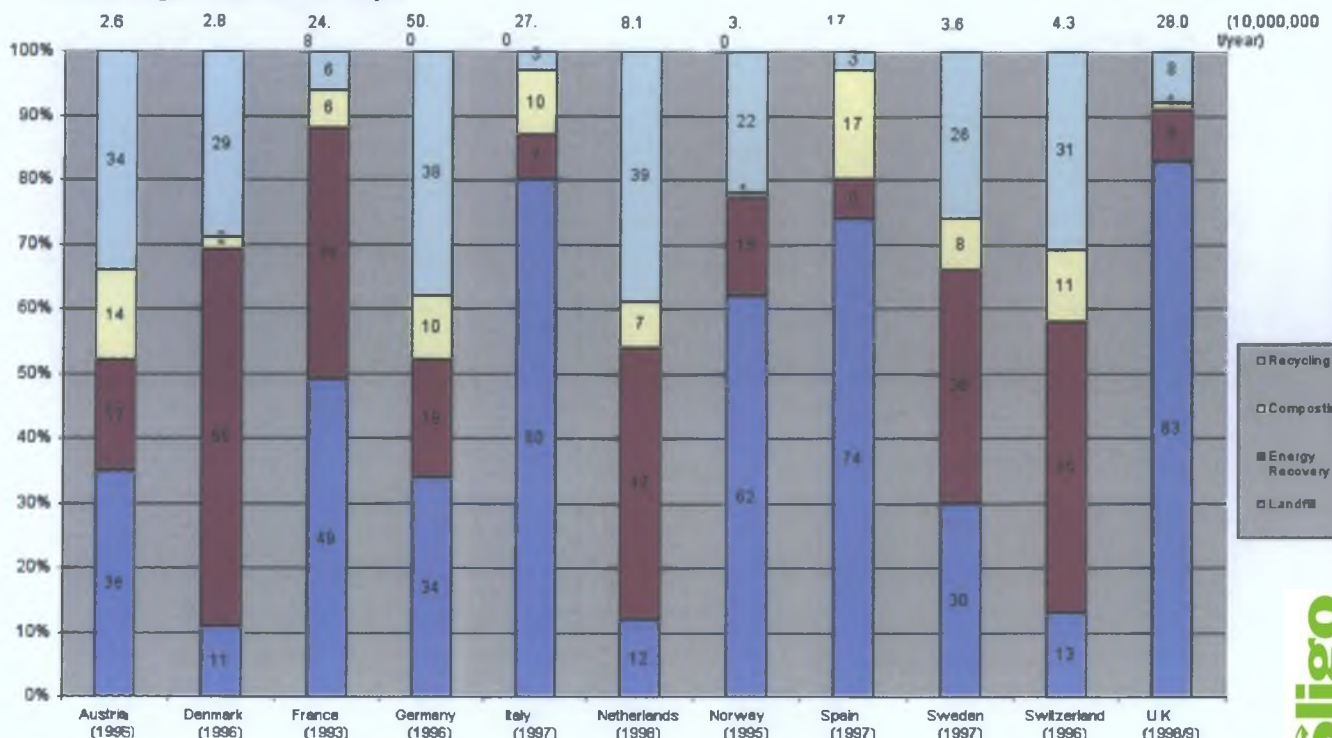


Figure 1 – Waste Management in Europe

2.2 COMPOSTING - THE PROCESS

Composting is the transformation of organic material (plant and animal matter) through decomposition into a soil-like material called compost. Invertebrates (insects and earthworms), and micro-organisms (bacteria and fungi) help in transforming the material into compost.

Biological decomposition is a natural process, which began with the first plants on earth and has been going on ever since. As vegetation falls to the ground, it slowly decays, releasing minerals and nutrients needed for plant growth. Composting is synonymous with biological decomposition, however composting is the controlled decomposition of organic matter by micro-organisms (mainly bacteria and fungi) into a stable humus material that is dark brown or black and has an earthy smell. The process is controlled with the aim of accelerating decomposition, optimising efficiency, and minimising any potential environmental or nuisance problems that could develop.

Composting programmes can be designed to handle yard trimmings (e.g. leaves, grass, clippings, tree prunings) or the compostable portion of a mixed solid waste stream (e.g. yard trimmings, food scraps, paper products and other de-compostable organics). These materials are the feedstocks or 'food' for the composting process. The rate of decomposition depends on physical, chemical and biological factors, such as micro-organisms, oxygen levels, moisture content, and temperature. Composting works best when these factors are carefully monitored and controlled. The end products of a well-run composting process are a humus like material, heat, water and carbon dioxide. (US Environmental Protection Agency, 1993).

Today there are several different reasons why composting remains a valuable practice. Yard and food wastes make up a large percentage of the waste stream in Ireland. Composting most of these waste streams would reduce the amount of Municipal Solid Waste (MSW) requiring disposal, while at the same time providing a nutrient-rich soil amendment. Compost added to gardens improves soil structure, texture, aeration, and water retention. When mixed with compost, clay soils are lightened, and sandy soils retain more water. Mixing compost with soil also contributes to erosion control, soil fertility, proper pH balance, and healthy root development in plants.

The standard means of disposal for most yard and food waste in Ireland is by landfilling. These practices are not as environmentally or economically sound as composting.

Organic waste which is landfilled breaks down very slowly due to the lack of oxygen. As it decomposes, it produces methane gas and acidic leachate.

Landfilling organic wastes also takes up unnecessary landfill space, which is at a premium. Incinerating moist organic waste is inefficient and results in poor combustion, which disrupts the energy generation of the facility and increases the pollutants that need to be removed by the pollution-control devices. Composting these wastes is a more effective and usually less expensive means of managing organic wastes.

The composting process occurs in two major phases. In the first stage, micro-organisms decompose the composting feedstock into simpler compounds, producing heat as a result of their metabolic activities. The size of the composting pile is reduced during this stage. In the second stage, the compost product is finished. Micro-organisms deplete the supply of energy rich nutrients in the compost, which, in turn, slows their activity. As a result, heat generation gradually diminishes and the compost becomes dry and crumbly in texture. Temperature increase depends on the size of the compost heap.

2.2.1 The Role of Micro-organisms

Composting is a succession of microbial activities, therefore different types of micro-organisms are active at different times in the composting pile. Bacteria have the most significant effect on the decomposition process and are the first to take hold in the composting pile, breaking down proteins, carbohydrates and sugars faster than any other type of micro-organism generating heat. Fungi, which compete with bacteria for food, play an important role later in the process as the pile dries, since fungi can tolerate lower moisture environments than bacteria. Some types of fungi also have lower nitrogen requirements than bacteria and are therefore able to decompose cellulose materials, which bacteria cannot.

Multi-cellular animals also play a role in the later stages of the composting process. Rotifers, nematodes, mites, springtails, sowbugs, beetles and earthworms reduce the size of the composting feedstock by foraging, moving in the compost pile, or chewing the compostable materials. These actions physically break down the materials, creating greater surface area and sites for further microbial activity to take place.

The bacteria and fungi important in decomposing the feedstock material can be classified as mesophilic or thermophilic. Mesophilic micro-organisms or mesophiles (grow best at temperatures between 25°C and 45°C) are dominant throughout the composting mass in the initial phases of the process when temperatures are relatively low. These organisms

use available oxygen to transform carbon from the composting feedstock to obtain energy and in doing so, produce carbon dioxide and water. Heat is also generated as the micro-organisms metabolise the composting feedstock. As long as the compost pile is of sufficient size to insulate internal layers from ambient temperatures and no artificial aeration or turning occurs, most of the heat generated by the micro-organisms will be trapped within the pile. In the insulated centre layers, temperatures of the composting mass will eventually rise above the tolerance levels of the mesophilic organisms. Figure 2 shows a typical temperature profile for a natural composting process (Bridlestone *et al.*, 2000). When the temperature reaches approximately 45°C, mesophiles die or become dormant while waiting for conditions to turn.

At this time, thermophiles (approximately 50°C – 70°C) become active, consuming the materials readily available to them, multiplying rapidly, and replacing the mesophiles in most sections of the composting pile. The thermophiles decompose the feedstock materials as long as nutrient and energy sources are plentiful. As these sources become depleted, thermophiles die and the temperature of the pile drops. Mesophiles then dominate the decomposition process once again until all readily available energy sources are utilised (Boyd *et al.*, 1984)

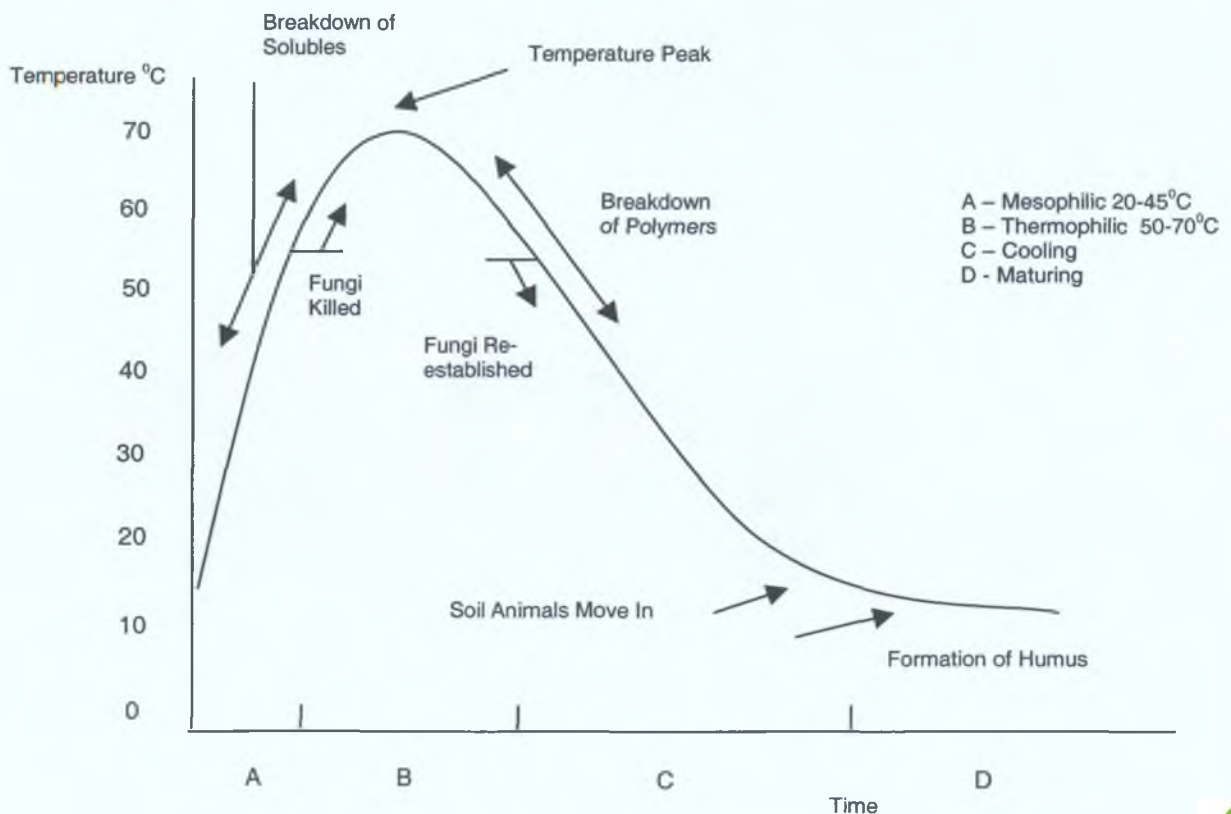


Fig 1 - Temperature Variations in a Compost Heap

2.3 FACTORS INFLUENCING THE COMPOSTING PROCESS

Because micro-organisms are essential to composting, environmental conditions that maximise microbial activity will maximise the rate of composting. Microbial activity is influenced by oxygen levels, particle sizes of the feedstock material, nutrient levels and balance (particularly by the carbon:nitrogen ratio), moisture content, temperature and pH. Any changes in these factors are interdependent; a change in one parameter can often result in changes in others. These factors are discussed below

2.3.1 Oxygen

Composting can occur under aerobic or anaerobic conditions, but aerobic composting is much faster (10-20 times faster) than anaerobic composting. Anaerobic composting also tends to generate more odours because gases such as hydrogen sulphide and amines are produced. Methane is also produced in the absence of oxygen.

Micro-organisms important to the aerobic composting process require oxygen to break down the organic compounds in the composting feedstock. Without sufficient oxygen, these micro. This occurs when the oxygen concentration in the air within the pile falls below 5-15 percent saturation. To support aerobic microbial activity, void spaces must be present in the composting material. These voids need to be filled with air. Oxygen can be provided by mixing or turning the pile only by forced aeration.

The amount of oxygen that needs to be supplied during composting depends on:

- The stage of the process – oxygen generally needs to be supplied in the initial stages of composting.
- The type of feedstock – dense, nitrogen-rich materials (e.g. grass clippings) will require more oxygen.
- The particle size of the feedstock – feedstock materials of small size will compact, reducing void spaces and inhibiting the movement of oxygen. For this reason, the feedstock should not be shredded too small before processing.
- The moisture content of the feedstock – materials with high moisture content (e.g. food scraps, garden trimmings) will require more oxygen.

Turning the compost pile is an effective means of adding oxygen and brings newly added material into contact with microbes. It can be done with a pitchfork or a shovel, or a special tool called an "aerator," designed specifically for that purpose. Care must be

taken, however, not to provide too much aeration, which can dry out the pile and impede composting (Boyd *et al*, 1984).

2.3.2 Particle Size

The particle size of the feedstock affects the composting process. The size of feedstock materials entering the composting process can vary significantly. In general, the smaller the shreds of composting feedstock, the higher the composting rate. Increasing the surface area of the material to be composted can be done by chopping, shredding, mowing, or breaking up the material. The increased surface area means that the micro-organisms are able to digest more material, multiply more quickly, and generate more heat. Smaller feedstock materials have greater surface areas in comparison to their volumes, hence more of the particle surface is exposed to direct microbial action and decomposition in the initial stages of composting. Smaller particles within the composting pile also result in a more homogenous mixture and improve insulation (Gray, *et al.*, 1971). Increased insulation capacity helps maintain optimum temperatures in the composting pile. As discussed above, the particles must not be so small as to compact too much, thus excluding oxygen from the void spaces.

2.3.3 Nutrient Levels and Balance

For composting to proceed efficiently, micro-organisms require specific nutrients in an available form, adequate concentration and the proper ratio. The essential macronutrients needed by micro-organisms in relatively large amounts include carbon (C), nitrogen (N), phosphorous (P) and potassium (K). Micro-organisms require C as an energy source. They also need C and N to synthesise proteins, build cells and reproduce. P and K are also essential for cell reproduction and metabolism. In a composting system, either C or N is usually the limiting factor for efficient decomposition (Richard, 1992).

Composting organisms also need micronutrients, or trace elements, in minute amounts to foster the proper assimilation of all nutrients. The primary micronutrients needed include boron, calcium, chloride, cobalt, copper, iron, magnesium, manganese, molybdenum, selenium, sodium and zinc (Boyd, 1984). While these nutrients are essential to life, micronutrients present in greater than minute amounts can be toxic to the composting life.

Even if these nutrients are present in sufficient amounts, their chemical form might make them unavailable to some or all micro-organisms. The ability to use the available organic

compounds present depends on the micro-organisms 'enzymatic machinery' (Boyd, 1984). Some micro-organisms cannot use certain forms of nutrients because they are unable to process them. Large molecules especially those with different types of bonds, cannot be easily broken down by most micro-organisms, this slows the decomposition process significantly. As a result some types of feedstock break down more slowly than others, regardless of composting conditions (Gray *et al.*, 1971). For example, lignin (found in wood) is a very large complex molecule and is not readily available to micro-organisms as food. This material therefore decomposes very slowly.

High C:N ratios inhibit the growth of micro-organisms that degrade compost feedstock. Low C:N ratios initially accelerate microbial growth and decomposition. With this acceleration, however, available oxygen is rapidly depleted and anaerobic, foul-smelling conditions result if the pile is not aerated properly. The excess N is released as ammonia gas. Excessive amounts of ammonia in a composting mass can be toxic to the microbial population, further inhibiting the composting process (Gray *et al.*, 1971). Excess nitrogen can also be lost as leachate, in either nitrate, ammonia or organic forms (Richard, 1992).

2.3.4 Moisture

The moisture content of a composting pile is interconnected with many other composting parameters, including moisture content of the feedstock, microbial activity within the pile, oxygen levels and temperature. Micro-organisms require moisture to assimilate nutrients, metabolise new cells and reproduce. They also produce water as part of the decomposition process. If water is accumulated faster than it is eliminated via either aeration or evaporation (driven by high temperatures), the oxygen flow is impeded and anaerobic conditions result (Gray *et al.*, 1971). This usually occurs at a moisture level of about 65% (Rynk *et al.*, 1992)

Water is the key ingredient that transports substances within the composting mass and makes the nutrients physically and chemically accessible to the microbes. If the moisture level drops below about 40-50%, the nutrients are no longer in an aqueous medium and easily available to the micro-organisms. Their microbial activity decreases and the composting process slows. Below 20% moisture, very little microbial activity occurs (Haug, 1980). In lay man's terms, the "squeeze test" is a good way to determine the moisture content of the composting materials. Squeezing a handful of material should have the moisture content of a well-wrung sponge. A pile that is too wet can be turned to release water vapour or can be corrected by adding dry materials.

2.3.5 Temperature

Temperature is a critical factor in determining the rate of decomposition that takes place in a composting pile. Composting temperatures largely depend on how the heat generated by the micro-organisms is offset by the heat lost through controlled aeration, surface cooling and moisture losses (Richard, 1992). If temperatures are less than 20°C, the microbes do not proliferate and decomposition slows. If temperatures are greater than 59°C, some micro-organisms are inhibited or killed, and the reduced diversity of organisms results in lower rates of decomposition (Finstein *et al.*, 1986).

Micro-organisms tend to decompose materials most efficiently at the higher ends of their tolerated temperature ranges. The rate of microbial decomposition therefore increases as temperatures rise until an absolute upper limit is reached. As a result, the most effective compost managing plan is to maintain temperatures at the highest level possible without inhibiting the rate of microbial decomposition (Richard *et al.*, 1992).

2.3.6 Acidity / Alkalinity (pH)

Bacteria prefer a pH of between 6-7.5. Fungi thrive in a wider range of pH levels than bacteria, in general preferring a pH between 5.5-8 (Boyd, 1984). If the pH drops below 6, micro-organisms, especially bacteria, die off and decomposition slows (Wiley, 1956). If the pH reaches 9, nitrogen is converted to ammonia and becomes unavailable to organisms (Rynk *et al.*, 1992). This also slows the decomposition process.

Like temperature, pH levels tend to follow a successional pattern through the composting process. Figure 3, shows the succession of pH over time in a composting pile. As is illustrated, most decomposition takes place between pH 5.5-9 (Rynk *et al.*, 1992). During the start of the composting process, organic acids typically are formed and the composting materials usually become acidic with a pH of about 5. At this point the acid tolerating fungi play a significant role in decomposition. Micro-organisms soon break down the acids and the pH levels gradually rise to a more neutral range, but can reach 8.5. The role of bacteria in composting increases in predominance again as pH levels rise. If the pH does not rise, this could be an indication that the compost product has not fully matured.

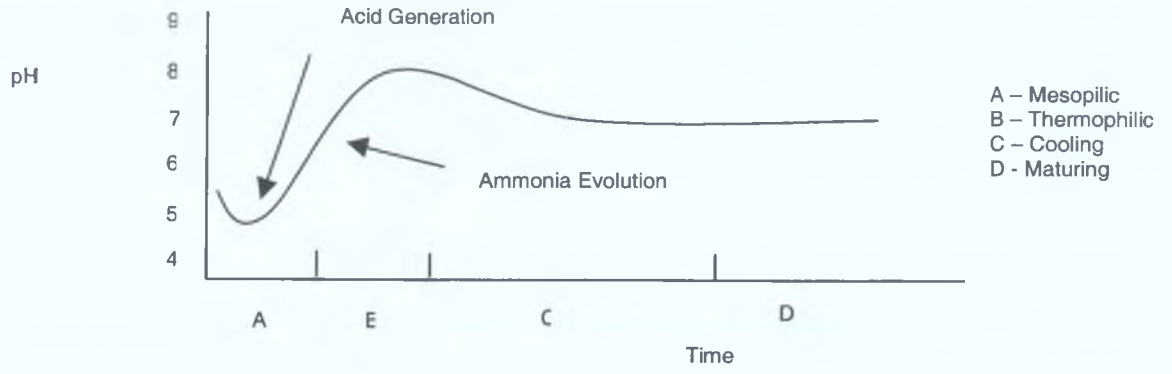


Fig 2 – pH variation in a Compost Heap

2.4 MATERIALS FOR COMPOSTING

Virtually anything which has once lived will decompose in a compost heap. Fresh green material breaks down very quickly, straws and woody material take longer. Leaves are the dominant organic waste in most backyard compost piles. Composting always proceeds better when a variety of organic wastes are being processed.

2.4.1 Materials

A compost heap needs a supply of mixed organic wastes, sometimes an activator to supply extra nitrogen and micro-organisms, a little soil and, if available, some compost from a previous heap. The mass needs moistening with water at times and then exposure to air for composting to proceed.

Some items should not be put into a compost heap. They will not break down and may cause problems for those handling the product. Such materials include, glass, pottery, metal, wire, plastic bottles or rubber. Organic materials which should not be put into heaps are plants or fruit with thorns and perennial weeds as the roots which can be persistent may not be killed by the heat evolved in the heap (Fletcher, *et al.*, 2001)

2.4.2 Kitchen Waste (Brown Waste)

Domestic waste include material from food preparation such as vegetable peelings and unwanted leaves, fruit skins, egg shells, tea leaves and coffee grounds. Scraps of fish or meat can lead to problems by attracting flies or vermin unless they are put into the hot centre of an active compost heap. A little paper and cardboard can be added, once it is torn up and preferably soaked in water first (Grey *et al.*, 1994). Rags of cotton or wool will eventually decompose.

2.4.3 Garden Waste (Green Waste)

Wastes from the garden include the remains of vegetable crops, dead flowers, stems, stalks and thin prunnings. Most garden weeds are of good value in a compost heap, they are normally the only whole plants put into a compost heap and contain a wide variety of trace elements, but weed seeds are best avoided as they are likely to germinate when the compost is added to soil. The roots of the persistent perennial weed should not be added to a compost heap

A proportion of dry, fallen tree leaves, can be used but an excess should be avoided as they can greatly reduce the decomposition rate of other wastes. Where there is an

excess of fallen leaves, they can be gathered into a separate heap and left to decay over 1-2 years; this heap needs little attention apart from the occasional watering. The resulting mould is useful for mulching and for potting mixtures. Similarly, an excess of fresh lawn mowings is undesirable as they can settle quickly into a thick layer which prevents air movement through the compost heap. Such mowing's should not exceed 50% of the heap and they must be mixed in with stalky, strawy material to keep the mass well opened out. Too much mowing will exclude air and will ferment in a similar manner to silage.

As much soil as possible should be shaken from the roots of garden plants before they are put into the heap as too much soil will slow down the composting process.

Figures 3, 4, & 5 indicate how a composting bin/heap can be layered and provides visual information on materials that are recommended for home composting and those materials that should be excluded.



Fig. 3 Layers in a composting bin



Fig. 4 What to add to a compost heap

- Vegetable and fruit scraps
- Fallen leaves
- Tea leaves and tea bags
- Coffee grounds
- Vacuum cleaner dust
- Soft stems
- Dead flowers
- Used vegetable cooking oil
- Egg shells
- Old newspapers
- Lawn clippings
- Sawdust (not from treated timber e.g. treated pine).
- Wood ash



Fig. 5 What not to add to a compost heap

- Meat and dairy products
- Diseased plants
- Metals, plastic, glass
- Fat
- Magazines
- Large branches
- Weeds that have seeds or underground stems
- Bread or cake (may attract mice)
- Bones
- Animal manures, especially the droppings of cats and dogs.
- Sawdust from treated timber

2.5 PRACTICAL COMPOSTING PROCESS

Backyard composting can be done using a variety of different systems, enclosures, or containers. Composting systems or bins can be constructed at home or purchased commercially. Depending on where one lives, there may be a problem with rodents if vegetative food wastes are combined with yard wastes. If so, an enclosed space or bin is advisable. The methods employed will vary somewhat depending on the system chosen, but the principles and purpose remain the same. This is true for large-scale composting projects also.

When building a compost heap, one should aim to build as large a heap as possible, ensuring that air can penetrate into the mass. The outer edges of a compost mass will be cool, ranging from ambient air temperature on the surface to the core temperature about 150mm inside. Hence the larger the feedstock, the greater the volume of the central core which will achieve adequate temperatures for pathogen and weed seed destruction. The larger the pile the greater the temperatures that can be reached within the pile for pathogen destruction. There will be a larger area within the pile to allow temperature build up. This effect is shown in Figure 3 below. Small heaps have a larger surface area to volume ratio than large heaps and thus lose relatively more heat. With small heaps, much benefit is obtained from side wall protection to improve insulation and thereby decreasing heat loss (Bertoldi *et al.*, 1983)

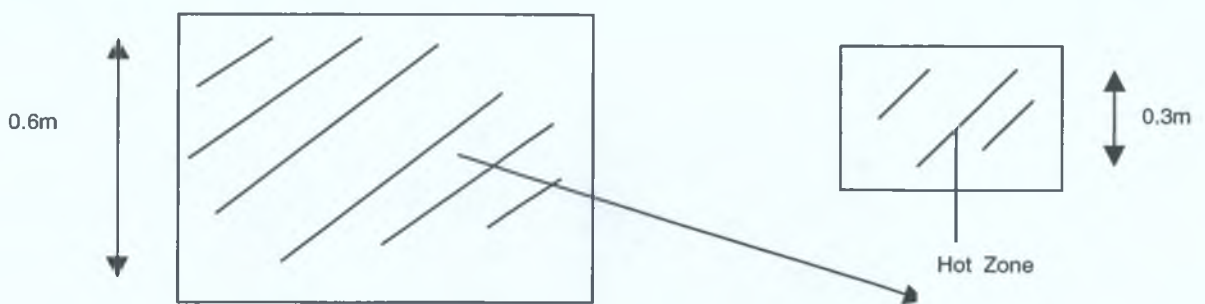


Fig 6 – Effect of Heap Size on Hot Zone

Air should be able to circulate freely underneath the composting mass. The air filters upwards into the heap and is then warmed in the heap, becoming less dense and rising up through the mass while pulling in more fresh air from underneath. This effect ensures that as long as the compost heap is at a higher temperature than the surrounding air,

there will always be a flow of air upwards through the heap so that it stays aerated and aerobic.

2.5.1 Turning the Compost

Turning the compost has a definite beneficial effect on the composting process. It helps mix the various wastes in the heap; it moves the cool and probably dry edges of the heap to the hot centre; it aids aeration where air has had difficulty in penetrating to the middle of the heap; it also gives an opportunity to moisten the material if it has become too dry. Turning is probably the most labouring part of the composting process, but will vastly speed up and improve the success of the composting process.

Turning also exposes seeds, insect larvae, and pathogens to lethal temperatures inside the pile. Odours may arise either from the addition of excessive amounts of wet plant materials like fruits or grass clippings, or from over-watering. A properly mixed and adequately turned compost heap will not have objectionable odours. An actively decomposing pile will reach temperatures of approximately 60 °C in the middle (Biddlestone *et al.*, 1981).

2.5.2 Location of the Compost Bin

The compost pile should be located close to where it will be used and where it will not interfere with activities in the yard or offend neighbours. From the aesthetic point of view, it is best to compost in a location screened from view of both your property and neighbour's property. It is not advised that a compost pile is located near a wall or on a slope that drains to surface water such as a stream or a pond. The pile will do best where it is protected from drying winds and in partial sunlight to help heat the pile. The more wind and sun the pile is exposed to, the more water it will need. Locating the pile too close to trees may also create problems as roots may grow into the bottom of the pile and make turning and handling the compost difficult.

2.5.3 Making the Compost Heap

Organic wastes, such as leaves, grass, and plant trimmings are put down in a layer eight to ten inches deep. Coarser materials will decompose faster if placed in the bottom layer. This layer should be watered until moist, but not soggy. A nitrogen source should be placed on top of this layer. One to two inches of livestock manure, or a nitrogen fertilizer such as ammonium nitrate or ammonium sulphate is advised (Fletcher *et al.*, 2000).

Plants that have been treated with herbicides or pesticides should be avoided for composting. Ideally, clippings from lawns recently treated with herbicides should be left on the lawn to decompose (Biddlestone, *et al.*, 1981).

About a one inch layer of soil or completed compost can be applied on top of the fertilizer layer. One purpose of adding soil is to ensure that the pile is inoculated with decomposing microbes. The use of soil in a compost pile should be considered optional. In most cases, organic yard wastes such as grass clippings or leaves contain enough micro-organisms on the surface to effect decomposition. One way to insure that activator microbes are present in the new compost is to mix in some old compost as the pile is prepared.

Most compost piles should initially be prepared in layers. This will facilitate decomposition by insuring proper mixing. Each pile ideally should be about 5 feet high. If only tree leaves are to be composted, layering may not be necessary. Fallen leaves can be added as they are collected. Leaves should be moistened if they are dry and since dead leaves lack adequate nitrogen for rapid decomposition, addition of a high-nitrogen fertilizer (10-30 % analysis) should be added to speed up breakdown (Pacey, 1998)

Reasons for the pile not heating up may be due to: too small a pile, not enough nitrogen, lack of oxygen, too much or not enough moisture. The pile should be turned when the temperature in the centre begins to cool. This will introduce oxygen and un-decomposed material into the centre and subsequently regenerate heating. The composting process is essentially complete when mixing no longer produces heat in the pile.

Generally, a well managed compost pile with shredded material under warm conditions will be ready in about 2-4 months. A pile left unattended and material not shredded may take over a year to decompose. Piles prepared in the late fall will not be ready for use the following spring. When the compost is finished, the pile will be about half its original size and have an earthy smell.

2.5.4 Shredding

Shredding raw materials is beneficial particularly when composting fibrous material such as leaves or woody plants. Shredding exposes a greater surface area which makes it more susceptible to bacterial invasion. Large pieces of wood or leaves packed together do not decompose quickly in a compost pile. Insufficient oxygen in the centre of a wood or pile of leaves does not permit more rapid aerobic decomposition.

Shredding material makes it more uniform in size, aerates it and makes it easier to handle. Smaller particles enables the compost to heat more evenly and to withstand excessive drying at the surface. The compost pile is then insulated against heat loss and also has a better ability to resist moisture penetration from rain. Shredding also improves fly control.

Initial shredding of all material is not absolutely necessary. Often, the best practice is to shred only large pieces of organic materials. Using some larger irregular pieces creates greater air spaces and hence more entrapped oxygen. Shredding material shortens the decomposition time.

2.6 COMPOSTING BINS

A bin is not absolutely necessary for composting. A pile in a well-drained area of the yard will work fine. However, bins are recommended because they help control factors like moisture of the pile, pests and make the yard look neater.

A well-designed bin should allow easy access to the pile inside and have spaces in the sides for air to circulate. A lid will help retain moisture but is not necessary.

It is necessary to build a compost pile that will be large enough to generate heat, but not be too large to handle/turn.

When purchasing or building a composter, the following must be considered:

- Aeration or airflow. How will the air flow through the composter, the greater the airflow through the unit will result in less need for turning.
- Accessibility to the composting material. This is important when turning and aerating the compost. Bins that have a removable front or such will be easier to turn and work with.
- The appearance of the composter. The composter will be a fixture in the backyard.

2.6.1 Composting using Plastic Garbage Bags

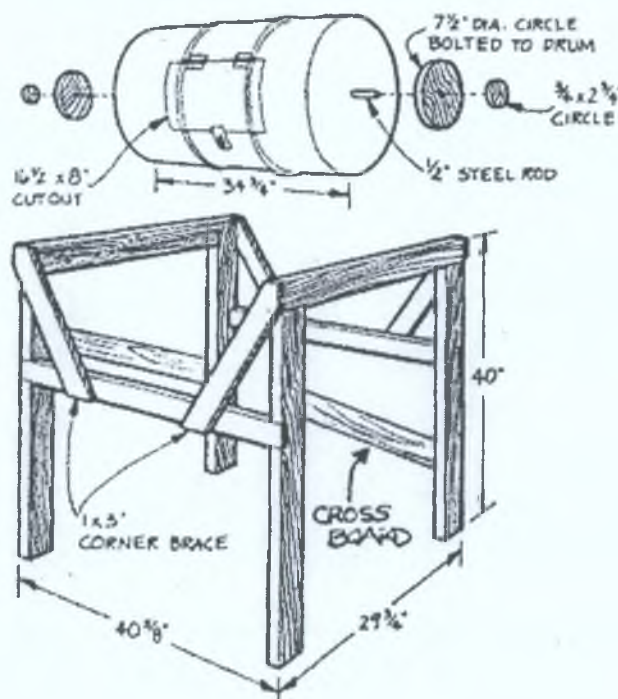
Use of plastic garbage bags is perhaps the simplest way to make compost. The bags are easy to handle, and require minimal maintenance. To make compost using this method, large plastic bags should be alternatively filled with plant wastes, fertilizer and lime. A small amount of garden fertilizer with a high nitrogen content should be used per bag. A little lime helps counteract the extra acidity caused by anaerobic composting. After filling, water should be added before closing the bag. The bag is generally left for six months to a year. Bags can be set in a shed or heated garage for better decomposition during winter months. Using garbage bags requires no turning or additional water after closing. The main advantage of composting in garbage bags is that it requires little maintenance; however, because oxygen is limited, the process is slow.

2.6.2 Composting using Barrel or Drum Composter

The barrel or drum composter generates compost in a relatively short period of time and provides an easy mechanism for turning. Air holes must be over the length of the barrel to allow for air circulation and drainage of excess moisture. The barrel is generally placed

upright on blocks to allow bottom air circulation. It is recommended that the barrel is 3/4 full with organic waste material and has a small amount of high (approximately 30 %N) nitrogen containing fertilizer. Water is then added until the compost is moist but not soggy.

When turning the drum, it is necessary to place the drum on its side and roll it around the yard to mix and aerate the compost. The lid can be removed after turning to allow for air penetration. Ideally, the compost should be ready in two to four months. The barrel composter is more suitable for the urban dweller with a relatively small yard. Figure 7 illustrates a barrel or drum composter.



2.6.3 Composting using Bins

For larger quantities of organic waste, bin type structures are the most practical. As an example, a circular bin can be made by using a length of small spaced woven wire fencing and holding it together with chain snaps. A stake may be driven in the middle of the bin before adding material to help maintain the shape of the pile and to facilitate adding water. Composting bins can also be purchased widely in various sizes to suit the client's needs. Most purchased bins have a hatch at the bottom to allow for easy removal of compost (Tucker, 2001).

2.7 MONITORING THE PROCESS

The progress of the composting reaction can be followed with a few simple tests. If a heap contains a lot of fresh green plant material it should warm up to peak temperatures in about three days; where it contains much strawy, stalky material it will probably take approximately 7 days to reach the same temperature. This evolution of heat will cause air to start circulating through the heap and moisture to rise to the top of the wastes (Bertoldi *et al.*, 1983).

Progress should be examined 3-7 days after heap construction. When the top cover is removed there should be a definite feeling of warm rising air and the top of the waste should be hot. There should be evidence of moisture drops. A metal or wooden rod can be pushed into the centre of the heap and left for approximately 10 minutes, on withdrawal it should be almost too hot to touch. In addition the rod should be moist. If temperature and moisture are following this behaviour the composting reaction is satisfactory. The wastes should also have settled down in height quite noticeably. If the temperature is satisfactory extra layers of pre-mixed wastes can be added, building the heap back to its original height (Bertoldi *et al.*, 1983)

The heap can be re-examined about 14 days later, 17-21 days after it was first built. With a small heap the temperature peak should have passed, although the wastes should still be warm. There should no longer be evidence of excess moisture.

Four weeks after construction the heap should be cool and small soil animals such as manure worms and mites will probably invade the mass and help the micro-organisms with the task of decomposition.

Provided that an adequate air supply has been arranged underneath the compost heap, there should be no bad odours given off once the heap has reached peak temperature.

2.7.1 Problems with the composting process

Composting processes can go wrong. If the temperature does not rise properly in the first few days, the pile may be too dry, too wet or the C:N ratio too high. If there is too little moisture for the micro-organisms, little heat is generated and there will be no evidence of moisture. In this case the heap will have to be re-built with more water sprinkled onto the wastes.

If the wastes are too wet, the air passages will probably be filled with moisture and the mass be anaerobic with a foul odour. The heap will need to be re-built, incorporating more absorbent strawy material to soak up the excess moisture.

If the C:N ratio is too high, particularly if the heap contains an excess of un-reactive woody wastes, more fresh green plant material or organic material (vegetable peelings) should be added to increase the energy release.

Where the mass has a lower than optimum C:N ration, no problems should arise as long as the heap is readily permeable to air. The temperature should increase easily but a light odour of ammonia will develop; this is not serious for the process but represents a loss of the plant nutrient nitrogen (Tucker, 2001)

2.7.2 Maturing the Product

About 4-6 weeks after the construction of the heap, a compost heap will have cooled back to the temperature of the ambient air. Most of the breakdown process will have taken place and the majority of the air requirement supplied. The weight of the wastes will have fallen to about half of the original amount due to oxidation of much carbon to carbon dioxide and loss of moisture. The volume will have nearly fallen to one third with a corresponding loss of weight plus the breakdown of larger particles to smaller ones which pack together more closely. The colour will have changed to dark brown/black. Maturing now takes place in which the broken-down fragments of the wastes are slowly converted into a very complex and stable humus product called compost.

The amount of maturity required in a compost heap depends on the use to which the product will be put. For mulching on the surface of the ground around established trees and shrubs, immature compost is perfectly acceptable. Its further maturing then takes place on the surface and the fragments of organic matter are eventually drawn down into the earth by the small soil animals such as worms.

Where the compost is required for direct incorporation into the soil, especially prior to sowing small seeds, a high degree of maturity is required. It is essential for good seed germination and seedling growth that the compost no longer release organic acids, or ammonia.

Since the maturing stage makes little demand on air supply and none on heat conservation, it does not make economic sense to retain the compost in the bin,

especially if further raw wastes are waiting to be processed. The immature compost can be removed from the bin and left on the ground. It is necessary to cover it to prevent rain leaching out the plant nutrients (Fletcher, 2001). Generally there should be no problems with vermin during the maturation period.

2.8 USES OF HOME COMPOST

For many people, the garden is an area surrounding or close to the house where trees and flowers grow and grass lawns are used for relaxation. Many householders will have little choice on the size of their garden, this may range from a small backyard to a large area of land.

When clearing the site for the first time, grasses, weeds and small bushes will have to be removed, these wastes can be saved to make the first compost heap. Large trees that are in the area should be kept as they are useful for supplying, wood, leafy branches for mulching, leaves for composting and shade for seed beds and compost heaps.

2.8.1 Mulching

Mulches can be of fine grasses, leaves, leafy branches, straws, stalks or coarse compost. They are very attractive to earthworms and on decomposition will be drawn down into the soil. A thick mulch will considerably decrease moisture loss from the soil surface and therefore reduce the need for watering. This is because it lowers the temperature of the soil surface and also covers the capillary passages through which water rises to the surface (Fletcher *et al.*, 2000).

2.8.2 Digging into the Soil

Mature compost can be used for improving soil structure, therefore improving the growth of trees, flowers and bushes in the garden. Good quality compost dug into the soil will provide plant nutrients and moisture retention properties for all life growing in the garden (Fletcher, 2000).

2.9 ENVIRONMENTAL ASPECTS

Some of the materials used for composting can cause environmental problems such as

- Flies attracting vermin during composting
- Production of unpleasant odours during composting
- Growth of weeds and seeds when compost is applied to soil

2.9.1 Flies and Vermin

Flies and vermin can be attracted to a compost heap that may contain material of human or animal/plant origin (meat, fish, nappies, fruit flies). The fly larve in composting material can originate from eggs laid in the material at its origin or from eggs laid by adult flies in the material at the composting site. A typical life cycle of a fly is as follows: egg, 1-2 days; larva, 3-5 days; pupa, 3-5 days; young fly, 7-11 days; egg laying by new fly, 10-14 days. The objective should be to interrupt this cycle and prevent development of adult flies. Temperature is an important factor in interrupting the cycle. As the material being composted passes through its temperature peak and becomes stabilised, it is less attractive to flies and vermin.

To avoid the problem, of flies and vermin, it is advisable to subject as much of the material as possible to higher temperatures. Fly larvae are unlikely to survive in temperatures above 55°C ; they are unlikely to be found in the cooler outer layers of a heap. By turning the heap and placing the outer material in the hot central region many of the larvae will be destroyed giving satisfactory fly control.

2.9.2 Odours

Breakdown of organic matter by aerobic oxidation produces no objectionable odours. If odours are present, either the process is deficient in air required by aerobic micro-organisms, or there are materials present, other than from biological oxidation, which have an odour. The breakdown of material in the absence of air, anaerobic breakdown, usually results in the release of the unpleasant smells of organic acid or hydrogen sulphide and other sulphur containing compounds. Increasing the temperatures by leaving the compost heap to increase in temperature for pathogen and fly control can also help reduce smells.

Once the composting material has passed its peak temperature and reached the point of stability, most of the sulphur and nitrogen which can cause odours have then become bound in the cells of new micro-organisms. Thereafter odours should not be generated.

2.9.3 Weeds and Seeds

Annual weeds only propagate from seeds, whereas perennial weeds can propagate both from seeds and from fragments of roots. A properly made and controlled compost heap should kill off most weed roots and seeds present. However, a badly made heap which does not heat up adequately may leave such material in a viable state; as a result the product compost could give rise to a profusion of weed seedlings when used.

The vast majority of seeds should be killed at temperatures of about 60°C, held over a period of approximately 3 days. Turning the compost helps to ensure the effective killing of weeds and seeds in various parts of the compost heap. In the case of persistent perennial weeds, it is better to ensure the roots do not enter the compost heap (US EPA, 1994).

Guidelines for ensuring a good composting operation are given in Appendix 2

2.10 MASTER COMPOSTERS

Master Composter programmes have been well established in the United States and the United Kingdom. These programmes have proved to be extremely popular and successful in promoting and benefits of home composting.

The main aims of the Master Composter Training Programme include

- To raise awareness amongst the wider public of the benefits of composting
- Encourage more people to home compost
- Help those already composting to do so more effectively
- Encourage the setting up of more community composting schemes.

Generally volunteers are recruited and receive training in composting and related environmental issues and are then expected to go on to promote composting in their local communities. Training courses range from 1-5 days in length, providing the trainees with the information they need about composting and the issues surrounding it. Following this, over the next year, the Master Composters are required to spend a set number of hours in their respective county promoting composting. This can include visits to schools, demonstrations to families, friends, helping to establish community composting schemes and writing articles for local papers or magazines. Volunteers must be provided with resources and back-up support.

The Master Composter Programme is seen as a means of promoting effective home and community composting, to achieve higher participation, to achieve increased waste diversion rates and to achieve high environmental education (www.compost-uk.org.uk)

2.11 HOME COMPOSTING PROJECTS IN THE UK, IRELAND AND BELGIUM

2.11.1 Education, Support and Monitoring of Home Composting in Lancashire

The aim of this project is to support and monitor a home composting initiative in Lancashire, on behalf of Lancashire County Council. Educational support is provided throughout the scheme. The results will provide a clear indication of householders' views on the practice of dealing with their organic waste at home. The project is led by HDRA Consultants and funded by the Lancashire Environmental Fund through the Landfill Tax Credit Scheme.

It is anticipated that in excess of 60,000 home compost units and kitchen scrap collection bins will be distributed, free of charge, to householders over a three-year period. Lancashire County Council has a commitment to increase this to 100,000 over the same period with additional support from surrounding councils.

Compost bins are distributed on an opt-in basis both in targeted areas (based on refuse collection rounds), specifically for monitoring purposes and on an adhoc basis to the County as a whole.

Method

The compost unit supplier was selected by means of a tendering process, the criteria of which included details of distribution. Compost unit manufacturers were invited to enter the tender process for each year of the project. Three Project Liaison Officers have been recruited in Lancashire to oversee the project's activities. A programme of monitoring and education support has been devised to ensure maximum publicity.

Monitoring

The scheme includes an extensive monitoring programme evaluating the success of the scheme including the educational activities (up-take rates and active participation rates over time, successes and problems encountered by participants, attitudes to home composting and waste recycling by composters and non-composters) and the impact of home composting on the amount of waste going to landfill.

Education and Promotion

Explanatory leaflet

Every household participating in the scheme is provided with a leaflet explaining how to compost: how to get started, what they should and should not compost and how to know when the compost is ready.

Newsletters

A quarterly (seasonal) newsletter is sent to every household participating in the scheme. These newsletters provide useful hints and tips on home composting in a friendly, accessible manner and are themed to cope with problems that occur at certain times of the year, e.g. fruit flies in the summer months or excessive water in the winter.

Composting Gurus

A series of training days have been held to provide members of the community with the information and tools to educate householders taking part in the scheme. The trained advisors are able to offer advice at a local level.

Promotional material and events

A mascot for the scheme has been designed and is used on all promotional literature and material associated with the scheme, e.g. T-shirts.

Roadshows and workshops

These are informal events and are based around HDRA Consultants' existing home composting display, which includes display boards and home composting equipment. The roadshows are run by the Project Liaison Officers who are available to give advice and guidance on home composting.

The Project Liaison Officers also run a series of workshops, offering practical advice to householders.

Website (www.compost-it.org.uk)

A dedicated website has been set up for the scheme. Householders are able to request compost units via the site. Additional advice on home composting and related issues is also available.

Achievements

- To date, in 2.5 years 77,000 compost bins and caddies have been distributed, free of charge, to Lancashire residents. A further 13,000 kits are scheduled for delivery before May 2004.
- In years 1 and 2 of the scheme, recruitment of participants in the target areas was 41% and 40% respectively.

- In total 74 community volunteers have been recruited and trained. The project's objective is to recruit and train a minimum of 60 volunteers.
- A total of 20 roadshows and 52 workshops have been undertaken throughout the County. The project's objective is to undertake 12 roadshows and 32 workshops over the 3 years.
- The website receives an average of 11,600 visitors a month.
- Baseline questionnaires are sent annually to samples of scheme participants and non-participants, followed by a monitoring questionnaire to participants one year on. The results so far show:
 - 93% of participants were still using their bin 12 months after receiving it.
 - Prior to receiving a compost bin 26% of participants filled their refuse bin and put out more waste beside it for the weekly collection. This dropped to 15% after composting for 12 months.
 - 59% of participants were new to home composting. This highlights the schemes ability to engage non-composters.

Further information on this project can be obtained from: HDRA Consultants, Ryton Organic Gardens, Coventry, CV8 3LG

2.11.2 Valentia Home Composting Study

In February 2001 over 200 composters were distributed to households on the Island of Valentia, Co. Kerry, Ireland. The bins were distributed by a project team along with the co-operation of local community representatives. The distribution process involved members of the project team explaining the basis of home composting to the householder. The cost of the home composting bins was borne by Kerry County Council along with the distribution costs. A book on home composting was produced and supplied with each of the bins.

A one-day home composting clinic was set up in order to advise participants on the home composting process; 25 householders visited during that day. Door to door visits were also carried out during July 2001. Each householder was visited and any problems with the composter were discussed. The feedback from participants was found to be good and the majority of those who had been using the composter had no major difficulties.

Before the bins were distributed a baseline waste composition survey was carried out on waste from the Island. The survey was carried out on Friday 2nd February 2001 and a

follow up waste composition survey was carried out on Friday 27th July 2001 in order to monitor the effectiveness of the scheme. The survey results were not directly comparable due to seasonal variation in waste. Further surveys were then carried out in February 2002 and July 2002 in order to compare results and to take into account seasonal variations.

The direct involvement of the community group in the establishment of the scheme helped the level of participation by the residents of the Island.

Results of the Survey

The baseline surveys conducted for the winter stream, February 2001 and February 2002 showed a reduction in the percentage composition of organics from 22% to 15%. Results of previous waste composition surveys for summer rural waste streams have shown that organics were in the region of 28% (Kerry Co. Co.) which is normally higher than the winter waste stream due to increased garden waste. The results for the summer waste stream for Valentia Island in 2001 and 2002 following the introduction of the home composting scheme are 18% and 16% organics in the waste stream respectively.

Surveys on the number of bins left out for collection each week showed a 10% reduction in the amount of bins left out for collection.

From the survey it is estimated that home composting bins diverted an average of 400kg of waste from landfill per week from Valentia Island, this equates to 135kgs of waste per household per annum.

Home Composting Bin Promotion

Following on from this survey a bin promotion was held during the months of April and May 2001. A mobile sales unit was set up in public car parks in Killorglin, Kenmare and Killarney. 800 home composting bins were sold. Each buyer was supplied with an information leaflet and a demonstration on how to use the unit. A freephone number and e-mail address was set up to deal with queries from members of the public.

2.11.3 The Home Composting Programme of VLACO (Flemish Composting Organisation)

To enable a positive market situation to be developed, supported by a good and reliable quality of compost. VALCO was developed in 1992. VLACO is the integration of communities, private compost producers, some cities, compost distributors and producers of growing media/soil conditioning products.

VALACO represents the composting sector in Flanders, with around 50 members and 25 compost producers.

Some of the main tasks of VLACO are as follows:

- Compost marketing
- Compost quality control and research
- Backyard composting

Thus VLACO acts as a discussion platform for all those involved in composting.

In order to encourage people to simulate backyard composting, 3 main tools were identified:

- Cheap composters / compost bins
- Price (polluter pays-principle)
- Information, sensitisation

Sensitisation by information and improving awareness was one of the most important features in the development of the programme

Development of the programme included:

- Distribution of several relevant sensitisation campaigns concerning waste prevention
- Training of 'compost masters'
- Establishment of compost masters
- Post-training courses
- Periodical information by publishing a quarterly journal
- Biannual congress
- Training of local civil servants
- Scenarios and action models for local authorities
- Promotional campaigns
- Technical and administrative support

VLACO opted for voluntary compost masters as they can integrate with the community delivering a positive message about home composting. There is also a constant source of information available to the members of the public. The master composter will normally be a member of the community so may be deemed to be more approachable.

However

- The success of compost masters depends on good collaboration with the local authority
- 'Clashes' may occur between enthusiastic volunteers and administrative rules of local government
- Thus in order to avoid disillusion a high level of motivation is essential.

Finally the individual household has to be taught the numerous advantages of home composting and the best practice to integrate home composting into everyday life.

Financial Support and Pricing

Beside the motivation of the population by information campaigns, intelligent economic measures played an important role. Measures addressed by the VLACO included financial support waste fees, unique tax per year, variable tax each time the bin is emptied.

VLACO also focuses on low waste gardening and several methods that can be used to diminish the amount of organic waste include:

- Worm bins and boxes for small scale vermin-composting
- Chicken keeping
- Mulching of shredded garden waste or grass trimmings
- Proper use of fertilisers and compost
- The entire field of ecological gardening.

Home composting can be performed successfully. Therefore the separate collection of both, organic kitchen and garden waste must be offered in all communities. It was also evident that in areas where separate collection was offered, the willingness for source separation in the household was higher.

Sensitisation and pricing

Motivation for home composting is closely linked to knowledge, continuous information and practical experience and demonstration. In addition people respond positively to a well balanced gratification for their commitment. Therefore the pricing of residual waste as well as bio waste collection of graded against the organic waste prevention via home composting helps to encourage the compost heap in the back yard.

Volunteers are very effective in sensitisation, but they should be regarded as volunteers. The acceptance of the idea of home composting can be effectively increased with the help of Compost Masters on a voluntary basis. Important tools keep this subsidiary communication and multiplier running in a satisfactory manner in the establishment of a set of support measures (e.g. equipment, follow-up training's, support good co-operation with the local authorities), keep the voluntary character of and show the appreciation of their commitment.

3.0 POLICY AND REGULATION

The last decade has seen a very significant evolution of policy and law in relation to waste management, which is increasingly reflected in improved waste management practice. Waste management in Ireland is in a transition phase and is moving, relatively rapidly, from an unsophisticated and one dimensional approach which is heavily dependant on landfill, to one which will better reflect and give effect to the waste hierarchy and the 'polluter pays' principle.

Waste was the last significant area of environmental management to be subject to modern policy development and legislation. Apart from the Litter Act, 1982, primary legislation on solid waste related principally to the public health functions of local authorities, and 87 sanitary authorities (county councils, borough councils and urban district councils) were involved in 'traditional' waste functions – i.e. street cleaning and collection and disposal of municipal solid waste.

Municipal waste collected by or on behalf of local authorities was mainly disposed of in landfill. The pre-eminence of landfill as a waste management option was due to its low relative cost, favourable geological conditions and Irish settlement patterns. Landfills were generally small in size and scale of operation, and were often badly designed, operated and maintained. There was limited private sector involvement in municipal waste collection, or the provision and operation of facilities for such wastes. Many landfills were not lined and leachate and gas could migrate from the site.

Local Authorities were responsible for permitting the disposal of wastes by the private sector, though there was no external regulation of their own collection and disposal activities.

There was little local authority involvement in the collection/management of industrial waste, though local authority facilities were used for the landfill of non-hazardous industrial wastes (DOELG, 2003)

The Environmental Protection Agency Act, 1992 was a significant interim development in waste management terms, insofar as-

- It provided for a system of integrated pollution control which addressed the generation, minimisation and implementation of BATNEEC and also regulated

significant waste recovery and disposal activities through a system of waste licensing.

- The EPA published criteria and procedures for the selection, management, operation and termination of use of landfill sites and
- It published statistics on waste by the publication of a national waste database and a national hazardous waste management plan.

The European Commission initially set out its Community-wide waste policy in the Community Strategy for Waste Management of 1989 (SEC(89) 934 Final 1989). This document forms the cornerstone of European waste policy. As well as many detailed measures, the strategy contains the following points:

- The establishment of a hierarchy of waste management. This prioritises the prevention of waste followed by its reuse and recycling and lastly the optimisation of its final disposal through, for example, energy recovery.
- Confirmation of the 'Proximity Principle'. This requires that waste is dealt with as near as possible to its source.
- The goal of waste disposal self-sufficiency at every level is emphasised. Subsequent to the Treaty on European Union entering into force in 1993 (establishing the European Union), a revised version of the strategy was adopted by the Commission in July 1996.

The 1996 strategy added the following points:

- Energy recovery may in some cases be environmentally superior to recycling within the hierarchy.
- The EU will investigate possible actions on incineration and the implications of using waste as a fuel at installations not originally designed for this.
- The Commission will introduce targets to substantially reduce the amount of waste generated and to generally achieve high waste recovery objectives.
- The principle of Producer Responsibility (where waste producers are actively involved in the waste management of their products) will be incorporated in all future measures.
- The commission will come forward with proposals to control landfill
- Suggestions are given for guidelines on use of economic instruments for waste management including the harmonisation of waste statistics and a common methodology for Life Cycle Analysis (a way of discovering the impacts a product has during all stages of its production, use and disposal).

When EU policy is agreed, legislation is brought forward to implement the policy. Directives 75/442/EEC (as revised by Directive 91/156/EEC) on waste and 91/689/EEC on hazardous waste provide the overall structure for an effective waste management regime within the EU. Directive 75/442/EEC is often referred to as the Framework Directive on Waste, as it includes references to more detailed 'daughter' directives that either:

1. Set requirements for the permitting and operations of waste disposal facilities;
2. Deal with disposal options for specific types of waste, or
3. Control the movement of waste within, into and out of the EU.

Although the Framework Directive on Waste was extensively revised through the 1991 amendment, the following five general duties on Member States still apply:

- Encourage the prevention and reduction of waste and reduce its potential for harm through cleaner technologies, new disposal techniques and new, more environmentally benign products.
- Encourage waste recovery such as recycling, reuse, reclamation and energy recovery.
- Ensure the above without endangering human health or harming any other part of the environment.
- Prohibit dumping and uncontrolled disposal of waste.
- Ensure an integrated and adequate network of waste installations using the 'Best Available Technology'.

3.1 Waste Management Act 1996

The Waste Management Act, 1996 provided the first legal framework for the control of waste and waste operations in Ireland.

The main objectives of the Act were to provide for:

- A more effective organisation of public authority functions in relation to waste management, involving new or re-defined roles for the Minister, the EPA and Local Authorities.
- Measures designed to improve performance in relation to the prevention and recovery of waste, and
- A comprehensive regulatory framework for the application of higher environmental standards, in response to EU and national requirements

To-date the primary focus in relation to the operation and implementation of the Waste Management Act has been the –

- Development and improvement of the waste management planning system as a basis for radical improvements in waste management practice and infrastructure.
- Implementation of an effective and comprehensive waste licensing and permitting system, which ensures that waste recovery and disposal activities comply with high standards of environmental protection.
- Development of producer responsibility initiatives aimed at improved waste recovery performance, and
- Introduction of secondary legislation in response to EU and national requirements reflected in the Act (DOELG, 2003)

This policy has been underpinned by clear policy direction, in particular the 1998 policy statement on waste management '*Changing our Ways*'.

Under the Waste Management (Amendment) Act, 2001; the main purpose was to provide a legal mechanism for local authorities to adopt the waste management plans (e.g. Connaught Waste Management Plan) as required under the Waste Management Act, 1996. The Waste Management Act, 1996 and The Waste Management (Amendment) Act, 2001 may be construed as one, namely the Waste Management Acts, 1996 and 2001.

3.2 Waste Management – Landfill Directive / Changing our ways

In 1999, the European Commission adopted a Directive dealing with the landfilling of waste, which is known as the 'Landfill Directive' (1999/31/EC). In addition to setting demanding new standards for all landfills in order to improve environmental protection, the Directive imposes a gradual phasing out of certain materials from landfills. This includes biodegradable waste.

Targets set under the Landfill Directive are as follows:

- A diversion of 50% of household waste away from landfill
- A minimum 65% reduction in biodegradable waste consigned to landfill
- The development of waste recovery facilities
- Recycling of 35% of municipal waste

The October 1998 policy statement on waste management - Changing our ways - was

addressed chiefly to local authorities, and was intended to provide a national policy framework for the adoption and implementation by local authorities of strategic waste management plans under which national objectives and targets will be attained. It outlines the Government's policy objectives in relation to waste management and suggests some key issues and considerations that must be addressed in order to achieve these objectives. In particular, it set the following ambitious targets for achievement over a fifteen year timescale:

- a diversion of 50% of overall household waste away from landfill,
- a minimum 65% reduction in biodegradable municipal wastes consigned to landfill,
- the development of composting and other feasible biological treatment facilities capable of treating up to 300,000 tonnes of organic waste annually,
- materials recycling of 35% of municipal waste,
- recovery of at least 50% of construction and demolition waste within a five year period, with a progressive increase to at least 85% over fifteen years, and
- rationalisation of municipal waste landfills, with progressive and sustained reductions in numbers, leading to an integrated network of some 20 or so state-of-the-art facilities incorporating energy recovery and high standards of environmental protection (DOELG, 2003)

3.3 Preventing and Recycling Waste – Delivering Change

This Policy Statement launched in March 2002 was aimed to look at the factors and practical elements that are relevant to achieving the Government policy objective for the prevention of waste and for the re-use and recycling of waste that is produced. It seeks to support the objective of moving from the undesirable situation whereby the majority of Ireland's waste is consigned to landfill. It is more desirable that the waste management hierarchy of minimisation, reduction, re-use and recycling are followed in order to manage our waste in a more sustainable fashion.

A number of actions were proposed to ensure the prevention of waste and minimisation of waste produced. These include:

- **The establishment of a National Waste Prevention Programme (NWPP)**
- **The establishment of a Core Prevention Team to drive the process**
- **The introduction of a system of mandatory waste audits and waste reduction programmes for businesses**

The re-use and recycling of waste is to be promoted by:

- Introduction of landfill levies and banning the landfilling of certain types of materials
- Implementation of the plastic bag levy which encourages consumers to use reusable bags
- Promoting the use of 'waste exchanges' and 'swap shops'
- The provision of monetary support for recycling infrastructure
- The establishment of a Market Development Programme which will identify and promote markets for recyclable goods. It is proposed that these markets will be developed in conjunction with the Dept. of the Environment in Northern Ireland, thus encompassing the island as a whole.

3.4 Waste Management (Planning) Regulations, 1997

These Regulations identify the matters which are to be included in a waste management plan made under section 22 of the Waste Management Act, 1996.

Over the period 1998-2002, waste management plans were drawn up by all local authorities. Seven regional groupings emerged (Dublin, North East, Midlands, Connaught, Limerick/Clare/Kerry, Cork & the South East), with three counties - Kildare, Wicklow and Donegal – preparing plans independently.

The plans include mechanisms to support waste minimisation and prevention and the provision of new systems for collection, recycling and recovery of waste. They also seek to ensure ongoing access to landfill capacity. Each region has set its own targets for improved performance to satisfy the National Targets of 'Changing our Ways'

3.5 The Connaught Waste Management Plan

The Connaught Waste Management Plan covers the year 1999-2004. It was adopted by executive order in all six local authorities in the region in 2001. The plan provides for a set of waste management operations and facilities which together form a comprehensive waste management system enabling the region to meet EU and national targets for waste prevention, minimisation re-use and recovery.

The Connaught counties, Galway, Mayo, Sligo, Roscommon and Leitrim produced a waste management plan as required by section 22 of the 1996 Waste Management Act (Shally, 2003).

- The Connaught Waste Management Plan sets out the practical means by which each element of the waste hierarchy is to proceed, however the plan did not include home composting in the modelling process, that is, waste reduction through home composting is not included in the figures for attainment of Plan targets. The plan advises that the success of home composting requires high levels of motivation and detailed information for the householder (Shally, 2003).

3.6 Race Against Waste Initiative

In 2003 the DOEHLG launched a major new public enforce the message that there is a crisis in waste management and that everyone has a responsibility to respond and improve attitudes and practices towards waste management. The campaign features initiatives such as radio and television advertisements, poster campaigns, web address and newsletters along with advise on practical measures that can be taken by individuals and business in helping to solve waste management problems, including measures for dealing with biodegradable waste such as advising the public to purchase loose fruit and vegetables rather than pre-packaged fruit and vegetables (DOEHLG, 2004).

3.7 Protection of the Environment Act 2003

The Protection of the Environment Act 2003 (PEA) strengthens the body of current Irish environmental legislation. It aligns the existing IPC and waste licensing systems with EU legislation in particular Directive 91/61/EC concerning IPPC (Integrated Pollution Prevention and Control). In addition it amends the EPA Act 1992, the Waste Management Act 1996 and the Litter Pollution Act 1997 to ensure that the 'polluter pays' principle is implemented and improve enforcement of the waste management sector.

The Act makes a number of amendments to the Waste Management Act, 1996. Some of these provisions include:

- The review, variation and replacement of a waste management plan has become an executive rather than reserved function i.e. this power has been removed from elected officials and given to County Managers.
- Local Authorities have powers to levy charges for waste services provided on their behalf.
- Local Authorities shall have no obligation to collect waste from a person who fails to pay their waste charges.

- Under a new section, landfill operators must recover the full cost of the facility over its lifetime through the levy of landfill charges.
- Fines have been increased under the Waste Management Act, 1996 and the Litter Pollution Act, 1997.

The Protection of the Environment Act, 2003 is one of the most significant pieces of Irish legislation enacted in the last seven years. The new Act provides for the full transposition of EU Directive 96/61/EC concerning integrated pollution prevention and control (IPPC). The Act will amend the integrated pollution control (IPC) licensing and waste licensing regimes that have been administered by the EPA under the EPA Act 1992 and the Waste Management Act 1996 for the purpose of bringing these licensing regimes into line with the Integrated Prevention Pollution and Control Directive 96/61/EC.

3.8 Biowaste Directive

A proposal for an EU Directive on the Biological Treatment of Biowaste is expected to be adopted in 2004. This will set standards for the suitable waste streams and treatment technologies and standards for the products of biological treatment and their associated uses. The Environmental Protection Agency essentially already adopted the treatment standards being promoted in the technical working documents associated with the proposed European Community Initiative on the Biological Treatment of Biodegradable Waste.

The principal treatment methods to be developed and controlled under the initiative are:

- Green Waste Composting
- Centralised Composting
- Anaerobic Digestion
- Emerging Technologies

3.9 National Strategy on Biodegradable Waste – Draft Report April 2004.

This document outlines the Government Policy for the diversion of biodegradable municipal waste from landfill building upon the key objectives in policy documents 'Changing our Ways' (1998) and 'Delivering Change – Preventing and Recycling Waste' (2002). The strategy focuses primarily on municipal waste, which is produced largely by households and commerce.

Home composting amongst other waste management strategies is seen as a key waste management practice for diversion of organic waste from landfill. The report estimates that home composting can divert 5-10% of organic waste. The target set is to treat 7% of all food waste and 40% of all garden waste by home composting in households with gardens.

The document also considers biological treatment, either composting or anaerobic digestion. The aim of biological treatment is to produce a high quality, marketable product. Separate collection will therefore be required and the provision of composting facilities for garden waste and centralised biological treatment facilities for food waste. The targets for central biological treatment are: households – 48% for garden waste and 30% for food waste by 2009.

3.10 Animal By-products Directive

The EU has adopted Regulation No. (EC) 1774 / 2002 and associated legislation laying down health rules concerning animal by-products not intended for human consumption. As a country with a large dependence on agriculture, Ireland must always be conscious of the need for caution when dealing with activities that have a potential to impact adversely on animal health and food safety. Ireland has therefore adopted particularly stringent national legislation on the management and use of animal by-products. In pursuing the objectives of developing the necessary biological treatment capacity in Ireland and the need to maintain animal health and food safety standards, due care and consideration must be given to ensuring appropriate adherence to the national criteria.

4.0 REVIEW OF INTERNATIONAL COMPOST STANDARDS

Investigations in Europe indicate that quality and marketing of end product are the most crucial composting issues. Both producers and users are of the opinion that sustainable recycling of organic waste demands clear regulations with regard to what is suitable to be recycled and how it should be arranged and controlled. Quality requirements for composts regarding heavy metals, organic pollutants and hygiene allow no other alternative. The introduction of source separation and composting must go hand in hand with the introduction of a quality assurance system (Barth, 2000)

4.1 Waste Situation in Europe

With regard to organic waste activities, Europe can be divided into four categories. In Austria, Belgium (Flanders), Germany, Switzerland, Luxembourg, Italy, Spain (Catalonia), Sweden and the Netherlands the waste policies are implemented countrywide. These countries of the first category recover about 80% of the organic waste fraction.

Denmark, UK and Norway form the second category of the implementing states. These countries have built up parts of the political, quality and organising framework for separate collection and composting.

Finland and France form the third category. These countries have developed strategies and are at the starting point of developing these plans.

The fourth category finds countries such as Ireland, Greece and Portugal where there is very little effort on composting of source separated organic waste (Barth, 2000).

4.2 Quality of Compost and Quality Management

When considering the introduction of composting, the end product should merit equal or more attention than the composting process and the composting technique.

The table in Appendix 5 gives an indication of the compost quality standards in various European Countries.

The quality criteria for compost vary in the European countries concerning the amount, the requirements and the limit values. Direct quality classes based on heavy metal limits exist only in Austria and the Netherlands. The Dutch requirements for the class 'very good compost' are so high that they can only be reached in exceptional cases, thus a large quantity of good quality compost which is sufficient for various uses will fail to be used.

4.3 Heavy Metal Content

The stipulation of quality criteria in countries across the European union varies. Austria and the Netherlands have relatively strict guidelines concerning heavy metals while Germany have relatively moderate values this results in Austria and the Netherlands having high deviations from the guidelines than Germany.

4.4 Compost Marketing and Use

Marketing of compost requires a standardised quality product. Compost which has been tested in a quality assurance system meet these requirements because:

- Quality Assurance is a good basis for sales promotion, for public relations work and a good argument for the building up of confidence in compost
- The quality label allows the establishment of a branded 'quality/tested compost' and a positive compost image.
- Regular analysis during compost production guarantees a quality assured product.
- Standardised analysis carried out in accordance with specified methods enable a nation-wide objective assessment of the compost

Significant differences on the market situation are to be recognised also in the European Union countries. Generally it can be recognised that even in the developed countries with a circumstantial compost production like Germany, compost sales were not affected. In all countries, uses for compost such as gardening, horticulture and landscaping have a good chance of succeeding.

4.5 Summary of Compost Standards in Ireland

(Nation Specific Supplement 8 to the Main Report 'Comparison of Compost Standards within the EU, North America and Australasia').

The management and disposal of organic waste through composting in Ireland is reviewed, covering: the current waste situation; legal regulations associated with organic material streams and compost production; definitions; structure/outline of standards for composting and compost licences; quality issues; and end uses and markets. Currently, 91.97% of the biodegradable fraction of household and commercial waste in Ireland is landfilled, including 98.8% of all organic wastes. Only 30 tonnes of organic waste was reported to be composted in 1995, entirely by home-composting (EPA, 1999) Home-composting schemes have been set up by local authorities, with eight projects receiving funding up to 1999. Ireland has no significant biological waste treatment capacity and two

of the four centralized composting plants in operation treat only green waste, with the other two devoted to the treatment of green waste with source-separated kitchen waste (Hogg, *et al*, 2002) The Irish Environment Protection Agency has strongly recommended considerable further development of centralized composting for organic waste (EPA, 2001)

5.0 SURVEY ON HOME COMPOSTING IN COUNTY LEITRIM

Contact was made by the author with the Environmental Education Officer in Leitrim Co. Co who was keen to have this research undertaken. A study was then initiated by the author.

The Home Composting scheme was initiated as a pro-active attempt by Leitrim Co. Co to comply with European and Irish Legislation to improve Waste Management Strategies. The home composting initiative began in 2000 by Leitrim Co. Co., however there was no formal follow up with those who purchased the units to determine if the units were being used. This report assists with the closure of this identified gap.

Leitrim County Council supplied two brand makes of home composting units the 'Recycone' and the 'Milko'

'The Recycone'

The 'Recycone' is a domestic waste composter. It is manufactured from 100% UV stabilised recycled plastic and is available in three sizes, 224 litres, 325 litres and 527 litres (See Fig 8 below). The recycone is made from old and damaged products made from medium density polyethylene which are cut up into small pieces and passed through a granulator to create a plastic pulp. This pulp is then placed in moulds and the plastic is recycled to create a new recycone. The lid on top of the composter opens fully for ease of insertion of waste. A hatch on the bottom is used for removal of the end product. It is recommended that the recycone is only emptied twice per year. Turning to aerate the compost in the recycone can be difficult which may be a reason for delays in the composting process. The topsoil under the composter must be removed before placing the composter in the garden, this allows worms and micro organisms to enhance the composting process. 'Recycone' supply two leaflets with each recycone sold.



Fig 8 Recycone Bin

'The Milko'

The 'Milko' which is similar to the Recycone is also manufactured from polyethylene which is considered to be a tough durable material. The 'Milko' has a capacity of 290 litres (see Fig. 9 below). It has a large hinged lid which allows for ease of access. The lid is fully removable for user convenience. There is an adjustable top vent which allows ventilation to be varied. The Milko also has a perforated base plate, which keeps scavenging animals out but allows worms and micro-organisms to enter to assist the composting process. Air vents around the side of the composter aid in ensuring that the compost is well ventilated. The air vents are connected to an air injector in the centre of the composter, this introduces air into the centre of the composting mass. An information sheet is also supplied with the purchase of a 'Milko' Home Composting Unit, however no information is provided on how to use the composter.



Fig. 9 'Milko' Composting Bin

5.1 METHODS

Information on the history of the scheme and names and addresses of those who had purchased composting units were supplied by Leitrim Co. Co. on a confidential basis.

The Home Composting scheme at Leitrim Co. Co began during the summer of 2000. Approximately 100 'Recycone' home composting units were sold to the public at a subsidised rate of £15.00 each. These bins have a capacity of 224 litres.

In 2001, 53 'Milko Premium' Composting bins were sold to the public at a subsidised price of £15.00. These bins have a capacity of 290 litres.

In 2002, 1000 'Recycone' Composting bins were made available to the public at a subsidised price of €24.00; to date approximately 800 of these bins have been purchased.

Each person who purchased a composting bin in 2000 was provided with a 'Home Composting – Information Fact Sheet'. The scheme has been promoted through adverts in the local newspaper and radio which covered the district. Leitrim County Council also provided home composting workshops and presentations in conjunction with 'The organic Centre, Rossinver, Co. Leitrim', on the use of home composting bins when the scheme began.

The survey was conducted by means of a questionnaire. The questionnaire was designed to obtain as much information as possible with the minimum number of questions. Major consideration was given to the design of the questionnaire in order to make it more attractive for completion.

The names and address of residents in Leitrim who had obtained home composting units were randomly selected to send the questionnaire. Questionnaires were posted to 100 households within Leitrim. A pre-paid return envelope was supplied and as an added incentive a prize of €50.00 was awarded to one who returned the questionnaire within one month of it being posted.

The aim of the questionnaire was to carry out a survey of a random selection of households who had participated in the scheme. The objective was to quantify the

positive and negative aspects of home composting and to estimate the quantity of household waste composted.

Some of the questions in the questionnaire were adapted from a survey conducted by Aberdeenshire Council on Home Composting (Jones, 1998) and a report developed by the Strathspey Waste Action Network (SWAN) – Adopt a Composter Project carried out in January 2000. The results will be compared where possible to this report.

Consideration was given to the formulation of the questionnaire with input from the Environmental Protection Agency, Leitrim County Council, Institute of Technology, Sligo, Henry Double Day Research Association, Strathspey Waste Action Network (SWAN) and Aberdeenshire Council.

A copy of the questionnaire used in this survey is given in Appendix 1.

Ultimately it is hoped that Leitrim County Council may use the results presented in this report to further develop Home Composting as a form of waste reduction, and that any future intentions regarding expansion of the scheme can be formulated more effectively on the basis of this information.

5.2 RESULTS AND DISCUSSION OF RESULTS

The highest return of questionnaires was in the first two weeks, however replies were still being received almost two months later.

The response rate to the questionnaire survey was 61%. The results were encouraging (and could be used to support a call for expansion of home composting as a form of waste reduction).

- The majority of respondents 87% regularly make compost and 72% participate in Leitrim County Council's Home Composting Scheme.
- 64% of respondents were happy with their home composting units.
- 62% had been composting for more than 1 year and 15% for more than 5 years.
- 62% of respondents had heard of the council's home composting scheme through the newspaper or radio.
- 30% of respondents use the Recycone to compost their waste and 13% use the Milko. 36% of respondents did not know what type of unit they had obtained and 21% had started to use a homemade heap or had purchased a unit from elsewhere.
- 54% of respondents believed that their soil had been improved as a result of Home Composting
- The main problems noted were that the composting process is too slow and that insects such as fruit flies are attracted to the unit.
- The main materials put into the composting units were vegetable peelings, annual weeds, grass mowings, plant debris e.g. leaves, potted plants and newspaper. Other material that was composted included egg shells, egg boxes, tea bags and turf mould.
- 7% stated that they would put cooked foods into a compost unit, 5% indicated that they would put either one or all of 'meat', 'bones' or 'fish' into the unit. 13% stated that they would put either or both, nappies or animal manure into their composting bins.
- 89% of respondents said that they put material into the composting units throughout the year.
- 28% of respondents stated that they turn their compost once per year, 19% twice per year, 2% six times per year, 3% twelve times per year and 3% stated that they never turn their compost.

- 74% indicated that they use their compost for digging into the soil and 20% stated they use it for planting seeds.
- 74% sourced all of their material for their compost unit from within their own garden or household. Other sources such as neighbours gardens, and farm were also cited.
- 72% of respondents stated the approximate quantity of waste they place in the compost bin per week. 44 households highlighted a total of 351.5kgs of waste being placed in their bin per week. This totals 16.872 tonnes of waste for 44 households per year.
- 36% said that they would be willing to participate in a collection service of organic waste within Leitrim and 56% stated that they would not participate.
- The majority of respondents were in the age bracket of 50-59 and were currently composting.

5.3 ANALYSIS OF THE RESULTS

(Q1) 87% of the respondents regularly make compost and 72% (Q2) participate in Leitrim County Council's Home Composting Scheme. Some of the reasons for not making compost were 'not enough space', 'too much effort' and 'friends say composting bin is unsuccessful' (Q3). The reasons for not making compost are dealt with at the end of this discussion.

Figure 5.1 illustrates how people initially found out about the scheme (Q4). Advertisements through the local newspapers and radio, was by far the most effective, indicated by 62% of all respondents. 20% cited 'word of mouth' as being their means of finding out about the scheme.

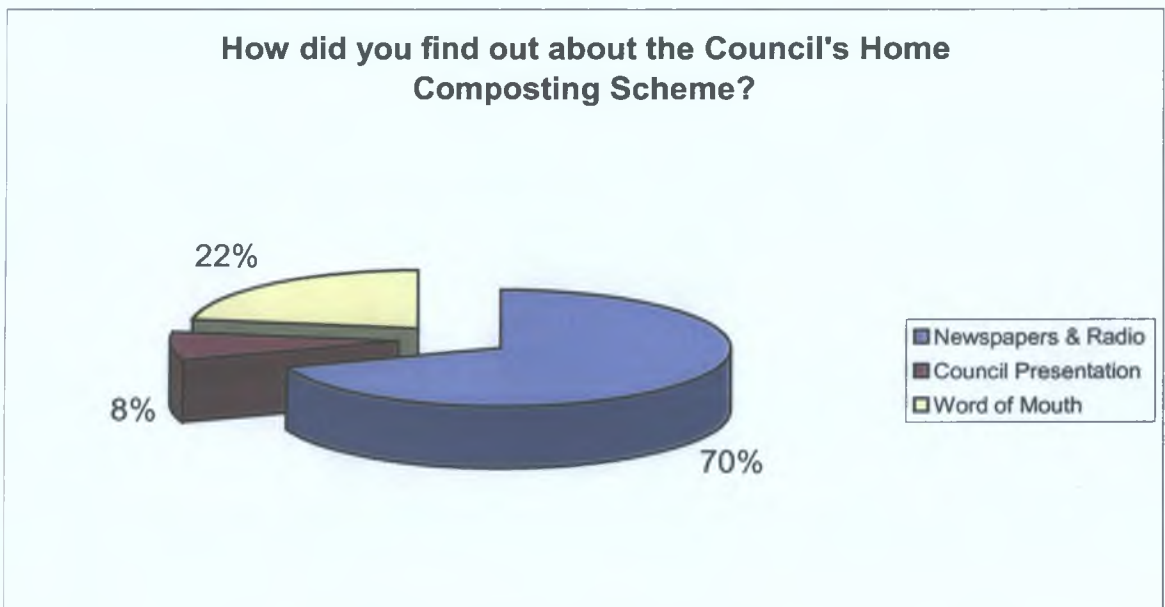


Figure 5.1 Methods employed to advertise the Home Composting Scheme

In the future direct mailing may be an option the council could consider for promoting waste management schemes.

Question 5 asked 'How many years have you been composting your organic waste?'. 62% stated that they had been composting for more than 1 year and 15% for more than 5 years.

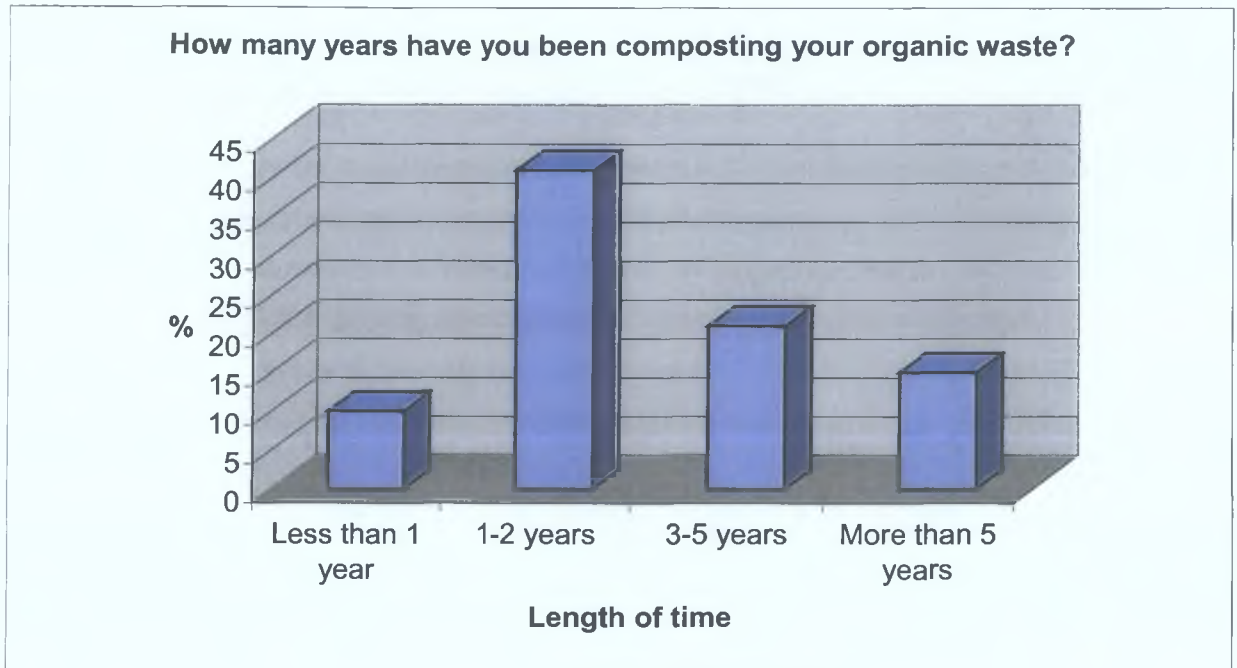


Figure 5.2 Length of time in years that respondents have been making compost.

These people who have been composting for more than 5 years could be a source of information regarding successful composting as they may have a wealth of knowledge and experience that could be documented by further research. These could be targeted to become 'Master Composters'

When asked 'What type of compost units do you use?', 77% stated 'purchased from the council's home composting scheme'. This would indicate that a large proportion of the respondents were encouraged to compost by the existence of the scheme and have been happy to continue using the composting units subsidised by the council. 23% cited that they are now using a home made composting unit or simply a compost heap, the main reason for this is belief that the composting units that can be purchased are too small, 'filled up quickly'. One person had started to use the Green Cone and one person started to use the 'Taylor' but gave no reasons why they had changed from the Council's units nor was a contact name or number provided.

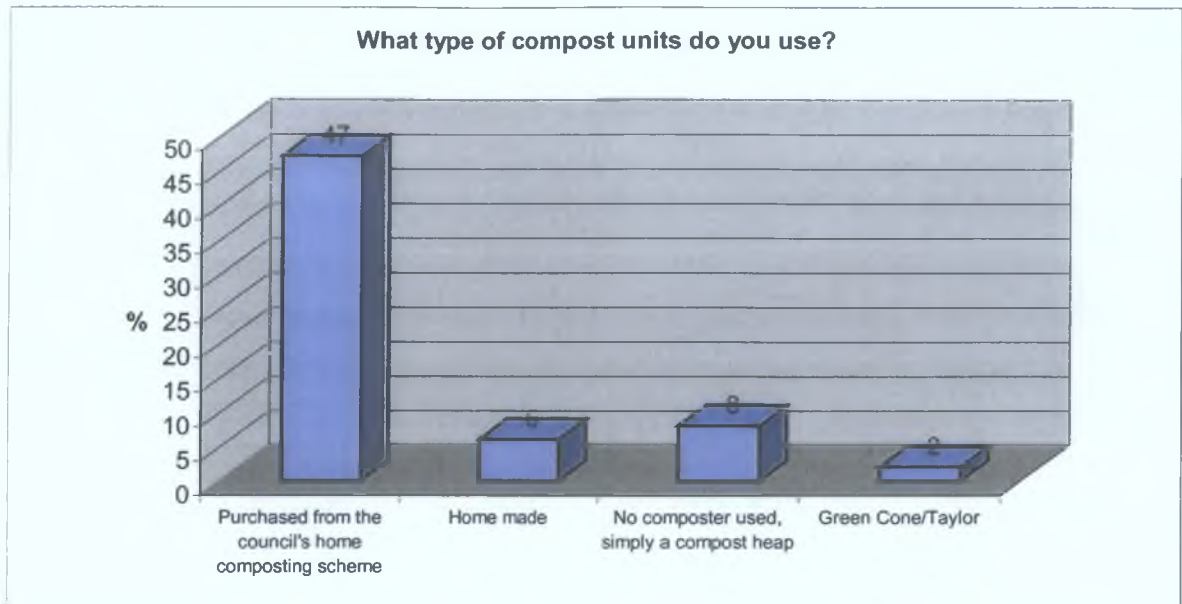


Figure 5.3 Composting units used in Leitrim.

Householders were asked in Question 7, 'what kind of compost units do you have and how many?'. Question 8 was linked to Question 7, asking, 'if you have more than one composter, please state which one you think makes the best compost?' – these questions were asked in order to determine if households required larger composting units and to establish if the general public felt that one particular composting unit was better than another. Unfortunately the majority of respondents who answered the question (36%) did not know what type of unit they were using and 21% did not answer the question, which would suggest that they may not know what type of unit they use. This would indicate that the manufacturers should engrave the name of the unit onto the composter in order for an evaluation to be made on the performance of the units.

25% stated that they had one 'Recycone' and 5% have two 'Recycone's'. 11.4% indicated that they had one Milko and 2% had two 'Milko's'. The 'Milko' Premium Composting bin was only made available as part of the Council's scheme in 2001, this may indicate why there are a smaller number of households using this bin.

One respondent stated that their household was using a wormery as they felt this was a more effective means of degrading organic waste. Three households had built

home composting units from wooden pallets and two householders had two composting bins from Leitrim Co Co. but were not aware of the name of the unit and also had two composting heaps in the garden. This respondent feels that the composting bins were 'probably' better.

Due to the fact that the 'Recycone' and 'Milko' home composting units operate in a similar manner it is difficult to suggest which unit may be more effective. Scientific analysis of the compost produced from units having received the same type and quantity of organic waste would be the only accurate means of determining the more effective home composting unit. However it is reasonable to suggest that both units when used correctly produce useable compost from organic household waste.

Question 9 asked users if they were happy with their home composting units – 64% replied positively. Only 8% of respondents indicated that they were not happy with their home composting units. There are many useful comments on the reasons why people may not be satisfied with their units. Appendix 3 gives some of the positive comments made by respondents and Appendix 4 provides some of the negative comments made by respondents. 15% of respondents had not indicated if they were happy with the home composting process, this was mainly due to the fact that they had not produced compost or were not composting long enough to have made a decision. The remainder did not answer the question.

Many of the comments clearly indicate that several householders require some advise on the use of their unit for producing compost. It is recommended that Leitrim County Council follow up with the respondents who had specifically asked for more guidance and advice as indicated in the 'comments' section of the questionnaire.

The implementation of a 'Master Composter Training Programme' would clearly be beneficial if one were to consider the comments made by respondents.

Incentives to encourage householders who have dropped out of the scheme or who have negative attitudes towards the scheme or who never joined the scheme could be effective in improving the up take of home composting. However it must be clarified that incentive schemes require the provisions of a back up scheme to ensure they are effective. Incentives alone may not improve participation in home composting.

Question 11 asked users to be specific about 'serious problem' associated with home composting.

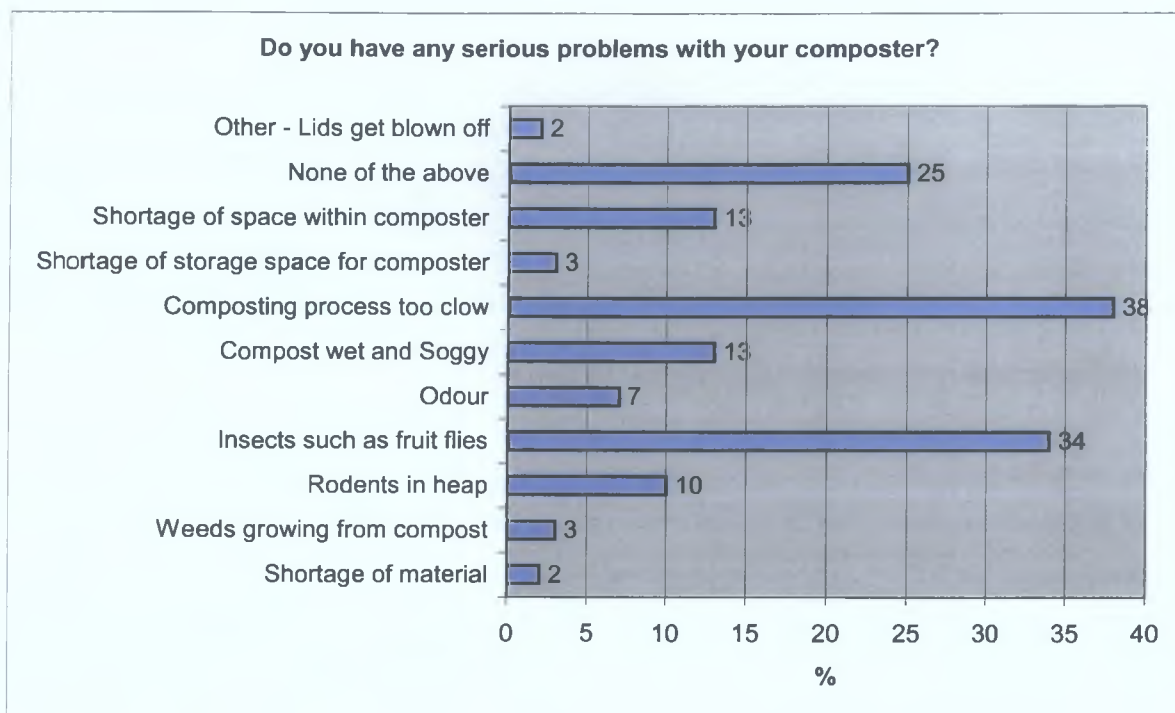


Figure 5.4 Common problems experienced in Home Composting

Respondents were asked to rank the problems 1, 2, 3, etc, number 1 being the most problematic, however not all respondents answered the question in this manner, therefore the number of households who ranked the problems have been indicated where necessary rather than using percentages. These figures should only be used as guidance.

The diagram indicates that 38% of all respondents found that the compost process was too slow. It may be that the addition of a commercial starter and some form of insulation on the unit especially in winter may help alleviate these complaints. One household indicated that this was the main problem with the composting process, while six households rated it as being the second principal problem. This may be due to the lack of heat because material is being continuously added to composting units and never given sufficient time to generate heat. It is recommended that material in composting units is left to degrade for 4-6 weeks without the addition of further waste, this will allow heat generation within the pile, producing compost is a faster timeframe than currently appears to be the case.

Shredding of material prior to placing it in the composter can also assist with speeding up the process and make it easier for breakdown of material. A hand held shredder could be used for shredding vegetable peelings etc to increase the surface area of the material prior to addition to the composting unit. The addition of commercial bags of shredded woodchip would aid in balancing the compostable mixture. Since the majority of respondents place vegetable peelings into their units the provision of shredded woodchip could prove beneficial for improving home composting in many homes.

34% cited the attraction of insects such as fruit flies with 3 % of householders rating it as being the most problematic. Fruit flies will be attracted to a unit or heap that has excess organic material, adding more shredded newspaper or small amounts of soil will assist with the elimination of this problem. It was noted from the questionnaire that these respondents were putting materials such as vegetable peelings and cooked food into their bins.

25% of respondents indicated that they had no problems with their composting units.

13% of respondents felt that their compost was wet and soggy. 5% of households stated that this was their main problem. Compost can become wet and soggy if material is constantly being placed into the unit. It is important to allow the original contents to begin the decomposition process prior to adding further material. After speaking to some of these respondents, it was identified that they believed material could be placed into the unit on a daily basis. From the questionnaires, it could be seen that those who had wet and soggy compost were placing mainly vegetable peelings/fruit skins and grass mowings into the unit and very little or no 'brown' material such as annual weeds, plant debris or soil. It is clearly evident from the respondents that the majority of those using compost bins would welcome further education and training with regard to home composting.

13% indicated that rodents in the heap was their primary problem. 5% stated that this was their main problem. Rodents are attracted to heaps of high organic content. It is advised that an equal balance of 'green' 'brown' material is added to the unit.

Growth of weeds when using the compost was not cited as a serious problem (3%), since 59% (Q11) of respondents put weeds into their compost. Perhaps the

temperature was sufficient during the composting process to kill the weed seeds. Further research would be required to verify this assumption such as members of the county council visiting users to determine temperature level within compost heaps with temperature probes.

Question 11 asked respondents to state the materials they usually compost by numbering 1-10, number 1 being the material composted most frequently. Again many respondents did not number the materials, ticking the boxes instead. Where most frequently composted materials has been cited, this has been highlighted.

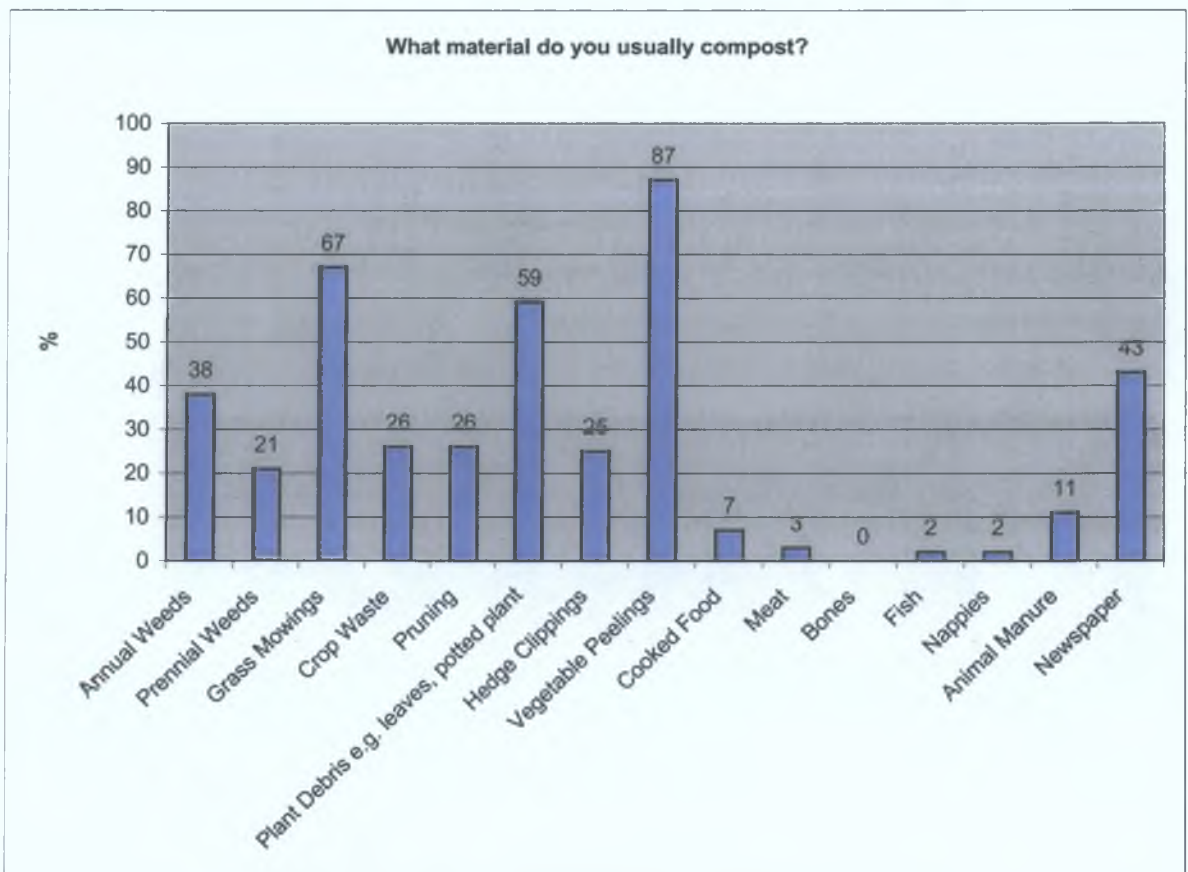


Figure 5.5 The main material put into compost bins.

87% of all respondents put 'Vegetable Peelings' into their compost bins as the main item of organic waste. Grass mowings (67%), plant debris (59%) and newspaper (43%) were the next most common items.

Grass Mowings are good activators which are often available in large quantities and are usually put into a compost unit. Unfortunately this large supply of nitrogen coupled with excess moisture, if the grass is wet, can produce a 'slimy smelly mess'

which can be rather off putting. Provided there are no grass seeds it is considered acceptable to use grass mowings as a mulch around other plants in the garden. This could be advised to respondents who had complained of this problem.

59% of respondents put annual weeds, perennial weeds or both into their compost units, it is not known if they were de-heading to remove weeds seeds which is the accepted best practice for both annual weeds and perennial weeds. However, as stated above only 3% of respondents stated that they had problems with the growth of weed seeds.

It should be noted that 43% of respondents were composting newspaper which in itself acts as a means of recycling this waste component.

Research carried out by the Center for Alternative Technology (CAT) indicates that the incorporation of non-recyclable waste paper and cardboard into the composting process (high fibre composting) can:

- Increase the simplicity and reliability of the composting process
- Eliminate the need for turning or any other attention
- Improve the quality and quantity of the finished product
- Further reduces the volume of solid waste collection (Harper, 1998).

Material put into the compost unit listed under 'other' were: wood shavings, natural fibres, wool, cotton, linen, turf mould, tea bags, egg shells and egg boxes.

All of the above are relatively slow to decompose with the exception of tea bags, they would need to be broken into small pieces and kept wet to aid the decomposition process.

It is possible to compost many items that would not traditionally be associated with composting and Question 11 dealt with many of the possible items that could potentially be composted (meat, fish, bones, animal manure, nappies). It was not the purpose of the questionnaire to suggest that these materials should be composted, however it was necessary to find out exactly what people's views were on what was acceptable to compost, regardless of the associated health issues. Disease can be passed onto humans from their manure and from animal manure if handled, so it would be unwise to recommend that these items are composted particularly if the compost is to be used in less than twelve months and if children are likely to have

access to it. 11% of households stated that the composted animal manure with one household citing it as the material used most frequently. One respondent indicated that they compost nappies, but indicated that this would be an infrequent practice.

A very small percentage of respondents 5% in total stated that they would compost meat, fish or bones while 7% stated that they would compost cooked foods. The main reason for not composting these materials is due to fear of attracting rodents or generating offensive smells.

Question 12 asked the user if they use the compost unit throughout the year, 89% of respondents stated that they use the bin from January to December. This is exceptionally high considering the poor climate experienced in the West of Ireland especially during the winter months. This result is significant as it indicates that the majority of respondents are potentially diverting a noteworthy amount of the organic waste fraction from their wheelie bin.

The remaining 11% of respondents did not answer the question, therefore it cannot be concluded that they are composting their waste throughout the year. A follow up phone call with two of these respondents indicated that they compost waste in a hazardous fashion, using the bin both frequently and infrequently but would place items into the composting bins all year around

The questionnaire therefore asked how often the compost is turned in Question 14. The results are shown in Figure 5.6.

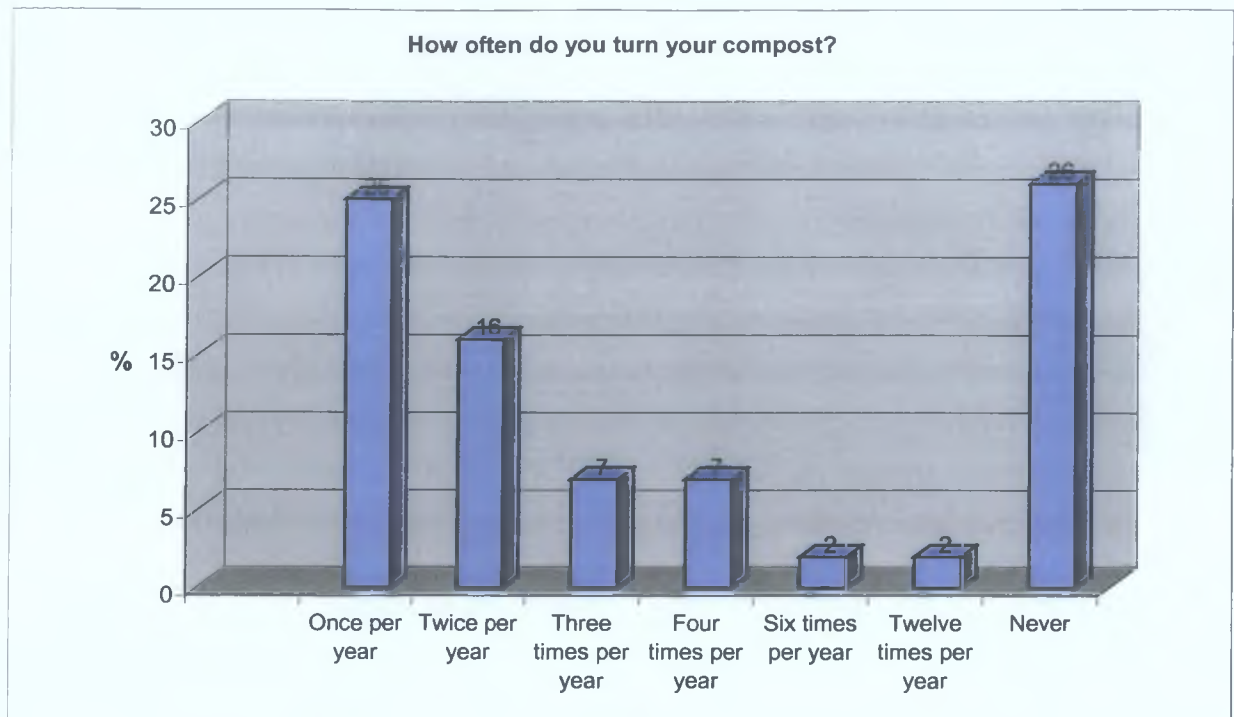


Figure 5.6 Turning of compost

56% of respondents turn their waste at least once per year with 2% turning it on a monthly basis. 26% never turn their compost, this could account for some of the failures in the composting process and complaints that it is too slow.

Further analysis of the data shows that of those who never turn their compost, approximately 40% of these respondents have problems with the slow rate of composting with one of these respondents stating that it was their primary problem. Approximately 35% of respondents complain that the compost rate is 'too slow' and do turn their compost. This may indicate that the user is expecting the organic waste to decompose at a greater rate than is possible or may need to turn their compost more frequently in order to increase the decomposition process.

Question 15 asked users to state what they used their compost for. Digging into the soil was cited by 74% of respondents as the main use to which the final compost product was put. Using the compost for planting seeds was cited by 20% of the respondents. However the following uses were also stated:

- 'For pots and baskets'
- 'Put out onto bigger compost heap and use on farm'

9% stated that they had not used the compost yet. 'Only composting 1-2 years'!

For Question 16, 74% of respondents sourced all of the material for their compost unit from within their own house or garden. One household obtains material from the farm in the form of farm yard manure. One household had began composting as part of the initiative with Leitrim Co. Co but had stopped and began to take the waste to a neighbour's garden where they managed a compost heap.

Question 17 asked if respondents felt that their soil had been improved as a result of home composting. 54% stated that the soil had been improved, 8% stated that they did not believe home composting had improved the condition of their soil while 18% affirmed that they had not used the compost so did not know if the soil had been improved. Figure 5.7 below illustrates this. It is widely documented that composting improves soil fertility, plant health and soil aeration. It acts as a slow release fertiliser, adds trace elements to the soil and increases the pH of the soil. Obviously this question is subjective whether the compost has actually improved the soil would need to be determined by scientific research and sampling of the soil over a period of time to prove any benefit. What the results indicate is a perceived benefit to the soil condition. If people perceive a benefit then they are more likely to continue to compost their household organic waste in the longer term.

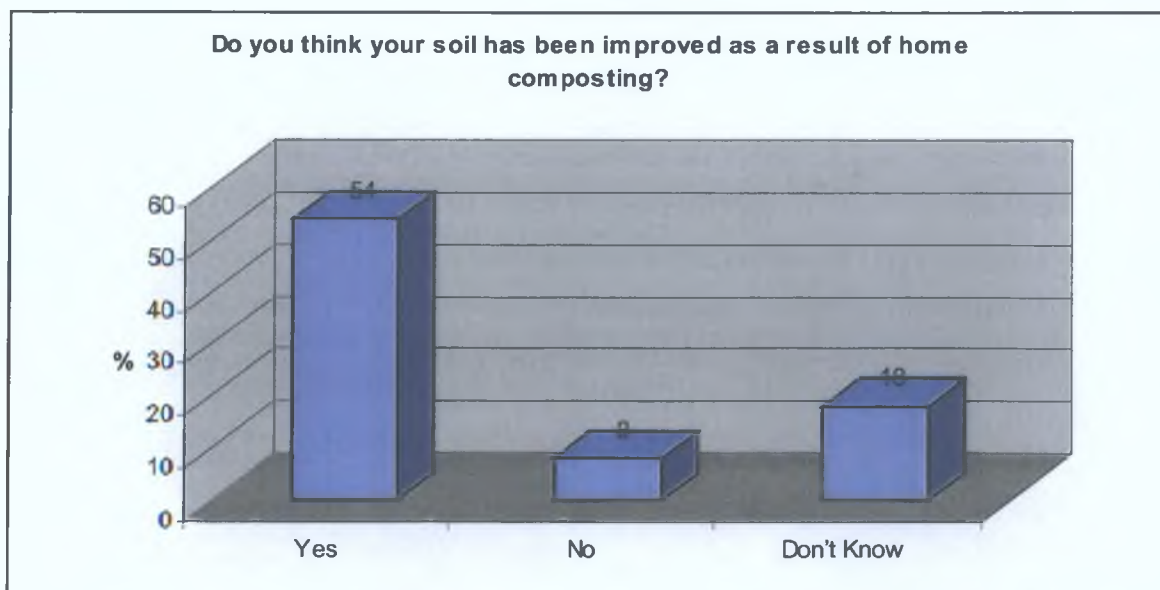


Figure 5.7 Perceived benefit to soil condition

Respondents were asked in Question 18 to state in kgs, per day, per week and per month the amount of waste that was placed into the composting unit. This question

was included to determine the amount of waste being diverted from landfill as a result of home composting.

44 households completed this question giving a total of 352.5 kgs of waste being put into their composting bins between them per week. This figure equates to a total of approximately 18 tonnes of waste per annum. In 2002, there were 9,099 houses within the functional area of Leitrim Co. Co. (Moloney, 2004), if all of these households were to compost their organic waste, it can be estimated that 35,000 tonnes of waste would be diverted from landfill on an annual basis.

According to the National Waste Database 2001, the quantity of municipal waste generated in 2001 is estimated to be 2,704,035 tonnes. This consists of 1,468,834 tonnes of household waste. Leitrim generated 22,603 tonnes of household waste for the year 2001, totaling 876 kgs per capita. The above figures on diversion of waste from landfill as a result of home composting would assist in improving waste management statistics for Leitrim Co. Co.

Based on the figures above there is a possibility that respondents to the questionnaire overestimated the amount of waste being composted in their homes. In order to obtain more accurate figures, weighing of material being composted would need to occur and be documented.

There is also wide variance in the quality of the information provided by Local Authorities to the Environmental Protection Agency for the generation of the National Waste Database. Applying county populations to the data for 2001, there is a wide range of values for household waste generation per capita, ranging from 248kg/capita to 876kg/capita. Local Authorities who show unusually high or low per capita waste generation, should take steps to examine their waste information management systems to ensure that they are up to the required standard of quality and robustness.

Figures from the National waste Database for 1998 show that household waste is continually on the increase having increased 20% from 1998 – 2001. The amount of household waste sent to landfill increased from 1,125,698 for 1998 to 1,254,857 for 2001 with 37,518 tonnes being recovered in 1998 and 74,887 tonnes being recovered in 2001.

Civic Waste Facilities, Bring Banks and Kerbsides are used to generate statistics for recycling within Leitrim Co. Co.

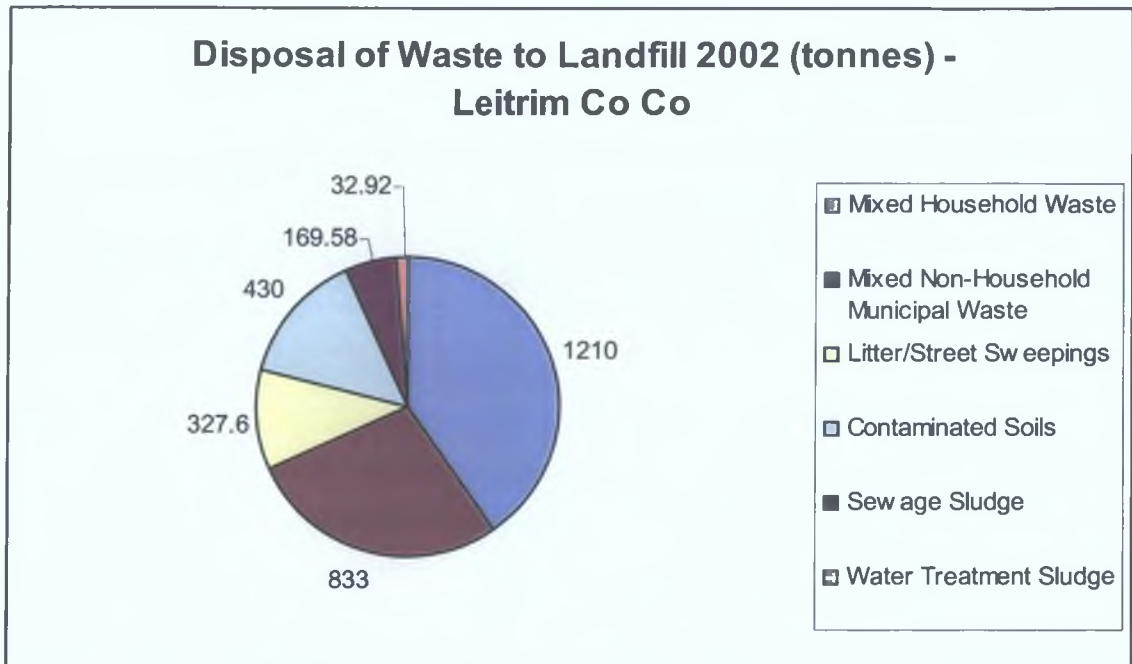


Figure 5.8 Disposal of Waste to Landfill

Figure 5.8 illustrates the amount of waste collected in Leitrim during the year 2002, this information was obtained from Leitrim County Council.

Question 19 asked respondents to state whether they would be willing to participate in a collection service of organic waste with Leitrim Co. Co using a separate bin. 36% indicated that they would while 56% stated that they would not be willing to participate. It is possible that the reason for more respondents citing 'no' may be because of a perceived cost associated with another collection. The majority of those who said 'no' were within the age bracket 50-59, this would indicate that this group of people may have families, and may therefore be concerned with the extra cost factor. It is also possible that they may want to keep their organic waste as they can produce a useable end product for themselves.

When asked how often respondents felt this collection should take place, during the summer months, 11% cited every week, 25% cited fortnightly and 7% stated monthly.

For the winter months, 5% indicated weekly, 10% cited fortnightly and 21% stated monthly. Although the response to the above was relatively low, a collection of

fortnightly for the summer months and monthly for the winter months could be perceived as acceptable to respondents.

Further research would need to be conducted in order to receive support from the public, if Leitrim Co. Co. were to consider the frequency of a door to door collection for organic waste.

Question 20 asked respondents to indicate their age group. Figure 5.9 shows that the largest age group (39%) were between 50-59 years of age. 21% were between the ages of 40-49 and 16% between the ages of 30-39. 15% of the respondents were over the age of 60. Composting seems to be something that is carried on into the later years of life. Perhaps the younger age groups need to be more effectively canvassed to join the scheme. However, it is also likely that the younger age groups just do not have their own house and garden.



Figure 5.9 Age range of the respondents to the questionnaire on home composting

Question 21 asked the respondents, how many people lived in their household. This question was asked in order to give an indication of the average number of people per household and to aim to make a connection with the amount of waste been generated per household (Q18).

Data concluded that there was very little correlation between the amount of waste composted and the number of people in the household as families with smaller numbers in their houses were composting more waste than households with bigger numbers in many cases. After further analysis of the data, it was clear that approximately 50% of those who were composting waste for more than 3 years were putting greater than 7kgs of waste into the composting bin per week. It is possible to suggest that the longer a household is composting, the greater the quantities they place into the composting bin. This may also explain anomalies for estimates of waste composted.

Question 1 asked respondents, 'do you regularly make compost?' 11% stated that they no longer compost waste and question 3 asked them to indicate the reasons for no longer composting their organic waste, ranking their reasons 1, 2, 3 etc.

8% (5 respondents) stated that the main reason for dropping out of the scheme was due to rodents or flies. 'I had a real problem with rodents when I started using the bin, so I stopped and would need a lot of convincing to restart because of the rodent problem'. Another respondent stated 'I think the composter is a great idea but it might be a good idea to place it on concrete so that rodents couldn't burrow in. I have never put meat into the composter but rats and mice burrowed in'. After further analysis it was clear that rodents were being attracted to bins where the majority of waste or all waste being put into the bin was vegetable peelings and cooked foods. The other reasons cited most frequently were 'composting process too slow' and 'too much effort'. One respondent now takes the household organic waste to a neighbour's garden where they compost the material in a heap. This respondent stated that they had obtained 'good soil' from the heap that the neighbour was developing.

Encouraging new starts is only part of the issue. The sustainability of home composting schemes will also depend on the level of drop-outs incurred. There will inevitably be drop-outs for a multitude of reasons (Tucker, *et al.*, 2003). The problems cited are relatively straightforward and could be rectified with the right knowledge or good advice.

This question only touches on the reasons for drop out, a more detailed survey would need to be conducted to determine, reasons for drop out which could look at length

of time users were composting prior to drop out, attitudes of users towards environmental issues and reasons for take up of the scheme.

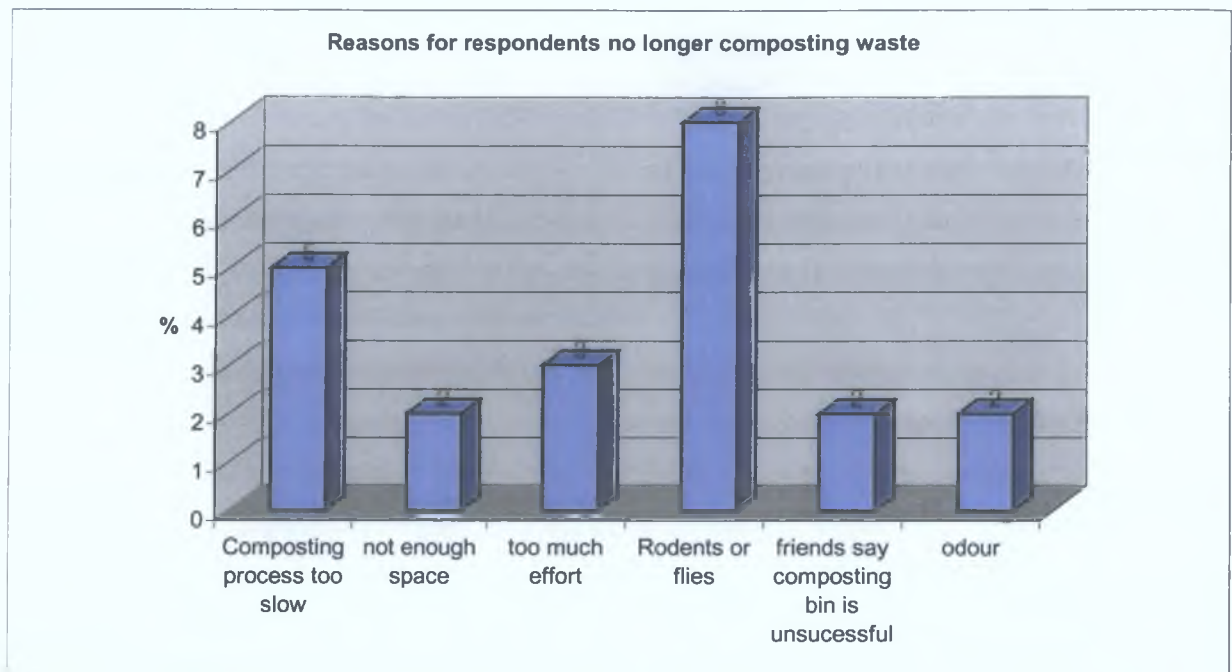


Figure 5.10 Reasons for users discontinuing with the home composting scheme.

6.0 COMPARRISON WITH OTHER SURVEYS CONDUCTED

There are at present few similar published research surveys with which the data in this report can be compared. However, Aberdeenshire Council carried out a similar survey in 1992. The aim of the survey was to determine the attitudes of people towards composting and to identify any major problems.

The aim of this survey is similar, however direct comparisons cannot be made, differences arise in the types of composting units used, quantities of waste generated and the possibility of residents participating in a collection scheme for organic waste. Hence although it is possible to compare some of the questions/answers, general trends is all that can be given.

The following questions were of similar nature in both surveys:

- Do you usually make compost
- How many years have you been making compost
- Are you satisfied with your compost unit
- What are the problems with the compost unit
- What materials do you usually put into the composting unit
- What do you use your compost for
- Do you source all of your material from within your garden or house

Many of the respondents in this survey had only one compost bin while the majority of respondents in the Aberdeenshire survey had more than one. This may be because the composting process is 'too slow', which was a common problem cited in both surveys. More than one compost unit allows the user to fill and leave one unit allowing the composting process to complete, whilst meanwhile using an alternative compost unit for storage.

The majority of people in this survey had been making compost for less than 5 years whereas 75% of the Aberdeenshire respondents had been making compost for more than 5 years. The sample sizes have different levels of experience in terms of composting organic waste.

Regarding satisfaction with the compost units, in the Aberdeenshire survey over 85% were satisfied with the units many of which had been in use for more than 5 years, whereas this survey showed 64% were satisfied with their compost units.

Regarding use of the compost both surveys showed that 'digging into the soil' was the preferred use.

Aberdeenshire noted that many of their respondents were taking neighbour's waste and therefore increasing recycling, however the respondents in this survey tended to source their compostables from within their own garden/kitchen.

Below a comparison is given with the Stathspey Waste Action Network (SWAN) – The Adopt a Composter Project (Lawson *et al.*, 2000).

The aim of the SWAN report was similar to this report also intending to

- Determine how successful home composting is
- Determine how willing members of local communities are to do home composting
- To compare different types of composting units to find out which one works best
- To estimate how much organic waste could be diverted from landfill
- To demonstrate the potential for home composting on a larger scale
- The target group for this project was households, business and schools, therefore while there are some similarities between the two reports, the following information is to be used as a general comparison

The following questions were similar in both reports

- Are you using your composter
- What are you putting into your composter
- What weight of waste are you putting in per week
- Are you having any problems with your composter?, If so, what
- Are you satisfied with your composter

96% of those contacted through the SWAN report were still using their composting unit compared with 87% through this survey. The larger target group associated with the SWAN report may have had a bearing on these results considering all schools were composting and all business except one were composting.

As expected, both reports identify that the bulk of material going into compost bins is vegetable waste, garden waste, paper, tea bags, egg shells, leaves and turf

The SWAN report asked respondents to differentiate between the quantity of household organic waste and garden waste being placed in the bin. It was estimated that the average household is placing 11.8kgs of waste into the bin per week in comparison with 8kgs of waste per household in Leitrim. The SWAN report did not specify the length of time respondents has been composting and this could have an effect on the results.

The most common problem cited with both surveys was 'composting process too slow', other problems encountered in the SWAN report were 'composter not big enough for all waste', flies in summer and part or all of bin is blown away by the wind. It appears that similar problems seem to arise with home composting initiatives. It is recommended that advice be sought from these organizations on how they progress following the reports.

7.0 RECOMMENDATIONS

1. As a result of this research a number of recommendations are suggested in order to increase the effectiveness of home composting to improve this strategy as a key element of waste reduction in Ireland.

The policy document 'Changing Our Ways' and 'Delivering Change' introduced the need for each local authority to recruit an Environmental Education Officer.

The responsibility of the environmental education officer is to increase environmental awareness throughout the counties of Ireland, through information campaigns and educational programmes.

Home Composting falls within the remit of the Environmental Education Officer. While a number of county councils are providing bins at a subsidised rate and some have conducted some form of research with regard to its effectiveness. There is no formal programme in place for developing home composting as a waste reduction strategy.

It is recommended that a common formal programme is developed for implementation by all county councils. A standardised survey method should be devised on a national or European basis for urban and rural dwellers. This would enable a comparison of results to take place. It is important to recognise that all county councils have a common objective – reduction of waste going to landfill, specifically 7% of all food waste and 40% of all garden waste for home composting (National Strategy on Biodegradable Waste, Draft, 2004)

Training programmes for Environmental Education Officers and regular meetings between Environmental Education Officers would also prove beneficial with the sharing of information and elimination of common problems which may aid in progressing the programme effectively.

2. The implementation of a Master Composter Training Program is highly recommended based on the results of the survey conducted as part of this report. Many respondents maintain a positive outlook on home composting despite feeling they have little knowledge of the process and would appreciate assistance. In order to maintain this positive outlook users need to be provided

with the knowledge they require. Motivation is closely linked to knowledge and education.

Master Composter Programmes have been effectively utilised as part of home composting programmes within the EU (particularly Finland) and USA.

Master Composters are selected from within the community generally through a variety of methods including press releases, letters to householders, articles in parish magazines and local radio.

A training programme must follow which can include but is not limited to training modules on:

- How to compost
- Decomposition of Organic Materials
- Home Yard Care
- Waste Reduction

The training programme must equip the trainees with all the information they need about composting and the issues surrounding it.

The Master Composter is then required to spend an allocated number of hours over a specified length of time in the respective county promoting and providing advise on home composting.

Master Composters must be provided with the resources and back-up support required to perform their duties.

3. Engraving the names of the composting unit and the supplier would aid in determining effective features of composting units and comparison surveys between different makes of home composting units.

This report was unable to make comparisons between the units supplied by Leitrim Co. Co. as respondents to the questionnaire did not know what type of unit they were using.

Research information of this type can prove beneficial for manufactures in improving or developing home composting units they supply.

4. Incentives to promote home composting and reduce household waste can be useful in encouraging householders to change their behaviour. Some of the examples below could be considered for further research

- performance rewards – pay by weight for general non recyclable refuse.
- prizes for recycling – a competition is held where participating householders have the chance to win a prize
- intensive education – an intensive education programme to promote participation in waste reduction and recycling schemes

Work would need to be taken forward to pilot these schemes to determine how successful they can be in Ireland.

5. The provision of hand held shredding units for home composters along with the availability of commercial woodchip may assist with obtaining the correct balance of green and brown waste for composting. Shredding also makes the heap more uniform in size, aerates it and enables the compost to heat more evenly. Shredding material would aid in reducing the decomposition time addressing one of the main problems with participants feeling the composting process is too slow.

According to the draft National Strategy for Biodegradable Waste 2004, home composting is seen as a viable means of diverting biodegradable municipal solid waste from landfill, however there is no recommendations on how to drive the strategy forward. This document may assist with that process.

Education and Awareness of home composting is the key to developing the home composting programme, experience gained by the public in operating a home composter may create an added awareness regarding the importance of separation at source should a collection service for organic waste from households be introduced by the council.

Home Composting can be deemed to be a success in so far as the majority of respondents in the Leitrim County Council's Home Composting Initiative are generally satisfied with their composting units.

The questionnaire survey has been effective in identifying specific problems.

It would be inappropriate to blame the manufacturers of compost units for the fact that some respondents are not satisfied with the home composting process as some of the respondents comments indicate that the users need some simple help and advise on how to make the composting process work better regardless of the type of unit. For the purpose of this survey, it is not possible to make much comparison between composting units as the 'Recycone' and the 'Milko' are very similar units.

From analysis of the questionnaires and talking to some of the residents of Co. Leitrim, it appears that there is great enthusiasm for Home Composting, this is evident from some of the comments in the questionnaires and from the response rate to the survey.

The opportunity to expand the scheme should be expanded especially in light of various governmental recommendations which favour Home Composting.

The provision of further information on composting, how to speed up the process and alleviate some of the problems would also be beneficial to the process. It is also recommended that the scheme is continually promoted in order to encourage residents to continue to compost and to recruit new residents to the scheme. The development of a Master Composter Programme may prove beneficial.

Ultimately the fundamental principles of the home composting strategy can be summarised as follows:

Employing a combination of instruments to promote home composting including

- Education
- Awareness
- Economic incentives
- Regulatory measures
- Adoption of formal programmes

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APPENDIX 1 - EFFECTIVENESS OF HOME COMPOSTING - QUESTIONNAIRE

Derryhane
Tarmonbarry
Clondra
Co. Longford



7th February 2004

Dear Occupier,

I am currently completing my MSc at Institute of Technology, Sligo on the Effectiveness of Home Composting in conjunction with Leitrim County Council.

I have obtained permission from Leitrim County Council (Environmental Section) to contact you as their records show that you currently have a home composting unit issued through their Home Composting Scheme.

This is an opportunity to state your views on the Composting Unit that you have. I would appreciate if you could spare 10 minutes to answer the following questions and send back in the pre-paid addressed envelope.

As an added incentive upon your completion and return of the addressed envelope your name will be entered into a draw to win a cheque for €50.

Leitrim County Council and Institute of Technology, Sligo consider that your views are vitally important (even if you are currently not composting your organic waste) in order to assess the effectiveness of the present home composting scheme.

I would appreciate if you could return completed questionnaires to me by Thursday 18th March 2004.

Miss Mary Casey BSc. PgD. Sligo Institute of Technology.



APPENDIX 1 - EFFECTIVENESS OF HOME COMPOSTING - QUESTIONNAIRE

Please tick more than one box if appropriate and please rank 1, 2, 3 etc, where asked

No	Question	Answer	
1	Do you regularly compost your organic waste	<input type="checkbox"/> Yes	<input type="checkbox"/> No
2	Do you currently participate in Leitrim County Council's Home Composting Scheme	<input type="checkbox"/> Yes	<input type="checkbox"/> No
3	If you do not compost your waste, please number as many boxes as apply, and then go to question 19. (Rank using 1, 2, 3 etc, No.1 being the main reason for not composting waste)	<input type="checkbox"/> don't like the idea <input type="checkbox"/> the composting process is too slow <input type="checkbox"/> not enough space <input type="checkbox"/> not enough ingredients <input type="checkbox"/> bins too expensive <input type="checkbox"/> it's unhealthy <input type="checkbox"/> because of rodents or flies <input type="checkbox"/> odour <input type="checkbox"/> too much effort <input type="checkbox"/> other (please specify)	
4	How did you find out about the Council's Home Composting Scheme	<input type="checkbox"/> Direct mailing <input type="checkbox"/> Newspapers and radio <input type="checkbox"/> Council presentation <input type="checkbox"/> Word of mouth <input type="checkbox"/> Other (please specify)	
5	How many years have you been composting your organic waste	<input type="checkbox"/> Less than 1 year <input type="checkbox"/> 1-2 years <input type="checkbox"/> 3-5 years <input type="checkbox"/> more than 5 years	
6	What type of compost units do you use	<input type="checkbox"/> purchased from the council composting scheme <input type="checkbox"/> home made <input type="checkbox"/> no composter used, simply a compost heap <input type="checkbox"/> purchased from elsewhere (please state supplier)	
7	What kind of compost units do you have and how many	<input type="checkbox"/> Recycone () <input type="checkbox"/> Milko () <input type="checkbox"/> Other (please specify) ()	
8	If you have more than one composter, please state the one you think makes the best compost		
9	Are you satisfied with your home composting units	<input type="checkbox"/> Yes	<input type="checkbox"/> No
10	Do you have any serious problems with your composter (please number as many as apply, Number 1 being the most problematic)	<input type="checkbox"/> shortage of material <input type="checkbox"/> weeds growing from compost <input type="checkbox"/> rodents in heap <input type="checkbox"/> insects such as fruit flies <input type="checkbox"/> odour <input type="checkbox"/> compost wet and soggy <input type="checkbox"/> composting process too slow <input type="checkbox"/> shortage of storage space for composter <input type="checkbox"/> shortage of space within composting unit <input type="checkbox"/> none of the above <input type="checkbox"/> other (please specify)	

APPENDIX 1 - EFFECTIVENESS OF HOME COMPOSTING - QUESTIONNAIRE

11	What materials do you usually compost (please number as many as apply, number 1 being the material you use the most)	<input type="checkbox"/> annual weeds <input type="checkbox"/> perennial weeds <input type="checkbox"/> grass mowings <input type="checkbox"/> crop waste <input type="checkbox"/> pruning <input type="checkbox"/> plant debris eg leaves, potted plant <input type="checkbox"/> hedge clippings <input type="checkbox"/> veg peelings <input type="checkbox"/> cooked food <input type="checkbox"/> meat <input type="checkbox"/> bones <input type="checkbox"/> fish <input type="checkbox"/> nappies <input type="checkbox"/> animal manure <input type="checkbox"/> newspaper <input type="checkbox"/> other (please specify)	
12	Do you put materials into the compost unit throughout the year	<input type="checkbox"/> Yes <input type="checkbox"/> No	
13	If you answered no to the above question, please state why and state the months you use the composter (e.g. March-October)		
14	How often do you turn the compost e.g. (once per year)		
15	What do you use your compost for	<input type="checkbox"/> digging into the soil <input type="checkbox"/> planting seeds <input type="checkbox"/> other (please specify)	
16	Do you source all of the material for your compost from within your garden/house (if no, please state where the material comes from e.g. neighbour's garden waste)	<input type="checkbox"/> Yes <input type="checkbox"/> No	
17	Do you think your soil condition has been improved as a result of home composting	<input type="checkbox"/> Yes <input type="checkbox"/> No	
18	Please state the quantity of waste you compost in kgs, per day, per week, per month. (Approximately how many kgs of waste do you put into the composter every day, every week and every month) 1 litre of milk weighs approximately 1 kg	<input type="checkbox"/> Every day <input style="width: 100px; height: 20px;" type="text"/> <input type="checkbox"/> Every week <input style="width: 100px; height: 20px;" type="text"/> <input type="checkbox"/> Every month <input style="width: 100px; height: 20px;" type="text"/>	
19	Would you be willing to participate in collection service of organic waste with Leitrim County Council using a separate bin	<input type="checkbox"/> Yes <input type="checkbox"/> No	
	How often do you feel this collection should take place	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> SUMMER <input type="checkbox"/> Every week <input type="checkbox"/> Fortnightly <input type="checkbox"/> Monthly </td> <td style="width: 50%; border: none;"> WINTER <input type="checkbox"/> Every week <input type="checkbox"/> Fortnightly <input type="checkbox"/> Monthly </td> </tr> </table>	SUMMER <input type="checkbox"/> Every week <input type="checkbox"/> Fortnightly <input type="checkbox"/> Monthly
SUMMER <input type="checkbox"/> Every week <input type="checkbox"/> Fortnightly <input type="checkbox"/> Monthly	WINTER <input type="checkbox"/> Every week <input type="checkbox"/> Fortnightly <input type="checkbox"/> Monthly		
20	Please indicate your age group	<input type="checkbox"/> below 20 <input type="checkbox"/> 20-29 <input type="checkbox"/> 30-39 <input type="checkbox"/> 40-49 <input type="checkbox"/> 50-59 <input type="checkbox"/> 60-69 <input type="checkbox"/> 70-79 <input type="checkbox"/> 79+	
21	Please state the number of people that live in your household		

APPENDIX 1 - EFFECTIVENESS OF HOME COMPOSTING - QUESTIONNAIRE

Any Other Comments

I would like to talk to a number of residents who have composting bins in order to clarify any further queries there may be regarding home composting. Your opinions on home composting are extremely valuable in making this research accurate and important in the task of improving Waste Management . Please write your contact number below, if you are willing to talk to me.

Returning the Questionnaire

You may remain anonymous, if you wish, but it would be helpful if you gave us your name and address for the prize draw. Winner of the €50.00 will be contacted during the last week of March 2004. The winner's name will also be published at Leitrim County Council.

Dr/Mr/Mrs/Miss _____

First Name _____

Surname _____

Address _____

Telephone No _____

APPENDIX 2

TROUBLESHOOTING

The following guidelines, will aid in ensuring that a composting operation should run fairly smoothly. If something is wrong, the following may be discovered (Quinn, 2003)

SYMPTOM	PROBLEM	SOLUTION
<p>THE COMPOST HAS A BAD ODOUR.</p> <p>Two basic odours occur in improperly managed compost piles: Sulphur (rotten egg smell) & Ammonia</p>	<p>Sulphur odour occurs when the pile is too wet.</p> <p>Ammonia odour occurs when there is an excess of nitrogen or green material.</p>	<p>For sulphur smells, simply mix in dry ingredients, such as soil or dried leaves or grass clippings.</p> <p>To remedy ammonia odour, add materials containing more carbon, such as leaves or dry grass clippings.</p> <p>Other methods of dealing with odours:</p> <ul style="list-style-type: none"> • Turn the pile. Extra soil added during the turning will help with the immediate odour problems. • Mix in materials that do not compact, such as green twigs and plant stems. These will help to create more air voids.
<p>COMPOST PILE WILL NOT HEAT UP</p>	<p>If the pile remains cold, it lacks moisture or nitrogen or the pile is too small.</p>	<p>Check the moisture level of the pile. It should be about as moist as a well- wrung sponge. Add high nitrogen materials, such as fresh grass clippings or vegetable scraps.</p>
<p>THE COMPOST PILE IS ATTRACTING PESTS</p>	<p>If pests, such as dogs, or mice, are attracted to the pile, improper materials have been added.</p>	<p>Do not add meat, fish, bones, dairy products or oily or greasy food.</p> <p>If there is concern about pests being attracted to the pile, create a bin that is fully lined with metal mesh. Lids are also helpful for keeping out pests.</p> <p>To avoid problems with flies, make certain that all freshly deposited kitchen scraps are covered over with soil or buried into the pile.</p>
<p>PROCESS IS TOO SLOW</p>	<p>If the organic matter is decomposing too slowly, the particles in the pile are too large.</p>	<p>Cut waste materials into small pieces. Mix in small amounts of topsoil with the materials. Adding livestock manure and bedding will also activate your pile.</p>
<p>COMPOST PILE IS TOO WET</p>	<p>A very wet compost pile signals poor drainage, too much rain, or a lack of air.</p>	<p>Move the composter to a location where there is proper drainage. Add dry leaves. Turn the pile to circulate air and remove the lid to allow evaporation.</p>

Appendix 3 Comments made by respondents who are satisfied with their home composting units

- I think the composter is a great idea
- I have got lovely soil from my neighbours compost heap.
- Home Composting should receive more promotion
- I like using the bin for vegetable waste and some grass mowings in summer. I am not good at layering in the way recommended but I find it good. I do not put in cooked food or meat as I would have a fear of it attracting rodents.
- I find home composting great, it is easy and convenient.
- Home composting is an excellent way to reduce waste. Very important for households with children to experience this waste management at home etc, from an early age. We haven't made any use of our compost yet due to changing house etc, but I'm sure it is definitely nurturing soil close by.
- Although our use is small, I think it is a good way of returning material to the earth, rather than landfill etc.
- The system has worked well for me, I don't have a system for cooked food as I have a dog, cat and an array of birds, this is not a problem. Bigger bins would be useful.
- Composting is a very important exercise and it should be part of every householders agenda as it is so important to save landfills. It should have been done for the last 30 years.
- Home Composting is an efficient way of making use of organic household waste. I find that it is essential to turn the compost as least once per month. Also it is important that the compost bin is in a sunny part of the garden. The compost should be ready for use in 3 months.

Appendix 4 Comments made on reasons for dis-satisfaction with home composting.

- I have never put meat into the composter but rats and mice have burrowed in.
- As I did not find the compost bin supplied by the council satisfactory, we take our compost to a neighbours' garden where they make compost
- I find it very difficult to rotate the compost as the bin is so deep. It would be a good idea if they could come up with a better idea for rotating
- I feel I just don't have the whole think right and could do with more information. Didn't know I had to turn it
- I really feel I am not doing everything correctly. I always understood food had to be uncooked so I would appreciate and literature or assistance.
- As I am not long at composting, how long does the waste take to become soil?. I tend to use nearly all vegetable peelings, tea bags, eggshells, fruit peelings. I wonder if this is the correct balance for making soil.
- Have had problems with council compost bin, flies etc. I found it filled up quickly. Am currently using homemade compost unit, but we have never got any compost made.
- The compost bin does not work as well in the winter months as in the summer. It must have something to do with the temperature.
- I got a compost bin from Leitrim Co. Co. I had a real problem with rodents when I started using it, so I stopped and would need a lot of convincing to restart because of the rodent problem.
- Slow in Winter time, Composter not big enough.

(Some of these comments come from respondents who have not decided if they are satisfied with the process)