

Earthmaker™ Compost Bin Trial

Report for:

Earthmaker Europe Ltd

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APPENDIX B – EARTHMAKER BROCHURE I

SUMMARY

The composting of garden and kitchen waste at home has become increasingly more common in the UK. The Earthmaker continuous cycle composter was developed in New Zealand and is of a significantly different design to other home compost bins on the UK market (see Appendix B). This is a report of a trial carried out to test the effectiveness and ease of use of this new bin. The results show that the Earthmaker was easy to assemble and use and that it produced good quality compost faster than the control bins chosen.

Three replicates of the Earthmaker bins were trialled alongside three replicates of a control home compost bin. Material was added on a weekly basis in an attempt to simulate the composting behaviour of a typical household. The material was a mixture of garden waste and kitchen waste, including cardboard and paper towels.

The assembly of the Earthmaker bins scored well in the trial and in general was found to be easy, scoring an average 3.7 on a scale of 1 to 5 (1 - hard, 5 – very easy). The average time of assembly, from boxed product to fully assembled bin was 23 minutes.

The Earthmaker bins scored very highly in the filling assessment. The average score of the 3 replicates was 4.8 on a scale of 1-5 (1 – hard, 5 – very easy), with no bin scoring less than 4 at each assessment. In comparison the control bins scored an average of 3.9. The Earthmaker bins were a good height and had a decent sized aperture and it was found that the lid could be rotated to the open or closed position using just one hand and because the material was contained in the top chamber it would be easy to mix if required.

The transference of material in the Earthmaker bins from stage one to stage two scored well in the trial (3.7 on a scale of 1-5 (1 – hard, 5 – very easy)). The whole process took approximately one minute and did not require much physical strength but the small size of hole behind the door made the process slightly awkward. The transference of material from stage two to stage three scored moderately well (2.6 on a scale of 1-5) and was deemed to be awkward but nevertheless only took 5 minutes on average.

The Earthmaker bins scored well when assessed on the ease of emptying the bin. The average score was 3.7 on a scale of 1-5 (1 – hard, 5 – very easy). It was found that the hatch was large enough to use a garden fork or spade to access the material. Furthermore, because the bins were divided into sections, the less decomposed material (material more recently added) within the bin was prevented from falling down onto the ready compost beneath. The average score was brought down by one of the replicates in which the shelf separating stages two and three had become dislodged from the sides of the bin. This blocked access to some of the material in stage three and made removal impossible without partially disassembling the bin to refit the shelf. This process took approximately five minutes. It was unclear whether the problem was caused by incorrect assembly or if the shelf was dislodged during emptying.

In the time period of this trial, the amount of ready-to-use compost produced by the Earthmakers was more than double that produced by the control bins during the trial. There was a much higher percentage of fully decomposed material in the Earthmaker bins (38%) than in the control bins (15%). The majority of material within the control bins was only partially decomposed, probably as a result of drying out around the edges, whereas the material in the Earthmakers was more homogeneous in terms of moisture content. In addition, the percentage reduction in the volumes of material in the Earthmaker bins was consistently higher than the reductions found in the control bins.

1 INTRODUCTION

The composting of garden and kitchen waste at home has become increasingly popular, driven in the main by local government campaigns to increase diversion of biodegradable waste from landfill. The range of home compost bin designs is wide and new types of bin are entering the market regularly. This report was commissioned by Earthmaker Europe Ltd to assess the effectiveness of their new invention, the Earthmaker compost bin, which has sold over 10,000 units in New Zealand and has recently entered the UK market. More specifically, the objectives of the report were to:

1. Assess the ease of assembly of the Earthmaker;
2. Assess the ease of use and the effectiveness of the Earthmaker;
3. Assess the quality of compost produced by the Earthmaker.

2 METHOD

The method by which the above three objectives were tested is set out below.

The trial consisted of three replicates of the Earthmaker and three of a control bin laid out in a straight line in a polytunnel. The trial was housed within a polytunnel to raise the ambient temperatures around the bins in an acknowledgement of the fact that the trial was carried out over the coldest months of the year (November-April).

The design of the control bin was chosen because of its similar shape, size, and construction material. Although this bin had a slightly higher capacity than the Earthmaker, both bins received the same amount of material. The control bin was there to represent the more traditional home composting system. It was agreed that the material in the control bins would not be turned or aerated using a compost aerator, in an attempt to simulate the composting behaviour of a typical household and thus the typical use of the control bin.

The bins were laid out to provide sufficient space for access.

2.1 Assembly of the bins

The Earthmaker bins were supplied unassembled. Three groups of two people assembled one bin each (assembly of the control bin was not tested as part of the trial). The assessors represented different age groups and genders. Record sheets were used to record relevant details such as the time taken to fully assemble the bin (record sheets can be found in Appendix A). As in all the assessments described below, the assessors were asked to rate the bins on a scale of 1 to 5, where

- 1 = Hard
- 2 = Moderately hard
- 3 = Moderately easy
- 4 = Easy
- 5 = Very easy

2.2 Filling of the bins and transference of material between the three stages

In order to simulate the composting behaviour of a typical household, the feedstock used to fill the bins consisted of a mixture of woody material (eg shrub prunings) and other carbon sources such as cardboard and egg boxes, as well as kitchen vegetable waste and grass clippings or other similar soft green material. The materials were well mixed immediately prior to filling the bins to ensure a consistent feedstock for each of the bins, however the materials were not shredded or chopped.

Each bin was filled at weekly intervals for twelve weeks starting on the 24th November 2005. At each occasion, stage one of the Earthmakers was filled with a set quantity of material (approximating 1/3 to 1/2 of capacity of stage one). The same amount of material was then put in the control bins. A record was kept of the volumes of feedstock added at each filling, and the ease of filling was rated on a scale of 1-5, where 1 is hard and 5 is very easy.

After four weeks, the material in stage one of the Earthmakers was transferred to stage two, where it remained for four weeks. After this time, the material was finally transferred into stage three, while at the same time, material from stage one was transferred into stage two.

2.3 Emptying of the bins

The trial protocol called for the filling of the bins to be discontinued after week twelve. Thereafter a fortnightly inspection of the material in the bins was planned with the final date for assessment of the quality of compost produced by both sets of bins, set for week eighteen. However, the unusually cold weather and freezing conditions during the winter of 2005-6 slowed the composting process and our interim inspections showed that the compost in the bins had an insufficient proportion of ready-to-use compost to be deemed suitable for final assessment.

After discussions with the clients we agreed that the final assessment of material in both the Earthmaker bins and the control bins should be postponed until end of May. At this time the material in stage two was transferred into stage three and the material from stage one was transferred to stage two. This was done to simulate what a user would have done in the same circumstance, that is, to move material down the bin to allow space at the top for fresh material.

The ease of emptying the bins was rated on a scale of 1-5 immediately prior to the final assessment.

2.4 Final assessment of the material

After 26 weeks a final assessment was made (30th May 2006) on the material in the Earthmakers. The material in the control bins was assessed at the same time. The material from each bin was assessed in turn and the assessment was carried out as follows. All the material from a bin was mixed thoroughly and the total volume was measured by filling the material into buckets. Following this, a sample of compost was taken from the material and analysed. The sample size was one bucket (14 litres). The sample was divided into five grades of material as set out in Figure 1 below. An estimate was then made of the of each grade of material in the sample.

Grade 1	Undecomposed, no difference from original substrate
Grade 2	Slightly decomposed, would need to be returned to bin
Grade 3	Partially decomposed, suitable for a rough mulch, or leave to complete decomposition
Grade 4	Almost fully decomposed, suitable as a mulch or for screening to produce compost
Grade 5	Fully decomposed, suitable for use as potting compost, individual components indistinguishable, soil-like texture

Figure 1. Grade scheme for the final assessment of the material

2.5 Additional monitoring

In addition to the assessments described above, the trial included additional weekly monitoring of the following factors.

2.5.1 Material temperatures

This involved recording the temperatures in each of the three stages (where material was present) of the Earthmaker bins, and of the material in the control bin. Ambient temperatures and weather conditions were monitored daily on site and could therefore be factored into the results.

2.5.2 Material moisture content

The material in the control bin and in each stage of the Earthmaker bins was monitored to ascertain whether it was sufficiently moist, too wet or too dry.

2.5.3 Settling

The material was checked to see to what extent it had settled.

2.5.4 Beneficial flora or pests

The presence of any compost pests was noted, as were creatures considered to be beneficial to compost production.

2.5.5 Durability of the bin

It was noted whether the bin appeared durable over the course of the trial or whether any related problems arose.

3 RESULTS

3.1 Assembly of the bins

The assembly of the Earthmaker bins was found to be easy, scoring on average 3.7 on a scale of 1 to 5 (1 - hard, 5 – very easy). The average time of assembly for two people, from boxed product to fully assembled bin was 23 minutes. All assessors judged that in theory it would be possible to assemble the bin with just one person, however it was noted that it would be advantageous to have two people present for some of the assembly (such as fitting the shelves and slide connectors). It was noted in two of the replicates that the pushing some of the lugs into place in order to connect different components of the bin was difficult.

3.2 Filling of the bins

The Earthmaker bins scored very highly in the filling assessment, in which the bins were filled four times at weekly intervals. The average score of the 3 replicates over four weeks was 4.8 on a scale of 1-5 (1 – hard, 5 – very easy), with no bin scoring less than 4 at each assessment. In comparison the control bins scored an average of 3.9.

Comments recorded by assessors filling the bin noted that the Earthmaker bins were a good height and had a decent sized aperture. It was also found that the lid could be rotated to the open position using just one hand. A further positive observation noted that because the material was contained in the top third of the bin and so did not fall to the bottom, it would be easy to mix the material if desired.

In total, twenty-three 14-litre buckets of material were added to each bin in the trial over a twelve-week period from the beginning of the trial. This equates to approximately 320 litres of material; the proportions of each material added are shown in Figure 2 below.

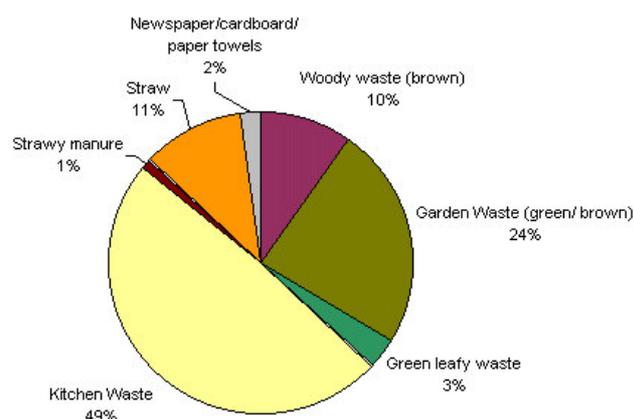


Figure 2. Proportions of material added to the bins.

3.3 Transference of material between the three stages of the bins

The transference of material in the Earthmaker bins from stage one to stage two scored well in the trial. The material in each of the three replicates was transferred three times and the average score for all three bins was 3.7 on a scale of 1-5 (1 – hard, 5 – very easy). It was found that when the pull-out panel was removed the material needed to be helped through from stage one to stage two using the push-pull tool. The best method found for doing this was to push some material down from stage one into stage two, and then push that material from the front to the back of stage two by poking the push-pull tool through the hole behind the door. The whole process took approximately one minute and did not require much physical strength, but the small size of hole behind the door made pushing material to the back of stage two rather fiddly.

The transference of material from stage two to stage three scored moderately well (2.6 on a scale of 1-5 (1 – hard, 5 – very easy)). In most cases the transference of material from stage two to stage three was deemed to be awkward. In one of the three replicates it was noted that it was difficult to pull material from the back of stage three. It was found that the process required one user to get on their knees but that overall the whole process still only took approximately 5 minutes.

3.4 Additional monitoring

3.4.1 Temperatures within the bins

The temperatures within all the bins were measured on a weekly basis from one week after the first filling of the bins for eleven weeks. In addition, the outside air temperature and temperature within the polytunnel were also measured. Figure 3 below shows four sets of data, which are made up of temperature measurements taken over the eleven week period. The data sets are: (i) the ambient temperature within the polytunnel, (ii) the temperature of material within stage one of the Earthmaker, averaged over the three replicates, (iii) the average temperature of material in the three control bins, and (iv) the temperature of the first batch of material as it passes through the three stages of the Earthmaker, again averaged over the three replicates.

It can be seen that the temperatures within the polytunnel were low for most of the trial, ranging from 5.3-13.9⁰C for the first ten weeks. It should also be noted that these are daytime temperatures and that temperatures during the night would, for the most part, have been significantly colder. The temperature of material in the Earthmaker bins initially rose more rapidly than in the control bins. This may have been due to the fact that the Earthmakers were divided into three sections and so the material within the top section was more insulated than in the control bin. The temperature of the material in the Earthmakers dropped after it was transferred from one stage to the next, but then rose in subsequent weeks. It is difficult to judge whether this was an effect of aeration of the material, or whether it was due to external temperature variations, but it would be expected that the temperature of composting material would, after aeration, initially decrease and then increase as the fresh supply of oxygen encouraged microbial activity. The decomposition of material in both sets of bins was sufficiently intense to maintain a higher than ambient temperature within the material for a period of five weeks (week 4-9), although this sustained elevated temperature may be partly attributable to the insulation provided by the bins.

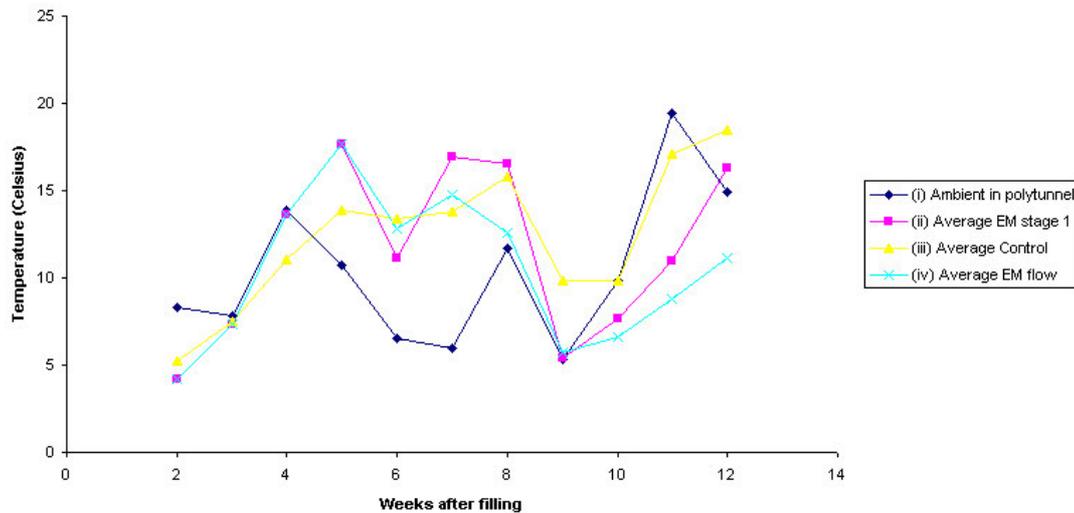


Figure 3. Temperature variations within the bins

The temperature in the control bins was generally higher than in the Earthmakers during the latter stages of the trial. This was possibly due to the larger bulk of material in the control bins, which was better able to insulate itself due to a lower surface area:volume ratio.

3.4.2 Material moisture content

The material in all Earthmaker bins remained moist throughout the trial. During the latter stages of the trial the material within the control bins began to dry out around the edges while remaining moist in the centre. The moisture content of the material in the Earthmakers remained more consistent throughout, probably due to the mixing that occurred during the transference of material between the stages.

3.5 Emptying of the bins

The Earthmaker bins generally scored well when assessed on the ease of emptying the bin. Two bins scored 4.5 on a scale of 1-5 (1 – hard, 5 – very easy). It was found that the hatch was large enough to use a garden fork or spade to access the material. The main reason these two bins scored so highly was the fact that because the bins were divided into sections, the more recent, less decomposed material within the bin was prevented from falling down onto the ready compost beneath.

The remaining Earthmaker bin scored less well (2 on a scale of 1-5 (1 – hard, 5 – very easy)), due to the fact that the shelf separating stages two and three had become dislodged from the sides of the bin. This blocked access to some of the material in stage three and made removal impossible. The only way to resolve this was to pull out the slide connectors at the front of the bin, remove the front panel and then replace the shelf, before putting the panel back on. This process only took approximately five minutes.

3.6 Final assessment of the material

Due to the cold weather it was decided to leave the final assessment until later than originally planned to allow the material to continue composting. The results of the final assessment can be seen in Figures 4 and 5 below. Figure 4 shows that there was on average a much higher percentage of fully decomposed (Grade 5) material in the Earthmaker bins (38%) than in the control bins (15%). It can also be seen that overall, there was a much higher percentage of ready-to-use (Grades 4 & 5) material in the Earthmaker bins (63%) than in the control bins (30%). The majority of material within the control bins was only partially decomposed, probably as a result of drying out around the edges, whereas the material in the Earthmakers was more homogeneous in terms of moisture content.

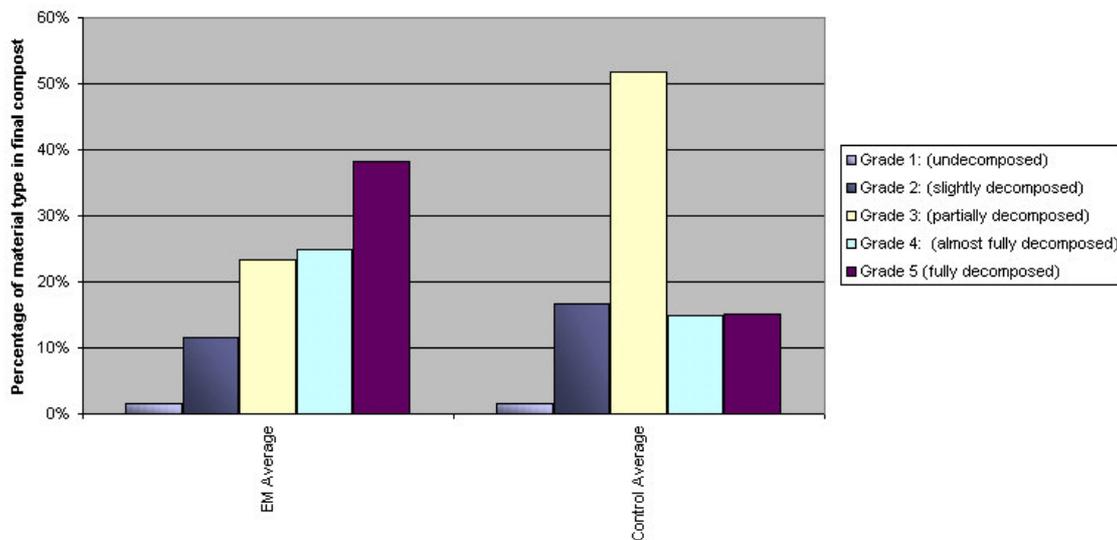


Figure 4. Assessment of material after 26 weeks

The volumes of material within the bins at the time of the final assessment were measured and the results are shown in Figure 5 below. It can be seen that the percentage reductions in the volumes of material in the Earthmaker bins was consistently higher than the reductions found in the control bins, with an average 72% volume reduction in the Earthmakers, compared to an average of 64% in the control bins.

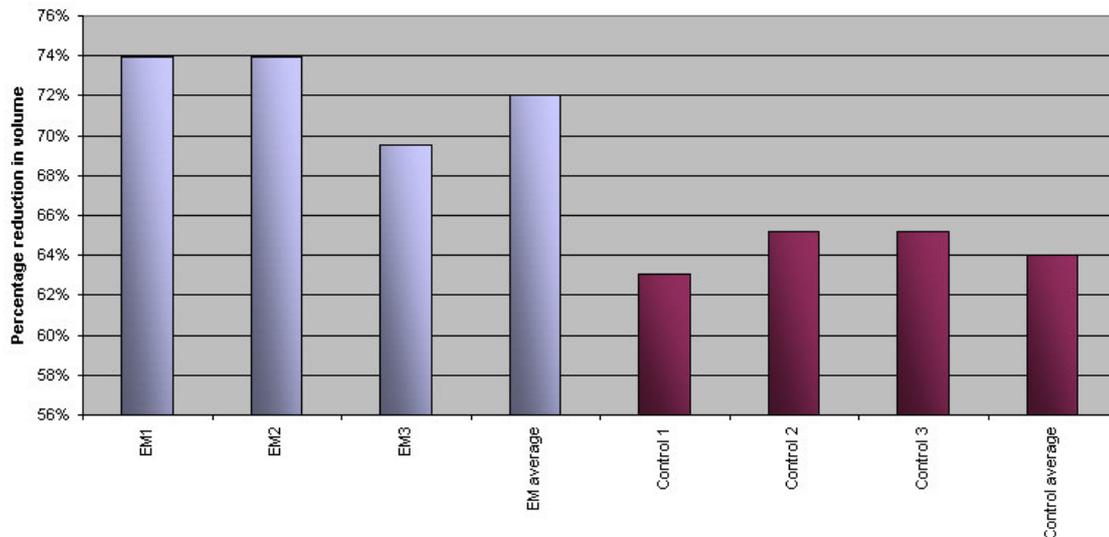


Figure 5. Reduction in volumes of material in the bins.

4 CONCLUSIONS

The Earthmaker compost bin has a significantly different design (see Appendix B) to other home compost bins, and the results of this report on a trial carried out to test the effectiveness and ease of use of this bin have shown that the design is easy to use and produced over twice as much good quality compost than the control bin over a 26 week period.

Although probably more complicated than most home compost bins on the market, the assembly of the Earthmaker bins was found to be easy, scoring on average 3.7 on a scale of 1 to 5 (1 - hard, 5 – very easy). It was noted in two of the replicates that the pushing some of the lugs into place in order to connect different components of the bin was difficult. The average time of assembly for two people, from boxed product to fully assembled bin was 23 minutes.

The Earthmaker bins scored very highly in the filling assessment. The average score of the 3 replicates was 4.8 (on a scale of 1-5 (1 – hard, 5 – very easy)), with no bin scoring less than 4 at each assessment. In comparison the control bins scored an average of 3.9. The Earthmaker bins were a good height and had a decent sized aperture. It was also found that the lid could be rotated to the open position using just one hand. This is a big advantage for a home composting bin because it means that the user can open the lid while holding a kitchen caddy full of waste in the other hand. A further positive observation noted that because the material was contained in the top third of the bin and so did not fall to the bottom, it would be easy to mix the material if desired.

The transference of material in the Earthmaker bins from stage one to stage two scored well in the trial (3.7 on a scale of 1-5 (1 – hard, 5 – very easy)). The whole process took

approximately one minute and did not require much physical strength, but the small size of hole behind the door made the process slightly awkward. The transference of material from stage two to stage three scored moderately well (2.6 on a scale of 1-5). In most cases the transference of material from stage two to stage three was deemed to be a little awkward. However, it was found that the process took approximately 5 minutes, which when compared to the time taken to aerate a more traditional home compost bin by manual turning with a garden fork, could be seen as preferential.

The Earthmaker bins generally scored well when assessed on the ease of emptying the bin. The average score was 3.7 on a scale of 1-5 (1 – hard, 5 – easy). It was found that the hatch was large enough to use a garden fork or spade to access the material, and that because the bins were divided into sections, the more recent, less decomposed material within the bin was prevented from falling down onto the ready compost beneath. The average score was brought down by one of the replicates in which the shelf separating stages two and three had become dislodged from the sides of the bin. This blocked access to some of the material in stage three and made removal impossible without partially disassembling the bin to refit the shelf. This whole process only took approximately five minutes. It was not clear whether this fault was due to incorrect assembly or if the shelf was dislodged during emptying.

During the time period of this trial, the volume of ready-to-use compost produced by the Earthmaker bin was much higher than that produced by the control bins. There was found to be a much higher percentage of fully decomposed (Grade 5) material in the Earthmaker bins (38%) than in the control bins (15%). The majority (71%) of the material in the control bins was only partially decomposed or completely undecomposed, probably as a result of drying out around the edges, whereas the majority of the material (63%) in the Earthmakers was ready-to-use and was more homogeneous in terms of moisture content. Volume reduction can be used as an indicator of how successfully a material has composted, and the trial showed that percentage reductions in the volumes of material in the Earthmaker bins was consistently higher than the reductions found in the control bins. The average volume reduction in the Earthmaker bins was 72%, compared with 64% in the control bins.

APPENDIX B – EARTHMAKER BROCHURE

