4. MASS BALANCE ANALYSIS OF HOME COMPOSTING

4.1 Waste input materials to home compost bins

The total amounts of waste deposited in the compost bins for a period 13 months were recorded and are shown in Table 4.1.

Table 4.1 Total amounts of waste deposited in home compost bins

Treatment	Garden waste (kg)	Kitchen waste (kg)	Paper waste (kg)	Total waste input (kg)	Inoculum (kg)	Total input (kg)
1	134.2	0.0	0.0	134.2	5.0	139.2
2	100.2	150.3	0.0	250.5	5.0	255.5
3	75.3	300.2	0.0	375.5	5.0	380.5
4	106.2	153.8	5.2	265.2	5.0	270.2
5	97.2	136.4	10.4	244.0	5.0	249.0
6	77.3	299.8	7.8	383.9	5.0	388.9
Blackwall	106.2	153.6	5.2	265.0	5.0	270.0

4.2 Mass balance results

Mass balances were constructed for the experimental treatments and dry matter and moisture losses were determined at the mid-point of the experiment on 26-27 July 2005 (Figures 4.1-4.7) and at the end of the monitoring period on 6 March 2006 (Figures 4.8-4.14). The overall reduction in mass of input material, due to volatile solids losses, was determined and is shown in Table 4.2.

During Period 1 of the composting experiment (February-July 2005) the average moisture content of garden waste was 38% and in Period 2 (July 2005-March 2006) it was 55% (Figures 4.1 and 4.8). The higher moisture content in the later period is explained by the addition of larger quantities of grass clippings to the bins compared to Period 1. Treatment 1 was also supplied with the largest volume of water (55 l) to reduce moisture limitation of the composting process in the bins only supplied with garden waste. A solution of soluble N containing approximately 200 mg l^{-1} of N as ammonium nitrate (NH_4NO_3) (10 l per bin) was initially added to Treatment 1 to provide a source of available N at the beginning of the experiment as the initial input to the bins was leaf litter of high C:N ratio. The other experimental treatments received inputs of food waste and were therefore better supplied with moisture and N in the input waste.

The results showed that approximately 19% of the garden waste deposited in Treatment 1 was removed during the composting process through moisture and volatile solids losses (Table 4.2), equivalent to 56 kg (29%) and 25 kg (13%) of the total input materials, respectively (Figure 4.8). However, the mass balances indicated much greater removals of moisture and solids occurred for treatments also including food and paper waste in the range 55 – 65 % (Table 4.2). The losses of moisture and dry matter for bins from specific treatments were approximately similar. The order of decreasing mass removal for the experimental treatments was: 6 > 3 > 5 > Blackwall = 4 > 2 > 1. Increasing the proportion of food waste supplied to home compost bins raised the overall mass removal and this was enhanced further by the addition of small amounts of paper equivalent to 2 - 4 % of the total input mass. Waste inputs in Treatment 4 to the Milko bin were duplicated in the alternative Blackwall bin to assess the effect of bin type on the mass balance and potential waste throughput by HC. The initial mass balance performed in July 2005 suggested that waste decomposition processes were marginally increased in the Milko bin (Treatment 4; Figure 4.4), indicated by the greater reduction in mass, compared to equivalent waste inputs and removals for the Blackwall bin type (Figure 4.7; Table 4.2). However, no effect of bin type on

the final waste mass balance (Figure 4.14, Table 4.2) was apparent at the end of the experiment after a monitoring period of 392 days.

A key objective of the controlled HC experiment was to quantify the potential maximum throughput and waste treatment capacity of small-scale (290 – 330 l) composting bins. The results showed that substantial amounts of waste may be treated by small-scale composters and, where a mixture of food, garden and paper waste is supplied, inputs of up to 400 kg waste per year may be possible. The smallest waste inputs were recorded here (140 kg) for compost bins only receiving garden waste and this was probably linked to moisture limitation of microbial activity. Food waste supplied moisture and N to support decomposition processes and enhanced the rate of degradation and therefore increased the overall treatment capacity and input of waste to the bins. Compost bins receiving waste additions comprising approximately 60 % food waste had a treatment capacity of approximately 250 kg y^{-1}.

Table 4.2 Input and output mass balance of home composting treatments for Feb-July 2005 and Feb 2005 – Mar 2006

Treatment	Total mass of waste input (kg)	Mass of final product (kg)	Reduction of waste input mass for Feb-July 2005 (%)	Overall reduction of waste input mass at end of monitoring period (%)
1	139.2	113.4	34.0	18.5
2	255.5	128.6	53.2	49.7
3	380.5	154.2	63.1	59.5
4	270.2	128.8	54.7	52.3
5	249.0	113.2	57.5	54.5
6	388.9	135.4	62.0	65.2
Blackwall	270.0	128.7	47.1	52.3

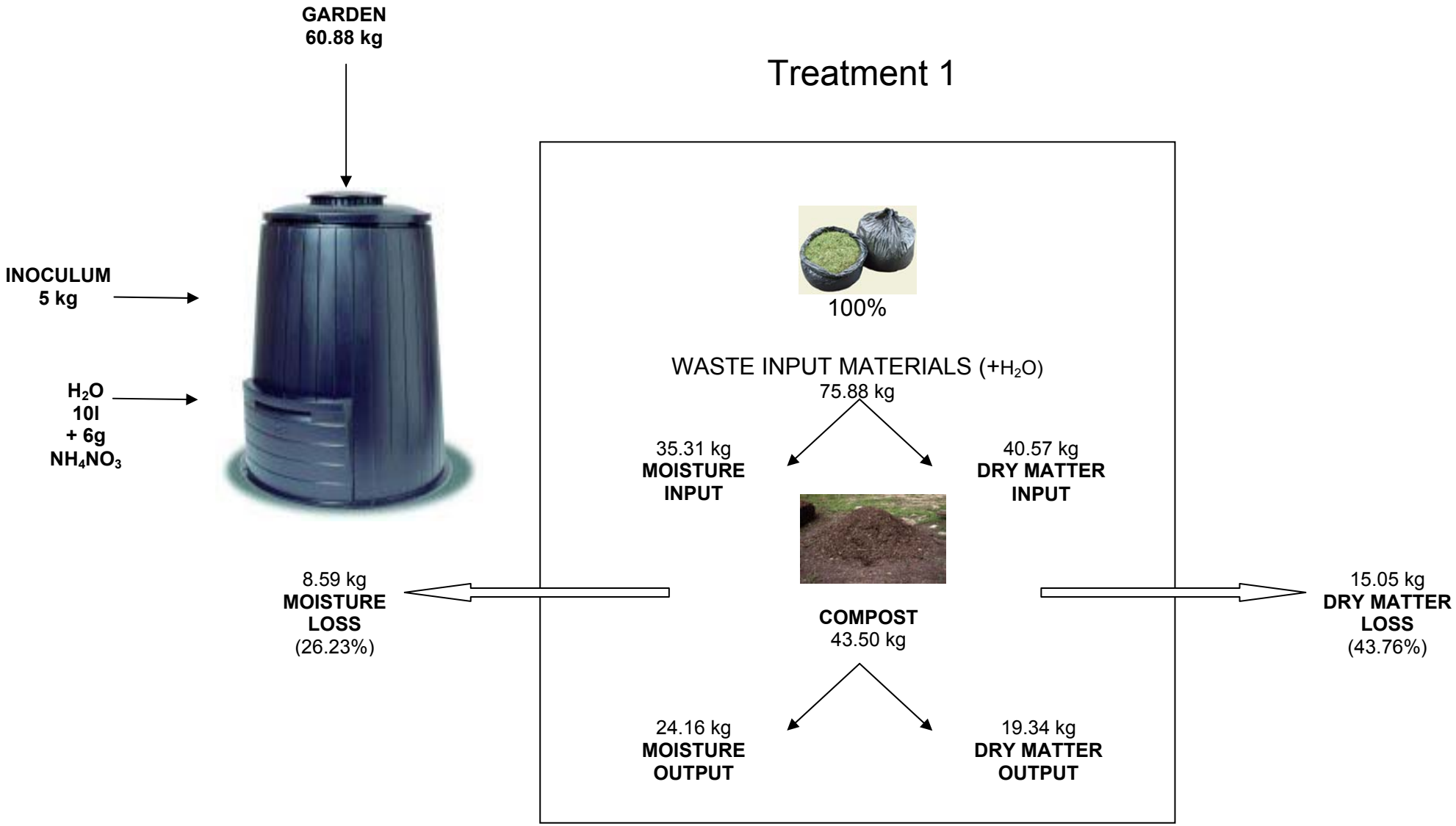

Figure 4.1 Total mass balance of waste processed in Treatment 1 between February and July 2005

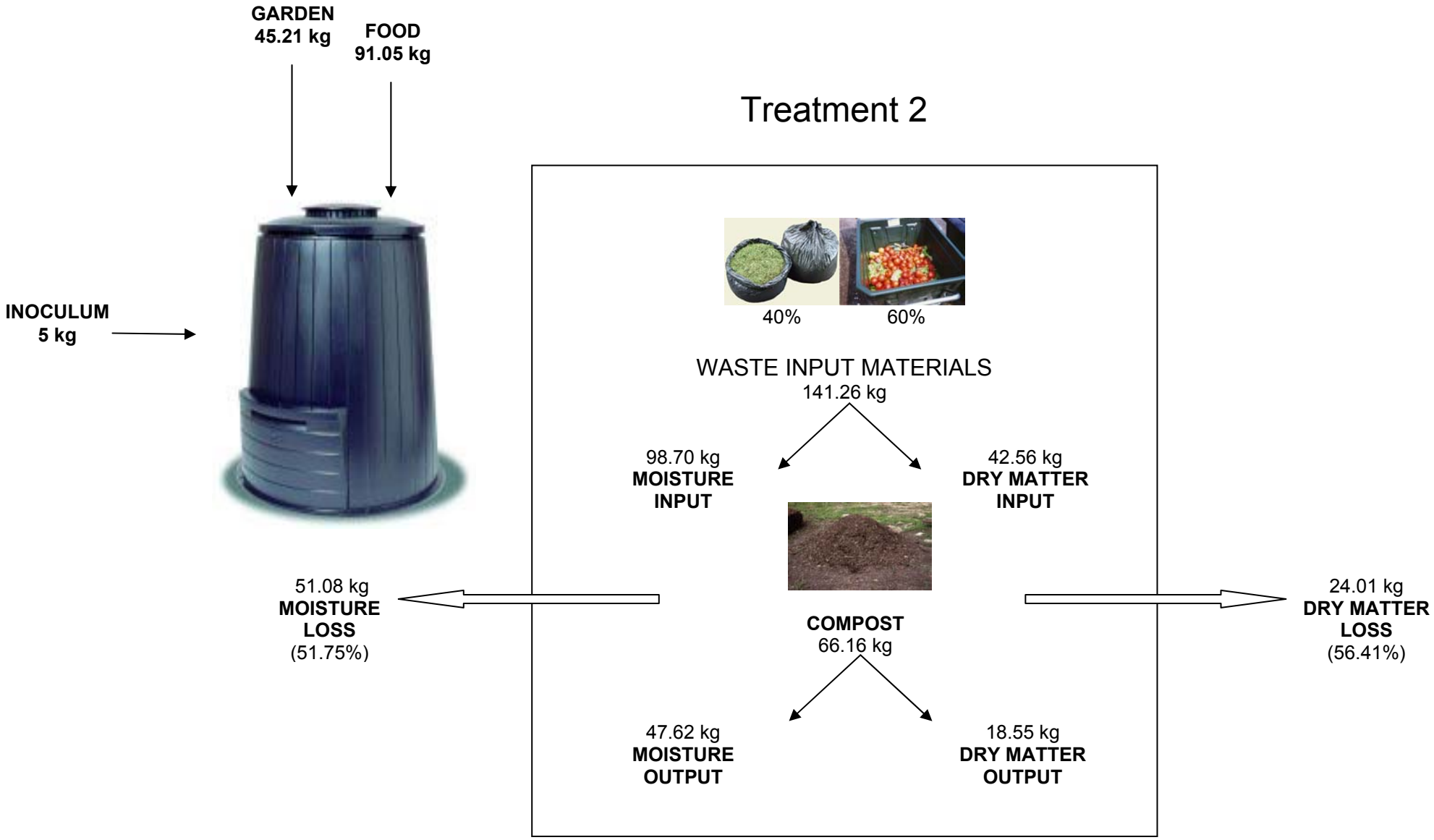

Figure 4.2 Total mass balance of waste processed in Treatment 2 between February and July 2005

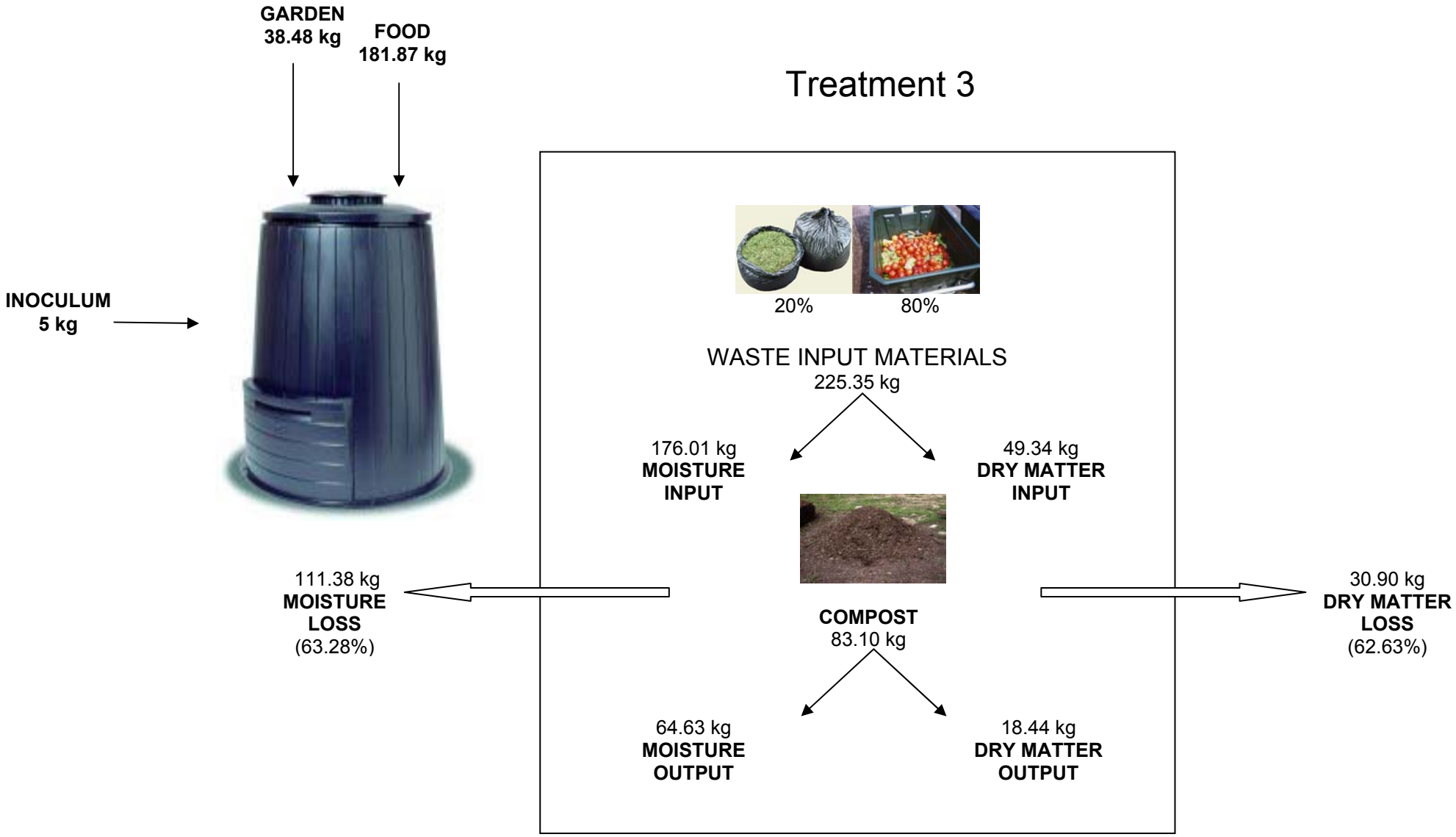

Figure 4.3 Total mass balance of waste processed in Treatment 3 between February and July 2005

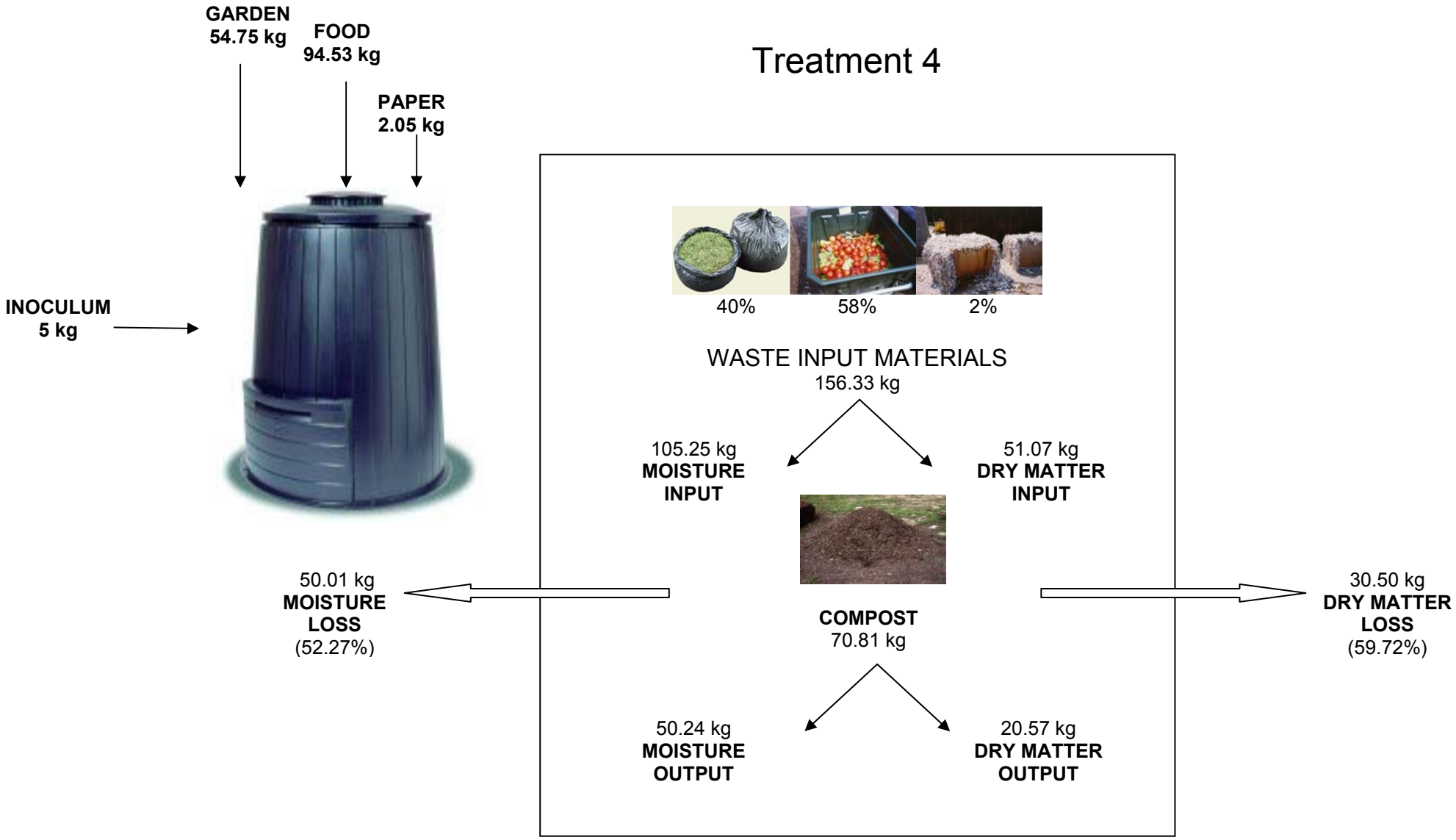

Figure 4.4 Total mass balance of waste processed in Treatment 4 between February and July 2005

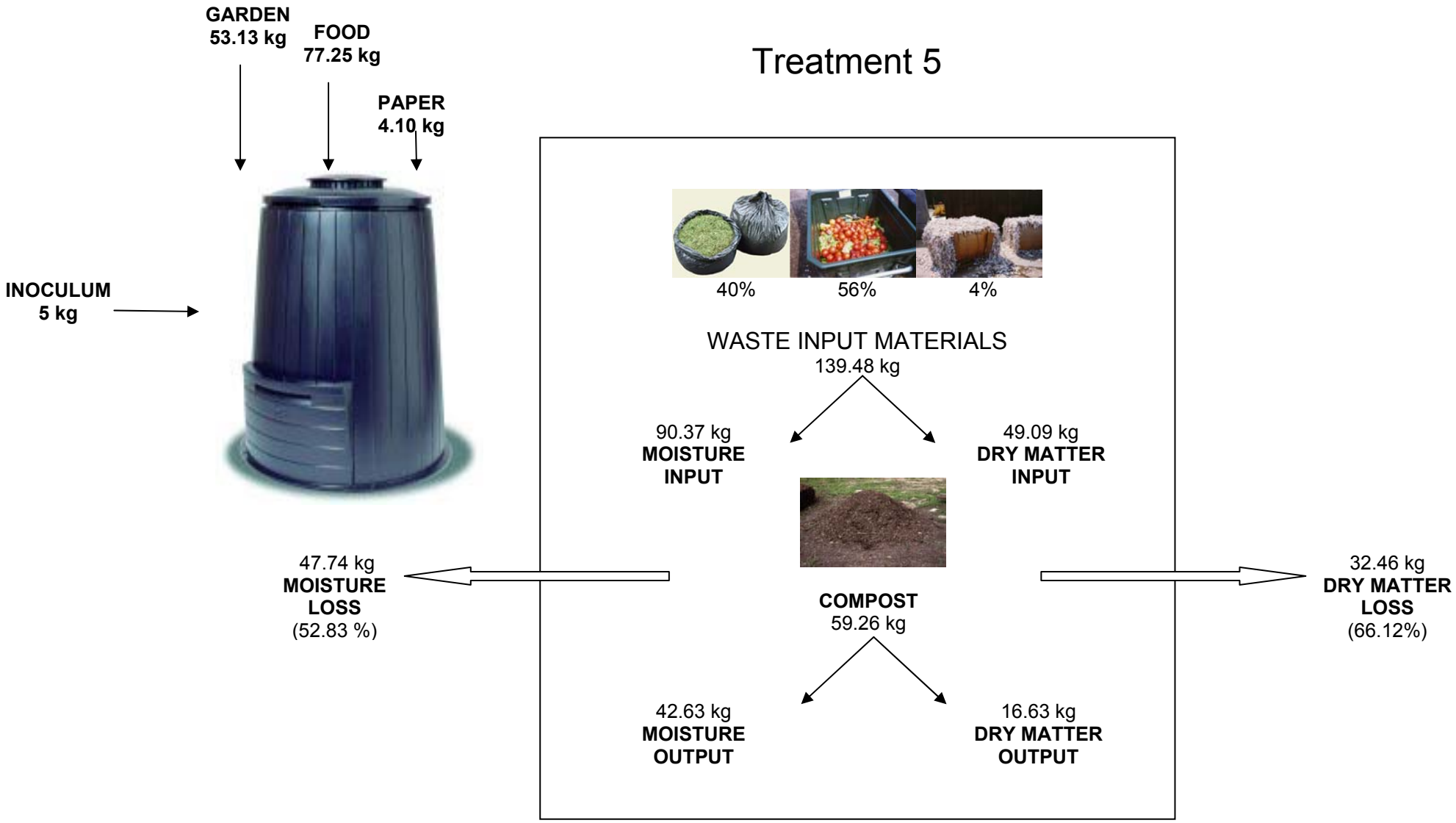

Figure 4.5 Total mass balance of waste processed in Treatment 5 between February and July 2005

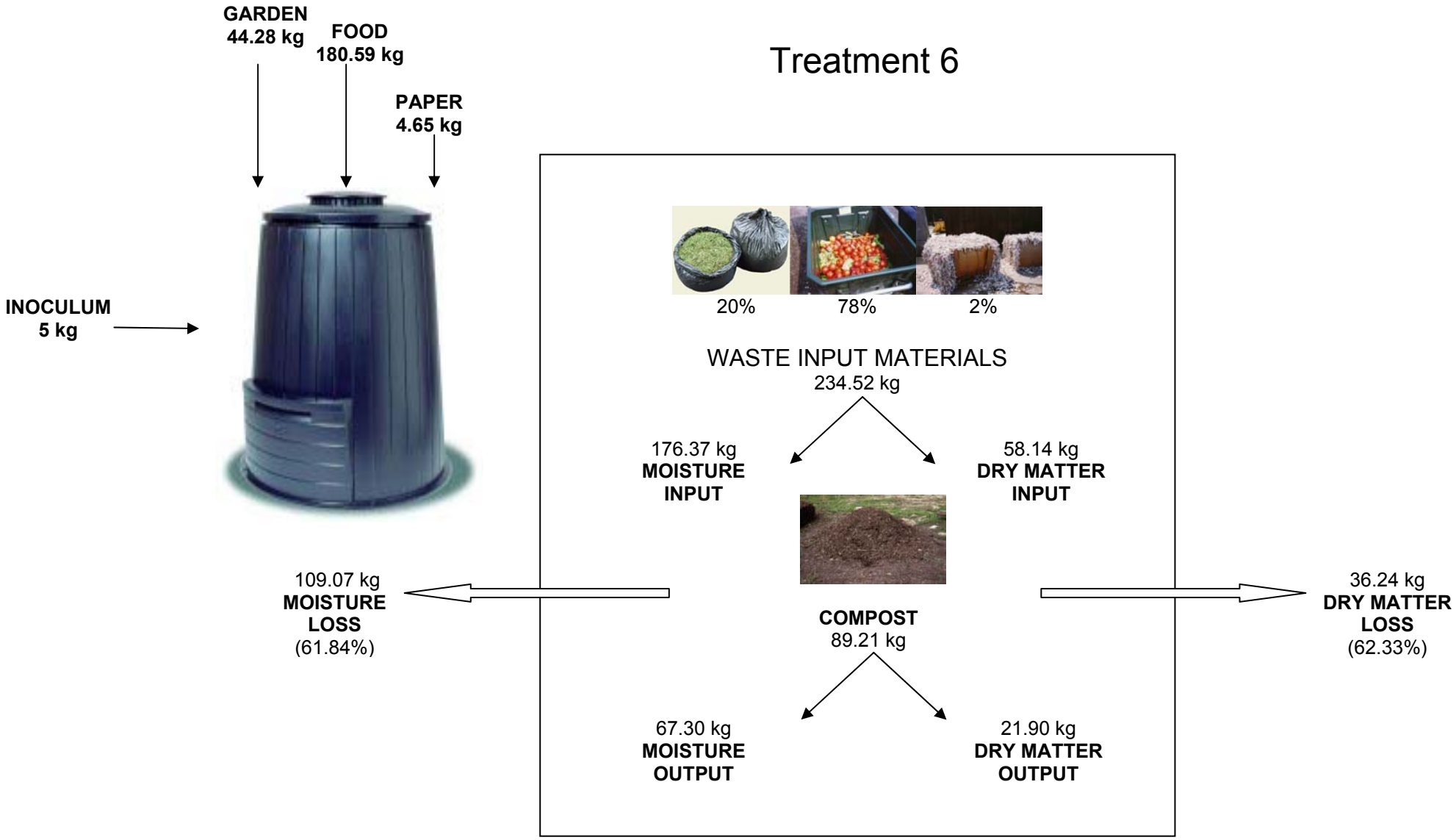

Figure 4.6 Total mass balance of waste processed in Treatment 6 between February and July 2005

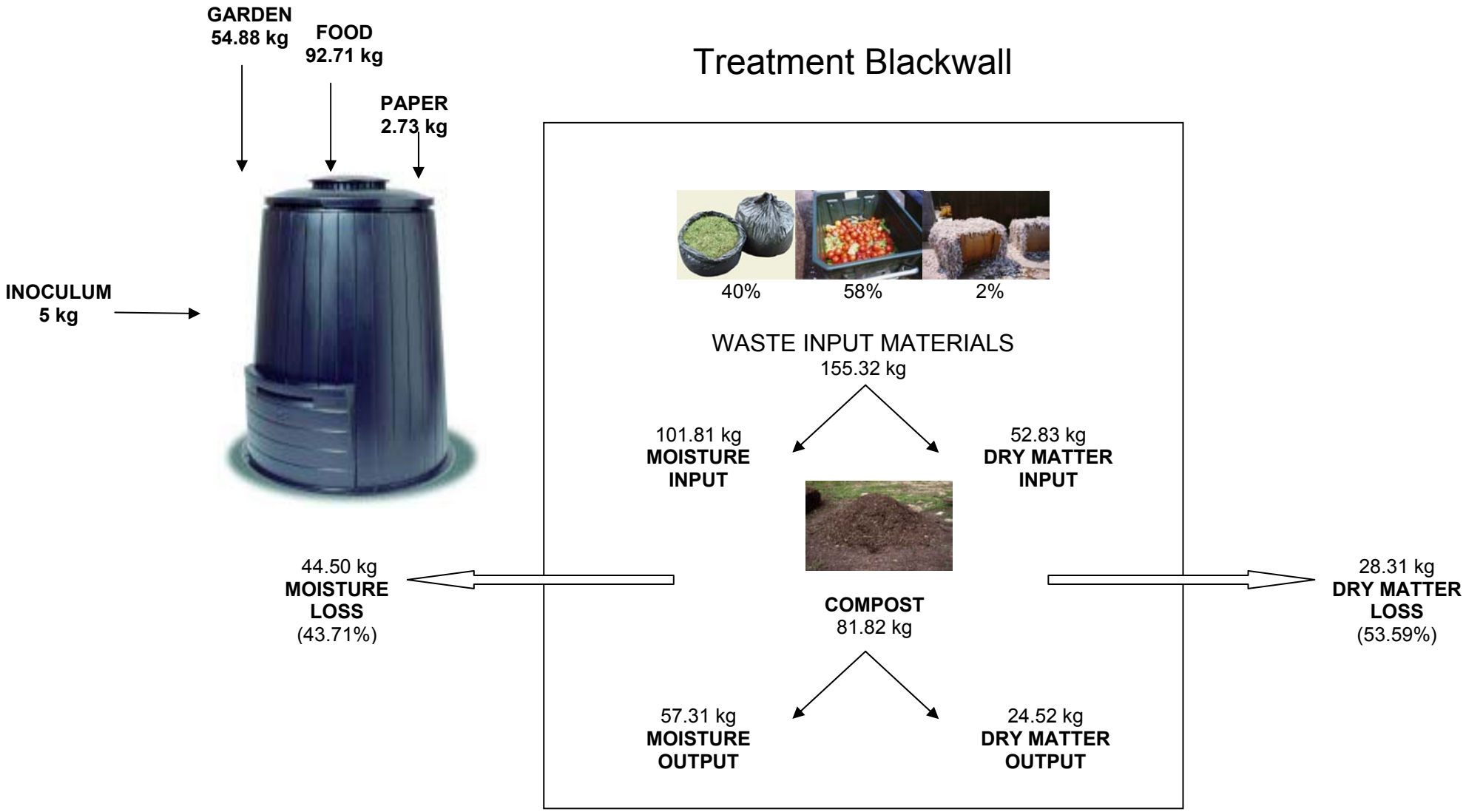

Figure 4.7 Total mass balance of waste processed in Blackwall compost bins between February and July 2005

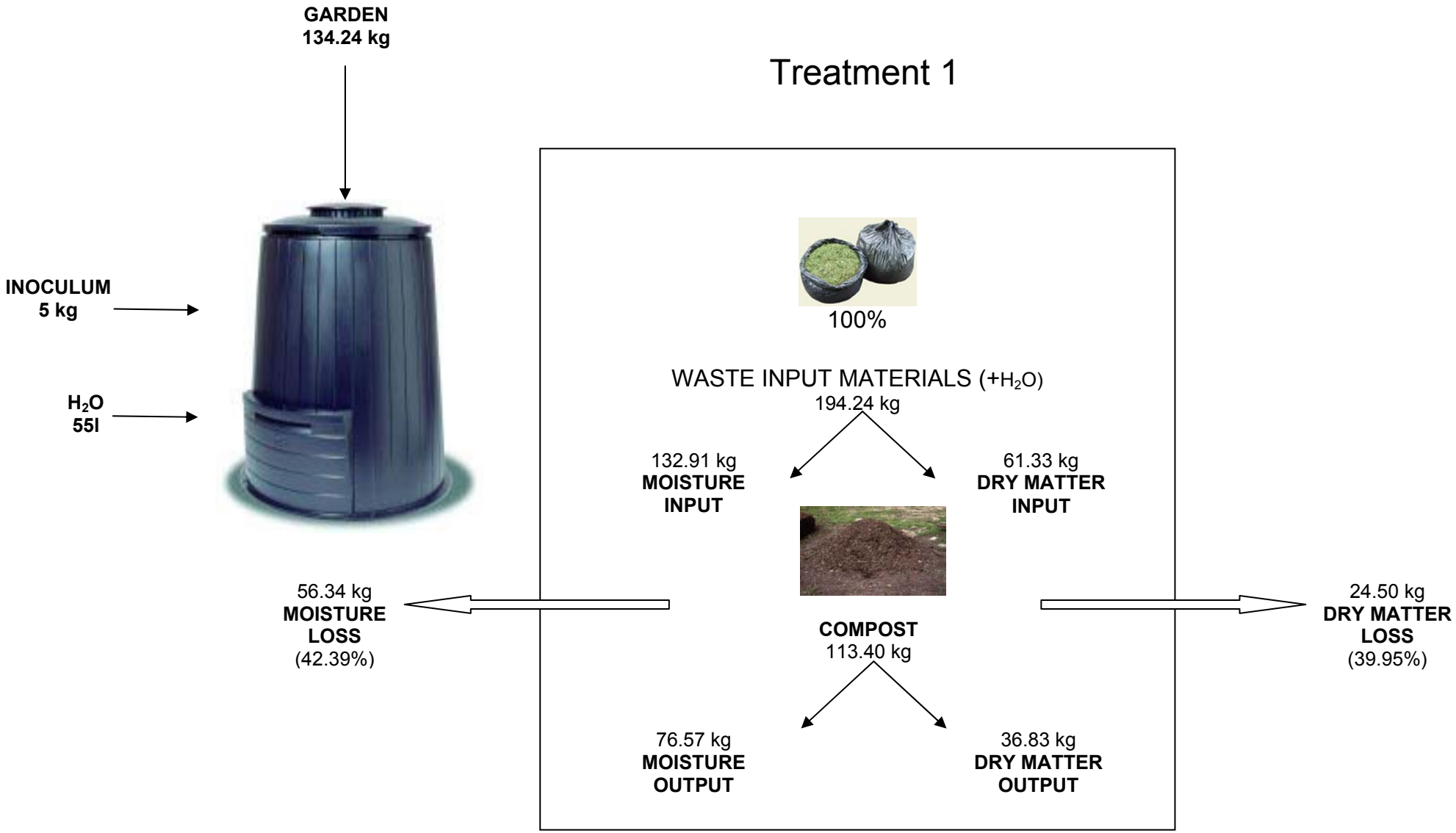

Figure 4.8 Total mass balance of waste processed in Treatment 1 between February 2005 and March 2006

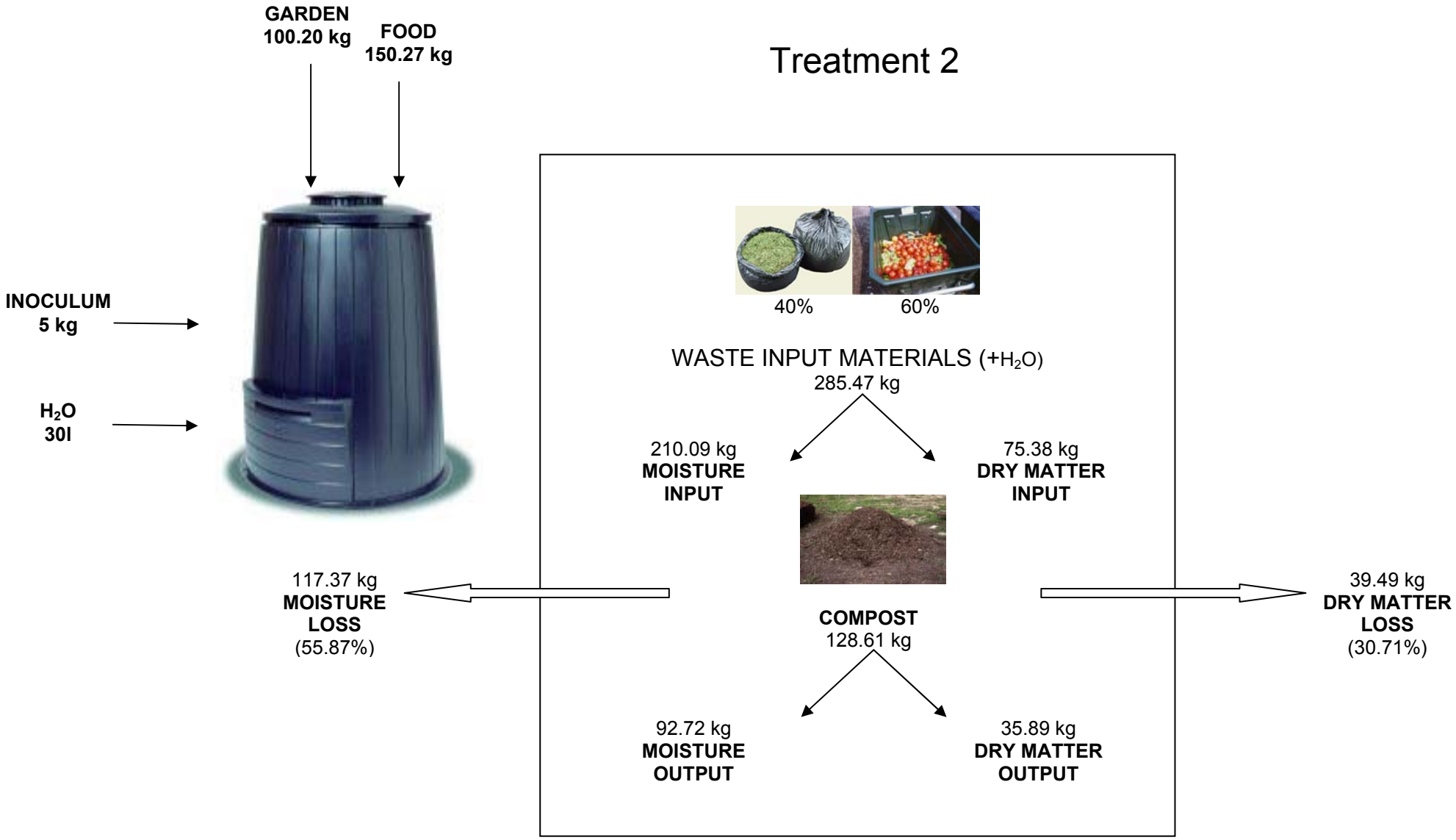

Figure 4.9 Total mass balance of waste processed in Treatment 2 between February 2005 and March 2006

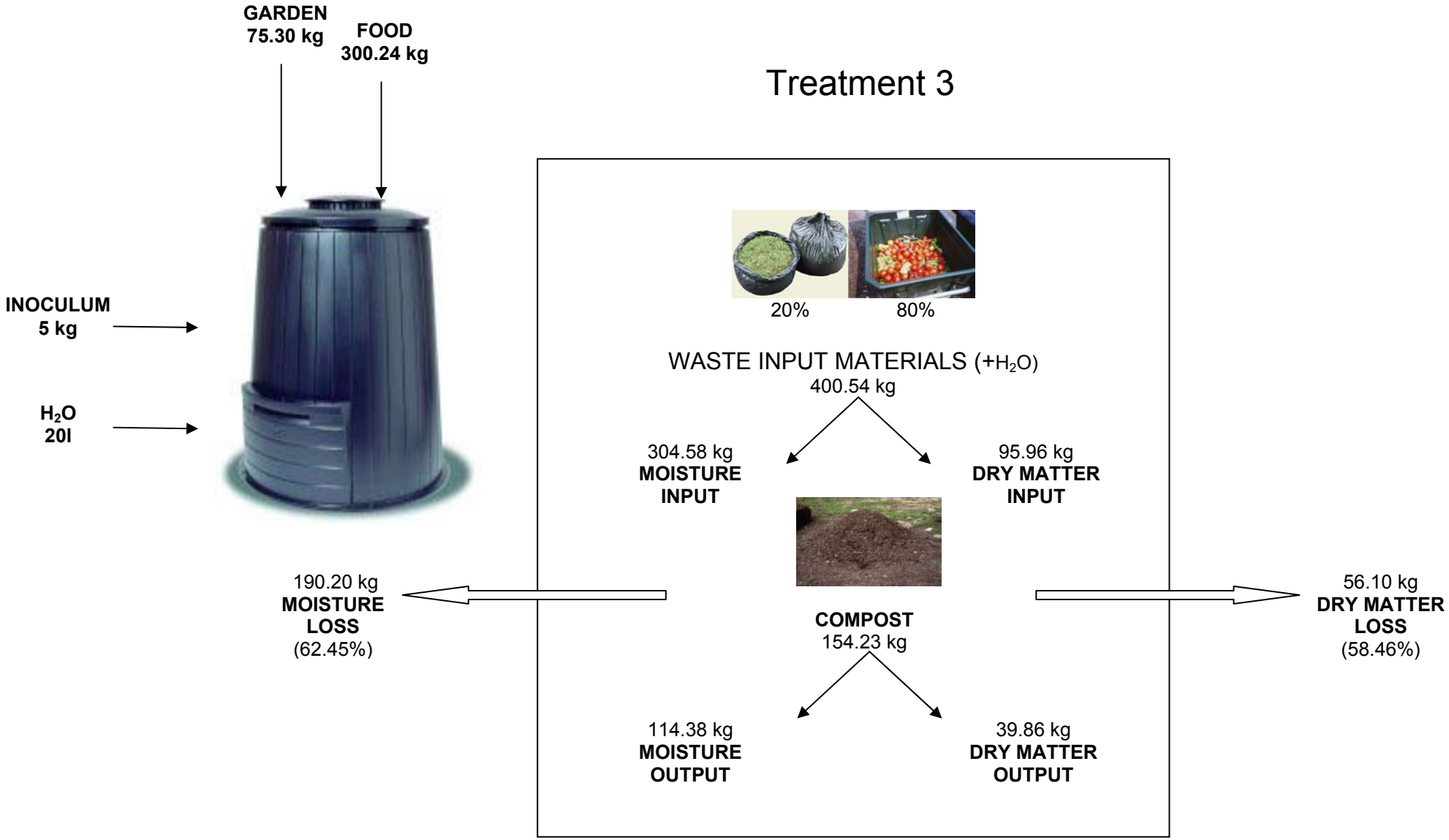

Figure 4.10 Total mass balance of waste processed in Treatment 3 between February 2005 and March 2006

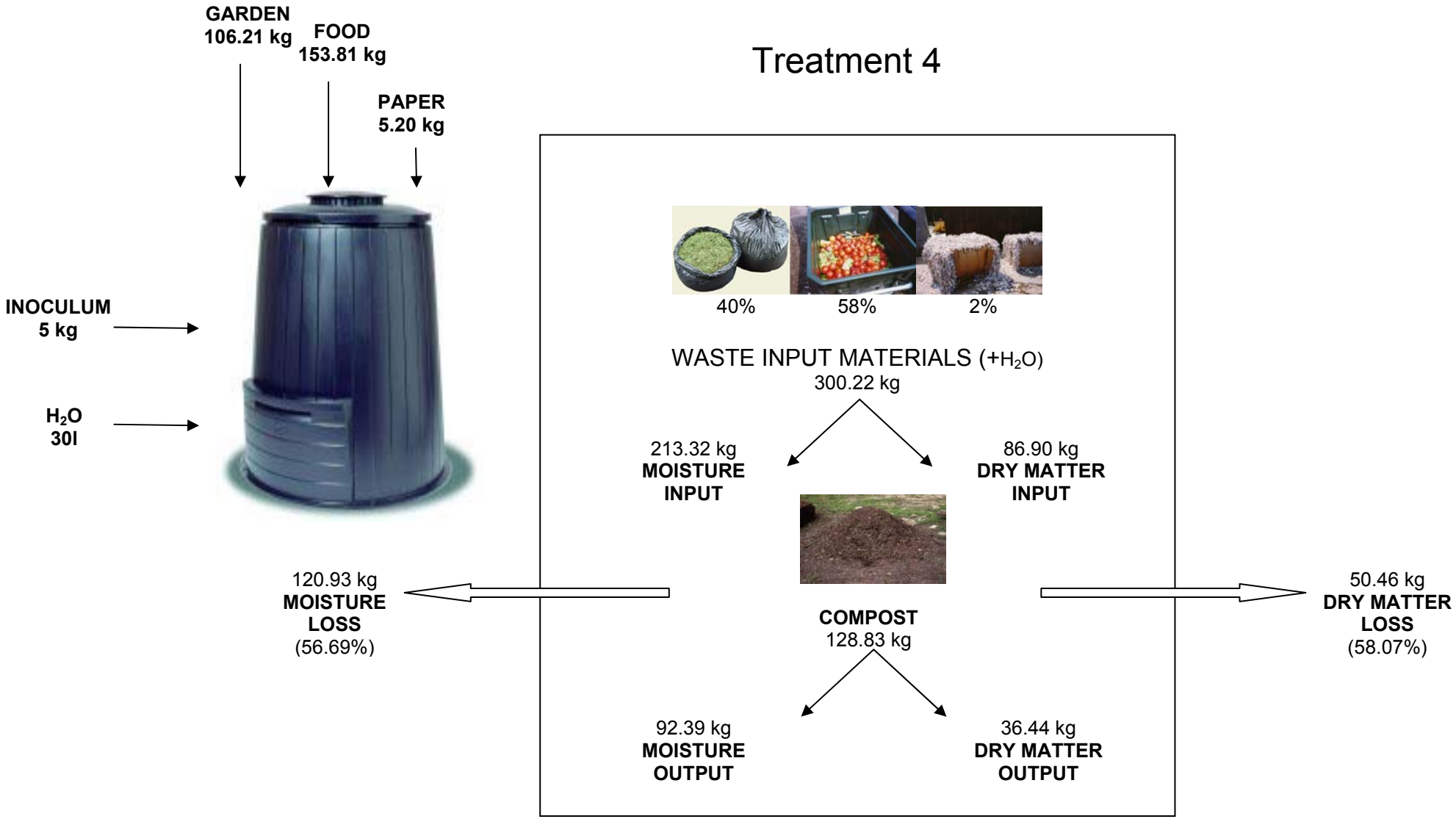

Figure 4.11 Total mass balance of waste processed in Treatment 4 between February 2005 and March 2006

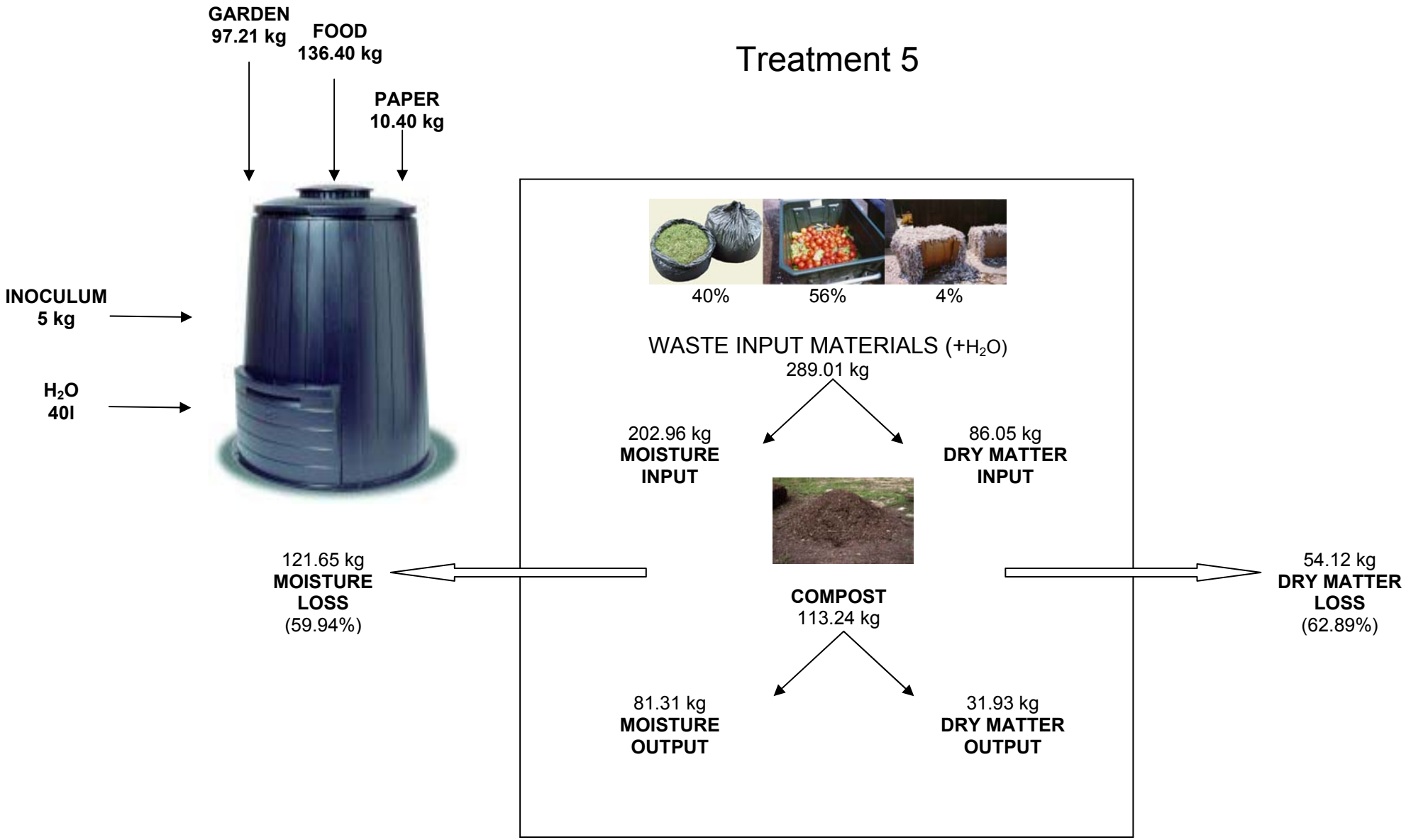

Figure 4.12 Total mass balance of waste processed in Treatment 5 between February 2005 and March 2006

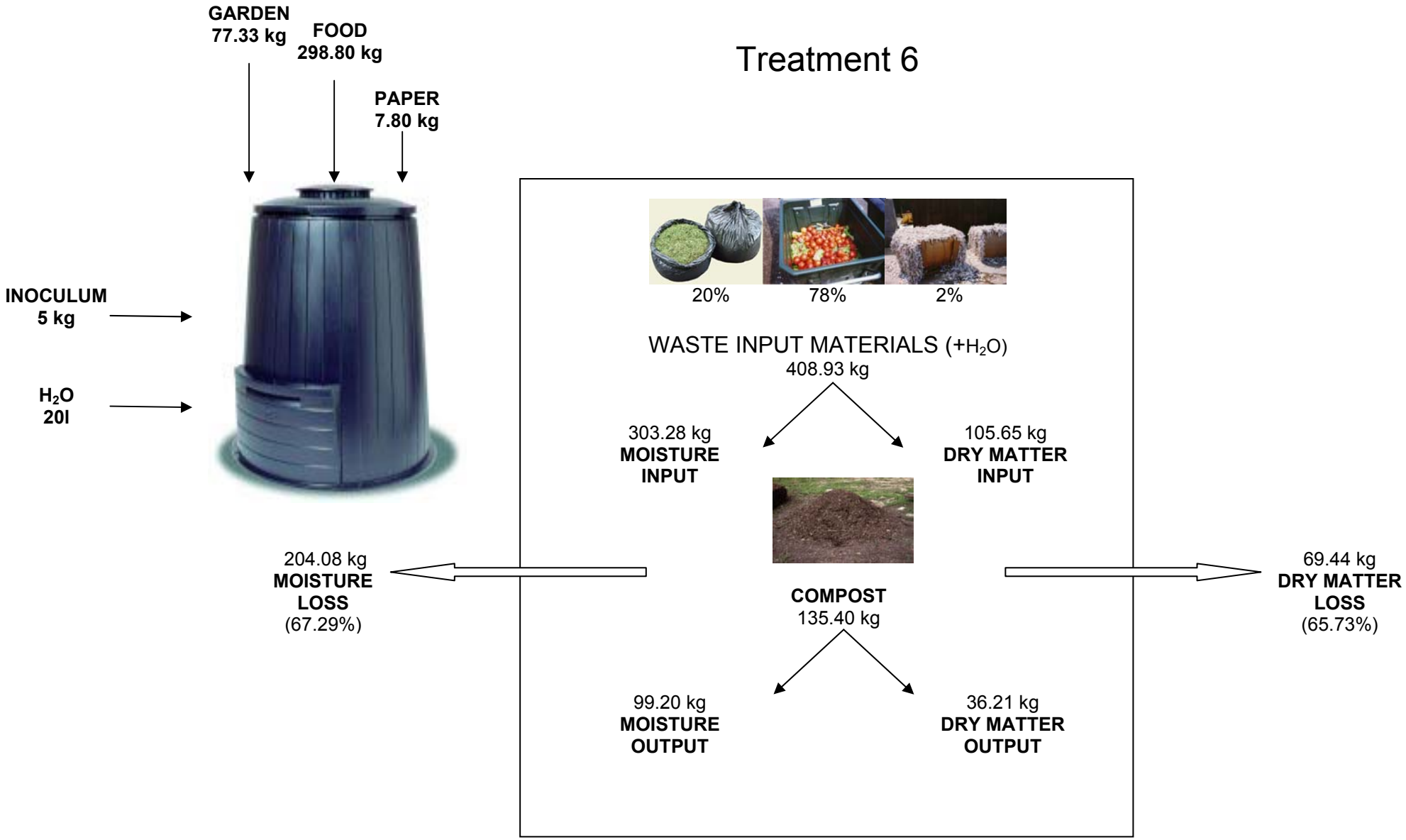

Figure 4.13 Total mass balance of waste processed in Treatment 6 between February 2005 and March 2006

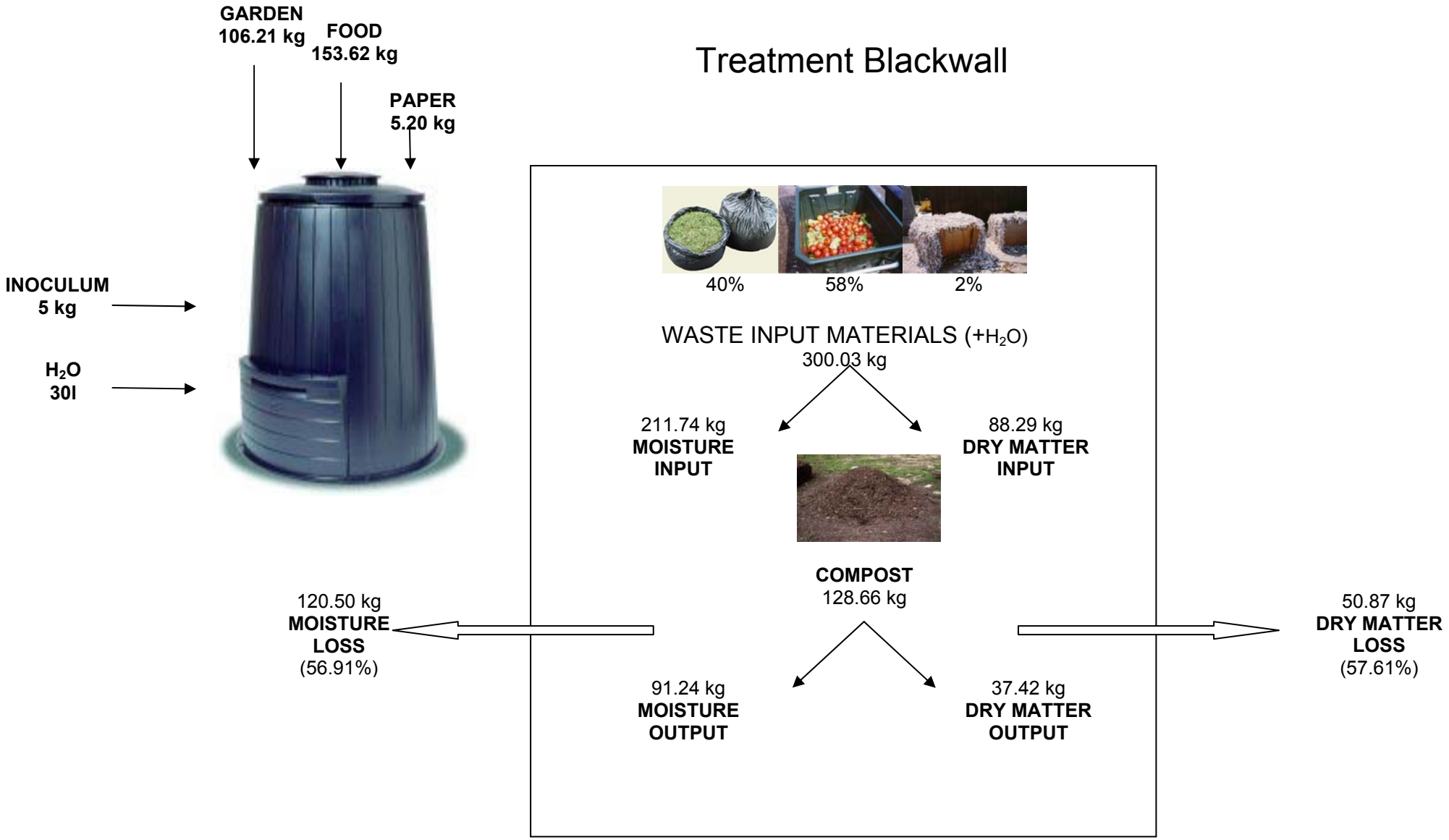

Figure 4.14 Total mass balance of waste processed in Blackwall bins between February 2005 and March 2006